CONTROL STRATEGY TOOL (COST)

"AT A GLANCE" CONTROL MEASURE DOCUMENT

Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

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Contents

NOx Control Measures

There are 222 NOx control measures included in this report

Summary:

Control Measure Name:	Catalytic Ceramic Filter; Glass Manufacturing - Flat
Abbreviation:	CATCFGMFT
Description:	Application: Filter tubes have nanobits of proprietary catalyst are embedded throughout the filter walls. The system can achieve excellent NOx removal using liquid ammonia that is injected upstream of the filters, reacting with NOx at the catalyst to form nitrogen gas and water vapor. This control applies to general glass manufacturing operations classified under SCC 30501403
Class:	Known
Pollutant:	NOX
Equipment Life:	20.0 years
Control Technology:	Catalytic Ceramic Filter
Source Group:	Glass Manufacturing - Flat
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2013	2013
CPT:	$997	$1,045
Ref Yr CPT:	$997	$1,045
Control Efficiency:	95.0	95.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.05000000074505806	0.05000000074505806
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.6	4.6
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		

Effective Date:	N/A	N/A
Cost Year:	2013	2013
CPT:	$997	$1,045
Ref Yr CPT:	$997	$1,045
Control Efficiency:	95.0	95.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.05000000074505806	0.05000000074505806
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.6	4.6
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace

References:

- Confidential Vendor Quote

Other information:

Summary:

Control Measure Name:	Air to Fuel Ratio Controller; Lean Burn ICE - NG
Abbreviation:	NAFRCICENG
Description:	N/A
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	Air to Fuel Ratio Controller
Source Group:	Lean Burn ICE - NG
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2001
CPT:	$200
Ref Yr CPT:	$255
Control Efficiency:	80.0
Min Emis:	0.0
Max Emis:	365.0
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.14000000059604645
Discount Rate:	7.0
Cap Ann Ratio:	7.023
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2001
CPT:	$200
Ref Yr CPT:	$255
Control Efficiency:	80.0
Min Emis:	0.0
Max Emis:	365.0
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	0.14000000059604645
Discount Rate:	7.0
Cap Ann Ratio:	7.023
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 2

Description: Non-EGU NOx

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Annual Cost = Annual Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base
Capital Coat = Capital Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base

Variable Name	Value
Pollutant	NOX
Cost Year	2001
Capital Cost Multiplier	511.194322944106
Capital Cost Exponent	1.0
Annual Cost Multiplier	72.7863370563914
Annual Cost Exponent	1.0
Incremental Capital Cost Multiplier	
Incremental Capital Cost Exponent	
Incremental Annual Cost Multiplier	
Incremental Annual Cost Exponent	
Capital Cost Base	4354.5
Annual Cost Base	619.99
Incremental Capital Cost Base	
Incremental Annual Cost Base	

Affected SCCs:

Code	Description
20200256	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Clean Burn
20200255	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Clean Burn
20200254	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Lean Burn
20200252	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Lean Burn

References:

- CARB 2001. Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Stationary Spark-Ignited Internal Combustion Engines. California Environmental Protection Agency, Air Resources Board, Stationary Source Division, Emissions Assessment Branch, Process Evaluation Section. November 2001.

Other information:

Summary:

Control Measure Name:	Adjust Air to Fuel Ratio; Internal Combustion Engines - Gas
Abbreviation:	NAFRICGS
Description:	Application: This control is the use of air/fuel ratio adjustment to reduce NOx emissions. This control applies to gasoline powered internal combustion engines with uncontrolled NOx emissions greater than 10 tons per year.
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Adjust Air to Fuel Ratio
Source Group:	Internal Combustion Engines - Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,570	$380
Ref Yr CPT:	$2,514	$609
Control Efficiency:	20.0	20.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.8	1.5
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,570	$380
Ref Yr CPT:	$2,514	$609
Control Efficiency:	20.0	20.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A

Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.8	1.5
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2310021351	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Lateral Compressors 4 Cycle Rich Burn
2310021302	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Rich Burn Compressor Engines 50 To 499 HP
2310021301	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Rich Burn Compressor Engines <50 HP
2310021251	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Lateral Compressors 4 Cycle Lean Burn
2310021202	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Lean Burn Compressor Engines 50 To 499 HP
2310021102	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 2Cycle Lean Burn Compressor Engines 50 To 499 HP
20400404	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Process Gas
20300802	Internal Combustion Engines; Commercial/Institutional; Landfill Gas; Reciprocating
20300707	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Reciprocating: Exhaust
20300702	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Reciprocating: POTW Digester Gas
20300204	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Reciprocating: Cogeneration
20300201	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Reciprocating
20200712	Internal Combustion Engines; Industrial; Process Gas; Reciprocating: Exhaust
20200702	Internal Combustion Engines; Industrial; Process Gas; Reciprocating Engine
20200256	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Clean Burn
20200255	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Clean Burn
20200254	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Lean Burn
20200253	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Rich Burn
20200252	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Lean Burn

20200204	Internal Combustion Engines; Industrial; Natural Gas; Reciprocating: Cogeneration
20200202	Internal Combustion Engines; Industrial; Natural Gas; Reciprocating
20100205	Internal Combustion Engines; Electric Generation; Natural Gas; Reciprocating: Crankcase Blowby
20100202	Internal Combustion Engines; Electric Generation; Natural Gas; Reciprocating

References:

- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Stationary Reciprocating Internal Combustion Engines," EPA,-453/R-93-032, Research Triangle Park, NC, July 1993.
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	20% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power (Pechan, 1998). Engines less than 4,000 horsepower were considered small engines. Capital and annual cost information was obtained from model engine data in the Alternative Control Techniques (ACT) document (EPA, 1993). A capital cost to annual cost ratio of 2.8 was developed to estimate default capital and operating and maintenance costs. From these determinations, default cost effectiveness values were assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 25% (Pechan, 2001).
COST_BASIS:	Sources are distinguished by power (Pechan, 1998). Engines less than 4,000 horsepower were considered large engines. Capital and annual cost information was obtained from model engine data in the Alternative Control Techniques (ACT) document (EPA, 1993). A capital cost to annual cost ratio of 1.5 was developed to estimate default capital and operating and maintenance costs. From these determinations, default cost effectiveness values were assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 25% (Pechan, 2001).
CPTON_TEXT:	The default cost effectiveness value is $1,570 per ton NOx reduced from both uncontrolled and RACT (1990$).
CPTON_TEXT:	The default cost effectiveness value is $380 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	20%

ELEC_PCT:	0%
ELEC_RT:	$0.06/kWh
FUEL_PCT:	0%
HG_CE_T:	20%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$4.13/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	11.57%
OPLBR_RT:	$26.23/hr
OTHR_PCT:	68.54%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	14.93%
UTIL_PCT:	4.94%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Adjust Air to Fuel Ratio and Ignition Retard; Internal Combustion Engines - Gas
Abbreviation:	NAFRIICGS
Description:	Application: This control is the use of air/fuel and ignition retard to reduce NOx emissions. This control applies to gasoline powered internal combustion engines with uncontrolled NOx emissions greater than 10 tons per year.
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Adjust Air to Fuel Ratio and Ignition Retard
Source Group:	Internal Combustion Engines - Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$460	$1,440
Ref Yr CPT:	$737	$2,306
Control Efficiency:	30.0	30.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	1.2	2.6
Incremental CPT:	150.0	270.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$460	$1,440
Ref Yr CPT:	$737	$2,306
Control Efficiency:	30.0	30.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0

Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	1.2	2.6
Incremental CPT:	150.0	270.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2310021351	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Lateral Compressors 4 Cycle Rich Burn
2310021302	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Rich Burn Compressor Engines 50 To 499 HP
2310021301	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Rich Burn Compressor Engines <50 HP
2310021251	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Lateral Compressors 4 Cycle Lean Burn
2310021202	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Lean Burn Compressor Engines 50 To 499 HP
2310021102	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 2Cycle Lean Burn Compressor Engines 50 To 499 HP
20400404	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Process Gas
20300802	Internal Combustion Engines; Commercial/Institutional; Landfill Gas; Reciprocating
20300707	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Reciprocating: Exhaust
20300702	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Reciprocating: POTW Digester Gas
20300204	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Reciprocating: Cogeneration
20300201	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Reciprocating
20200712	Internal Combustion Engines; Industrial; Process Gas; Reciprocating: Exhaust
20200702	Internal Combustion Engines; Industrial; Process Gas; Reciprocating Engine
20200256	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Clean Burn
20200255	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Clean Burn
20200254	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Lean Burn
20200253	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Rich Burn
20200252	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Lean Burn

20200204	Internal Combustion Engines; Industrial; Natural Gas; Reciprocating: Cogeneration
20200202	Internal Combustion Engines; Industrial; Natural Gas; Reciprocating
20100205	Internal Combustion Engines; Electric Generation; Natural Gas; Reciprocating: Crankcase Blowby
20100202	Internal Combustion Engines; Electric Generation; Natural Gas; Reciprocating

References:

- Pechan, 2006: E.H. Pechan and Associates, Inc., "AirControlNET Control Measure Documentation Report", May 2006.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	30% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power (Pechan, 1998). Engines less than 4,000 horsepower were considered small engines. Capital and annual cost information was obtained from model engine data in the Alternative Control Techniques (ACT) document (EPA, 1993). A capital cost to annual cost ratio of 2.6 was developed to estimate default capital and operating and maintenance costs. From these determinations, default cost effectiveness values were assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 25% (Pechan, 2001).
COST_BASIS:	Sources are distinguished by power (Pechan, 1998). Engines less than 4,000 horsepower were considered large engines. Capital and annual cost information was obtained from model engine data in the Alternative Control Techniques (ACT) document (EPA, 1993). A capital cost to annual cost ratio of 1.2 was developed to estimate default capital and operating and maintenance costs. From these determinations, default cost effectiveness values were assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 25% (Pechan, 2001).
CPTON_H:	$460/ton
CPTON_H:	$1440/ton
CPTON_L:	$150/ton
CPTON_L:	$270/ton
CPTON_TEXT:	The default cost effectiveness values are $460 per ton NOx reduced from uncontrolled and $150 per ton NOx reduced from RACT (1990$).
CPTON_TEXT:	The default cost effectiveness values are $1,440 per ton NOx reduced from uncontrolled and $270 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	30%
ELEC_PCT:	0%

ELEC_RT:	$0.06/kWh
FUEL_PCT:	0%
HG_CE_T:	30%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$4.13/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	9.33%
OPLBR_RT:	$26.23/hr
OTHR_PCT:	75.54%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	11.85%
UTIL_PCT:	3.27%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Flue Gas Recirculation; ICI Boilers - Distillate Oil
Abbreviation:	NBFIBDO
Description:	Application: Gas from the boiler, economizer or air heater outlet is reintroduced to the furnace by fans and flues. Flue Gas Recirculation (FGR) is feasible as long as there is no minimum operational temperature/oxygen requirement for the boiler. Flue gas recirculation would lower the temperature range and oxygen levels in the boiler. Should there be a requirement for a minimum temperature or oxygen level (or both) from the boiler (for other processes at the facility) then FGR may not be feasible. Those requirements would need to be assessed on a source-by-source basis. In addition, FGR is generally implemented in conjunction with low NOx burners. FGR may also affect fan capacity, furnace pressure, burner pressure drop, and turndown stability. If these are critical parameters for processes associated with the boiler then FGR may be infeasible (MACTEC 2005).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Flue Gas Recirculation
Source Group:	ICI Boilers - Distillate Oil
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$11,100
Ref Yr CPT:	$11,959
Control Efficiency:	40.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$11,100
Ref Yr CPT:	$11,959

Control Efficiency:	40.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula:

Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	86330.02
Capital Cost Exponent No. 1	0.22
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	225238.9
O&M Cost Size Multiplier No. 1	3453.2
O&M Cost Exponent No. 1	0.22
O&M Cost Size Multiplier No. 2	0.0

O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.3
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Flue Gas Recirculation; ICI Boilers - LPG
Abbreviation:	NBFIBLP
Description:	Application: Gas from the boiler, economizer or air heater outlet is reintroduced to the furnace by fans and flues. Flue Gas Recirculation (FGR) is feasible as long as there is no minimum operational temperature/oxygen requirement for the boiler. Flue gas recirculation would lower the temperature range and oxygen levels in the boiler. Should there be a requirement for a minimum temperature or oxygen level (or both) from the boiler (for other processes at the facility) then FGR may not be feasible. Those requirements would need to be assessed on a source-by-source basis. In addition, FGR is generally implemented in conjunction with low NOx burners. FGR may also affect fan capacity, furnace pressure, burner pressure drop, and turndown stability. If these are critical parameters for processes associated with the boiler then FGR may be infeasible (MACTEC 2005).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Flue Gas Recirculation
Source Group:	ICI Boilers - LPG
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$11,100
Ref Yr CPT:	$11,959
Control Efficiency:	40.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$11,100
Ref Yr CPT:	$11,959

Control Efficiency:	40.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	86330.02
Capital Cost Exponent No. 1	0.22
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	225238.9
O&M Cost Size Multiplier No. 1	3453.2
O&M Cost Exponent No. 1	0.22
O&M Cost Size Multiplier No. 2	0.0

O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.3
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10301002	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Propane
10301001	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane
10201002	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Propane
10201001	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Butane

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Flue Gas Recirculation; ICI Boilers - Natural Gas
Abbreviation:	NBFIBNG
Description:	Application: Gas from the boiler, economizer or air heater outlet is reintroduced to the furnace by fans and flues. Flue Gas Recirculation (FGR) is feasible as long as there is no minimum operational temperature/oxygen requirement for the boiler. Flue gas recirculation would lower the temperature range and oxygen levels in the boiler. Should there be a requirement for a minimum temperature or oxygen level (or both) from the boiler (for other processes at the facility) then FGR may not be feasible. Those requirements would need to be assessed on a source-by-source basis. In addition, FGR is generally implemented in conjunction with low NOx burners. FGR may also affect fan capacity, furnace pressure, burner pressure drop, and turndown stability. If these are critical parameters for processes associated with the boiler then FGR may be infeasible (MACTEC 2005).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Flue Gas Recirculation
Source Group:	ICI Boilers - Natural Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$11,100
Ref Yr CPT:	$11,959
Control Efficiency:	40.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$11,100
Ref Yr CPT:	$11,959

Control Efficiency:	40.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	86330.02
Capital Cost Exponent No. 1	0.22
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	225238.9
O&M Cost Size Multiplier No. 1	3453.2
O&M Cost Exponent No. 1	0.22
O&M Cost Size Multiplier No. 2	0.0

O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.3
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Flue Gas Recirculation; ICI Boilers - Process Gas
Abbreviation:	NBFIBPG
Description:	Application: Gas from the boiler, economizer or air heater outlet is reintroduced to the furnace by fans and flues. Flue Gas Recirculation (FGR) is feasible as long as there is no minimum operational temperature/oxygen requirement for the boiler. Flue gas recirculation would lower the temperature range and oxygen levels in the boiler. Should there be a requirement for a minimum temperature or oxygen level (or both) from the boiler (for other processes at the facility) then FGR may not be feasible. Those requirements would need to be assessed on a source-by-source basis. In addition, FGR is generally implemented in conjunction with low NOx burners. FGR may also affect fan capacity, furnace pressure, burner pressure drop, and turndown stability. If these are critical parameters for processes associated with the boiler then FGR may be infeasible (MACTEC 2005).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Flue Gas Recirculation
Source Group:	ICI Boilers - Process Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$11,100
Ref Yr CPT:	$11,959
Control Efficiency:	40.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$11,100
Ref Yr CPT:	$11,959

Control Efficiency:	40.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	86330.02
Capital Cost Exponent No. 1	0.22
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	225238.9
O&M Cost Size Multiplier No. 1	3453.2
O&M Cost Exponent No. 1	0.22
O&M Cost Size Multiplier No. 2	0.0

O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.3
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10201402	External Combustion Boilers; Industrial; CO Boiler; Process Gas
10200799	External Combustion Boilers; Industrial; Process Gas; Other: Specify in Comments
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Flue Gas Recirculation; ICI Boilers - Residual Oil
Abbreviation:	NBFIBRO
Description:	Application: Gas from the boiler, economizer or air heater outlet is reintroduced to the furnace by fans and flues. Flue Gas Recirculation (FGR) is feasible as long as there is no minimum operational temperature/oxygen requirement for the boiler. Flue gas recirculation would lower the temperature range and oxygen levels in the boiler. Should there be a requirement for a minimum temperature or oxygen level (or both) from the boiler (for other processes at the facility) then FGR may not be feasible. Those requirements would need to be assessed on a source-by-source basis. In addition, FGR is generally implemented in conjunction with low NOx burners. FGR may also affect fan capacity, furnace pressure, burner pressure drop, and turndown stability. If these are critical parameters for processes associated with the boiler then FGR may be infeasible (MACTEC 2005).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Flue Gas Recirculation
Source Group:	ICI Boilers - Residual Oil
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$11,100
Ref Yr CPT:	$11,959
Control Efficiency:	40.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$11,100
Ref Yr CPT:	$11,959

Control Efficiency:	40.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	86330.02
Capital Cost Exponent No. 1	0.22
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	225238.9
O&M Cost Size Multiplier No. 1	3453.2
O&M Cost Exponent No. 1	0.22
O&M Cost Size Multiplier No. 2	0.0

O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.3
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300404	External Combustion Boilers; Commercial/Institutional; Residual Oil; Grade 5 Oil
10300402	External Combustion Boilers; Commercial/Institutional; Residual Oil; 10-100 Million BTU/hr **
10300401	External Combustion Boilers; Commercial/Institutional; Residual Oil - Grade 6; Boiler
10201404	External Combustion Boilers; Industrial; CO Boiler; Residual Oil
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200405	External Combustion Boilers; Industrial; Residual Oil; Cogeneration
10200404	External Combustion Boilers; Industrial; Residual Oil; Grade 5 Oil
10200403	External Combustion Boilers; Industrial; Residual Oil; < 10 Million BTU/hr
10200402	External Combustion Boilers; Industrial; Residual Oil; 10-100 Million BTU/hr
10200401	External Combustion Boilers; Industrial; Residual Oil; Grade 6 oil

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Biosolid Injection Technology; Cement Kilns
Abbreviation: NBINTCEMK
Description: Application: This control applies to cement kilns
Class: Known
Pollutant: NOX
Equipment Life: 15.0 years
Control Technology: Biosolid Injection Technology
Source Group: Cement Kilns
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1997
CPT:	$310
Ref Yr CPT:	$425
Control Efficiency:	23.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	7.3
Incrememental CPT:	N/A
Details:	Applied to large source types
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1997
CPT:	$310
Ref Yr CPT:	$425
Control Efficiency:	23.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	7.3
Incremental CPT:	N/A
Details:	Applied to large source types
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.
- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

ADMIN_PCT:	0%
CE_TEXT:	23% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Capital cost to annual ratio is 7.3
CPTON_TEXT:	The cost effectiveness is $310 per ton of NOx reduction (1997$).
CTRL_EFF_T:	23%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr

MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Catalytic Combustion; Gas Turbine - Natural Gas

Abbreviation: NCATCGTNG

Description: Application: This control is the use of catalytic combustion to reduce NOx emissions. Catalytic combustors reduce the amount of NOx created by oxidizing fuel at lower temperatures (and without a flame) than in conventional combustors. Catalytic combustion uses a catalytic bed to oxidize a lean air fuel mixture within a combustor instead of burning with a flame. The fuel and air mixture oxidizes at lower temperatures than in a conventional combustor, producing less NOx.

Currently installed only on a few 1.4 MW combustion turbines, and commercially available for turbines rated up to 10 MW (CT-1).

Class: Emerging

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Catalytic Combustion

Source Group: Gas Turbines - Natural Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX	NOX
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	1999	1999	1999
CPT:	$920	$670	$370
Ref Yr CPT:	$1,229	$895	$494
Control Efficiency:	98.0	98.0	98.0
Min Emis:	0.0	365.0	365.0
Max Emis:	365.0	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	0.10999999940395355	0.10999999940395355	0.10999999940395355
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	1.7	1.2	0.7
Incremental CPT:	4760.0	2580.0	2200.0
Details:	Applied to small source types (3 to 26 MW), uncontrolled emissions <365 tpy.	Applied to small source types (3 to 26 MW), uncontrolled emissions >365 tpy.	Applied to large source types (~170 MW)
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	NOX	NOX	NOX
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	1999	1999	1999
CPT:	$920	$670	$370

Ref Yr CPT:	$1,229	$895	$494
Control Efficiency:	98.0	98.0	98.0
Min Emis:	0.0	365.0	365.0
Max Emis:	365.0	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	0.10999999940395355	0.10999999940395355	0.10999999940395355
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	1.7	1.2	0.7
Incremental CPT:	4760.0	2580.0	2200.0
Details:	Applied to small source types (3 to 26 MW), uncontrolled emissions <365 tpy.	Applied to small source types (3 to 26 MW), uncontrolled emissions >365 tpy.	Applied to large source types (~170 MW)
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 2

Description: Non-EGU NOx

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Annual Cost = Annual Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base
Capital Coat = Capital Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base

Variable Name	Value
Pollutant	NOX
Cost Year	1999
Capital Cost Multiplier	20668.0
Capital Cost Exponent	0.57
Annual Cost Multiplier	4254.2
Annual Cost Exponent	0.82
Incremental Capital Cost Multiplier	0.0
Incremental Capital Cost Exponent	1.0
Incremental Annual Cost Multiplier	743.22
Incremental Annual Cost Exponent	1.0
Capital Cost Base	
Annual Cost Base	
Incremental Capital Cost Base	
Incremental Annual Cost Base	54105.0

Affected SCCs:

Code	Description
50100420	Waste Disposal; Solid Waste Disposal - Government; Landfill Dump; Waste Gas Recovery: Gas Turbines
20400304	Internal Combustion Engines; Engine Testing; Turbine; Landfill Gas
20400301	Internal Combustion Engines; Engine Testing; Turbine; Natural Gas
20300809	Internal Combustion Engines; Commercial/Institutional; Landfill Gas; Turbine: Exhaust
20300801	Internal Combustion Engines; Commercial/Institutional; Landfill Gas; Turbine
20300709	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Turbine: Exhaust
20300701	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Turbine
20300209	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine: Exhaust
20300203	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine: Cogeneration
20300202	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine
20200714	Internal Combustion Engines; Industrial; Process Gas; Turbine: Exhaust
20200705	Internal Combustion Engines; Industrial; Process Gas; Refinery Gas: Turbine
20200701	Internal Combustion Engines; Industrial; Process Gas; Turbine
20200209	Internal Combustion Engines; Industrial; Natural Gas; Turbine: Exhaust
20200203	Internal Combustion Engines; Industrial; Natural Gas; Turbine: Cogeneration
20200201	Internal Combustion Engines; Industrial; Natural Gas; Turbine

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References:

- Bay Area Air Quality Management District, 2010. Preliminary Determination of Compliance. Marsh Landing Generating Station. March 2010. Available at: http://www.energy.ca.gov/sitingcases/marshlanding/documents/other/2010-03-24_Bay_Area_AQMD_PDOC.pdf
- Onsite Sycom Energy Corporation, 1999. “Cost Analysis of NOx Control Alternatives for Stationary Gas Turbines.” Prepared for U.S. Department of Energy. Environmental Programs Chicago Operations Office. November 5, 1999. Available at: https://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/gas_turbines_nox_cost_analysis.pdf

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Other information:

Summary:

Control Measure Name: Cullet Preheat; Glass Manufacturing - Container
Abbreviation: NCLPTGMCN
Description: Application: This control is the use of cullet preheat technologies to reduce NOx emissions from glass manufacturing operations.

This control is applicable to container glass manufacturing operations classified under 305010402.
Class: Emerging
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: Cullet Preheat
Source Group: Glass Manufacturing - Container
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2002	2002
CPT:	$5,000	$5,000
Ref Yr CPT:	$6,287	$6,287
Control Efficiency:	5.0	5.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.5	4.5
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2002	2002
CPT:	$5,000	$5,000
Ref Yr CPT:	$6,287	$6,287
Control Efficiency:	5.0	5.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0

Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.5	4.5
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.
- Oxygen Enriched Air Staging a Cost-effective Method For Reducing NOx Emissions. Industrial Technologies. April 2002. Available at: http://www1.eere.energy.gov/manufacturing/resources/glass/pdfs/airstaging.pdf

Other information:

ADMIN_PCT:	0%
CE_TEXT:	25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1994). Capital and annual cost information was obtained from control-specific cost data based on tons of glass produced. O&M costs were back calculated from annual costs. From these determinations, default cost per ton values were assigned along with a capital to annual cost ratio of 4.5 (Pechan, 1998). A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment lifetime of 10 years (EPA, 1994).

CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $940 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	25%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	25%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Cullet Preheat; Glass Manufacturing - Pressed
Abbreviation: NCUPHGMPD
Description: Application: This control is the use of cullet preheat technologies to reduce NOx emissions from glass manufacturing operations.

This control is applicable to pressed glass manufacturing operations classified under 305010404.
Class: Emerging
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: Cullet Preheat
Source Group: Glass Manufacturing - Pressed
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2002	2002
CPT:	$5,000	$5,000
Ref Yr CPT:	$6,287	$6,287
Control Efficiency:	5.0	5.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.5	4.5
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2002	2002
CPT:	$5,000	$5,000
Ref Yr CPT:	$6,287	$6,287
Control Efficiency:	5.0	5.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0

Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.5	4.5
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.
- Oxygen Enriched Air Staging a Cost-effective Method For Reducing NOx Emissions. Industrial Technologies. April 2002. Available at: http://www1.eere.energy.gov/manufacturing/resources/glass/pdfs/airstaging.pdf

Other information:

ADMIN_PCT:	0%
CE_TEXT:	25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1994). Capital and annual cost information is obtained from control-specific cost data based on tons of glass produced. O&M costs were back calculated from annual costs. From these determinations, default cost per ton values were assigned along with a capital to annual cost ratio of 4.5 (Pechan, 1998). A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment lifetime of 10 years (EPA, 1994).

CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $810 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	25%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	25%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Dry Low NOx Combustion; Gas Turbines - Natural Gas
Abbreviation:	NDLNCGTNG
Description:	Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. This control applies to large (83.3 MW to 161 MW) natural gas fired turbines with uncontrolled NOx emissions greater than 10 tons per year. Discussion: LNBs are designed to "stage" combustion so that two combustion
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Dry Low NOx Combustion
Source Group:	Gas Turbines - Natural Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$300	$130
Ref Yr CPT:	$401	$174
Control Efficiency:	84.0	84.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10999999940395355	0.10999999940395355
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.0	7.4
Incremental CPT:	540.0	140.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$300	$130
Ref Yr CPT:	$401	$174
Control Efficiency:	84.0	84.0

Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10999999940395355	0.10999999940395355
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.0	7.4
Incremental CPT:	540.0	140.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 2

Description: Non-EGU NOx

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Annual Cost = Annual Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base
Capital Coat = Capital Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base

Variable Name	Value
Pollutant	NOX
Cost Year	1999
Capital Cost Multiplier	2860.6
Capital Cost Exponent	1.0
Annual Cost Multiplier	584.5
Annual Cost Exponent	0.96
Incremental Capital Cost Multiplier	
Incremental Capital Cost Exponent	
Incremental Annual Cost Multiplier	
Incremental Annual Cost Exponent	
Capital Cost Base	25427.0
Annual Cost Base	
Incremental Capital Cost Base	
Incremental Annual Cost Base	

Affected SCCs:

Code	Description
50100420	Waste Disposal; Solid Waste Disposal - Government; Landfill Dump; Waste Gas Recovery: Gas Turbines
20400304	Internal Combustion Engines; Engine Testing; Turbine; Landfill Gas

20400301	Internal Combustion Engines; Engine Testing; Turbine; Natural Gas
20300809	Internal Combustion Engines; Commercial/Institutional; Landfill Gas; Turbine: Exhaust
20300801	Internal Combustion Engines; Commercial/Institutional; Landfill Gas; Turbine
20300709	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Turbine: Exhaust
20300701	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Turbine
20300209	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine: Exhaust
20300203	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine: Cogeneration
20300202	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine
20200714	Internal Combustion Engines; Industrial; Process Gas; Turbine: Exhaust
20200705	Internal Combustion Engines; Industrial; Process Gas; Refinery Gas: Turbine
20200701	Internal Combustion Engines; Industrial; Process Gas; Turbine
20200209	Internal Combustion Engines; Industrial; Natural Gas; Turbine: Exhaust
20200203	Internal Combustion Engines; Industrial; Natural Gas; Turbine: Cogeneration
20200201	Internal Combustion Engines; Industrial; Natural Gas; Turbine

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Stationary Gas Turbines," EPA,-453/R-93-007, Research Triangle Park, NC, January 1993.
- Onsite Sycom Energy Corporation, 1999. “Cost Analysis of NOx Control Alternatives for Stationary Gas Turbines.” Prepared for U.S. Department of Energy. Environmental Programs Chicago Operations Office. November 5, 1999. Available at: https://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/gas_turbines_nox_cost_analysis.pdf
- Resource Dynamics Corporation, 2001. “Assessment of Distributed Generation Technology Applications.” Prepared for Maine Public Utilities Commission. February 2001. Available at: http://www.distributed-generation.com/Library/Maine.pdf

Other information:

ADMIN_PCT: 0%

CE_TEXT:	84% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by the following (Pechan, 1998). Small source = 3.3 MW to 34.4 MW Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). Capital and annual cost information was obtained from the Alternative Control Techniques Document (EPA, 1993). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 9.1. A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 76% (Pechan, 2001). O&M Cost Components: There are no O&M costs associated with dry low NOx combustors.
COST_BASIS:	Sources are distinguished by the following (Pechan, 1998). Large source = greater than 83.3 MW and less than 161 MW Where information was available in the Alternative Control Techniques (ACT) document (EPA, 1993), capacity-based equations are used to calculate costs. A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 76% (Pechan, 2001). The following equations, based primarily on information in the Air Pollution Cost Manual (EPA, 2002), are used for large NOx sources as defined above: From Uncontrolled: Capital Cost = 71,281.1 * Capacity (MMBtu/hr)^0.505 Annual Cost = 7,826.3 * Capacity (MMBtu/hr)^0.505 From RACT Baseline: Capital Cost = 71,281.1 * Capacity (MMBtu/hr)^0.505 Annual Cost = 7,826.3 * Capacity (MMBtu/hr)^0.505 Note: All costs are in 1990 dollars. O&M Cost Components: There are no O&M costs associated with dry low NOx combustors.
CPTON_H:	$140/ton
CPTON_H:	$540/ton
CPTON_L:	$490/ton
CPTON_L:	$100/ton
CPTON_TEXT:	When capacity is available and within the applicable range of 0 to 2,000 MMBTU/hr the cost equations are used to calculate cost effectiveness. The default cost effectiveness value, used when capacity information is not available, is $100 per ton NOx reduced from uncontrolled and $140 per ton NOx reduced from RACT (1990$).
CPTON_TEXT:	The default cost effectiveness values are $490 per ton NOx reduced from uncontrolled and $540 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	84%
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%

HG_CE_T:	84%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	OXY-Firing; Glass Manufacturing - General
Abbreviation:	NDOXYFGMG
Description:	Application: This control is the use of OXY-firing in glass manufacturing furnaces to reduce NOx emissions. Oxygen enrichment refers to the substitution of oxygen for nitrogen in the combustion air used to burn the fuel in a glass furnace. Oxygen enrichment above 90 percent is sometimes called "oxy-firing." Discussion: The basic rationale for oxy-firing is improved efficiency, i.e., more of the theoretical heat of combustion is transferred to the glass melt and is not lost in the flue gas. Many other co
Class:	Emerging
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	OXY-Firing
Source Group:	Glass Manufacturing - General
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,277
Ref Yr CPT:	$5,712
Control Efficiency:	85.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,277
Ref Yr CPT:	$5,712
Control Efficiency:	85.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremememtal CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501401	Industrial Processes; Mineral Products; Glass Manufacture; Furnace/General**

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; In-Process; Bituminous Coal; Cement Kiln

Abbreviation: NDSCRBCCK

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

This control applies to bituminous coal-fired cement kilns (SCC 39000201) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Emerging

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: In-Process; Bituminous Coal; Cement Kiln

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,119
Ref Yr CPT:	$2,830
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,119
Ref Yr CPT:	$2,830
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000201	Industrial Processes; In-process Fuel Use; Bituminous Coal; Cement Kiln/Dryer (Bituminous Coal)

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; In-Process Fuel Use;Bituminous Coal; Gen

Abbreviation: NDSCRBCGN

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

This control applies to operations with general (in process) bituminous coal use and uncontrolled NOx emissions greater than 10 tons per year. These sources are classified under SCC 39000289.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Emerging

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Catalytic Reduction

Source Group: In-Process Fuel Use;Bituminous Coal; Gen

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,027

Ref Yr CPT:	$4,043
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,027
Ref Yr CPT:	$4,043
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000289	Industrial Processes; In-process Fuel Use; Bituminous Coal; General (Bituminous)

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; In-Process; Bituminous Coal; Lime Kiln
Abbreviation:	NDSCRBCLK
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control applies to bituminous coal-fired lime kilns (SCC 39000203) with uncontrolled NOx emissions greater than 10 tons per year. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Emerging
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	In-Process; Bituminous Coal; Lime Kiln
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,119
Ref Yr CPT:	$2,830

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,119
Ref Yr CPT:	$2,830
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000203	Industrial Processes; In-process Fuel Use; Bituminous Coal; Lime Kiln (Bituminous)

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; Cement Manufacturing - Dry
Abbreviation:	NDSCRCMDY
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control applies to dry-process cement manufacturing (SCC 30500606) and Natural Gas Cement Kilns (SCC 39000602) with uncontrolled NOx emissions greater than 10 tons per year. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Emerging
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Cement Manufacturing - Dry
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,636

Ref Yr CPT:	$6,192
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,636
Ref Yr CPT:	$6,192
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39009602	The SCC entry is not found in the reference.scc table
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; Cement Manufacturing - Wet

Abbreviation: NDSCRCMWT

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

This control applies to large(>1 ton NOx per OSD) wet-process cement manufacturing (SCC 30500706) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent
reacts selectively with the flue gas NOx within a specific temperature range and in the presence of
the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Emerging

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Cement Manufacturing - Wet

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,962

Ref Yr CPT:	$5,291
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,962
Ref Yr CPT:	$5,291
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500706	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Kilns

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

ADMIN_PCT:	14.09%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	18.01%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Large source = emission levels greater than 1 ton per ozone season day Efficiencies for stationary source NOx control were updated for a 2020 base year based on analysis performed by the EPA for the Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone (EPA, 2007).-á Default cost per ton was increased by 11.4% to account for a change in -áSCR efficiency from 80% to 90%.-á This cost in 1990$ was then converted to 1999$ by applying a growth factor of 1.235 (Sorrels, 2007). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in the EC/R report Tables 6-3, 6-13 and 6-14. The breakdown was obtained using the average costs for furnaces having capacities of 113 and 180 MMBTU per hour. A capacity factor of 0.913 is used in estimating the O&M cost breakdown. Operating labor: $22.12/hr Maintenance labor: $24.33/hr Fuel (natural gas): $3.42/MMBTU (ECR, 2000)
CPTON_TEXT:	The cost effectiveness values (for both small and large sources) used in AirControlNET are $3,962 per ton NOx reduced from both uncontrolled and RACT baselines (1999$).
CTRL_EFF_T:	80%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	29.09%
HG_CE_T:	90%
INSRNC_PCT:	7.05%
MNTLBR_PCT:	0.57%
MNTLBR_RT:	$24.33/hr
MNTMTL_PCT:	0.57%
NG_RT:	$3.42/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	1.42%
OPLBR_RT:	$22.12/hr
OTHR_PCT:	0%

OVRHD_PCT:	0.17%
PROPTX_PCT:	7.05%
RPLMTL_PCT:	20.3%
RULE:	Not Applicable
SPVLBR_PCT:	0.21%
STEAM_PCT:	0%
TDIR_PCT:	70.16%
TINDIR_PCT:	29.84%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Selective Catalytic Reduction; Taconite Iron Ore Processing - Induration - Coal or Gas
Abbreviation:	NDSCRFEP
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Known
Pollutant:	NOX
Equipment Life:	N/A years
Control Technology:	Selective Catalytic Reduction
Source Group:	Taconite Iron Ore Processing - Induration - Coal or Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$5,269
Ref Yr CPT:	$7,037
Control Efficiency:	90.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$5,269
Ref Yr CPT:	$7,037
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30302359	Industrial Processes; Primary Metal Production; Taconite Iron Ore Processing; Induration: Grate/Kiln, Coal-fired, Acid Pellets
30302352	Industrial Processes; Primary Metal Production; Taconite Iron Ore Processing; Induration: Grate/Kiln, Gas-fired, Flux Pellets

30302351	Industrial Processes; Primary Metal Production; Taconite Iron Ore Processing; Induration: Grate/Kiln, Gas-fired, Acid Pellets

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; Fluid Cat Cracking Units; Cracking Unit
Abbreviation:	NDSCRFFCCU
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control is applicable to fluid catalytic cracking units with uncontrolled NOx emissions greater than 10 tons per year. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Emerging
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Fluid Cat Cracking Units; Cracking Unit
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,457
Ref Yr CPT:	$4,617

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,457
Ref Yr CPT:	$4,617
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30600201	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Fluid Catalytic Cracking Unit

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; In-Process; Process Gas; Coke Oven Gas
Abbreviation:	NDSCRFPGCO
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Applies to process gas fired ICI boilers with NOx emissions greater than 10 tons per year. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Emerging
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	In-Process; Process Gas; Coke Oven Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$6,371
Ref Yr CPT:	$8,509

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$6,371
Ref Yr CPT:	$8,509
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000701	Industrial Processes; In-process Fuel Use; Process Gas; Coke Oven or Blast Furnace

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; ICI Boilers - Coal/FBC

Abbreviation: NDSCRIBCF

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.
Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).
Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.
The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.
The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).
The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

A SCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor, reactor pressure loss, and steam i.e., sootblowing (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: ICI Boilers - Coal/FBC

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	41040.93
Capital Cost Exponent No. 1	0.59
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	471911.2
O&M Cost Size Multiplier No. 1	1641.64
O&M Cost Exponent No. 1	0.59
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300216	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom (Tangential)
10200217	External Combustion Boilers; Industrial; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Bubbling Bed

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).

- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; ICI Boilers - Coal/Stoker

Abbreviation: NDSCRIBCS

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.
Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).
Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.
The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.
The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).
The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

A SCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor, reactor pressure loss, and steam i.e., sootblowing (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: ICI Boilers - Coal/Stoker

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	41040.93
Capital Cost Exponent No. 1	0.59
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	471911.2
O&M Cost Size Multiplier No. 1	1641.64
O&M Cost Exponent No. 1	0.59
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300209	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Spreader Stoker
10300207	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Overfeed Stoker
10200205	External Combustion Boilers; Industrial; Bituminous Coal; Overfeed Stoker
10200204	External Combustion Boilers; Industrial; Bituminous Coal; Spreader Stoker
10200104	External Combustion Boilers; Industrial; Anthracite Coal; Traveling Grate (Overfeed) Stoker

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis

- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; ICI Boilers - LPG
Abbreviation:	NDSCRIBLP
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001). A SCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor, reactor pressure loss, and steam i.e., sootblowing (NESCAUM 2009).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	ICI Boilers - LPG
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula:

Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	41040.93
Capital Cost Exponent No. 1	0.59
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	471911.2
O&M Cost Size Multiplier No. 1	1641.64
O&M Cost Exponent No. 1	0.59
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10201002	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Propane

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical

Support Document.

- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; ICI Boilers - Process Gas
Abbreviation:	NDSCRIBPG
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001). A SCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor, reactor pressure loss, and steam i.e., sootblowing (NESCAUM 2009).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	ICI Boilers - Process Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	41040.93
Capital Cost Exponent No. 1	0.59
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	471911.2
O&M Cost Size Multiplier No. 1	1641.64
O&M Cost Exponent No. 1	0.59
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10210079	The SCC entry is not found in the reference.scc table
10201402	External Combustion Boilers; Industrial; CO Boiler; Process Gas
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; Indust. Incinerators

Abbreviation: NDSCRIDIN

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

This control applies to industrial incinerators IC boilers with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Emerging

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Indust. Incinerators

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,109
Ref Yr CPT:	$4,152

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,109
Ref Yr CPT:	$4,152
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39990013	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Natural Gas: Incinerators
30590013	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Incinerators

30190014	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Process Gas: Incinerators
30190013	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Natural Gas: Incinerators

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; Iron & Steel Mills - Annealing

Abbreviation: NDSCRISAN

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

Applies to iron and steel annealing operations with NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Emerging

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Iron & Steel Mills - Annealing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$5,269
Ref Yr CPT:	$7,037

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$5,269
Ref Yr CPT:	$7,037
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; Nitric Acid Manufacturing

Abbreviation: NDSCRNAMF

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

Applies to nitric acid manufacturing operations with NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Emerging

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Nitric Acid Manufacturing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$812
Ref Yr CPT:	$1,084

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$812
Ref Yr CPT:	$1,084
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30101302	Industrial Processes; Chemical Manufacturing; Nitric Acid; Absorber Tail Gas (Post-1970 Facilities)
30101301	Industrial Processes; Chemical Manufacturing; Nitric Acid; Absorber Tail Gas (Pre-1970 Facilities)

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; Pulp and Paper - Natural Gas - Incinerators
Abbreviation:	NDSCRPPNG
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Emerging
Pollutant:	NOX
Equipment Life:	N/A years
Control Technology:	Selective Catalytic Reduction
Source Group:	Pulp and Paper - Natural Gas - Incinerators
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,109
Ref Yr CPT:	$4,152
Control Efficiency:	90.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,109
Ref Yr CPT:	$4,152
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30790013	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Natural Gas: Incinerators

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; Solid Waste Disp;Gov;Other Incin;Sludge
Abbreviation:	NDSCRSWIN
Description:	Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). This control applies to solid waste disposal operations (classified under SCC 50100506) with uncontrolled NOx emissions greater than 10 tons per year. Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002). Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications. The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: Reaction temperature range; Residence time available in the optimum temperature range; Degree of mixing between the injected reagent and the combustion gases Uncontrolled NOx concentration level; Molar ratio of injected reagent to uncontrolled NOx ; and Ammonia slip.
Class:	Emerging
Pollutant:	NOX
Equipment Life:	20.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Solid Waste Disp;Gov;Other Incin;Sludge
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,109
Ref Yr CPT:	$4,152
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,109
Ref Yr CPT:	$4,152
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
50300506	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Sludge
50300104	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Conical Design (Tee Pee) Municipal Refuse
50300102	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Single Chamber
50300101	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Multiple Chamber
50200506	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sludge

50100506	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Sludge
50100102	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Mass Burn: Single Chamber
50100101	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Starved Air: Multiple Chamber

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; In-Process Fuel Use; Natural Gas; Gen

Abbreviation: NDSCRUNGGN

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

This control is applicable to operations with in-process natural gas usage and uncontrolled NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Emerging

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: In-Process Fuel Use; Natural Gas; Gen

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,953
Ref Yr CPT:	$6,615

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,953
Ref Yr CPT:	$6,615
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000689	Industrial Processes; In-process Fuel Use; Natural Gas; General

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; In-Process; Process Gas; Coke Oven Gas2
Abbreviation:	NDSCRUPGCO
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control is applicable to operations with in-process process gas usage from Coke Oven Gas. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Emerging
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	In-Process; Process Gas; Coke Oven Gas2
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,953
Ref Yr CPT:	$6,615

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,953
Ref Yr CPT:	$6,615
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000789	Industrial Processes; In-process Fuel Use; Process Gas; Coke Oven Gas

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; In-Process Fuel Use; Residual Oil; Gen
Abbreviation:	NDSCRUROGN
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control is applicable to operations with in-process residual oil usage and uncontrolled NOx emissions greater than 10 tons per year. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Emerging
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	In-Process Fuel Use; Residual Oil; Gen
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,458
Ref Yr CPT:	$5,954

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,458
Ref Yr CPT:	$5,954
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000489	Industrial Processes; In-process Fuel Use; Residual Oil; General

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.

Other information:

Summary:

Control Measure Name: Electric Boost; Glass Manufacturing - Container

Abbreviation: NELBOGMCN

Description: Application: This control is the use of electric boost technologies to reduce NOx emissions from glass manufacturing operations.

This control applies to container glass manufacturing operations classified under SCC 30501402.

Discussion: The 250 tons per day plant is assumed to be representative of container glass plants (Pechan, 1998).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Electric Boost

Source Group: Glass Manufacturing - Container

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$7,150	$7,150
Ref Yr CPT:	$11,450	$11,450
Control Efficiency:	10.0	10.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$7,150	$7,150
Ref Yr CPT:	$11,450	$11,450
Control Efficiency:	10.0	10.0

Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incrememental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	10% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1994). Capital, and annual cost information that was obtained from control-specific cost data based on tons of glass produced. O&M costs were back calculated from annual costs. From these determinations, default cost per ton values were assigned along with a capital to annual cost ratio of 4.5. A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment lifetime of 10 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $7,150 per ton NOx reduced from both uncontrolled and RACT (1990$).

CTRL_EFF_T:	10%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	10%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Electric Boost; Glass Manufacturing - Flat
Abbreviation:	NELBOGMFT
Description:	Application: This control is the use of electric boost technologies to reduce NOx emissions from glass manufacturing operations. This control applies to flat glass manufacturing operations classified under SCC 30501403. Discussion: The 500 tons per day plant is assumed to be representative of flat glass plants (Pechan, 1998).
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	Electric Boost
Source Group:	Glass Manufacturing - Flat
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,320	$2,320
Ref Yr CPT:	$3,715	$3,715
Control Efficiency:	10.0	10.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,320	$2,320
Ref Yr CPT:	$3,715	$3,715
Control Efficiency:	10.0	10.0

Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	10% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1994). Capital and annual cost information that was obtained from control-specific cost data based on tons of glass produced. O&M costs were back calculated from annual costs. From these determinations, default cost per ton values were assigned along with a capital to annual cost ratio of 4.5. A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment lifetime of 10 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $2,320 per ton NOx reduced from both uncontrolled and RACT (1990$).

CTRL_EFF_T:	10%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	10%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Electric Boost; Glass Manufacturing - General
Abbreviation: NELBOGMGN
Description: Application: This control is the use of electric boost technologies to reduce NOx emissions from glass manufacturing operations.

This control applies to general glass manufacturing operations classified under SCC 30501401.
Class: Known
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: Electric Boost
Source Group: Glass Manufacturing - Container
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2002	2002
CPT:	$7,100	$7,100
Ref Yr CPT:	$8,928	$8,928
Control Efficiency:	30.0	30.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2002	2002
CPT:	$7,100	$7,100
Ref Yr CPT:	$8,928	$8,928
Control Efficiency:	30.0	30.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0

Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501401	Industrial Processes; Mineral Products; Glass Manufacture; Furnace/General**

References:

- Oxygen Enriched Air Staging a Cost-effective Method For Reducing NOx Emissions. Industrial Technologies. April 2002. Available at: http://www1.eere.energy.gov/manufacturing/resources/glass/pdfs/airstaging.pdf

Other information:

Summary:

Control Measure Name: Electric Boost; Glass Manufacturing - Pressed
Abbreviation: NELBOGMPD
Description: Application: This control is the use of electric boost technologies to reduce NOx emissions from glass manufacturing operations.

This control applies to pressed glass manufacturing operations classified under SCC 30501403.

Discussion: The 50 tons per day plant is assumed to be representative of pressed glass plants (Pechan, 1998).
Class: Known
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: Electric Boost
Source Group: Glass Manufacturing - Pressed
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$8,760	$2,320
Ref Yr CPT:	$14,028	$3,715
Control Efficiency:	10.0	10.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	8760.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$8,760	$2,320
Ref Yr CPT:	$14,028	$3,715
Control Efficiency:	10.0	10.0

Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	8760.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	10% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1994). Capital, and annual cost information that was obtained from control-specific cost data based on tons of glass produced. O&M costs were back calculated from annual costs. From these determinations, default cost per ton values were assigned along with a capital to annual cost ratio of 4.5. A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment lifetime of 10 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $8,760 per ton NOx reduced from both uncontrolled and RACT (1990$).

CTRL_EFF_T:	10%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	10%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: EMx and Dry Low NOx Combustion; Gas Turbines - Natural Gas

Abbreviation: NEMXDGTNG

Description: Application: This control is the use of EMx in combination with dry low NOx combustion. EMx is a post-combustion catalytic oxidation and absorption technology that uses a two- stage catalyst/absorber system for the control of NOx as well as CO, VOC, and optionally SOx. A coated catalyst oxidizes NO to NO2, CO to CO2, and VOC to CO2 and water. The NO2 is then absorbed onto the catalyst surface where it is chemically converted to and stored as potassium nitrates and nitrites. A proprietary regeneration gas is periodically passed through the catalyst to desorb the NO2 from the catalyst and reduce it to elemental nitrogen (N2). EMx has been successfully demonstrated on several small combustion turbine projects up to 45 MW. The manufacturer has claimed that EMx can be effectively scaled up to larger turbines (CT-1).

Cost estimates for DLN combustion in 2008 dollars are not available. Thus, the total system cost in this analysis in 2008 dollars was developed from 1999 cost estimates for DLN combustion that were escalated to 2008 dollars and added to the available 2008 estimate for the EMx system.

Class: Emerging

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: EMx and Dry Low NOx Combustion

Source Group: Gas Turbines - Natural Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,040
Ref Yr CPT:	$2,198
Control Efficiency:	99.0
Min Emis:	365.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10999999940395355
Discount Rate:	N/A
Cap Ann Ratio:	4.1
Incremental CPT:	12370.0
Details:	Applied to large source types (50 to 180 MW); DLN costs estimated in 1999 dollars were escalated to 2008 dollars using the CEPCI, except parts and repair costs were assumed to be the same in 2008 as in 1999.
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,040
Ref Yr CPT:	$2,198
Control Efficiency:	99.0
Min Emis:	365.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10999999940395355
Discount Rate:	N/A
Cap Ann Ratio:	4.1
Incremental CPT:	12370.0
Details:	Applied to large source types (50 to 180 MW); DLN costs estimated in 1999 dollars were escalated to 2008 dollars using the CEPCI, except parts and repair costs were assumed to be the same in 2008 as in 1999.
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 2

Description: Non-EGU NOx

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Annual Cost = Annual Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base
Capital Coat = Capital Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Multiplier	126892.0
Capital Cost Exponent	0.74
Annual Cost Multiplier	20041.0
Annual Cost Exponent	0.8
Incremental Capital Cost Multiplier	156349.0
Incremental Capital Cost Exponent	0.68
Incremental Annual Cost Multiplier	17252.0
Incremental Annual Cost Exponent	0.8
Capital Cost Base	

Annual Cost Base	
Incremental Capital Cost Base	
Incremental Annual Cost Base	

Affected SCCs:

Code	Description
50100420	Waste Disposal; Solid Waste Disposal - Government; Landfill Dump; Waste Gas Recovery: Gas Turbines
20400304	Internal Combustion Engines; Engine Testing; Turbine; Landfill Gas
20400301	Internal Combustion Engines; Engine Testing; Turbine; Natural Gas
20300809	Internal Combustion Engines; Commercial/Institutional; Landfill Gas; Turbine: Exhaust
20300801	Internal Combustion Engines; Commercial/Institutional; Landfill Gas; Turbine
20300709	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Turbine: Exhaust
20300701	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Turbine
20300209	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine: Exhaust
20300203	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine: Cogeneration
20300202	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine
20200714	Internal Combustion Engines; Industrial; Process Gas; Turbine: Exhaust
20200705	Internal Combustion Engines; Industrial; Process Gas; Refinery Gas: Turbine
20200701	Internal Combustion Engines; Industrial; Process Gas; Turbine
20200209	Internal Combustion Engines; Industrial; Natural Gas; Turbine: Exhaust
20200203	Internal Combustion Engines; Industrial; Natural Gas; Turbine: Cogeneration
20200201	Internal Combustion Engines; Industrial; Natural Gas; Turbine

References:

- Bay Area Air Quality Management District, 2010. Preliminary Determination of Compliance. Marsh Landing Generating Station. March 2010. Available at: http://www.energy.ca.gov/sitingcases/marshlanding/documents/other/2010-03-24_Bay_Area_AQMD_PDOC.pdf
- Onsite Sycom Energy Corporation, 1999. “Cost Analysis of NOx Control Alternatives for Stationary Gas Turbines.” Prepared for U.S. Department of Energy. Environmental Programs Chicago Operations Office. November 5, 1999. Available at: https://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/gas_turbines_nox_cost_analysis.pdf
- EmeraChem Power, 2008. Attachment in email from Jeff Valmus, EmeraChem Power, to Weyman Lee, BAAQMD. Request for EMx Cost Information. September 8, 2008. Available at: http://www.baaqmd.gov/~/media/Files/Engineering/Public%20Notices/2010/18404/Footnotes/EMx%20BACT%20economic%20analysis%20f inal09072008.ashx

- CH2MHill, 2002. Walnut Energy Center Application for Certification. Prepared for California Energy Commission. November 2002. Available at: www.energy.ca.gov/sitingcases/turlock/documents/applicant_files/volume_2/App_08.01E_Eval_Control.pdf.
- CARB, 2004. California Environmental Protection Agency. Air Resources Board. Report to the Legislature. Gas-Fired Power Plant NOx Emission Controls and Related Environmental Impacts. Stationary Source Division. May 2004. Available at: http://www.arb.ca.gov/research/apr/reports/l2069.pdf

Other information:

Summary:

Control Measure Name: EMx and Water Injection; Gas Turbines - Natural Gas
Abbreviation: NEMXWGTNG
Description: Application: This control is the use of EMx in combination with water injection.

Cost estimates for water injection in 2008 dollars are not available. Thus, the total system cost in this analysis in 2008 dollars was developed from 1999 cost estimates for water injection that were escalated to 2008 dollars and added to the available 2008 estimate for the EMx system.

Class: Emerging
Pollutant: NOX
Equipment Life: 15.0 years
Control Technology: EMx and Water Injection
Source Group: Gas Turbines - Natural Gas
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,960
Ref Yr CPT:	$3,189
Control Efficiency:	99.0
Min Emis:	365.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10999999940395355
Discount Rate:	N/A
Cap Ann Ratio:	2.9
Incremental CPT:	7120.0
Details:	Applied to large source types (50 to 180 MW); WI costs estimated using the same procedure as for NSCRWGTNG applied to large sources.
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,960
Ref Yr CPT:	$3,189
Control Efficiency:	99.0

Min Emis:	365.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10999999940395355
Discount Rate:	N/A
Cap Ann Ratio:	2.9
Incremental CPT:	7120.0
Details:	Applied to large source types (50 to 180 MW); WI costs estimated using the same procedure as for NSCRWGTNG applied to large sources.
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 2

Description: Non-EGU NOx

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Annual Cost = Annual Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base
Capital Coat = Capital Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Multiplier	196928.0
Capital Cost Exponent	0.68
Annual Cost Multiplier	18747.0
Annual Cost Exponent	0.86
Incremental Capital Cost Multiplier	156349.0
Incremental Capital Cost Exponent	0.68
Incremental Annual Cost Multiplier	17252.0
Incremental Annual Cost Exponent	0.8
Capital Cost Base	
Annual Cost Base	
Incremental Capital Cost Base	
Incremental Annual Cost Base	

Affected SCCs:

Code	Description
50100420	Waste Disposal; Solid Waste Disposal - Government; Landfill Dump; Waste Gas Recovery: Gas Turbines

20400304	Internal Combustion Engines; Engine Testing; Turbine; Landfill Gas
20400301	Internal Combustion Engines; Engine Testing; Turbine; Natural Gas
20300809	Internal Combustion Engines; Commercial/Institutional; Landfill Gas; Turbine: Exhaust
20300801	Internal Combustion Engines; Commercial/Institutional; Landfill Gas; Turbine
20300709	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Turbine: Exhaust
20300701	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Turbine
20300209	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine: Exhaust
20300203	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine: Cogeneration
20300202	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine
20200714	Internal Combustion Engines; Industrial; Process Gas; Turbine: Exhaust
20200705	Internal Combustion Engines; Industrial; Process Gas; Refinery Gas: Turbine
20200701	Internal Combustion Engines; Industrial; Process Gas; Turbine
20200209	Internal Combustion Engines; Industrial; Natural Gas; Turbine: Exhaust
20200203	Internal Combustion Engines; Industrial; Natural Gas; Turbine: Cogeneration
20200201	Internal Combustion Engines; Industrial; Natural Gas; Turbine

References:

- Bay Area Air Quality Management District, 2010. Preliminary Determination of Compliance. Marsh Landing Generating Station. March 2010. Available at: http://www.energy.ca.gov/sitingcases/marshlanding/documents/other/2010-03-24_Bay_Area_AQMD_PDOC.pdf
- EmeraChem Power, 2008. Attachment in email from Jeff Valmus, EmeraChem Power, to Weyman Lee, BAAQMD. Request for EMx Cost Information. September 8, 2008. Available at: http://www.baaqmd.gov/~/media/Files/Engineering/Public%20Notices/2010/18404/Footnotes/EMx%20BACT%20economic%20analysis%20f inal09072008.ashx

Other information:

Summary:

Control Measure Name: Seasonal Ban (Ozone Season Daily Only) (base year = 1996);Agricultural Burning

Abbreviation: NEPABURN96

Description: Application: An ozone season ban of burning is a ban of burning on an ozone season day where ozone exceedances are predicted. Ozone season daily ban of agricultural burning to reduce NOx emissions during the ban.

This control is applicable to field burning where the entire field would be set on fire, and can be applied to all crop types. These sources are classified under 2801500000.

Discussion: Costs may be incurred if personnel scheduled to participate in the agricultural burning cannot be used elsewhere or if fire personnel or other professionals have been scheduled to participate.

Assuming full compliance with the regulation, ozone season daily emission reductions from such a regulation would be 100 percent. However, annual emission reductions would not be expected, because there would likely be a shift in the timing of the emissions, not a reduction in the total amount of annual NOx emitted. A compliance rate of 80 percent is used in estimating daily reductions (Pechan, 1997).

Class: Known

Pollutant: NOX

Equipment Life: N/A years

Control Technology: Seasonal Ban (Ozone Season Daily Only)

Source Group: Agricultural Burning

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	100.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	80.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	new 9/24/99 - Apply Only to OSD Emissions (seasonal shift; ann emis remain same)
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	

Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	100.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	80.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	new 9/24/99 - Apply Only to OSD Emissions (seasonal shift; ann emis remain same)
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2801500000	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Unspecified crop type and Burn Method
2801500111	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Alfalfa : Headfire Burning
2801500120	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Asparagus: Burning Techniques Not Significant
2801500141	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Bean (red): Headfire Burning
2801500150	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Corn: Burning Techniques Not Important
2801500170	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Grasses: Burning Techniques Not Important
2801500182	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Hay (wild): Backfire Burning
2801500192	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Oats: Backfire Burning
2801500202	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Pea: Backfire Burning
2801500220	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Rice: Burning Techniques Not Significant

2801500240	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Sorghum: Burning Techniques Not Significant
2801500261	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Wheat: Headfire Burning
2801500300	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop Unspecified
2801500320	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Apple
2801500340	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Avocado
2801500360	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Citrus (orange, lemon)
2801500380	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Fig
2801500400	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Olive
2801500420	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Pear
2801500440	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Walnut
2801500500	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Vine Crop Unspecified
2801500610	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Forest Residues: Species are Hemlock, Douglas fir, Cedar
2801501000	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Unspecified crop types
2801501130	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Barley
2801501260	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Wheat
2801502000	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Unspecified crop types
2801502130	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Barley
2801502260	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Wheat
2801500100	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crops Unspecified
2801500112	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Alfalfa: Backfire Burning
2801500130	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Barley: Burning Techniques Not Significant
2801500142	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Bean (red): Backfire Burning
2801500160	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Cotton: Burning Techniques Not Important
2801500181	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Hay (wild): Headfire Burning
2801500191	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Oats: Headfire Burning

2801500201	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Pea: Headfire Burning
2801500210	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Pineapple: Burning Techniques Not Significant
2801500230	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Safflower: Burning Techniques Not Significant
2801500250	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Sugar Cane: Burning Techniques Not Significant
2801500262	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Wheat: Backfire Burning
2801500310	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Almond
2801500330	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Apricot
2801500350	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Cherry
2801500370	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Date palm
2801500390	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Nectarine
2801500410	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Peach
2801500430	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Prune
2801500450	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Filbert (Hazelnut)
2801500600	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Forest Residues Unspecified (see also 28-10-015-000)
2801500620	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Forest Residues: Species is Ponderosa Pine (see also 28-10-015-000)
2801501105	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Cereal Grains, Total
2801501170	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Grass
2801501270	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Mint
2801502105	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Cereal Grains, Total
2801502170	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Grass
2801502270	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Mint

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf

- Pechan, 1997: E.H. Pechan & Associates, "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for U.S. Environmental Protection Agency, July 1997.

Other information:

Summary:

Control Measure Name: Episodic Ban (Daily Only) (base year = 1996);Open Burning

Abbreviation: NEPOBURN96

Description: Application: This is a generic control measure that would ban open burning on days where ozone exceedances were predicted, reducing NOx emissions on those days. This measure would not reduce the annual emissions.

Discussion: Generally, the relatively low temperatures associated with open burning tend to suppress NOx emissions. Because of the relatively low level of NOx emissions expected to result from open burning, little attention has been paid to quantifying or controlling the NOx emissions from this source. However, some jurisdictions control open burning by limiting the types of material that can be burned, or, based on ambient conditions limiting the days on which materials can be burned.

Assuming full compliance with the regulation, daily NOx emission reductions from such a regulation would be 100% (Pechan, 1996). However, annual emission reductions would not be expected because there would likely be a shift in the timing of emissions, not a reduction in the total amount of annual NOx emitted.

Class: Known

Pollutant: NOX

Equipment Life: N/A years

Control Technology: Episodic Ban (Daily Only)

Source Group: Open Burning

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	100.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	80.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	3/5/97 - Added 100% control to all years
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A

Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	100.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	80.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	3/5/97 - Added 100% control to all years
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2610040400	Waste Disposal, Treatment, and Recovery; Open Burning; Municipal (collected from residences, parks,other for central burn); Yard Waste - Total (includes Leaves, Weeds, and Brush)
2610030000	Waste Disposal, Treatment, and Recovery; Open Burning; Residential; Household Waste (use 26-10-000-xxx for Yard Wastes)
2610020000	Waste Disposal, Treatment, and Recovery; Open Burning; Commercial/Institutional; Total
2610010000	Waste Disposal, Treatment, and Recovery; Open Burning; Industrial; Total
2610000500	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)
2610000400	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Yard Waste - Brush Species Unspecified
2610000320	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Weed Species is Tales (wild reeds)
2610000310	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Weed Species is Russian thistle (tumbleweed)
2610000300	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Yard Waste - Weed Species Unspecified (incl Grass)
2610000270	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Sugar Maple
2610000260	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Red Oak
2610000250	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Tulip

2610000240	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is California Sycamore
2610000230	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is American Sycamore
2610000220	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Silver Maple
2610000210	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Magnolia
2610000200	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Black Locust
2610000190	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Sweet Gum
2610000180	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Eucalyptus
2610000170	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is American Elm
2610000160	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Cottonwood
2610000150	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Horse Chestnut
2610000140	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Catalpa
2610000130	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is White Ash
2610000120	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Modesto Ash
2610000110	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Black Ash
2610000100	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Yard Waste - Leaf Species Unspecified
2610000000	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Total

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1997: E.H. Pechan & Associates, "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for U.S. Environmental Protection Agency, July 1997.
- Pechan, 1996: E.H. Pechan & Associates, "The Emission Reduction and Cost Analysis Model for NOx (ECRAM-NOx)," Revised Documentation, prepared for U.S. Environmental Protection Agency, Ozone Policy and Strategies Group, Research Triangle Park, NC, September 1996.

Other information:

Summary:

Control Measure Name: Extended Absorption; Adipic Acid Manufacturing

Abbreviation: NEXABADMF

Description: Application: This control is the use of extended absorption technologies to reduce NOx emissions.

This control applies to Adipic acid manufacturing operations classified under SCC 30100101.

Discussion: Extended absorption reduces NOx by increasing the efficiency of absorption by installing a single large tower, extending the height of existing absorption tower, or adding a second tower in series with an existing tower. As an add-on control, it is typically one of the latter two options as new plants are generally designed with a single large absorption tower as part of new plant design.

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Extended Absorption

Source Group: Adipic Acid Manufacturing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$90	$90
Ref Yr CPT:	$144	$144
Control Efficiency:	86.0	86.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.7	6.7
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$90	$90
Ref Yr CPT:	$144	$144

Control Efficiency:	86.0	86.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.7	6.7
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30100101	Industrial Processes; Chemical Manufacturing; Adipic Acid; General

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1991: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- Nitric and Adipic Acid Manufacturing Plants," EPA-450/3-91-026, Research Triangle Park, NC, January 1991.

Other information:

Summary:

Control Measure Name: Extended Absorption; Nitric Acid Manufacturing
Abbreviation: NEXABNAMF
Description: Application: This control is the use of extended absorption technologies to reduce NOx emissions.

This control applies to nitric acid manufacturing operations classified under SCCs 30101301, 30101302.

Discussion: Extended absorption reduces NOx by increasing the efficiency of absorption by installing a single large tower, extending the height of existing absorption tower, or adding a second tower in series with an existing tower. As an add-on control, it is typically one of the latter two options as new plants are generally designed with a single large absorption tower as part of new plant design.
Class: Known
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: Extended Absorption
Source Group: Nitric Acid Manufacturing
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$480	$480
Ref Yr CPT:	$769	$769
Control Efficiency:	95.0	95.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	8.1	8.1
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$480	$480
Ref Yr CPT:	$769	$769

Control Efficiency:	95.0	95.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	8.1	8.1
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30101302	Industrial Processes; Chemical Manufacturing; Nitric Acid; Absorber Tail Gas (Post-1970 Facilities)
30101301	Industrial Processes; Chemical Manufacturing; Nitric Acid; Absorber Tail Gas (Pre-1970 Facilities)

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1991: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- Nitric and Adipic Acid Manufacturing Plants," EPA-450/3-91-026, Research Triangle Park, NC, January 1991.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1991). Capital and annual cost information was obtained from control-specific cost data, allowing for the back calculation of operating and maintenance costs. From these determinations, default cost per ton values were assigned (Pechan, 1998). A capital cost to annual cost ratio of 8.1 was developed to estimate default capital and operating and maintenance costs. A discount rate of 10% was assumed for all sources. The equipment life was assumed to be 10 years. O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Tables 6-1 and 6-2 of the Nitric and Adipic Acid Manufacturing Plant ACT document. The breakdown was obtained using O&M costs for a 500 ton per day plant. A capacity factor of 0.5 is used in estimating the O&M cost breakdown. Operating labor: $22.00 per man-hr Operating labor GÇô supervision: 20% of operating labor Maintenance materials and labor: 4% of capital cost Electricity: $0.06 per kw-hr Water: $0.74 per 1000 gallon
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $480 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	95%
ELEC_PCT:	33.71%
ELEC_RT:	$0.06/kWh
FUEL_PCT:	0%
HG_CE_T:	95%
INSRNC_PCT:	11.92%
MNTLBR_PCT:	11.92%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	13.04%
OPLBR_RT:	$22/hr
OTHR_PCT:	0%
OVRHD_PCT:	16.92%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	2.61%
STEAM_PCT:	0%
TDIR_PCT:	71.16%
TINDIR_PCT:	28.84%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Ignition Retard; IC Engines - Gas, Diesel, LPG
Abbreviation: NIRICGD
Description: Application: This control is the use of ignition retard technologies to reduce NOx emissions.

This applies to small (<1 ton NOx per OSD) gas, diesel and LPG IC engines with uncontrolled NOx emissions greater than 10 tons per year.
Class: Known
Pollutant: NOX
Equipment Life: 15.0 years
Control Technology: Ignition Retard
Source Group: IC Engines - Gas/ Diesel/ LPG
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$770	$490
Ref Yr CPT:	$1,233	$785
Control Efficiency:	25.0	25.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	1.1	0.6
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$770	$490
Ref Yr CPT:	$1,233	$785
Control Efficiency:	25.0	25.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A

Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	1.1	0.6
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
20400409	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Liquified Petroleum Gas (LPG)
20400406	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Kerosene/Naphtha (Jet Fuel)
20400402	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Diesel/Kerosene
20400401	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Gasoline
20301001	Internal Combustion Engines; Commercial/Institutional; Liquified Petroleum Gas (LPG); Propane: Reciprocating
20300301	Internal Combustion Engines; Commercial/Institutional; Gasoline; Reciprocating
20201707	Internal Combustion Engines; Industrial; Gasoline; Reciprocating: Exhaust
20201702	Internal Combustion Engines; Industrial; Gasoline; Reciprocating Engine
20201607	Internal Combustion Engines; Industrial; Methanol; Reciprocating: Exhaust
20201602	Internal Combustion Engines; Industrial; Methanol; Reciprocating Engine
20201012	Internal Combustion Engines; Industrial; Liquified Petroleum Gas (LPG); Reciprocating Engine
20201002	Internal Combustion Engines; Industrial; Liquified Petroleum Gas (LPG); Butane: Reciprocating
20201001	Internal Combustion Engines; Industrial; Liquified Petroleum Gas (LPG); Propane: Reciprocating
20200902	Internal Combustion Engines; Industrial; Kerosene/Naphtha (Jet Fuel); Reciprocating
20200407	Internal Combustion Engines; Industrial; Large Bore Engine; Exhaust
20200405	Internal Combustion Engines; Industrial; Large Bore Engine; Crankcase Blowby
20200403	Internal Combustion Engines; Industrial; Large Bore Engine; Cogeneration: Dual Fuel
20200402	Internal Combustion Engines; Industrial; Large Bore Engine; Dual Fuel (Oil/Gas)
20200401	Internal Combustion Engines; Industrial; Large Bore Engine; Diesel

References:

- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Stationary Reciprocating Internal Combustion Engines," EPA,-453/R-93-032, Research Triangle Park, NC, July 1993.
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power (Pechan, 1998). Engines less than 4,000 horsepower were considered small engines. Capital and annual cost information was obtained from model engine data in the Alternative Control Techniques (ACT) document (EPA, 1993). A capital cost to annual cost ratio of 1.1 was developed to estimate default capital and operating and maintenance costs. From these determinations, default cost effectiveness values were assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 25% (Pechan, 2001).
CPTON_TEXT:	The default cost effectiveness value is $770 per ton NOx reduced from both uncontrolled RACT baselines (1990$).
CTRL_EFF_T:	25%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	25%
INSRNC_PCT:	0%
MNTLBR_PCT:	3.2%
MNTLBR_RT:	$26.23/hr
MNTMTL_PCT:	0%
NG_RT:	$4.13/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	86.54%
OVRHD_PCT:	0%

PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	4%
UTIL_PCT:	6.24%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Ignition Retard; Internal Combustion Engines - Gas
Abbreviation: NIRICGS
Description: Application: This control is the use of ignition retard technologies to reduce NOx emissions.

This applies to small (<4,000 HP) gasoline powered IC engines with uncontrolled NOx emissions greater than 10 tons per year.
Class: Known
Pollutant: NOX
Equipment Life: 15.0 years
Control Technology: Ignition Retard
Source Group: Internal Combustion Engines - Gas
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$550	$1,020
Ref Yr CPT:	$881	$1,633
Control Efficiency:	20.0	20.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	0.7	1.2
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$550	$1,020
Ref Yr CPT:	$881	$1,633
Control Efficiency:	20.0	20.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0

Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	0.7	1.2
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2310021351	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Lateral Compressors 4 Cycle Rich Burn
2310021302	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Rich Burn Compressor Engines 50 To 499 HP
2310021301	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Rich Burn Compressor Engines <50 HP
2310021251	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Lateral Compressors 4 Cycle Lean Burn
2310021202	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Lean Burn Compressor Engines 50 To 499 HP
2310021102	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 2Cycle Lean Burn Compressor Engines 50 To 499 HP
20400404	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Process Gas
20300802	Internal Combustion Engines; Commercial/Institutional; Landfill Gas; Reciprocating
20300707	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Reciprocating: Exhaust
20300702	Internal Combustion Engines; Commercial/Institutional; Digester Gas; Reciprocating: POTW Digester Gas
20300204	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Reciprocating: Cogeneration
20300201	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Reciprocating
20200712	Internal Combustion Engines; Industrial; Process Gas; Reciprocating: Exhaust
20200702	Internal Combustion Engines; Industrial; Process Gas; Reciprocating Engine
20200256	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Clean Burn
20200255	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Clean Burn
20200254	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Lean Burn
20200253	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Rich Burn
20200252	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Lean Burn

20200204	Internal Combustion Engines; Industrial; Natural Gas; Reciprocating: Cogeneration
20200202	Internal Combustion Engines; Industrial; Natural Gas; Reciprocating
20100205	Internal Combustion Engines; Electric Generation; Natural Gas; Reciprocating: Crankcase Blowby
20100202	Internal Combustion Engines; Electric Generation; Natural Gas; Reciprocating

References:

- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Stationary Reciprocating Internal Combustion Engines," EPA,-453/R-93-032, Research Triangle Park, NC, July 1993.
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	20% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power (Pechan, 1998). Engines less than 4,000 horsepower were considered small engines. Capital and annual cost information was obtained from model engine data in the Alternative Control Techniques (ACT) document (EPA, 1993). A capital cost to annual cost ratio of 1.2 was developed to estimate default capital and operating and maintenance costs. From these determinations, default cost effectiveness values were assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 25% (Pechan, 2001).
COST_BASIS:	Sources are distinguished by power (Pechan, 1998). Engines greater than 4,000 horsepower were considered large engines. Capital and annual cost information was obtained from model engine data in the Alternative Control Techniques (ACT) document (EPA, 1993). A capital cost to annual cost ratio of 0.7 was developed to estimate default capital and operating and maintenance costs. From these determinations, default cost effectiveness values were assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 25% (Pechan, 2001).
CPTON_TEXT:	The default cost effectiveness value is $550 per ton NOx reduced from both uncontrolled RACT baselines (1990$).
CPTON_TEXT:	The default cost effectiveness value is $1,020 per ton NOx reduced from both uncontrolled RACT baselines (1990$).
CTRL_EFF_T:	20%

ELEC_PCT:	0%
ELEC_RT:	$0.06/kWh
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	20%
INSRNC_PCT:	0%
MNTLBR_PCT:	3.2%
MNTLBR_PCT:	30.83%
MNTLBR_RT:	$26.23/hr
MNTMTL_PCT:	0%
NG_RT:	$4.13/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	7.02%
OTHR_PCT:	86.54%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	4%
TINDIR_PCT:	70.46%
UTIL_PCT:	5.74%
UTIL_PCT:	6.24%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Ignition Retard; Internal Combustion Engines - Oil
Abbreviation:	NIRICOL
Description:	Application: This control is the use of ignition retard technologies to reduce NOx emissions. This applies to small (<4,000 HP) oil IC engines with uncontrolled NOx emissions greater than 10 tons per year.
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Ignition Retard
Source Group:	Internal Combustion Engines - Oil
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$770	$490
Ref Yr CPT:	$1,233	$785
Control Efficiency:	25.0	25.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	1.1	0.6
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$770	$490
Ref Yr CPT:	$1,233	$785
Control Efficiency:	25.0	25.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A

Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	1.1	0.6
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
20400402	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Diesel/Kerosene
20300107	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating: Exhaust
20300105	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating: Crankcase Blowby
20300101	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating
20200501	Internal Combustion Engines; Industrial; Residual/Crude Oil; Reciprocating
20200107	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Exhaust
20200104	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Cogeneration
20200102	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating
20100107	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating: Exhaust
20100105	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating: Crankcase Blowby
20100102	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating

References:

- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Stationary Reciprocating Internal Combustion Engines," EPA,-453/R-93-032, Research Triangle Park, NC, July 1993.
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power (Pechan, 1998). Engines less than 4,000 horsepower were considered small engines. Capital and annual cost information was obtained from model engine data in the Alternative Control Techniques (ACT) document (EPA, 1993). A capital cost to annual cost ratio of 1.1 was developed to estimate default capital and operating and maintenance costs. From these determinations, default cost effectiveness values were assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 25% (Pechan, 2001).
CPTON_TEXT:	The default cost effectiveness value is $770 per ton NOx reduced from both uncontrolled RACT baselines (1990$).
CTRL_EFF_T:	25%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	25%
INSRNC_PCT:	0%
MNTLBR_PCT:	3.2%
MNTLBR_RT:	$26.23/hr
MNTMTL_PCT:	0%
NG_RT:	$4.13/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	86.54%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	4%
UTIL_PCT:	6.24%

WSTDSP_PCT:	0%

Summary:

Control Measure Name: Ignition Retard; Reciprocating IC Engines - Oil

Abbreviation: NIRRICOIL

Description: Application: This control is the use of ignition retard technologies to reduce NOx emissions.

This applies to small (<4,000 HP) oil IC engines with uncontrolled NOx emissions greater than 10 tons per year.

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Ignition Retard

Source Group: Reciprocating IC Engines - Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$770
Ref Yr CPT:	$1,028
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	1.1
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$770
Ref Yr CPT:	$1,028
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	1.1
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
20400499	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Other Not Classified
20400408	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Residual Oil/Crude Oil
20400403	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Distillate Oil
20400402	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Diesel/Kerosene
20400400	Internal Combustion Engines;Engine Testing;Reciprocating Engine;undefined
20300101	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating
20200501	Internal Combustion Engines; Industrial; Residual/Crude Oil; Reciprocating
20200104	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Cogeneration
20200102	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating
20100102	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating

References:

- Pechan, 2006: E.H. Pechan and Associates, Inc., "AirControlNET Control Measure Documentation Report", May 2006.

Other information:

Summary:

Control Measure Name: Layered Combustion; Lean Burn ICE 2 stroke Large Bore - NG

Abbreviation: NLCICE2SLBNG

Description: Layered combustion - for Large Bore, 2 stroke, Lean Burn, Slow Speed (High Pressure Fuel Injection achieves 90% reduction; Turbocharging achieves 75% reduction; Precombustion chambers achieves 90% reduction; Cylinder Head Modifications). All retrofit combustion- related controls may not be available for all manufacturers and models of 2-stroke lean burn engines. Actual NOx emission rates would be engine design specific. Efficiency achieved may range from 60 to 90%, depending on the make/model of engine (approximate range of NOx emissions of 3.0 to 0.5 g/bhp-hr).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Layered Combustion

Source Group: Lean Burn ICE - NG

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2010	2010
CPT:	$1,500	$38,000
Ref Yr CPT:	$1,585	$40,143
Control Efficiency:	97.0	97.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	7.0	7.0
Cap Ann Ratio:	7.024	7.024
Incremental CPT:	N/A	N/A
Details:	Apply to large source types. Assumed Interest Rate of 7 percent (not provided in documentation) to calculate annual costs.	Apply to small source types.
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2010	2010
CPT:	$1,500	$38,000
Ref Yr CPT:	$1,585	$40,143

Control Efficiency:	97.0	97.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	7.0	7.0
Cap Ann Ratio:	7.024	7.024
Incremental CPT:	N/A	N/A
Details:	Apply to large source types. Assumed Interest Rate of 7 percent (not provided in documentation) to calculate annual costs.	Apply to small source types.
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
20200403	Internal Combustion Engines; Industrial; Large Bore Engine; Cogeneration: Dual Fuel
20200402	Internal Combustion Engines; Industrial; Large Bore Engine; Dual Fuel (Oil/Gas)
20200401	Internal Combustion Engines; Industrial; Large Bore Engine; Diesel
20200256	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Clean Burn
20200255	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Clean Burn
20200254	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Lean Burn
20200252	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Lean Burn

References:

- OTC 2012. Technical Information Oil and Gas Sector, Significant Stationary Sources of NOx Emissions. Final. October 17, 2012.

Other information:

Summary:

Control Measure Name: Layered Combustion; Lean Burn ICE 2 stroke - NG

Abbreviation: NLCICE2SNG

Description: Layered combustion - 2 stroke, Lean Burn, NG (Air Supply; Fuel Supply; Ignition; Electronic Controls; Engine Monitoring). Evaluation for 3 most representative made/models of 2 stroke LB compressor engines. All retrofit combustion-related controls may not be available for all manufacturers and models of 2-stroke lean burn engines. Actual NOx emission rates would be engine design specific. Efficiency achieved may range from 60 to 90%, depending on the make/model of engine (approximate range of NOx emissions of 3.0 to 0.5 g/bhp-hr).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Layered Combustion

Source Group: Lean Burn ICE - NG

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2009
CPT:	$4,900
Ref Yr CPT:	$5,240
Control Efficiency:	97.0
Min Emis:	0.0
Max Emis:	365.0
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.14000000059604645
Discount Rate:	7.0
Cap Ann Ratio:	7.024
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2009
CPT:	$4,900
Ref Yr CPT:	$5,240
Control Efficiency:	97.0
Min Emis:	0.0

Max Emis:	365.0
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.14000000059604645
Discount Rate:	7.0
Cap Ann Ratio:	7.024
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
20200256	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Clean Burn
20200255	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Clean Burn
20200254	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Lean Burn
20200252	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Lean Burn

References:

- OTC 2012. Technical Information Oil and Gas Sector, Significant Stationary Sources of NOx Emissions. Final. October 17, 2012.

Other information:

Summary:

Control Measure Name: Low Excess Air; Iron & Steel Mills - Reheating

Abbreviation: NLEAISRH

Description: Application: The reduction in NOx emissions is achieved through the use of low excess air techniques, such that there is less available oxygen convert fuel nitrogen to NOx.

This control applies to iron & steel reheating furnaces classified under SCC 30300933.

Discussion: Low excess air works by reducing levels of excess air to the combustor, usually by adjustments to air registers and/or fuel injection positions, or through control of overfire air dampers. The lower oxygen concentration in the burner zone reduces conversion of the fuel nitrogen to NOx. Also, under excess air conditions in the flame zone, a greater portion of fuel-bound nitrogen is converted to N2 therefore reducing the formation of fuel NOx (ERG, 2000).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low Excess Air

Source Group: Iron & Steel Mills - Reheating

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,320	$1,320
Ref Yr CPT:	$2,114	$2,114
Control Efficiency:	13.0	13.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	3.8	3.8
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,320	$1,320

Ref Yr CPT:	$2,114	$2,114
Control Efficiency:	13.0	13.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	3.8	3.8
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300933	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Reheat Furnaces

References:

- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Stationary Reciprocating Internal Combustion Engines," EPA,-453/R-93-032, Research Triangle Park, NC, July 1993.
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- ERG, 2000: Eastern Research Group, Inc., "How to Incorporate the Effects of Air Pollution Control Device Efficiencies and Malfunctions into Emission Inventory Estimates," prepared for Emission Inventory Improvement Program, Point Sources Committee, July 2000.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	13% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Capital and annual cost information was obtained from model engine data in the Alternative Control Techniques (ACT) document (EPA, 1994). A capital cost to annual cost ratio of 3.8 was developed to estimate default capital and operating and maintenance costs. From these determinations, default cost effectiveness values were assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies greater than 15% and less than or equal to 25% (Pechan, 2001).
CPTON_TEXT:	The default cost effectiveness value is $1,320 per ton NOx reduced from both uncontrolled RACT baselines (1990$).
CTRL_EFF_T:	13%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	13%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Low Emission Combustion;Lean Burn IC Engines - Gas
Abbreviation:	NLECICEGAS
Description:	Application: This control is the application of Low Emission Combustion firing techniques to gas-fired lean burn IC engines.
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	Low Emission Combustion
Source Group:	Lean Burn IC Engine - Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1993
CPT:	$422
Ref Yr CPT:	$625
Control Efficiency:	87.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	2.3
Incrementental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1993
CPT:	$422
Ref Yr CPT:	$625
Control Efficiency:	87.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	2.3
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2310021251	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Lateral Compressors 4 Cycle Lean Burn
2310021202	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Lean Burn Compressor Engines 50 To 499 HP
2310021102	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 2Cycle Lean Burn Compressor Engines 50 To 499 HP
20200256	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Clean Burn
20200255	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Clean Burn
20200254	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Lean Burn
20200252	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Lean Burn

References:

- Pechan, 2006: E.H. Pechan and Associates, Inc., "AirControlNET Control Measure Documentation Report", May 2006.
- Pechan, 2001: E.H. Pechan & Associates, Inc., "Revisions to AirControlNET, and Particulate Matter Control Strategies and Cost Analysis," Revised Report, prepared for U.S. Environmental Protection Agency, Innovative Strategies and Economics Group, Research Triangle Park, September 2001.

Other information:

Summary:

Control Measure Name:	Low Emission Combustion; Lean Burn ICE - NG
Abbreviation:	NLECICENG
Description:	Low Emission Combustion includes Precombustion chamber head and related equipment on a Lean Burn engine.
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	Low Emission Combustion
Source Group:	Lean Burn ICE - NG
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2001
CPT:	$1,000
Ref Yr CPT:	$1,277
Control Efficiency:	80.0
Min Emis:	0.0
Max Emis:	365.0
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.14000000059604645
Discount Rate:	7.0
Cap Ann Ratio:	7.025
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2001
CPT:	$1,000
Ref Yr CPT:	$1,277
Control Efficiency:	80.0
Min Emis:	0.0
Max Emis:	365.0
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	0.14000000059604645
Discount Rate:	7.0
Cap Ann Ratio:	7.025
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 2b

Description: Non-EGU NOx

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Annual Cost = Annual Cost Multiplier x e ^ (Boiler Capacity [in HP] x Exponent)
Capital Coat = Capital Cost Multiplier x e ^ (Boiler Capacity [in HP] x Exponent)

Variable Name	Value
Pollutant	NOX
Cost Year	2001
Capital Cost Multiplier	16019.0
Capital Cost Exponent	0.0016
Annual Cost Multiplier	2280.8
Annual Cost Exponent	0.0016

Affected SCCs:

Code	Description
20200256	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Clean Burn
20200255	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Clean Burn
20200254	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Lean Burn
20200252	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Lean Burn

References:

- CARB 2001. Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Stationary Spark-Ignited Internal Combustion Engines. California Environmental Protection Agency, Air Resources Board, Stationary Source Division, Emissions Assessment Branch, Process Evaluation Section. November 2001.

Other information:

Summary:

Control Measure Name:	Low NOx Burner and Flue Gas Recirculation; Ammonia Prod; Feedstock Desulfurization
Abbreviation:	NLNBFAPFD
Description:	Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. This control is applicable to small (<1 ton per OSD) feedstock desulfurization processes in ammonia products operations with uncontrolled NOx emissions greater than 10 tons per year. Discussion: It is assumed that the superheated steam needed to regenerate the activated carbon bed used in the desulfurization process is the NOx source. LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	Low NOx Burner and Flue Gas Recirculation
Source Group:	Ammonia Prod; Feedstock Desulfurization
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,560	$590
Ref Yr CPT:	$4,100	$945
Control Efficiency:	60.0	60.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.9	7.5
Incremental CPT:	2470.0	280.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,560	$590
Ref Yr CPT:	$4,100	$945
Control Efficiency:	60.0	60.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.9	7.5
Incremental CPT:	2470.0	280.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30100305	Industrial Processes; Chemical Manufacturing; Ammonia Production; Feedstock Desulfurization

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.9. An equipment life of 10 years is assumed (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_H:	$2560/ton
CPTON_L:	$2470/ton
CPTON_TEXT:	The default cost effectiveness values are $2,560 per ton NOx reduced from uncontrolled and $2,470 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%

TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; In-Proc;Process Gas;Coke Oven/Blast Furn

Abbreviation: NLNBFCOBF

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton per OSD) sources with in-process coke/blast furnaces and uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: In-Proc;Process Gas;Coke Oven/Blast Furn

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,470	$3,190
Ref Yr CPT:	$3,955	$5,108
Control Efficiency:	55.0	55.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.8	6.9
Incremental CPT:	830.0	1430.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		

Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,470	$3,190
Ref Yr CPT:	$3,955	$5,108
Control Efficiency:	55.0	55.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.8	6.9
Incremental CPT:	830.0	1430.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000799	Industrial Processes; In-process Fuel Use; Process Gas; General
39000798	Industrial Processes; In-process Fuel Use; Process Gas; General
39000797	Industrial Processes; In-process Fuel Use; Process Gas; General
39000788	Industrial Processes; In-process Fuel Use; Process Gas; General
39000702	Industrial Processes; In-process Fuel Use; Process Gas; Coke Oven Gas
39000701	Industrial Processes; In-process Fuel Use; Process Gas; Coke Oven or Blast Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research

Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	55% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1993). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 6.9. A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_H:	$3190/ton
CPTON_L:	$1430/ton
CPTON_TEXT:	The default cost effectiveness values are $3,190 per ton NOx reduced from uncontrolled and $1,430 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	55%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	55%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%

STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Pri Cop Smel; Reverb Smelt Furn

Abbreviation: NLNBFCSRS

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually us

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Pri Cop Smel; Reverb Smelt Furn

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$750	$750
Ref Yr CPT:	$1,201	$1,201
Control Efficiency:	60.0	60.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	250.0	250.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$750	$750
Ref Yr CPT:	$1,201	$1,201
Control Efficiency:	60.0	60.0

Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	250.0	250.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300507	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Smelting Furnace w/ Ore Charge w/o Roasting

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Fluid Cat Cracking Units; Cracking Unit

Abbreviation: NLNBFFCCU

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton per OSD) fluid catalytic cracking units with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: The source of emissions for fluidized catalytic cracking come from process heaters and catalyst regenerators.

LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Fluid Cat Cracking Units; Cracking Unit

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,470	$3,190
Ref Yr CPT:	$3,955	$5,108
Control Efficiency:	55.0	55.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.8	6.9
Incremental CPT:	830.0	1430.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,470	$3,190
Ref Yr CPT:	$3,955	$5,108
Control Efficiency:	55.0	55.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.8	6.9
Incremental CPT:	830.0	1430.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30600202	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Catalyst Handling System
30600201	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Fluid Catalytic Cracking Unit

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	55% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1993). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 6.9. An equipment life of 15 years is assumed (EPA, 1993).
CPTON_H:	$3190/ton
CPTON_L:	$1430/ton
CPTON_TEXT:	The default cost effectiveness values are $3,190 per ton NOx reduced from uncontrolled and $1,430 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	55%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	55%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Fuel Fired Equip; Process Htrs; Pro Gas

Abbreviation: NLNBFFPHP

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small process heaters with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two com

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Fuel Fired Equip; Process Htrs; Pro Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,470	$3,190
Ref Yr CPT:	$3,955	$5,108
Control Efficiency:	55.0	55.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.8	6.9
Incremental CPT:	830.0	1430.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,470	$3,190
Ref Yr CPT:	$3,955	$5,108
Control Efficiency:	55.0	55.0

Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.8	6.9
Incremental CPT:	830.0	1430.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30390004	Industrial Processes; Primary Metal Production; Fuel Fired Equipment; Process Gas: Process Heaters

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1993). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.0. A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 50% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Table 6-4 and Ch. 6 of the Process Heaters ACT. The breakdown was obtained using the O&M costs for a mechanical draft process heater fired on distillate oil and having a capacity of 69 MMBTU per hour. The cost percentage is applied to heaters fired on LPG via technology transfer (Pechan, 1998). A capacity factor of 0.58 is used in estimating the O&M cost breakdown. Electricity: $0.06 per kw-hr
CPTON_TEXT:	The default cost effectiveness values are $570 per ton NOx reduced from uncontrolled.
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Ammonia - NG-Fired Reformers

Abbreviation: NLNBFFRNG

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton NOx per OSD) ammonia production operations with natural gas-fired reformers (SCC 30100306) and uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Ammonia - NG-Fired Reformers

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,560	$590
Ref Yr CPT:	$4,100	$945
Control Efficiency:	60.0	60.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.9	7.5
Incremental CPT:	2470.0	280.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		

Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,560	$590
Ref Yr CPT:	$4,100	$945
Control Efficiency:	60.0	60.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.9	7.5
Incremental CPT:	2470.0	280.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30100306	Industrial Processes; Chemical Manufacturing; Ammonia Production; Primary Reformer: Natural Gas Fired

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data for mechanical draft heaters firing natural gas and oil contained in the Alternative Control Techniques (ACT) document (EPA, 1993). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.9. An equipment life of 10 years is assumed (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_H:	$2560/ton
CPTON_L:	$2470/ton
CPTON_TEXT:	The default cost effectiveness values are $2,560 per ton NOx reduced from uncontrolled and $2,470 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Ammonia - Oil-Fired Reformers

Abbreviation: NLNBFFROL

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually us

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Ammonia - Oil-Fired Reformers

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,120	$390
Ref Yr CPT:	$1,794	$625
Control Efficiency:	60.0	60.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.9	7.5
Incremental CPT:	1080.0	190.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,120	$390
Ref Yr CPT:	$1,794	$625
Control Efficiency:	60.0	60.0

Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.9	7.5
Incremental CPT:	1080.0	190.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30100307	Industrial Processes; Chemical Manufacturing; Ammonia Production; Primary Reformer: Oil Fired

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name:	Low NOx Burner and Flue Gas Recirculation; ICI Boilers - Distillate Oil
Abbreviation:	NLNBFIBDO
Description:	Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Burner and Flue Gas Recirculation
Source Group:	ICI Boilers - Distillate Oil
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$12,000
Ref Yr CPT:	$12,929
Control Efficiency:	61.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$12,000

Ref Yr CPT:	$12,929
Control Efficiency:	61.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	86330.02
Capital Cost Exponent No. 2	0.22
O&M Known Costs	389766.8
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65

O&M Cost Size Multiplier No. 2	3453.2
O&M Cost Exponent No. 2	0.22
O&M Flowrate Multiplier	19.3
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.9. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Appendix E of ICI boiler ACT document (see pages E-27 and E-28). A capacity factor of 0.58 is used in estimating the O&M cost breakdown. The model boiler size used to develop cost estimates is 45 MMBtu/hr. Electricity cost: $0.05/kW-hr Natural gas cost: $3.63/MMBtu
CPTON_H:	$2490/ton
CPTON_L:	$1090/ton
CPTON_TEXT:	The default cost effectiveness values are $2,490 per ton NOx reduced from uncontrolled and $1,090 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%

UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Low NOx Burner and Flue Gas Recirculation; ICI Boilers - LPG
Abbreviation:	NLNBFIBLP
Description:	Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Burner and Flue Gas Recirculation
Source Group:	ICI Boilers - LPG
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$12,000
Ref Yr CPT:	$12,929
Control Efficiency:	61.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$12,000

Ref Yr CPT:	$12,929
Control Efficiency:	61.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	86330.02
Capital Cost Exponent No. 2	0.22
O&M Known Costs	389766.8
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65

O&M Cost Size Multiplier No. 2	3453.2
O&M Cost Exponent No. 2	0.22
O&M Flowrate Multiplier	19.3
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10301002	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Propane
10301001	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane
10201002	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Propane
10201001	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Butane

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.9. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Appendix E of ICI boiler ACT document (see pages E-27 and E-28). A capacity factor of 0.58 is used in estimating the O&M cost breakdown. The model boiler size used to develop cost estimates is 45 MMBtu/hr. Electricity cost: $0.05/kW-hr Natural gas cost: $3.63/MMBtu
CPTON_H:	$2490/ton
CPTON_L:	$1090/ton
CPTON_TEXT:	The default cost effectiveness values are $2,490 per ton NOx reduced from uncontrolled and $1,090 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%

UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Low NOx Burner and Flue Gas Recirculation; ICI Boilers - Natural Gas
Abbreviation:	NLNBFIBNG
Description:	Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Burner and Flue Gas Recirculation
Source Group:	ICI Boilers - Natural Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$12,000
Ref Yr CPT:	$12,929
Control Efficiency:	61.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$12,000

Ref Yr CPT:	$12,929
Control Efficiency:	61.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	86330.02
Capital Cost Exponent No. 2	0.22
O&M Known Costs	389766.8
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65

O&M Cost Size Multiplier No. 2	3453.2
O&M Cost Exponent No. 2	0.22
O&M Flowrate Multiplier	19.3
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Appendix E of ICI boiler ACT document (see pages E-27 and E-28). A capacity factor of 0.58 is used in estimating the O&M cost breakdown. The model boiler size used to develop cost estimates is 45 MMBtu/hr. Electricity cost: $0.05/kW-hr Natural gas cost: $3.63/MMBtu
CPTON_H:	$2560/ton
CPTON_L:	$2470/ton
CPTON_TEXT:	The default cost effectiveness values are $2,560 per ton NOx reduced from uncontrolled and $2,470 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; ICI Boilers - Process Gas
Abbreviation: NLNBFIBPG
Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
Class: Known
Pollutant: NOX
Equipment Life: 15.0 years
Control Technology: Low NOx Burner and Flue Gas Recirculation
Source Group: ICI Boilers - Process Gas
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$12,000
Ref Yr CPT:	$12,929
Control Efficiency:	61.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$12,000

Ref Yr CPT:	$12,929
Control Efficiency:	61.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula:

Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	86330.02
Capital Cost Exponent No. 2	0.22
O&M Known Costs	389766.8
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65

O&M Cost Size Multiplier No. 2	3453.2
O&M Cost Exponent No. 2	0.22
O&M Flowrate Multiplier	19.3
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10201402	External Combustion Boilers; Industrial; CO Boiler; Process Gas
10200799	External Combustion Boilers; Industrial; Process Gas; Other: Specify in Comments
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.9. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Appendix E of ICI boiler ACT document (see pages E-27 and E-28). A capacity factor of 0.58 is used in estimating the O&M cost breakdown. The model boiler size used to develop cost estimates is 45 MMBtu/hr. Electricity cost: \$0.05/kW-hr Natural gas cost: \$3.63/MMBtu
CPTON_H:	\$2560/ton
CPTON_L:	\$2470/ton
CPTON_TEXT:	The default cost effectiveness values are \$2,560 per ton NOx reduced from uncontrolled and \$2,470 per ton NOx reduced from RACT (1990\$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	\$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	\$0/hr
MNTMTL_PCT:	0%
NG_RT:	\$3.63/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	\$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%

UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; ICI Boilers - Residual Oil
Abbreviation: NLNBFIBRO
Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
Class: Known
Pollutant: NOX
Equipment Life: 15.0 years
Control Technology: Low NOx Burner and Flue Gas Recirculation
Source Group: ICI Boilers - Residual Oil
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$12,000
Ref Yr CPT:	$12,929
Control Efficiency:	61.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$12,000

Ref Yr CPT:	$12,929
Control Efficiency:	61.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	86330.02
Capital Cost Exponent No. 2	0.22
O&M Known Costs	389766.8
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65

O&M Cost Size Multiplier No. 2	3453.2
O&M Cost Exponent No. 2	0.22
O&M Flowrate Multiplier	19.3
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300404	External Combustion Boilers; Commercial/Institutional; Residual Oil; Grade 5 Oil
10300402	External Combustion Boilers; Commercial/Institutional; Residual Oil; 10-100 Million BTU/hr **
10300401	External Combustion Boilers; Commercial/Institutional; Residual Oil - Grade 6; Boiler
10201404	External Combustion Boilers; Industrial; CO Boiler; Residual Oil
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200405	External Combustion Boilers; Industrial; Residual Oil; Cogeneration
10200404	External Combustion Boilers; Industrial; Residual Oil; Grade 5 Oil
10200403	External Combustion Boilers; Industrial; Residual Oil; < 10 Million BTU/hr
10200402	External Combustion Boilers; Industrial; Residual Oil; 10-100 Million BTU/hr
10200401	External Combustion Boilers; Industrial; Residual Oil; Grade 6 oil

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.9. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Appendix E of ICI boiler ACT document (see pages E-27 and E-28). A capacity factor of 0.58 is used in estimating the O&M cost breakdown. The model boiler size used to develop cost estimates is 45 MMBtu/hr. Electricity cost: $0.05/kW-hr Natural gas cost: $3.63/MMBtu
CPTON_H:	$1080/ton
CPTON_L:	$1120/ton
CPTON_TEXT:	The default cost effectiveness values are $1,120 per ton NOx reduced from uncontrolled and $1,080 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%

UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Iron Prod; Blast Furn; Blast Htg Stoves

Abbreviation: NLNBFIPBH

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to reheating processes in iron production operations with blast heating stoves ant uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 5.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Iron Prod; Blast Furn; Blast Htg Stoves

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$380	$380
Ref Yr CPT:	$609	$609
Control Efficiency:	77.0	77.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.23999999463558197	0.23999999463558197
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.1	4.1
Incremental CPT:	150.0	150.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A

Cost Year:	1990	1990
CPT:	$380	$380
Ref Yr CPT:	$609	$609
Control Efficiency:	77.0	77.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.23999999463558197	0.23999999463558197
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.1	4.1
Incrementental CPT:	150.0	150.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT: 0%

CE_TEXT:	77% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 4.1. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 5 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness values are $380 per ton NOx reduced from uncontrolled and $150 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	77%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	77%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Iron & Steel Mills - Annealing
Abbreviation: NLNBFISAN
Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to iron and steel annealing operations with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion s
Class: Known
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: Low NOx Burner and Flue Gas Recirculation
Source Group: Iron & Steel Mills - Annealing
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$750	$750
Ref Yr CPT:	$1,201	$1,201
Control Efficiency:	60.0	60.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	250.0	250.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$750	$750
Ref Yr CPT:	$1,201	$1,201
Control Efficiency:	60.0	60.0

Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	250.0	250.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.0. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 55% (Pechan, 2001).
CPTON_H:	$750/ton
CPTON_L:	$250/ton
CPTON_TEXT:	The default cost effectiveness values are $750 per ton NOx reduced from uncontrolled and $250 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Iron & Steel Mills - Galvanizing

Abbreviation: NLNBFISGV

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to iron and steel galvanizing operations with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion

Class: Known

Pollutant: NOX

Equipment Life: 9.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Iron & Steel Mills - Galvanizing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$580	$580
Ref Yr CPT:	$929	$929
Control Efficiency:	60.0	60.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.15000000596046448	0.15000000596046448
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.5	6.5
Incremental CPT:	190.0	190.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$580	$580
Ref Yr CPT:	$929	$929
Control Efficiency:	60.0	60.0

Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.15000000596046448	0.15000000596046448
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.5	6.5
Incremental CPT:	190.0	190.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300936	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Coating: Tin, Zinc, etc.

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 6.5. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 9 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 55% (Pechan, 2001).
CPTON_H:	$580/ton
CPTON_L:	$190/ton
CPTON_TEXT:	The default cost effectiveness values are $580 per ton NOx reduced from uncontrolled and $190 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Iron & Steel - In-Process Combustion - Process Gas -Coke Oven/ Blast Furnace

Abbreviation: NLNBFISIPCG

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. This control is applicable to operations with in-process combustion (Process Gas - Coke Oven/ Blast Furnace) in the Iron & Steel industry with uncontrolled NOx emissions greater than 10 tons per year.

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Iron & Steel - In-Process Combustion - Process Gas -Coke Oven/ Blast Furnace

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$3,190	$2,470
Ref Yr CPT:	$5,108	$3,955
Control Efficiency:	55.0	55.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.9	6.8
Incremental CPT:	1430.0	830.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$3,190	$2,470
Ref Yr CPT:	$5,108	$3,955
Control Efficiency:	55.0	55.0

Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.9	6.8
Incrememental CPT:	1430.0	830.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30301524	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Hot Metal Transfer
30301523	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Tapping
30301522	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Melting and Refining
30301521	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Charging
30301520	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Basic Oxygen Furnace (BOF)
30301514	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Taphole and Trough Only
30301513	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Casting, Furnace with Local Evacuation
30301512	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Casting, Uncontrolled Casthouse Roof Monitor
30301511	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Charging
30301510	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Slip
30301506	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Cold Screen
30301505	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Cooler
30301504	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Discharge End
30301503	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Windbox

30301502	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Raw Materials Handling
30300914	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Closed Hood-Stack
30300913	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Open Hood-Stack
30300829	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Taphole and Trough
30300828	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Local Evacuation
30300826	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace Slips
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300820	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Conveyor: Transfer Station
30300819	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Process (Combined Code includes 15,16,17,18)

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 2010: "NOX CONTROL STRATEGIES IN THE IRON AND STEEL INDUSTRY (11-11-10).pdf", pdf document provided by Donnalee Jones (jones.donnalee@epamail.epa.gov) via email to Amy Vasu 11/16/10.

Other information:

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Iron & Steel Mills - Reheating

Abbreviation: NLNBFISRH

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to reheating processes in iron and steel mills with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" comb

Class: Known

Pollutant: NOX

Equipment Life: 5.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Iron & Steel Mills - Reheating

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$380	$380
Ref Yr CPT:	$609	$609
Control Efficiency:	77.0	77.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.23999999463558197	0.23999999463558197
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.1	4.1
Incremental CPT:	150.0	150.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$380	$380
Ref Yr CPT:	$609	$609
Control Efficiency:	77.0	77.0

Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.23999999463558197	0.23999999463558197
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.1	4.1
Incremental CPT:	150.0	150.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300933	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Reheat Furnaces

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	77% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 4.1. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 5 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies greater than 15% and less than or equal to 25% (Pechan, 2001).
CPTON_H:	$380/ton
CPTON_L:	$150/ton
CPTON_TEXT:	The default cost effectiveness values are $380 per ton NOx reduced from uncontrolled and $150 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	77%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	77%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Plastics Prod-Specific; (ABS) Resin

Abbreviation: NLNBFPPAR

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to with acrylonitrile-butadiene-styrene plastic production uncontrolled NOx emissions greater than 10 tons per year.

Discussion: It is assumed that the NOx source is a process heater or boiler.

LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Plastics Prod-Specific; (ABS) Resin

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$3,190	$2,470
Ref Yr CPT:	$5,108	$3,955
Control Efficiency:	55.0	55.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.9	6.8
Incremental CPT:	1430.0	830.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		

Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$3,190	$2,470
Ref Yr CPT:	$5,108	$3,955
Control Efficiency:	55.0	55.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.9	6.8
Incremental CPT:	1430.0	830.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30101849	Industrial Processes; Chemical Manufacturing; Plastics Production; Acrylonitrile-Butadiene-Styrene (ABS) Resin

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	55% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 6.9. An equipment life of 15 years (EPA, 1994).
CPTON_H:	$3190/ton
CPTON_L:	$1430/ton
CPTON_TEXT:	The default cost effectiveness values are $3,190 per ton NOx reduced from uncontrolled and $1,430 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	55%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	55%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Sand/Gravel; Dryer

Abbreviation: NLNBFSGDR

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton NOx per OSD) sand and gravel drying processes with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Sand/Gravel; Dryer

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$3,190	$2,470
Ref Yr CPT:	$5,108	$3,955
Control Efficiency:	55.0	55.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.9	6.8
Incremental CPT:	1430.0	830.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A

Cost Year:	1990	1990
CPT:	$3,190	$2,470
Ref Yr CPT:	$5,108	$3,955
Control Efficiency:	55.0	55.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.9	6.8
Incrementemental CPT:	1430.0	830.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30502508	Industrial Processes; Mineral Products; Construction Sand and Gravel; Dryer ** (See 3-05-027-20 thru -24 for Industrial Sand Dryers)

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT: 0%

CE_TEXT:	55% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emissions (Pechan, 1998). Small source = less than 1 ton NOx emissions per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data for mechanical draft heaters firing natural gas and oil contained in the Alternative Control Techniques (ACT) document (EPA, 1993). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 6.9. An equipment life of 15 years is assumed (EPA, 1993).
CPTON_H:	$3190/ton
CPTON_L:	$1430/ton
CPTON_TEXT:	The default cost effectiveness values are $3,190 per ton NOx reduced from uncontrolled and $1,430 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	55%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	55%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Space Heaters - Distillate Oil

Abbreviation: NLNBFSHDO

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton per OSD) residual oil-fired process heaters with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Space Heaters - Distillate Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,500	$760
Ref Yr CPT:	$4,003	$1,217
Control Efficiency:	60.0	60.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.9	7.5
Incremental CPT:	1090.0	370.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A

Cost Year:	1990	1990
CPT:	$2,500	$760
Ref Yr CPT:	$4,003	$1,217
Control Efficiency:	60.0	60.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.9	7.5
Incrememental CPT:	1090.0	370.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10500205	External Combustion; Space Heaters; Commercial/Institutional; Distillate Oil
10500105	External Combustion; Space Heaters; Industrial; Distillate Oil

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT: 0%

CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.9. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_H:	$2490/ton
CPTON_L:	$1090/ton
CPTON_TEXT:	The default cost effectiveness values are $2,490 per ton NOx reduced from uncontrolled and $1,090 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Space Heaters - Natural Gas

Abbreviation: NLNBFSHNG

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton per OSD) LPG-fired process heaters with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage"

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Space Heaters - Natural Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,650	$590
Ref Yr CPT:	$4,244	$945
Control Efficiency:	60.0	60.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.9	7.5
Incremental CPT:	2470.0	280.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,650	$590
Ref Yr CPT:	$4,244	$945
Control Efficiency:	60.0	60.0

Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.9	7.5
Incrementental CPT:	2470.0	280.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10500206	External Combustion; Space Heaters; Commercial/Institutional; Natural Gas
10500106	External Combustion; Space Heaters; Industrial; Natural Gas
10500102	External Combustion; Space Heaters; Industrial; Coal **

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled

CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.9. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_H:	$2560/ton
CPTON_L:	$2470/ton
CPTON_TEXT:	The default cost effectiveness values are $2,560 per ton NOx reduced from uncontrolled and $2,470 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Starch Mfg; Combined Operations

Abbreviation: NLNBFSMCO

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton per OSD) starch manufacturing with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: The NOx source is generally a natural gas-fired dryer. Therefore, applicable control technologies are assumed to be LNB with FGR.

LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Starch Mfg; Combined Operations

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,470	$3,190
Ref Yr CPT:	$3,955	$5,108
Control Efficiency:	55.0	55.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.8	6.9
Incremental CPT:	830.0	1430.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,470	$3,190
Ref Yr CPT:	$3,955	$5,108
Control Efficiency:	55.0	55.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.8	6.9
Incremental CPT:	830.0	1430.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30201422	Industrial Processes; Food and Agriculture; Starch Manufacturing; Fugitive Emissions: Starch Packaging
30201421	Industrial Processes; Food and Agriculture; Starch Manufacturing; Fugitive Emissions: General
30201413	Industrial Processes; Food and Agriculture; Starch Manufacturing; Unmodified Starch Drying: Spray Dryers
30201412	Industrial Processes; Food and Agriculture; Starch Manufacturing; Unmodified Starch Drying: Flash Dryers
30201411	Industrial Processes; Food and Agriculture; Starch Manufacturing; Modified Starch Drying: Spray Dryers
30201410	Industrial Processes; Food and Agriculture; Starch Manufacturing; Modified Starch Drying: Flash Dryers
30201408	Industrial Processes; Food and Agriculture; Starch Manufacturing; Starch Bulk Loadout
30201407	Industrial Processes; Food and Agriculture; Starch Manufacturing; Starch Storage Bin
30201406	Industrial Processes; Food and Agriculture; Starch Manufacturing; Starch Filtering
30201405	Industrial Processes; Food and Agriculture; Starch Manufacturing; Centrifuging
30201404	Industrial Processes; Food and Agriculture; Starch Manufacturing; Screening
30201403	Industrial Processes; Food and Agriculture; Starch Manufacturing; Grinding

30201402	Industrial Processes; Food and Agriculture; Starch Manufacturing; Steeping (Acidification)
30201401	Industrial Processes; Food and Agriculture; Starch Manufacturing; Combined Operations

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	55% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by power output (Pechan, 1998). Small source = less than 1 ton NOx per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 6.9. An equipment life of 15 years was uncontrolled (EPA, 1994).
CPTON_H:	$3190/ton
CPTON_L:	$1430/ton
CPTON_TEXT:	The default cost effectiveness values are $3,190 per ton NOx reduced from uncontrolled and $1,430 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	55%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	55%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf

NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Flue Gas Recirculation; Steel Prod; Soaking Pits

Abbreviation: NLNBFSPSP

Description: Application: This control is the use of low NOx burner (LNB) technology and flue gas recirculation (FGR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to soaking pits at steel production operations with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: Soaking pits are a combustion source which can fire natural gas, oil or coal. Emissions of NOx are similar to boilers emissions.

LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner and Flue Gas Recirculation

Source Group: Steel Prod; Soaking Pits

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$750	$750
Ref Yr CPT:	$1,201	$1,201
Control Efficiency:	60.0	60.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	250.0	250.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$750	$750
Ref Yr CPT:	$1,201	$1,201
Control Efficiency:	60.0	60.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	250.0	250.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300911	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Soaking Pits

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.0. An equipment life of 10 years was uncontrolled (EPA, 1994).
CPTON_H:	$750/ton
CPTON_L:	$250/ton
CPTON_TEXT:	The default cost effectiveness values are $750 per ton NOx reduced from uncontrolled and $250 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; ICI Natural Gas Space Heaters and Water Heaters

Abbreviation: NLNBICISWH

Description: Application: The South Coast and Bay Area AQMDs set emission limits for water heaters and space heaters. This control is based on the installation of low-NOx space heaters and water heaters in commercial and institutional sources for the reduction of NOx emissions.

The control applies to natural gas burning sources classified under SCC 2103006000.

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: ICI Space and Water Heaters

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$1,230
Ref Yr CPT:	$1,970
Control Efficiency:	7.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	5.5
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$1,230
Ref Yr CPT:	$1,970
Control Efficiency:	7.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	5.5
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10500206	External Combustion; Space Heaters; Commercial/Institutional; Natural Gas
10500200	External Combustion Boilers;Space Heaters;Commercial/Institutional;undefined
10500106	External Combustion; Space Heaters; Industrial; Natural Gas
10500100	External Combustion Boilers;Space Heaters;Industrial;undefined

References:

- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan, Appendix IV-A: Stationary and Mobile Source Control Measures." August 1996.
- Pechan, 2006: E.H. Pechan and Associates, Inc., "AirControlNET Control Measure Documentation Report", May 2006.

Other information:

Summary:

Control Measure Name: Low NOx Burner; Iron & Steel - In-Process Combustion - Natural Gas or Coke Oven Process Gas

Abbreviation: NLNBISIPCG

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. This control is applicable to operations with in-process combustion (Natural Gas or Coke Oven Process Gas) in the Iron & Steel industry with uncontrolled NOx emissions greater than 10 tons per year.

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: Iron & Steel - In-Process Combustion - Natural Gas or Coke Oven Process Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,200	$1,800
Ref Yr CPT:	$3,523	$2,882
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,200	$1,800
Ref Yr CPT:	$3,523	$2,882
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0

Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30301524	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Hot Metal Transfer
30301523	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Tapping
30301522	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Melting and Refining
30301521	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Charging
30301520	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Basic Oxygen Furnace (BOF)
30301514	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Taphole and Trough Only
30301513	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Casting, Furnace with Local Evacuation
30301512	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Casting, Uncontrolled Casthouse Roof Monitor
30301511	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Charging
30301510	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Slip
30301506	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Cold Screen
30301505	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Cooler
30301504	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Discharge End
30301503	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Windbox

30301502	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Raw Materials Handling
30300914	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Closed Hood-Stack
30300913	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Open Hood-Stack
30300829	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Taphole and Trough
30300828	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Local Evacuation
30300826	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace Slips
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300820	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Conveyor: Transfer Station
30300819	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Process (Combined Code includes 15,16,17,18)

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 2010: "NOX CONTROL STRATEGIES IN THE IRON AND STEEL INDUSTRY (11-11-10).pdf", pdf document provided by Donnalee Jones (jones.donnalee@epamail.epa.gov) via email to Amy Vasu 11/16/10.

Other information:

Summary:

Control Measure Name: Low NOx Burner and Selective Non-catalytic Reduction; Iron & Steel Mills - Annealing

Abbreviation: NLNBNISAN

Description: Application: This control is the use of low NOx burner (LNB) technology and selective catalytic reduction (SCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

This control is applicable to iron and steel annealing operations with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner and Selective Noncatalytic Reduction

Source Group: Iron & Steel Mills - Annealing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,720	$1,720
Ref Yr CPT:	$2,754	$2,754
Control Efficiency:	80.0	80.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	3.7	3.7
Incremental CPT:	1320.0	1320.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,720	$1,720
Ref Yr CPT:	$2,754	$2,754
Control Efficiency:	80.0	80.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	3.7	3.7
Incremental CPT:	1320.0	1320.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	80% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 3.7. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 55% (Pechan, 2001).
CPTON_H:	$1720/ton
CPTON_L:	$1320/ton
CPTON_TEXT:	The default cost effectiveness values are $1,720 per ton NOx reduced from uncontrolled and $1,320 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	80%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	80%

INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Over Fire Air; Utility Boiler - Bit Coal/Wall

Abbreviation: NLNBOUBCW

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control applies to wall fired (coal) utility boilers

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Stagi

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Over Fire Air

Source Group: Utility Boiler - Coal/Wall

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	72.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	72.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:

Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	65.0
Fixed O&M Cost Multiplier	0.5
Variable O&M Cost Multiplier	0.09
Scaling Factor - Model Size (MW)	300.0
Scaling Factor - Exponent	0.36
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential

10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom

References:

- US EPA, 2010: Clean Air Markets Division. "Documentation for EPA Base Case 2010 (V4.1), Using the Integrated Planning Model," Washington, DC., August 2010.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT: 0%

CPTON_TEXT:	Cost effectiveness is variable and based on plant size (nameplate capacity in MW) and the following factors: the total capital cost of $26.12 per kW; the fixed O&M costs of $0.40 per kW per year; and variable O&M costs of $0.08 mills per kW per year (2004$).
CE_TEXT:	55.9% from uncontrolled
CHEM_PCT:	0%
CTRL_EFF_T:	56%

COST_BASIS:

The cost equations used in this analysis are based on cost equations from EPA's IPM (EPA, 2004). In the IPM, model plants applying LNB had capacities of 300 MW. The equations were scaled to develop costs for smaller or larger boilers than the model plant. The cost equations also assume a capacity utilization factor of 85% for the utility boilers, as well as a 7% discount rate and 15-year lifetime of the controls.

Capital Costs (CC):

Nameplate Capacity: netdc [=] MW
Total Capital Costs: TCC = $26.12 per kW
Scaling Factor: SF = (sfn / netdc)^sfe = (300 / MW)^0.359

CC (for netdc < 500) = TCC * netdc * 1000 * SF
CC (for netdc > 500) = TCC * netdc * 1000

Operating & Maintenance (O&M):

Fixed O&M: omf = $0.40 per kW per year
Variable O&M: omv = $0.08 mills per kW-hr
Capacity Factor: capfac = 0.85

O&M = (omf * netdc * 1000) + (omv * netdc * 1000 * capfac * 8760 / 1000)

Equipment Life in Years = Equiplife
Interest Rate = i
Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1]

Total Cost = (CRF * CC) + O&M

O&M Cost Components: With the retrofit of combustion controls, the boiler unburned carbon may increase. This increase results in a reduction in boiler efficiency, requiring more coal to be burned to maintain the boiler output. As the coal firing rate increases, there are corresponding increases in the solid waste generation and auxiliary power usage. The O&M costs were evaluated for tangential-fired boilers only. With no changes in the capital cost for wall-fired boilers, the fixed O&M costs, generally taken as a function of the capital cost, are not expected to vary. Also, no changes in the variable O&M costs are expected, since unburned carbon assumptions are unchanged.

For tangential-fired boilers, the general maintenance cost was conservatively taken as 1.5 percent of the total project cost for each technology. Also, a plant capacity factor of 85 percent was assumed.

Coal Cost: $1.20/MMBtu
Solid waste disposal: $12/ton
Auxiliary power: 25 mills/KWh

Note: O&M costs are in 1999 dollars, all others are in 2004 dollars

FUEL_PCT:	0%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf

NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Sec Alum Prod; Smelting Furn/Reverb

Abbreviation: NLNBSASF

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to secondary aluminum production operations with smelting furnaces (SCC 30400103) and uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" com

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: Sec Alum Prod; Smelting Furn/Reverb

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$570	$570
Ref Yr CPT:	$913	$913
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$570	$570
Ref Yr CPT:	$913	$913

Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30400103	Industrial Processes; Secondary Metal Production; Aluminum; Smelting Furnace/Reverberatory

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) (EPA, 1994). Capital, and annual cost information was obtained from control-specific cost data. Some O&M costs were included. Missing O&M costs were back calculated from annual costs (Pechan, 1998). From these determinations, an average cost per ton values was assigned along with a capital cost to annual cost ratio of 7.0. A discount rate of 7% was assumed for all sources. The equipment life is 10 years.
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $570 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner and Selective Catalytic Reduction; Iron & Steel Mills - Annealing

Abbreviation: NLNBSISAN

Description: Application: This control is the use of low NOx burner (LNB) technology and selective catalytic reduction (SCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

This control is applicable to small (<1 ton NOx per OSD) iron and steel annealing operations with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner and Selective Catalytic Reduction

Source Group: Iron & Steel Mills - Annealing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$4,080	$4,080
Ref Yr CPT:	$6,534	$6,534
Control Efficiency:	90.0	90.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.1	5.1
Incremental CPT:	3720.0	3720.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$4,080	$4,080
Ref Yr CPT:	$6,534	$6,534
Control Efficiency:	90.0	90.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.1	5.1
Incremental CPT:	3720.0	3720.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emissions (Pechan, 1998). Small source = less than 1 ton NOx emissions per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.1. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 55% (Pechan, 2001).
CPTON_H:	$4080/ton
CPTON_L:	$3720/ton
CPTON_TEXT:	The default cost effectiveness values are $4,080 per ton NOx reduced from uncontrolled and $3,720 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	90%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh

FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Low NOx Burner; Water Heater, Space Heater - Natural Gas
Abbreviation:	NLNBSPWHNG
Description:	Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to
Class:	Known
Pollutant:	NOX
Equipment Life:	N/A years
Control Technology:	Low NOx Burner
Source Group:	Water Heater, Space Heater - Natural Gas
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$770
Ref Yr CPT:	$1,028
Control Efficiency:	7.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$770
Ref Yr CPT:	$1,028
Control Efficiency:	7.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2862002000	Miscellaneous Area Sources; Swimming Pools; Residential; Total
2862000000	Miscellaneous Area Sources; Swimming Pools; Total (Commercial, Residential, Public); Total
2104006010	Stationary Source Fuel Combustion; Residential; Natural Gas; Residential Furnaces
2104006000	Stationary Source Fuel Combustion; Residential; Natural Gas; Total: All Combustor Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf

Other information:

Summary:

Control Measure Name: Low NOx Burner; Asphaltic Conc; Rotary Dryer; Conv Plant

Abbreviation: NLNBUACCP

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton NOx per OSD) construction operations with rotary driers and uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion s

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: Asphaltic Conc; Rotary Dryer; Conv Plant

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,200	$1,800
Ref Yr CPT:	$3,523	$2,882
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,200	$1,800
Ref Yr CPT:	$3,523	$2,882
Control Efficiency:	50.0	50.0

Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500201	Industrial Processes; Mineral Products; Asphalt Concrete; Rotary Dryer: Conventional Plant (see 3-05-002-50 to -53 for subtypes)

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.3. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993).
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $2,200 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Conv Coating of Prod; Acid Cleaning Bath

Abbreviation: NLNBUCCAB

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton NOx per OSD) acid cleaning bath/conversion coating processes at metal product fabricating operations with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: The source of emissions for acid cleaning baths come from heating of the baths.

LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: Conv Coating of Prod; Acid Cleaning Bath

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,800	$2,200
Ref Yr CPT:	$2,882	$3,523
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,800	$2,200
Ref Yr CPT:	$2,882	$3,523
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30901199	Industrial Processes; Fabricated Metal Products; Conversion Coating of Metal Products; Other Not Classified
30901104	Industrial Processes; Fabricated Metal Products; Conversion Coating of Metal Products; Rinsing/Finishing
30901103	Industrial Processes; Fabricated Metal Products; Conversion Coating of Metal Products; Anodizing Kettle
30901102	Industrial Processes; Fabricated Metal Products; Conversion Coating of Metal Products; Acid Cleaning Bath (Pickling)
30901101	Industrial Processes; Fabricated Metal Products; Conversion Coating of Metal Products; Alkaline Cleaning Bath

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.

- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). Capital and annual cost information was obtained from the Alternative Control Techniques Document (EPA, 1993). The data provided for LNB applied to process heaters firing natural gas are assumed to be representative of the costs and emission reductions for this source. From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.3. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993).
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $2,200 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%

RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Coal Cleaning-Thrml Dryer; Fluidized Bed

Abbreviation: NLNBUCCFB

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton NOx per OSD) thermal drying processes at coal cleaning operations with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: Thermal dryers are a direct-heat device.

LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: Coal Cleaning-Thrml Dryer; Fluidized Bed

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2003	2003
CPT:	$1,000	$200
Ref Yr CPT:	$1,233	$247
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.5	4.5
Incremental CPT:	1460.0	1090.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2003	2003
CPT:	$1,000	$200
Ref Yr CPT:	$1,233	$247
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.5	4.5
Incremental CPT:	1460.0	1090.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501001	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Fluidized Bed Reactor

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 4.5. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994).
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $1,460 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Ceramic Clay Mfg; Drying

Abbreviation: NLNBUCCMD

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton NOx per OSD) drying processes at ceramic clay manufacturing operations with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "sta

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: Ceramic Clay Mfg; Drying

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,200	$1,800
Ref Yr CPT:	$3,523	$2,882
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,200	$1,800
Ref Yr CPT:	$3,523	$2,882

Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500801	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying ** (use SCC 3-05-008-13)

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Cement Manufacturing," EPA,-453/R-94-004, Research Triangle Park, NC, March 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). Capital and annual cost information was obtained from the Alternative Control Techniques Document (EPA, 1993). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.3. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993).
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $2,200 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Low NOx Burner; Surf Coat Oper;Coating Oven Htr;Nat Gas
Abbreviation:	NLNBUCHNG
Description:	Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. This control is applicable to small (<1 ton NOx per OSD) natural gas-fired coating oven heater at surface coating operations with uncontrolled NOx emissions greater than 10 tons per year. Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Burner
Source Group:	Surf Coat Oper;Coating Oven Htr;Nat Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,800	$2,200
Ref Yr CPT:	$2,882	$3,523
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		

Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,800	$2,200
Ref Yr CPT:	$2,882	$3,523
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40201001	Petroleum and Solvent Evaporation; Surface Coating Operations; Coating Oven Heater; Natural Gas

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emissions (Pechan, 1998). Small source = less than 1 ton NOx emissions per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data for mechanical draft heaters firing natural gas and oil contained in the Alternative Control Techniques (ACT) document (EPA, 1993). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.3. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1993).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $2,200 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Cement Manufacturing - Dry

Abbreviation: NLNBUCMDY

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control applies to dry-process cement manufacturing operations with indirect-fired kilns (SCC 30500606) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" co

Class: Emerging

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: Cement Manufacturing - Dry

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1997	1997
CPT:	$440	$440
Ref Yr CPT:	$603	$603
Control Efficiency:	25.0	25.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.0	5.0
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1997	1997
CPT:	$440	$440
Ref Yr CPT:	$603	$603
Control Efficiency:	25.0	25.0

Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.0	5.0
Incrememental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500602	The SCC entry is not found in the reference.scc table

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Cement Manufacturing," EPA,-453/R-94-004, Research Triangle Park, NC, March 1994.
- EC/R, 2000: EC/R Incorporated, "NOx Control Technologies for the Cement Industry," prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC, September 2000.

Other information:

ADMIN_PCT:	19.13%
CE_TEXT:	25% from uncontrolled

CHEM_PCT:	0%
COST_BASIS:	Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). Capital and annual cost information was obtained from a NOx control technologies for the cement industry report (EC/R, 2000). Cost for low-NOx burners were developed using model plants. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1994). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Tables 6-5, 6-6, 6-7 and 6-8 of the ACT document. The breakdown was developed using the average costs for 2 direct-fired and 2 indirect-fired model furnaces. A capacity factor of 0.91 is used in estimating the O&M cost breakdown. Operating Labor: $22.12/hr Maintenance Labor: $24.33/hr
CPTON_H:	$620/ton
CPTON_L:	$300/ton
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $440 per ton NOx reduced from both uncontrolled and RACT (1997$). The cost effectiveness range is $300 to $620 per ton NOx reduced.
CTRL_EFF_T:	25%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	25%
INSRNC_PCT:	9.56%
MNTLBR_PCT:	12.06%
MNTLBR_RT:	$24.33/hr
MNTMTL_PCT:	12.06%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	12.59%
OPLBR_RT:	$22.12/hr
OTHR_PCT:	0%
OVRHD_PCT:	37.71%
PROPTX_PCT:	9.56%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	1.89%
STEAM_PCT:	0%
TDIR_PCT:	38.06%
TINDIR_PCT:	61.41%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Cement Manufacturing - Wet

Abbreviation: NLNBUCMWT

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control applies to wet-process cement manufacturing operations with indirect-fired kilns (SCC 30500706) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" co

Class: Emerging

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: Cement Manufacturing - Wet

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1997	1997
CPT:	$440	$440
Ref Yr CPT:	$603	$603
Control Efficiency:	25.0	25.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.0	5.0
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1997	1997
CPT:	$440	$440
Ref Yr CPT:	$603	$603
Control Efficiency:	25.0	25.0

Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.0	5.0
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500706	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Kilns

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Cement Manufacturing," EPA,-453/R-94-004, Research Triangle Park, NC, March 1994.
- EC/R, 2000: EC/R Incorporated, "NOx Control Technologies for the Cement Industry," prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC, September 2000.

Other information:

ADMIN_PCT:	22.09%
CE_TEXT:	25% from uncontrolled

CHEM_PCT:	0%
COST_BASIS:	Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). Capital and annual cost information was obtained from a NOx control technologies for the cement industry report (EC/R, 2000). A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1994). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in the EC/R report, Tables 6-5, 6-6, 6-7 and 6-8. The breakdown was obtained using the average costs for two direct and two indirect-fired furnaces having capacities (1 direct and 1 indirect) of 180 and 300 MMBTU per hour. A capacity factor of 0.913 is used in estimating the O&M cost breakdown. (EC/R, 2000) Operating labor: $22.12/hr Maintenance labor: $24.33 per hour times 0.5 hours per 8 hour shift
CPTON_H:	$620/ton
CPTON_L:	$300/ton
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $440 per ton NOx reduced from both uncontrolled and RACT (1997$). The cost effectiveness range is $300 to $620 per ton NOx reduced.
CTRL_EFF_T:	25%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	25%
INSRNC_PCT:	11.04%
MNTLBR_PCT:	10.9%
MNTLBR_RT:	$24.33/hr
MNTMTL_PCT:	10.9%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	11.38%
OPLBR_RT:	$22.12/hr
OTHR_PCT:	0%
OVRHD_PCT:	20.94%
PROPTX_PCT:	11.04%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	1.7%
STEAM_PCT:	0%
TDIR_PCT:	34.89%
TINDIR_PCT:	65.11%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Fuel Fired Equip; Furnaces; Natural Gas

Abbreviation: NLNBUFFNG

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control applies to natural gas fired equipment classified under SCC 30490033 with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combus

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: Fuel Fired Equip; Furnaces; Natural Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$570	$570
Ref Yr CPT:	$913	$913
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$570	$570
Ref Yr CPT:	$913	$913
Control Efficiency:	50.0	50.0

Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30490033	Industrial Processes; Secondary Metal Production; Fuel Fired Equipment; Natural Gas: Furnaces

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). Capital and annual cost information was obtained from the Alternative Control Techniques Document (EPA, 1993). The data provided for LNB applied to process heaters firing natural gas are assumed to be representative of the costs and emission reductions for this source. From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.0. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1993
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $570 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Fbrglass Mfg; Txtle-Type Fbr; Recup Furn

Abbreviation: NLNBUFMTF

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to textile-type fiberglass manufacturing operations with recuperative furnaces and uncontrolled NOx emissions greater than 10 tons per year.

Discussion: Recuperative furnaces may be gas- or oil-fired.

LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 3.0 years

Control Technology: Low NOx Burner

Source Group: Fbrglass Mfg; Txtle-Type Fbr; Recup Furn

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,690	$1,690
Ref Yr CPT:	$2,706	$2,706
Control Efficiency:	40.0	40.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.3799999952316284	0.3799999952316284
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.2	2.2
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		

Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,690	$1,690
Ref Yr CPT:	$2,706	$2,706
Control Efficiency:	40.0	40.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.3799999952316284	0.3799999952316284
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.2	2.2
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501212	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Textile-type Fiber)

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	40% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). Capital and annual cost information was obtained from the Alternative Control Techniques Document (EPA, 1994). The data provided for LNB applied to process heaters firing natural gas are assumed to be representative of the costs and emission reductions for this source. From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 2.2. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 3 years (EPA, 1994).
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $1,690 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	40%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	40%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Ammonia - NG-Fired Reformers

Abbreviation: NLNBUFRNG

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton NOx per OSD) ammonia production operations with natural gas-fired reformers (SCC 30100306) and uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: Ammonia - NG-Fired Reformers

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	2008
CPT:	$820	$800
Ref Yr CPT:	$1,313	$862
Control Efficiency:	50.0	50.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.5	5.9
Incremental CPT:	N/A	N/A
Details:	Applied to small source types; no new information was available for small sources during 2013 update	Applied to large source types; equipment life of 10 years and 7% interest
Existing Measure:		
Existing NEI Dev:	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	2008
CPT:	$820	$800
Ref Yr CPT:	$1,313	$862
Control Efficiency:	50.0	50.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.5	5.9
Incremental CPT:	N/A	N/A
Details:	Applied to small source types; no new information was available for small sources during 2013 update	Applied to large source types; equipment life of 10 years and 7% interest
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30100306	Industrial Processes; Chemical Manufacturing; Ammonia Production; Primary Reformer: Natural Gas Fired

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.

- Indian Nations Council of Governments (INCOG), 2008: Indian Nations Council of Governments (INCOG), “Tulsa Metropolitan Area 8-Hour Ozone Flex Plan: 2008 8-O3 Flex Program,” March 6, 2008. url: http://www.epa.gov/ozoneadvance/pdfs/Flex-Tulsa.pdf

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.5. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $820 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%

TDIR_PCT:	0%
TINDIR_PCT:	100%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Low NOx Burner; Ammonia - Oil-Fired Reformers
Abbreviation:	NLNBUFROL
Description:	Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	Low NOx Burner
Source Group:	Ammonia - Oil-Fired Reformers
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$400	$430
Ref Yr CPT:	$641	$689
Control Efficiency:	50.0	50.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.5	5.5
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$400	$430
Ref Yr CPT:	$641	$689
Control Efficiency:	50.0	50.0

Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.5	5.5
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30100307	Industrial Processes; Chemical Manufacturing; Ammonia Production; Primary Reformer: Oil Fired

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Low NOx Burner; Glass Manufacturing - Container

Abbreviation: NLNBUGMCN

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to container glass manufacturing operations classified under 305010402 with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: The 250 tons per day plant is assumed to be representative of container glass plants (Pechan, 1998).

LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: Glass Manufacturing - Container

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2007	2007
CPT:	$1,072	$1,365
Ref Yr CPT:	$1,178	$1,500
Control Efficiency:	40.0	40.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.3	4.2
Incremental CPT:	1690.0	1690.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2007	2007
CPT:	$1,072	$1,365
Ref Yr CPT:	$1,178	$1,500
Control Efficiency:	40.0	40.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.3	4.2
Incremental CPT:	1690.0	1690.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 2a

Description: Non-EGU NOx

Inventory Fields:

Formula: Annual Cost = Annual Cost = Annual Cost Multiplier x (Emissions Reduction [in tons/day]) ^ Exponent + Base
Capital Coat = Capital Cost Multiplier x (Emissions Reduction [in tons/day]) ^ Exponent + Base

Variable Name	Value
Pollutant	NOX
Cost Year	2007
Capital Cost Multiplier	30930.0
Capital Cost Exponent	0.45
Annual Cost Multiplier	9377.0
Annual Cost Exponent	0.4
Incremental Capital Cost Multiplier	
Incremental Capital Cost Exponent	
Incremental Annual Cost Multiplier	
Incremental Annual Cost Exponent	
Capital Cost Base	
Annual Cost Base	

Incremental Capital Cost Base	
Incremental Annual Cost Base	

Affected SCCs:

Code	Description
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.
- Best Available Techniques (BAT) Reference Document for the Manufacture of Glass. European Commission 2013. Available at: http://eippcb.jrc.ec.europa.eu/reference/BREF/GLS_Adopted_03_2012.pdf

Other information:

ADMIN_PCT:	0%
CE_TEXT:	40% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1994). Capital and annual cost information was obtained from control-specific cost data based on tons of glass produced. O&M costs were back calculated from annual costs. From these determinations, default cost per ton values were assigned along with a capital to annual cost ratio of 2.2 (Pechan, 1998). A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment lifetime of 10 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $1,690 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	40%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	40%
INSRNC_PCT:	0%

MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Glass Manufacturing - Flat

Abbreviation: NLNBUGMFT

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to flat glass manufacturing operations classified under 305010404 with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: The 500 tons per day plant is assumed to be representative of flat glass plants (Pechan, 1998).

LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: Glass Manufacturing - Flat

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2007	2007
CPT:	$574	$447
Ref Yr CPT:	$631	$491
Control Efficiency:	40.0	40.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.2	4.3
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2007	2007
CPT:	$574	$447
Ref Yr CPT:	$631	$491
Control Efficiency:	40.0	40.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.2	4.3
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 2a

Description: Non-EGU NOx

Inventory Fields:

Formula: Annual Cost = Annual Cost = Annual Cost Multiplier x (Emissions Reduction [in tons/day]) ^ Exponent + Base
Capital Coat = Capital Cost Multiplier x (Emissions Reduction [in tons/day]) ^ Exponent + Base

Variable Name	Value
Pollutant	NOX
Cost Year	2007
Capital Cost Multiplier	527.0
Capital Cost Exponent	1.0
Annual Cost Multiplier	132.0
Annual Cost Exponent	1.0
Incremental Capital Cost Multiplier	
Incremental Capital Cost Exponent	
Incremental Annual Cost Multiplier	
Incremental Annual Cost Exponent	
Capital Cost Base	664557.0
Annual Cost Base	150105.0

Incremental Capital Cost Base	
Incremental Annual Cost Base	

Affected SCCs:

Code	Description
30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.
- Best Available Techniques (BAT) Reference Document for the Manufacture of Glass. European Commission 2013. Available at: http://eippcb.jrc.ec.europa.eu/reference/BREF/GLS_Adopted_03_2012.pdf

Other information:

ADMIN_PCT:	0%
CE_TEXT:	40% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1994). Capital and annual cost information is obtained from control-specific cost data based on tons of glass produced. O&M costs were back calculated from annual costs. From these determinations, default cost per ton values were assigned along with a capital to annual cost ratio of 2.2 (Pechan, 1998). A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment lifetime of 3 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $700 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	40%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	40%

INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Glass Manufacturing - Pressed

Abbreviation: NLNBUGMPD

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to pressed glass manufacturing operations classified under 305010404 with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: The 500 tons per day plant is assumed to be representative of flat glass plants (Pechan, 1998).

LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: Glass Manufacturing - Pressed

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,500	$1,500
Ref Yr CPT:	$2,402	$2,402
Control Efficiency:	40.0	40.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.2	2.2
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,500	$1,500
Ref Yr CPT:	$2,402	$2,402
Control Efficiency:	40.0	40.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.2	2.2
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	40% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1994). Capital and annual cost information is obtained from control-specific cost data based on tons of glass produced. O&M costs were back calculated from annual costs. From these determinations, default cost per ton values were assigned along with a capital to annual cost ratio of 2.2 (Pechan, 1998). A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment lifetime of 10 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $1,500 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	40%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	40%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Gas Turbines - Natural Gas

Abbreviation: NLNBUGTNG

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control applies to large (83.3 MW to 161 MW) natural gas fired turbines with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combustion

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: Gas Turbines - Natural Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$100	$490
Ref Yr CPT:	$160	$785
Control Efficiency:	84.0	68.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	9.1	9.1
Incremental CPT:	140.0	540.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$100	$490
Ref Yr CPT:	$160	$785
Control Efficiency:	84.0	68.0

Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	9.1	9.1
Incremental CPT:	140.0	540.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 2

Description: Non-EGU NOx

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Annual Cost = Annual Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base
Capital Coat = Capital Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base

Variable Name	Value
Pollutant	NOX
Cost Year	1990
Capital Cost Multiplier	71281.1
Capital Cost Exponent	0.51
Annual Cost Multiplier	7826.3
Annual Cost Exponent	0.51
Incremental Capital Cost Multiplier	71281.1
Incremental Capital Cost Exponent	0.51
Incremental Annual Cost Multiplier	7826.3
Incremental Annual Cost Exponent	0.51
Capital Cost Base	
Annual Cost Base	
Incremental Capital Cost Base	
Incremental Annual Cost Base	

Affected SCCs:

Code	Description
20300203	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine: Cogeneration
20300202	Internal Combustion Engines; Commercial/Institutional; Natural Gas; Turbine

20200203	Internal Combustion Engines; Industrial; Natural Gas; Turbine: Cogeneration
20200201	Internal Combustion Engines; Industrial; Natural Gas; Turbine
20100201	Internal Combustion Engines; Electric Generation; Natural Gas; Turbine

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Stationary Gas Turbines," EPA,-453/R-93-007, Research Triangle Park, NC, January 1993.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	84% from uncontrolled
CHEM_PCT:	0%
CPTON_H:	$140/ton
CPTON_H:	$540/ton
ELEC_RT:	$0/kWh
CTRL_EFF_T:	84%
CTRL_EFF_T:	50%
ELEC_PCT:	0%
COST_BASIS:	Sources are distinguished by the following (Pechan, 1998). Small source = 3.3 MW to 34.4 MW Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). Capital and annual cost information was obtained from the Alternative Control Techniques Document (EPA, 1993). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 9.1. A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 76% (Pechan, 2001). O&M Cost Components: There are no O&M costs associated with dry low NOx combustors.

COST_BASIS:	Sources are distinguished by the following (Pechan, 1998). Large source = greater than 83.3 MW and less than 161 MW Where information was available in the Alternative Control Techniques (ACT) document (EPA, 1993), capacity-based equations are used to calculate costs. A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 76% (Pechan, 2001). The following equations, based primarily on information in the Air Pollution Cost Manual (EPA, 2002), are used for large NOx sources as defined above: From Uncontrolled: Capital Cost = 71,281.1 * Capacity (MMBtu/hr)^0.505 Annual Cost = 7,826.3 * Capacity (MMBtu/hr)^0.505 From RACT Baseline: Capital Cost = 71,281.1 * Capacity (MMBtu/hr)^0.505 Annual Cost = 7,826.3 * Capacity (MMBtu/hr)^0.505 Note: All costs are in 1990 dollars. O&M Cost Components: There are no O&M costs associated with dry low NOx combustors.
CPTON_L:	$100/ton
CPTON_L:	$490/ton
CPTON_TEXT:	The default cost effectiveness values are $490 per ton NOx reduced from uncontrolled and $540 per ton NOx reduced from RACT (1990$).
CPTON_TEXT:	When capacity is available and within the applicable range of 0 to 2,000 MMBTU/hr the cost equations are used to calculate cost effectiveness. The default cost effectiveness value, used when capacity information is not available, is $100 per ton NOx reduced from uncontrolled and $140 per ton NOx reduced from RACT (1990$).
FUEL_PCT:	0%
HG_CE_T:	50%
HG_CE_T:	84%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable

SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; ICI Boilers - Coal/Wall

Abbreviation: NLNBUIBCW

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

These technologies are prevalent in the electric power industry as well as in Industrial, Commercial and Institutional (ICI) boilers at present and increasingly used by ICIs, even at small sizes i.e., less than 10 MMBtu/hr (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: ICI Boilers - Coal/Wall

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A

Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	164527.9

O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	0.0
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300222	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Pulverized Coal: Dry Bottom
10300221	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Pulverized Coal: Wet Bottom
10300206	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom
10300205	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Wet Bottom
10300103	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Hand-fired
10300101	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Pulverized Coal
10200301	External Combustion Boilers; Industrial; Lignite; Pulverized Coal: Dry Bottom, Wall Fired
10200229	External Combustion Boilers; Industrial; Subbituminous Coal; Cogeneration
10200222	External Combustion Boilers; Industrial; Subbituminous Coal; Pulverized Coal: Dry Bottom
10200219	External Combustion Boilers; Industrial; Bituminous Coal; Cogeneration
10200213	External Combustion Boilers; Industrial; Bituminous Coal; Wet Slurry
10200212	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom (Tangential)
10200202	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom
10200201	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Wet Bottom
10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.

- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 4.5. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Appendix F of the ACT document (see page F-4). The model boiler size used to develop O&M cost components is 766 MMBtu/hr. A capacity factor of 0.58 is used in estimating the O&M cost breakdown. Electricity cost: $0.05/kW-hr
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Large source = emission levels greater than 1 ton per ozone season day Where information was available in the Alternative Control Techniques (ACT) document (EPA, 1994), capacity-based equations are used to calculate costs. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). The following equations, based primarily on information in the Air Pollution Cost Manual (EPA, 2002), are used for large NOx sources as defined above: From Uncontrolled: Capital Cost = 53,868.7 * Capacity (MMBtu/hr)^0.6 Annual Cost = 11,861.1 * Capacity (MMBtu/hr)^0.6 From RACT Baseline: Capital Cost = 53,868.7 * Capacity (MMBtu/hr)^0.6 Annual Cost = 11,861.1 * Capacity (MMBtu/hr)^0.6 O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Appendix F of the ACT document (see page F-4). The model boiler size used to develop O&M cost components is 766 MMBtu/hr. A capacity factor of 0.58 is used in estimating the O&M cost breakdown. Electricity cost: $0.05/kW-hr Note: All costs are in 1990 dollars.
CPTON_TEXT:	When capacity is available and within the applicable range of 0 to 2,000 MMBTU/hr the cost equations are used to calculate cost effectiveness. The default cost effectiveness value, used when capacity information is not available, is $1,090 per ton NOx reduced from both uncontrolled and RACT baselines (1990$).

CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $1,460 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	9.91%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	9.86%
NG_RT:	$3.63/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	8.63%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	20.54%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	51.04%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; ICI Boilers - Distillate Oil

Abbreviation: NLNBUIBDO

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

These technologies are prevalent in the electric power industry as well as in Industrial, Commercial and Institutional (ICI) boilers at present and increasingly used by ICIs, even at small sizes i.e., less than 10 MMBtu/hr (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: ICI Boilers - Distillate Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A

Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	164527.9

O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	0.0
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled

CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.5. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the information in the appendix to the 1994 ICI Boiler ACT document. The only O&M cost for LNBs is for administrative, property tax, and insurance, and these are estimated (in total) as 4 percent of the capital investment cost.
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $1,180 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	100%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; ICI Boilers - LPG

Abbreviation: NLNBUIBLP

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

These technologies are prevalent in the electric power industry as well as in Industrial, Commercial and Institutional (ICI) boilers at present and increasingly used by ICIs, even at small sizes i.e., less than 10 MMBtu/hr (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: ICI Boilers - LPG

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A

Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	164527.9

O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	0.0
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10301002	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Propane
10301001	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane
10201002	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Propane
10201001	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Butane

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.5. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the information in the appendix to the 1994 ICI Boiler ACT document. The only O&M cost for LNBs is for administrative, property tax, and insurance, and these are estimated (in total) as 4 percent of the capital investment cost.
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $1,180 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	100%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; ICI Boilers - Natural Gas

Abbreviation: NLNBUIBNG

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

These technologies are prevalent in the electric power industry as well as in Industrial, Commercial and Institutional (ICI) boilers at present and increasingly used by ICIs, even at small sizes i.e., less than 10 MMBtu/hr (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: ICI Boilers - Natural Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A

Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	164527.9

O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	0.0
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.5. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the information in the appendix to the 1994 ICI Boiler ACT document. The only O&M cost for LNBs is for administrative, property tax, and insurance, and these are estimated (in total) as 4 percent of the capital investment cost.
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $820 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	100%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; ICI Boilers - Process Gas

Abbreviation: NLNBUIBPG

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

These technologies are prevalent in the electric power industry as well as in Industrial, Commercial and Institutional (ICI) boilers at present and increasingly used by ICIs, even at small sizes i.e., less than 10 MMBtu/hr (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: ICI Boilers - Process Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A

Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	164527.9

O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	0.0
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10201402	External Combustion Boilers; Industrial; CO Boiler; Process Gas
10200799	External Combustion Boilers; Industrial; Process Gas; Other: Specify in Comments
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.5. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the information in the appendix to the 1994 ICI Boiler ACT document. The only O&M cost for LNBs is for administrative, property tax, and insurance, and these are estimated (in total) as 4 percent of the capital investment cost.
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $820 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	100%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; ICI Boilers - Residual Oil

Abbreviation: NLNBUIBRO

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

These technologies are prevalent in the electric power industry as well as in Industrial, Commercial and Institutional (ICI) boilers at present and increasingly used by ICIs, even at small sizes i.e., less than 10 MMBtu/hr (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: ICI Boilers - Residual Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A

Cost Year:	2008
CPT:	$1,280
Ref Yr CPT:	$1,379
Control Efficiency:	47.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremememtal CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	164527.9

O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	0.0
O&M Emissions Multiplier	0.0

Affected SCCs:

Code	Description
10300404	External Combustion Boilers; Commercial/Institutional; Residual Oil; Grade 5 Oil
10300402	External Combustion Boilers; Commercial/Institutional; Residual Oil; 10-100 Million BTU/hr **
10300401	External Combustion Boilers; Commercial/Institutional; Residual Oil - Grade 6; Boiler
10201404	External Combustion Boilers; Industrial; CO Boiler; Residual Oil
10200405	External Combustion Boilers; Industrial; Residual Oil; Cogeneration
10200404	External Combustion Boilers; Industrial; Residual Oil; Grade 5 Oil
10200403	External Combustion Boilers; Industrial; Residual Oil; < 10 Million BTU/hr
10200402	External Combustion Boilers; Industrial; Residual Oil; 10-100 Million BTU/hr
10200401	External Combustion Boilers; Industrial; Residual Oil; Grade 6 oil

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.5. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the information in the appendix to the 1994 ICI Boiler ACT document. The only O&M cost for LNBs is for administrative, property tax, and insurance, and these are estimated (in total) as 4 percent of the capital investment cost.
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $400 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	100%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Iron & Steel Mills - Annealing

Abbreviation: NLNBUISAN

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to iron and steel annealing operations with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are c

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: Iron & Steel Mills - Annealing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$570	$570
Ref Yr CPT:	$913	$913
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$570	$570
Ref Yr CPT:	$913	$913

Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document for annealing, reheating and galvanizing (EPA, 1994). Capital, and annual cost information was obtained from control-specific cost data. Some O&M costs were included. Missing O&M costs were back calculated from annual costs (Pechan, 1998). From these determinations, an average cost per ton values was assigned along with a capital cost to annual cost ratio of 7.0. A discount rate of 7% was assumed for all sources. The equipment life is 10 years. In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 55% (Pechan, 2001).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $570 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	100%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Iron & Steel Mills - Galvanizing

Abbreviation: NLNBUISGV

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to iron and steel galvanizing operations (SCC 30300936) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combu

Class: Known

Pollutant: NOX

Equipment Life: 9.0 years

Control Technology: Low NOx Burner

Source Group: Iron & Steel Mills - Galvanizing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$490	$490
Ref Yr CPT:	$785	$785
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.15000000596046448	0.15000000596046448
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.5	6.5
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$490	$490
Ref Yr CPT:	$785	$785
Control Efficiency:	50.0	50.0

Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.15000000596046448	0.15000000596046448
Discount Rate:	N/A	N/A
Cap Ann Ratio:	6.5	6.5
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300936	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Coating: Tin, Zinc, etc.

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document for annealing, reheating and galvanizing (EPA, 1994). Capital, and annual cost information was obtained from control-specific cost data. Some O&M costs were included. Missing O&M costs were back calculated from annual costs (Pechan, 1998). From these determinations, an average cost per ton values was assigned along with a capital cost to annual cost ratio of 6.5. A discount rate of 7% was assumed for all sources. The equipment life is 9 years. In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 55% (Pechan, 2001).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $490 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	100%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Iron & Steel Mills - Reheating

Abbreviation: NLNBUISRH

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to iron and steel reheating operations (SCC 30300933) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combust

Class: Known

Pollutant: NOX

Equipment Life: 5.0 years

Control Technology: Low NOx Burner

Source Group: Iron & Steel Mills - Reheating

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$300	$300
Ref Yr CPT:	$480	$480
Control Efficiency:	66.0	66.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.23999999463558197	0.23999999463558197
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$300	$300
Ref Yr CPT:	$480	$480
Control Efficiency:	66.0	66.0

Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.23999999463558197	0.23999999463558197
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300933	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Reheat Furnaces

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	66% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document for annealing, reheating and galvanizing (EPA, 1994). Capital, and annual cost information was obtained from control-specific cost data. Some O&M costs were included. Missing O&M costs were back calculated from annual costs (Pechan, 1998). From these determinations, an average cost per ton values was assigned along with a capital cost to annual cost ratio of 4.1. A discount rate of 7% was assumed for all sources. The equipment life is 5 years. In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies greater than 15% and less than or equal to 25% (Pechan, 2001).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $300 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	66%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	66%
INSRNC_PCT:	0%
MNTLBR_PCT:	100%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Lime Kilns

Abbreviation: NLNBULMKN

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to lime kilns with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich com

Class: Emerging

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: Lime Kilns

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$560	$560
Ref Yr CPT:	$897	$897
Control Efficiency:	30.0	30.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.0	5.0
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$560	$560
Ref Yr CPT:	$897	$897

Control Efficiency:	30.0	30.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.0	5.0
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30700106	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Lime Kiln
30501606	Industrial Processes; Mineral Products; Lime Manufacture; Fluidized Bed Kiln
30501605	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Calcimatic Kiln
30501604	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Rotary Kiln ** (See SCC Codes 3-05-016-18,-19,-20,-21)
30501603	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Vertical Kiln

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Cement Manufacturing," EPA,-453/R-94-004, Research Triangle Park, NC, March 1994.

Other information:

ADMIN_PCT:	19.13%
CE_TEXT:	30% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1994). Capital, and annual cost information was obtained from control-specific cost data. O&M costs were back calculated from annual costs (Pechan, 1998). From these determinations, an average cost per ton values was assigned along with a capital cost to annual cost ratio of 5.0. A discount rate of 7% was assumed for all sources. The equipment life is 15 years. O&M Cost Components: These were estimated for lime kilns using the example applications of this control technique to the cement manufacturing. See the cement kiln documentation for more information.
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $560 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	30%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	30%
INSRNC_PCT:	9.56%
MNTLBR_PCT:	12.06%
MNTLBR_RT:	$24.33/hr
MNTMTL_PCT:	12.06%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	12.59%
OPLBR_RT:	$22.12/hr
OTHR_PCT:	0%
OVRHD_PCT:	37.71%
PROPTX_PCT:	9.56%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	1.89%
STEAM_PCT:	0%
TDIR_PCT:	38.06%
TINDIR_PCT:	61.41%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Low NOx Burner; In-Process Fuel Use; Natural Gas; Gen
Abbreviation:	NLNBUNGGN
Description:	Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. This control is applicable to small (<1 ton NOx per OSD) operations with in-process natural gas usage and uncontrolled NOx emissions greater than 10 tons per year. Discussion: LNBs are designed to "stage" combustion
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Burner
Source Group:	In-Process Fuel Use; Natural Gas; Gen
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,800	$2,200
Ref Yr CPT:	$2,882	$3,523
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,800	$2,200
Ref Yr CPT:	$2,882	$3,523
Control Efficiency:	50.0	50.0

Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000689	Industrial Processes; In-process Fuel Use; Natural Gas; General
39000680	The SCC entry is not found in the reference.scc table

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.3. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $2,200 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; In-Process; Process Gas; Coke Oven Gas

Abbreviation: NLNBUPGCO

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton NOx per OSD) operations with in-process coke oven gas usage and uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combusti

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: In-Process; Process Gas; Coke Oven Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,800	$2,200
Ref Yr CPT:	$2,882	$3,523
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,800	$2,200
Ref Yr CPT:	$2,882	$3,523
Control Efficiency:	50.0	50.0

Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000799	Industrial Processes; In-process Fuel Use; Process Gas; General
39000798	Industrial Processes; In-process Fuel Use; Process Gas; General
39000797	Industrial Processes; In-process Fuel Use; Process Gas; General
39000789	Industrial Processes; In-process Fuel Use; Process Gas; Coke Oven Gas
39000788	Industrial Processes; In-process Fuel Use; Process Gas; General
39000702	Industrial Processes; In-process Fuel Use; Process Gas; Coke Oven Gas

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50%from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.3. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $2,200 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; In-Process Fuel Use; Residual Oil; Gen

Abbreviation: NLNBUROGN

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton NOx per OSD) operations with in-process residual oil usage and uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustio

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: In-Process Fuel Use; Residual Oil; Gen

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$710	$2,520
Ref Yr CPT:	$1,137	$4,035
Control Efficiency:	37.0	37.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$710	$2,520
Ref Yr CPT:	$1,137	$4,035
Control Efficiency:	37.0	37.0

Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.3	7.3
Incrementental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000489	Industrial Processes; In-process Fuel Use; Residual Oil; General

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	37% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emissions level less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.3. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $2,250 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	37%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	37%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Steel Foundries; Heat Treating Furn

Abbreviation: NLNBUSFHT

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to heat treating operations at steel foundries (SCC 30400704) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: Steel Foundries; Heat Treating Furn

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$570	$570
Ref Yr CPT:	$913	$913
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$570	$570
Ref Yr CPT:	$913	$913
Control Efficiency:	50.0	50.0

Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	7.0	7.0
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30400704	Industrial Processes; Secondary Metal Production; Steel Foundries; Heat Treating Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data for mechanical draft heaters firing natural gas and oil contained in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 7.0. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $570 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Space Heaters - Distillate Oil

Abbreviation: NLNBUSHDO

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton NOx per OSD) distillate oil-fired space heaters with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: Space Heaters - Distillate Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,070	$1,180
Ref Yr CPT:	$3,315	$1,890
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.5	5.5
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,070	$1,180
Ref Yr CPT:	$3,315	$1,890
Control Efficiency:	50.0	50.0

Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.5	5.5
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10500214	External Combustion; Space Heaters; Commercial/Institutional; Waste Oil: Vaporizing Burner
10500213	External Combustion; Space Heaters; Commercial/Institutional; Waste Oil: Air Atomized Burner
10500205	External Combustion; Space Heaters; Commercial/Institutional; Distillate Oil
10500114	External Combustion; Space Heaters; Industrial; Waste Oil: Vaporizing Burner
10500113	External Combustion; Space Heaters; Industrial; Waste Oil: Air Atomized Burner
10500105	External Combustion; Space Heaters; Industrial; Distillate Oil

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emissions (Pechan, 1998). Small source = less than 1 ton NOx emissions per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data for mechanical draft heaters firing natural gas and oil contained in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.5. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $1,180 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	100%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Space Heaters - Natural Gas

Abbreviation: NLNBUSHNG

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control is applicable to small (<1 ton NOx per OSD) natural gas-fired space heaters with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: LNBs are designed to "stage" combustion so that two

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Low NOx Burner

Source Group: Space Heaters - Natural Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$820	$650
Ref Yr CPT:	$1,313	$1,041
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.5	5.5
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$820	$650
Ref Yr CPT:	$1,313	$1,041
Control Efficiency:	50.0	50.0

Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.5	5.5
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10500210	External Combustion; Space Heaters; Commercial/Institutional; Liquified Petroleum Gas (LPG)
10500206	External Combustion; Space Heaters; Commercial/Institutional; Natural Gas
10500110	External Combustion; Space Heaters; Industrial; Liquified Petroleum Gas (LPG)
10500106	External Combustion; Space Heaters; Industrial; Natural Gas

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT: 0%

CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emissions (Pechan, 1998). Small source = less than 1 ton NOx emissions per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). The basis of the costs are model plant data for mechanical draft heaters firing natural gas and oil contained in the Alternative Control Techniques (ACT) document (EPA, 1994). From this analysis, default cost per ton values are assigned along with a capital to annual costs ratio of 5.5. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $820 per ton NOx reduced from both uncontrolled and RACT (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	100%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner; Utility Boiler - Bit Coal/Wall

Abbreviation: NLNBUUBCW

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control applies to wall fired (coal) utility boilers

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Stagi

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner

Source Group: Utility Boiler - Coal/Wall

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	57.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	57.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:
Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	48.0
Fixed O&M Cost Multiplier	0.3
Variable O&M Cost Multiplier	0.07
Scaling Factor - Model Size (MW)	300.0
Scaling Factor - Exponent	0.36
Capacity Factor	1.0

Affected SCCs:

Code	Description
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom

References:

- US EPA, 2010: Clean Air Markets Division. "Documentation for EPA Base Case 2010 (V4.1), Using the Integrated Planning Model," Washington, DC., August 2010.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

UTIL_PCT:	0%
WSTDSP_PCT:	0%
ADMIN_PCT:	0%
CE_TEXT:	41% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The cost equations used in this analysis are based on cost equations from EPA's IPM (EPA, 2004). In the IPM, model plants applying LNB had capacities of 300 MW. The equations were scaled to develop costs for smaller or larger boilers than the model plant. The cost equations also assume a capacity utilization factor of 85% for the utility boilers, as well as a 7% discount rate and 15-year lifetime of the controls. Capital Costs (CC): Nameplate Capacity: netdc [=] MW Total Capital Costs: TCC = $19.24 per kW Scaling Factor: SF = (sfn / netdc)^sfe = (300 / MW)^0.359 CC (for netdc < 500) = TCC * netdc * 1000 * SF CC (for netdc > 500) = TCC * netdc * 1000 Operating & Maintenance (O&M): Fixed O&M: omf = $0.29 per kW per year Variable O&M: omv = $0.06 mills per kW-hr Capacity Factor: capfac = 0.85 O&M = (omf * netdc * 1000) + (omv * netdc * 1000 * capfac * 8760 / 1000) Equipment Life in Years = Equiplife Interest Rate = i Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1] Total Cost = (CRF * CC) + O&M O&M Cost Components: With the retrofit of combustion controls, the boiler unburned carbon may increase. This increase results in a reduction in boiler efficiency, requiring more coal to be burned to maintain the boiler output. As the coal firing rate increases, there are corresponding increases in the solid waste generation and auxiliary power usage. The O&M costs were evaluated for tangential-fired boilers only. With no changes in the capital cost for wall-fired boilers, the fixed O&M costs, generally taken as a function of the capital cost, are not expected to vary. Also, no changes in the variable O&M costs are expected, since unburned carbon assumptions are unchanged. For tangential-fired boilers, the general maintenance cost was conservatively taken as 1.5 percent of the total project cost for each technology. Also, a plant capacity factor of 85 percent was assumed. Coal Cost: $1.20/MMBtu Solid waste disposal: $12/ton Auxiliary power: 25 mills/KWh Note: All costs are in 1999 dollars.
ELEC_RT:	$0/kWh
ELEC_PCT:	0%
CPTON_TEXT:	Cost effectiveness is variable and based on plant size (nameplate capacity in MW) and the following factors: the total capital cost of $19.24 per kW; the fixed O&M costs of $0.29 per kW per year; and variable O&M costs of $0.06 mills per kW per year (2004$).
CTRL_EFF_T:	41%
FUEL_PCT:	0%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%

MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%

Summary:

Control Measure Name: Low NOx Coal-and-Air Nozzles with cross-Coupled Overfire Air; Utility Boiler - Bit Coal/Tangential

Abbreviation: NLNC1UBCT

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control applies to wall fired (coal) utility boilers

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Stagi

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Coal-and-Air Nozzles with cross-Coupled Overfire Air

Source Group: Utility Boiler - Coal/Tangential

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	42.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	

Control Efficiency:	42.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:
Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	26.0
Fixed O&M Cost Multiplier	0.2
Variable O&M Cost Multiplier	0.0
Scaling Factor - Model Size (MW)	300.0
Scaling Factor - Exponent	0.36
Capacity Factor	1.0

Affected SCCs:

Code	Description
10102101	External Combustion Boilers; Electric Generation; Other Oil; All

10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired

References:

- US EPA, 2010: Clean Air Markets Division. "Documentation for EPA Base Case 2010 (V4.1), Using the Integrated Planning Model," Washington, DC., August 2010.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

COST_BASIS:	The cost equations used in this analysis are based on cost equations from EPA's IPM (EPA, 2004). In the IPM, model plants applying LNB had capacities of 300 MW. The equations were scaled to develop costs for smaller or larger boilers than the model plant. The cost equations also assume a capacity utilization factor of 85% for the utility boilers, as well as a 7% discount rate and 15-year lifetime of the controls. Capital Costs (CC): Nameplate Capacity: netdc [=] MW Total Capital Costs: TCC = $10.14 per kW Scaling Factor: SF = (sfn / netdc)^sfe = (300 / MW)^0.359 CC (for netdc < 500) = TCC * netdc * 1000 * SF CC (for netdc > 500) = TCC * netdc * 1000 Operating & Maintenance (O&M): Fixed O&M: omf = $0.16 per kW per year Variable O&M: omv = $0.0 mills per kW-hr Capacity Factor: capfac = 0.85 O&M = (omf * netdc * 1000) + (omv * netdc * 1000 * capfac * 8760 / 1000) Equipment Life in Years = Equiplife Interest Rate = I Note: All Costs are in 2004 Dollars
ADMIN_PCT:	0%
CE_TEXT:	33.1% from uncontrolled
CHEM_PCT:	0%
ELEC_RT:	$0/kWh
ELEC_PCT:	0%
CPTON_TEXT:	Cost effectiveness is variable and based on plant size (nameplate capacity in MW) and the following factors: the total capital cost of $10.14 per kW; the fixed O&M costs of $0.16 per kW per year; and variable O&M costs of $0.0 mills per kW per year (1999$).
CTRL_EFF_T:	33%
FUEL_PCT:	0%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%

RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Low NOx Coal-and-Air Nozzles with separated Overfire Air; Utility Boiler - Bit Coal/Tangential
Abbreviation:	NLNC2UBCT
Description:	Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. This control applies to wall fired (coal) utility boilers Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Stagi
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Coal-and-Air Nozzles with separated Overfire Air
Source Group:	Utility Boiler - Coal/Tangential
Sectors:	ptipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	47.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	

Control Efficiency:	47.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	35.0
Fixed O&M Cost Multiplier	0.2
Variable O&M Cost Multiplier	0.03
Scaling Factor - Model Size (MW)	300.0
Scaling Factor - Exponent	0.36
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired

References:

- US EPA, 2010: Clean Air Markets Division. "Documentation for EPA Base Case 2010 (V4.1), Using the Integrated Planning Model," Washington, DC., August 2010.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	12.71% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The cost equations used in this analysis are based on cost equations from EPA's IPM (EPA, 2004). In the IPM, model plants applying LNB had capacities of 300 MW. The equations were scaled to develop costs for smaller or larger boilers than the model plant. The cost equations also assume a capacity utilization factor of 85% for the utility boilers, as well as a 7% discount rate and 15-year lifetime of the controls. Capital Costs (CC): Nameplate Capacity: netdc [=] MW Total Capital Costs: TCC = $14.17 per kW Scaling Factor: SF = (sfn / netdc)^sfe = (300 / MW)^0.359 CC (for netdc < 500) = TCC * netdc * 1000 * SF CC (for netdc > 500) = TCC * netdc * 1000 Operating & Maintenance (O&M): Fixed O&M: omf = $0.21 per kW per year Variable O&M: omv = $0.027 mills per kW-hr Capacity Factor: capfac = 0.85 O&M = (omf * netdc * 1000) + (omv * netdc * 1000 * capfac * 8760 / 1000) Equipment Life in Years = Equiplife Interest Rate = I Capital Recovery Factor: CRF = [I (1 + I) ^ Equiplife] / [((1 + I)^ Equiplife) - 1] Total Cost = (CRF * CC) + O&M O&M Cost Components: With the retrofit of combustion controls, the boiler unburned carbon may increase. This increase results in a reduction in boiler efficiency, requiring more coal to be burned to maintain the boiler output. As the coal firing rate increases, there are corresponding increases in the solid waste generation and auxiliary power usage. The O&M costs were evaluated for tangential-fired boilers only. With no changes in the capital cost for wall-fired boilers, the fixed O&M costs, generally taken as a function of the capital cost, are not expected to vary. Also, no changes in the variable O&M costs are expected, since unburned carbon assumptions are unchanged. For tangential-fired boilers, the general maintenance cost was conservatively taken as 1.5 percent of the total project cost for each technology. Also, a plant capacity factor of 85 percent was assumed. Coal Cost: $1.20/MMBtu Solid waste disposal: $12/ton Auxiliary power: 25 mills/KWh Note: O&M cost components are in 1999 dollars, all others are in $2004.
ELEC_RT:	$0/kWh
ELEC_PCT:	0%
CPTON_TEXT:	Cost effectiveness is variable and based on plant size (nameplate capacity in MW) and the following factors: the total capital cost of $14.17 per kW; the fixed O&M costs of $0.21 per kW per year; and variable O&M costs of $0.027 mills per kW per year (2004$).
CTRL_EFF_T:	38%
FUEL_PCT:	0%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%

NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Coal-and-Air Nozzles with Cross-Coupled and Separated Overfire Air; Utility Boiler - Bit Coal/Tangential

Abbreviation: NLNC3UBCT

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

This control applies to wall fired (coal) utility boilers

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Stagi

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Coal-and-Air Nozzles with Cross-Coupled and Separated Overfire Air

Source Group: Utility Boiler - Coal/Tangential

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	62.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	

Control Efficiency:	62.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:
Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	41.0
Fixed O&M Cost Multiplier	0.3
Variable O&M Cost Multiplier	0.03
Scaling Factor - Model Size (MW)	300.0
Scaling Factor - Exponent	0.36
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace

10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired

References:

- US EPA, 2010: Clean Air Markets Division. "Documentation for EPA Base Case 2010 (V4.1), Using the Integrated Planning Model," Washington, DC., August 2010.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	53.1% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The cost equations used in this analysis are based on cost equations from EPA's IPM (EPA, 2004). In the IPM, model plants applying LNB had capacities of 300 MW. The equations were scaled to develop costs for smaller or larger boilers than the model plant. The cost equations also assume a capacity utilization factor of 85% for the utility boilers, as well as a 7% discount rate and 15-year lifetime of the controls. Capital Costs (CC): Nameplate Capacity: netdc [=] MW Total Capital Costs: TCC = $16.19 per kW Scaling Factor: SF = (sfn / netdc)^sfe = (300 / MW)^0.359 CC (for netdc < 500) = TCC * netdc * 1000 * SF CC (for netdc > 500) = TCC * netdc * 1000 Operating & Maintenance (O&M): Fixed O&M: omf = $0.25 per kW per year Variable O&M: omv = $0.027 mills per kW-hr Capacity Factor: capfac = 0.85 O&M = (omf * netdc * 1000) + (omv * netdc * 1000 * capfac * 8760 / 1000) Equipment Life in Years = Equiplife Interest Rate = I Capital Recovery Factor: CRF = [I (1 + I) ^ Equiplife] / [((1 + I)^ Equiplife) - 1] Total Cost = (CRF * CC) + O&M O&M Cost Components: With the retrofit of combustion controls, the boiler unburned carbon may increase. This increase results in a reduction in boiler efficiency, requiring more coal to be burned to maintain the boiler output. As the coal firing rate increases, there are corresponding increases in the solid waste generation and auxiliary power usage. The O&M costs were evaluated for tangential-fired boilers only. With no changes in the capital cost for wall-fired boilers, the fixed O&M costs, generally taken as a function of the capital cost, are not expected to vary. Also, no changes in the variable O&M costs are expected, since unburned carbon assumptions are unchanged. For tangential-fired boilers, the general maintenance cost was conservatively taken as 1.5 percent of the total project cost for each technology. Also, a plant capacity factor of 85 percent was assumed. Coal Cost: $1.20/MMBtu Solid waste disposal: $12/ton Auxiliary power: 25 mills/KWh Note: O&M cost components are in 1999 dollars, all others are in $2004.
ELEC_RT:	$0/kWh
ELEC_PCT:	0%
CPTON_TEXT:	Cost effectiveness is variable and based on plant size (nameplate capacity in MW) and the following factors: the total capital cost of $16.19 per kW; the fixed O&M costs of $0.25 per kW per year; and variable O&M costs of $0.027 mills per kW per year (1999$).
CTRL_EFF_T:	53%
FUEL_PCT:	0%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%

OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Low NOx Burner (1997 AQMD) (base year = 2003);Commercial/Institutional - NG

Abbreviation: NLNCMNGC03

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

The South Coast and Bay Area AQMDs set emission limits for water heaters and space heaters. This control is based on the installation of low-NOx space heaters and water heaters in commercial and institutional sources for the reduction of NOx emissions.

The control applies to natural gas burning sources classified under SCC 2103006000.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

The 1997 South Coast AQMD estimates a cost savings for new commercial and residential water heaters meeting a low-NOx standard. The cost savings is based on capital costs associated with installation of energy efficient equipment existing demand-side management programs, energy savings, associated emission reductions, and the prevailing emission credit price (SCAQMD, 1996).

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Low NOx Burner (1997 AQMD)

Source Group: Commercial/Institutional - NG

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX	NOX	NOX
Locale:				
Effective Date:	2003-01-01 00:00:00.0	2005-01-01 00:00:00.0	2006-01-01 00:00:00.0	2007-01-01 00:00:00.0
Cost Year:	1990	1990	1990	1990
CPT:	$595	$595	$595	$595
Ref Yr CPT:	$953	$953	$953	$953
Control Efficiency:	75.0	75.0	75.0	75.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	20.0	20.0	40.0	48.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A

Details:	new 9/24/99 - from 1997 AQMD	new 9/24/99 - from 1997 AQMD	new 9/24/99 - from 1997 AQMD	new 9/24/99 - from 1997 AQMD
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	2008-01-01 00:00:00.0	2010-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:	$595	$595
Ref Yr CPT:	$953	$953
Control Efficiency:	75.0	75.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	57.0	73.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:	new 9/24/99 - from 1997 AQMD	new 9/24/99 - from 1997 AQMD
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2103007010	Stationary Source Fuel Combustion; Commercial/Institutional; Liquified Petroleum Gas (LPG); Asphalt Kettle Heaters
2103007005	Stationary Source Fuel Combustion; Commercial/Institutional; Liquified Petroleum Gas (LPG); All Boiler Types
2103007000	Stationary Source Fuel Combustion; Commercial/Institutional; Liquified Petroleum Gas (LPG); Total: All Combustor Types
2103006000	Stationary Source Fuel Combustion; Commercial/Institutional; Natural Gas; Total: Boilers and IC Engines

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Low NOx Burner and Selective Catalytic Reduction; ICI Boilers - LPG

Abbreviation: NLNDSCRIBLP

Description: Application: This control is the use of low NOx burner (LNB) technology and selective catalytic reduction (SCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).
Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.
The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.
The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Selective Catalytic Reduction

Source Group: ICI Boilers - LPG

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	41040.93
Capital Cost Exponent No. 2	0.59
O&M Known Costs	636439.1
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	1641.64
O&M Cost Exponent No. 2	0.59
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10201002	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Propane

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical

Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Low NOx Burner and Selective Catalytic Reduction; ICI Boilers - Process Gas
Abbreviation:	NLNDSCRIBPG
Description:	Application: This control is the use of low NOx burner (LNB) technology and selective catalytic reduction (SCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002). Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Burner and Selective Catalytic Reduction
Source Group:	ICI Boilers - Process Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name:	Type 13
Description:	ICI Boiler Cost Equations
Inventory Fields:	design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	41040.93
Capital Cost Exponent No. 2	0.59
O&M Known Costs	636439.1
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	1641.64
O&M Cost Exponent No. 2	0.59
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10201402	External Combustion Boilers; Industrial; CO Boiler; Process Gas
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Low NOx Burner (1997 AQMD) (base year = 2003);Residential NG

Abbreviation: NLNRSNGC03

Description: Application: This control is the use of low NOx burner (LNB) technology to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another.

The South Coast and Bay Area AQMDs set emission limits for water heaters and space heaters. This control is based on the installation of low-NOx space heaters and water heaters in residential sources for the reduction of NOx emissions.

The control applies to natural gas burning sources classified under SCC 2104006000.

Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNBs create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNBs create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).

The 1997 South Coast AQMD estimates a cost savings for new commercial and residential water heaters meeting a low-NOx standard. The cost savings is based on capital costs associated with installation of energy efficient equipment existing demand-side management programs, energy savings, associated emission reductions, and the prevailing emission credit price (SCAQMD, 1996).

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Low NOx Burner (1997 AQMD)

Source Group: Residential NG

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX	NOX	NOX
Locale:				
Effective Date:	2003-01-01 00:00:00.0	2005-01-01 00:00:00.0	2006-01-01 00:00:00.0	2007-01-01 00:00:00.0
Cost Year:	1990	1990	1990	1990
CPT:	$595	$595	$595	$595
Ref Yr CPT:	$953	$953	$953	$953
Control Efficiency:	75.0	75.0	75.0	75.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	1.0	20.0	40.0	48.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A

Details:	new 9/24/99 - from 1997 AQMD	new 9/24/99 - from 1997 AQMD	new 9/24/99 - from 1997 AQMD	new 9/24/99 - from 1997 AQMD
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	2008-01-01 00:00:00.0	2010-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:	$595	$595
Ref Yr CPT:	$953	$953
Control Efficiency:	75.0	75.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	57.0	73.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:	new 9/24/99 - from 1997 AQMD	new 9/24/99 - from 1997 AQMD
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104007000	Stationary Source Fuel Combustion; Residential; Liquified Petroleum Gas (LPG); Total: All Combustor Types
2104006010	Stationary Source Fuel Combustion; Residential; Natural Gas; Residential Furnaces

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name:	Low NOx Burner and Selective Catalytic Reduction; ICI Boilers - Coal/Wall
Abbreviation:	NLNSCRIBCW
Description:	Application: This control is the use of low NOx burner (LNB) technology and selective catalytic reduction (SCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002). Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Burner and Selective Catalytic Reduction
Source Group:	ICI Boilers - Coal/Wall
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incrementemental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incrementemental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	41040.93
Capital Cost Exponent No. 2	0.59
O&M Known Costs	636439.1
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	1641.64
O&M Cost Exponent No. 2	0.59
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300222	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Pulverized Coal: Dry Bottom
10300221	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Pulverized Coal: Wet Bottom
10300206	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom
10300205	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Wet Bottom
10300103	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Hand-fired
10300101	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Pulverized Coal
10200301	External Combustion Boilers; Industrial; Lignite; Pulverized Coal: Dry Bottom, Wall Fired
10200229	External Combustion Boilers; Industrial; Subbituminous Coal; Cogeneration
10200222	External Combustion Boilers; Industrial; Subbituminous Coal; Pulverized Coal: Dry Bottom

10200219	External Combustion Boilers; Industrial; Bituminous Coal; Cogeneration
10200213	External Combustion Boilers; Industrial; Bituminous Coal; Wet Slurry
10200212	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom (Tangential)
10200202	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom
10200201	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Wet Bottom
10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Low NOx Burner and Selective Catalytic Reduction; ICI Boilers - Distillate Oil
Abbreviation:	NLNSCRIBDO
Description:	Application: This control is the use of low NOx burner (LNB) technology and selective catalytic reduction (SCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002). Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Burner and Selective Catalytic Reduction
Source Group:	ICI Boilers - Distillate Oil
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	41040.93
Capital Cost Exponent No. 2	0.59
O&M Known Costs	636439.1
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	1641.64
O&M Cost Exponent No. 2	0.59
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Low NOx Burner and Selective Catalytic Reduction; ICI Boilers - Natural Gas

Abbreviation: NLNSCRIBNG

Description: Application: This control is the use of low NOx burner (LNB) technology and selective catalytic reduction (SCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).
Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.
The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.
The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Selective Catalytic Reduction

Source Group: ICI Boilers - Natural Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	41040.93
Capital Cost Exponent No. 2	0.59
O&M Known Costs	636439.1
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	1641.64
O&M Cost Exponent No. 2	0.59
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Low NOx Burner and Selective Catalytic Reduction; ICI Boilers - Gas

Abbreviation: NLNSCRICBG

Description: Application: This control is the use of low NOx burner (LNB) technology and selective catalytic reduction (SCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).
Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.
The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.
The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Selective Catalytic Reduction

Source Group: ICI Boilers - Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incrementemal CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$3,480
Ref Yr CPT:	$3,749
Control Efficiency:	91.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incrementemal CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	41040.93
Capital Cost Exponent No. 2	0.59
O&M Known Costs	636439.1
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	1641.64
O&M Cost Exponent No. 2	0.59
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Low NOx Burner and Selective Non-Catalytic Reduction; ICI Boilers - Coal/Wall
Abbreviation:	NLNSNCRIBCW
Description:	Application: This control is the use of low NOx burner (LNB) technology and selective non-catalytic reduction (SNCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002). SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002). Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications. The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: ? Reaction temperature range; ? Residence time available in the optimum temperature range; ? Degree of mixing between the injected reagent and the combustion gases ? Uncontrolled NOx concentration level; ? Molar ratio of injected reagent to uncontrolled NOx ; and ? Ammonia slip.
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Burner and Selective Non-Catalytic Reduction
Source Group:	ICI Boilers - Coal/Wall
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,870
Ref Yr CPT:	$3,092
Control Efficiency:	69.5
Min Emis:	25.0

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,870
Ref Yr CPT:	$3,092
Control Efficiency:	69.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	208706.86
Capital Cost Exponent No. 2	0.21
O&M Known Costs	297928.9
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	8348.3
O&M Cost Exponent No. 2	0.21
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10300222	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Pulverized Coal: Dry Bottom
10300221	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Pulverized Coal: Wet Bottom
10300206	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom
10300205	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Wet Bottom
10300103	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Hand-fired
10300101	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Pulverized Coal
10200301	External Combustion Boilers; Industrial; Lignite; Pulverized Coal: Dry Bottom, Wall Fired
10200229	External Combustion Boilers; Industrial; Subbituminous Coal; Cogeneration
10200222	External Combustion Boilers; Industrial; Subbituminous Coal; Pulverized Coal: Dry Bottom

10200219	External Combustion Boilers; Industrial; Bituminous Coal; Cogeneration
10200213	External Combustion Boilers; Industrial; Bituminous Coal; Wet Slurry
10200212	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom (Tangential)
10200202	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom
10200201	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Wet Bottom
10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Low NOx Burner and Selective Non-Catalytic Reduction; ICI Boilers - Distillate Oil

Abbreviation: NLNSNCRIBDO

Description: Application: This control is the use of low NOx burner (LNB) technology and selective non-catalytic reduction (SNCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).
Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.
The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include:
? Reaction temperature range;
? Residence time available in the optimum temperature range;
? Degree of mixing between the injected reagent and the combustion gases
? Uncontrolled NOx concentration level;
? Molar ratio of injected reagent to uncontrolled NOx ; and
? Ammonia slip.

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Selective Non-Catalytic Reduction

Source Group: ICI Boilers - Distillate Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,870
Ref Yr CPT:	$3,092
Control Efficiency:	69.5
Min Emis:	25.0

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,870
Ref Yr CPT:	$3,092
Control Efficiency:	69.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	208706.86
Capital Cost Exponent No. 2	0.21
O&M Known Costs	297928.9
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	8348.3
O&M Cost Exponent No. 2	0.21
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Low NOx Burner and Selective Non-Catalytic Reduction; ICI Boilers - Natural Gas
Abbreviation:	NLNSNCRIBNG
Description:	Application: This control is the use of low NOx burner (LNB) technology and selective non-catalytic reduction (SNCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002). SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002). Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications. The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: ? Reaction temperature range; ? Residence time available in the optimum temperature range; ? Degree of mixing between the injected reagent and the combustion gases ? Uncontrolled NOx concentration level; ? Molar ratio of injected reagent to uncontrolled NOx ; and ? Ammonia slip.
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Burner and Selective Non-Catalytic Reduction
Source Group:	ICI Boilers - Natural Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,870
Ref Yr CPT:	$3,092
Control Efficiency:	69.5
Min Emis:	25.0

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,870
Ref Yr CPT:	$3,092
Control Efficiency:	69.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	208706.86
Capital Cost Exponent No. 2	0.21
O&M Known Costs	297928.9
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	8348.3
O&M Cost Exponent No. 2	0.21
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Low NOx Burner and Selective Non-Catalytic Reduction; ICI Boilers - Residual Oil

Abbreviation: NLNSNCRIBRO

Description: Application: This control is the use of low NOx burner (LNB) technology and selective non-catalytic reduction (SNCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).
Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002).
SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).
Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.
The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include:
? Reaction temperature range;
? Residence time available in the optimum temperature range;
? Degree of mixing between the injected reagent and the combustion gases
? Uncontrolled NOx concentration level;
? Molar ratio of injected reagent to uncontrolled NOx ; and
? Ammonia slip.

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Low NOx Burner and Selective Non-Catalytic Reduction

Source Group: ICI Boilers - Residual Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,870
Ref Yr CPT:	$3,092
Control Efficiency:	69.5
Min Emis:	25.0

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,870
Ref Yr CPT:	$3,092
Control Efficiency:	69.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula:

Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	208706.86
Capital Cost Exponent No. 2	0.21
O&M Known Costs	297928.9
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	8348.3
O&M Cost Exponent No. 2	0.21
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10300404	External Combustion Boilers; Commercial/Institutional; Residual Oil; Grade 5 Oil
10300402	External Combustion Boilers; Commercial/Institutional; Residual Oil; 10-100 Million BTU/hr **
10300401	External Combustion Boilers; Commercial/Institutional; Residual Oil - Grade 6; Boiler
10201404	External Combustion Boilers; Industrial; CO Boiler; Residual Oil
10200405	External Combustion Boilers; Industrial; Residual Oil; Cogeneration
10200404	External Combustion Boilers; Industrial; Residual Oil; Grade 5 Oil
10200403	External Combustion Boilers; Industrial; Residual Oil; < 10 Million BTU/hr
10200402	External Combustion Boilers; Industrial; Residual Oil; 10-100 Million BTU/hr
10200401	External Combustion Boilers; Industrial; Residual Oil; Grade 6 oil

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Low NOx Burner and Selective Non-Catalytic Reduction; ICI Boilers - Gas
Abbreviation:	NLNSNCRICBG
Description:	Application: This control is the use of low NOx burner (LNB) technology and selective non-catalytic reduction (SNCR) to reduce NOx emissions. LNBs reduce the amount of NOx created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). Discussion: LNBs are designed to "stage" combustion so that two combustion zones are created, one fuel-rich combustion and one at a lower temperature. Staging techniques are usually used by LNB to supply excess air to cool the combustion process or to reduce available oxygen in the flame zone. Staged-air LNB's create a fuel-rich reducing primary combustion zone and a fuel-lean secondary combustion zone. Staged-fuel LNB's create a lean combustion zone that is relatively cool due to the presence of excess air, which acts as a heat sink to lower combustion temperatures (EPA, 2002). SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002). Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications. The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: ? Reaction temperature range; ? Residence time available in the optimum temperature range; ? Degree of mixing between the injected reagent and the combustion gases ? Uncontrolled NOx concentration level; ? Molar ratio of injected reagent to uncontrolled NOx ; and ? Ammonia slip.
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Low NOx Burner and Selective Non-Catalytic Reduction
Source Group:	ICI Boilers - Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,870
Ref Yr CPT:	$3,092
Control Efficiency:	69.5
Min Emis:	25.0

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,870
Ref Yr CPT:	$3,092
Control Efficiency:	69.5
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	5460.27
Capital Cost Exponent No. 1	0.65
Capital Cost Size Multiplier No. 2	208706.86
Capital Cost Exponent No. 2	0.21
O&M Known Costs	297928.9
O&M Cost Size Multiplier No. 1	218.4
O&M Cost Exponent No. 1	0.65
O&M Cost Size Multiplier No. 2	8348.3
O&M Cost Exponent No. 2	0.21
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Mid-Kiln Firing; Cement Manufacturing - Dry

Abbreviation: NMKFRCMDY

Description: Application: This control is the use of mid- kiln firing to reduce NOx emissions.

This control applies to dry-process cement manufacturing (SCC 30500606) with uncontrolled NOx emissions greater than 10 tons per year.

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Mid-Kiln Firing

Source Group: Cement Manufacturing - Dry

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1997	1997
CPT:	$55	$55
Ref Yr CPT:	$75	$75
Control Efficiency:	30.0	30.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	3.4	3.4
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1997	1997
CPT:	$55	$55
Ref Yr CPT:	$75	$75
Control Efficiency:	30.0	30.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0

Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	3.4	3.4
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500602	The SCC entry is not found in the reference.scc table

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Cement Manufacturing," EPA,-453/R-94-004, Research Triangle Park, NC, March 1994.
- EC/R, 2000: EC/R Incorporated, "NOx Control Technologies for the Cement Industry," prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC, September 2000.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Cost equations for cement plants NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). Capital and annual cost information was obtained from a NOx control technologies for the cement industry report (EC/R, 2000). Cost for low-NOx burners were developed using model plants. A discount rate of 10% and an equipment life of 15 years was assumed. O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in the EC/R report, Tables 6-3, 6-9 and 6-10. Per the EC/R report, electricity costs are negligible. The breakdown was obtained using the average O&M costs for furnaces having capacities of 113 and 180 MMBTU per hour. A capacity factor of is used in estimating the O&M cost breakdown. Maintenance labor: $24.33 per hour times 0.5 hour per 8-hour shift Fuel (tires): -$42.50 per ton
CPTON_H:	$730/ton
CPTON_L:	$-460/ton
CPTON_TEXT:	The default cost effectiveness value is $55 per ton NOx reduced from both uncontrolled and RACT baselines (1997$). The cost effectiveness range is from a savings of $460 to a cost of $720 per ton NOx reduced.
CTRL_EFF_T:	25%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	25%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$24.33/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Mid-Kiln Firing; Cement Manufacturing - Wet
Abbreviation:	NMKFRCMWT
Description:	Application: This control is the use of mid- kiln firing to reduce NOx emissions. This control applies to wet-process cement manufacturing (SCC 30500706) with uncontrolled NOx emissions greater than 10 tons per year.
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Mid-Kiln Firing
Source Group:	Cement Manufacturing - Wet
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1997	1997
CPT:	$55	$55
Ref Yr CPT:	$75	$75
Control Efficiency:	30.0	30.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	3.6	3.6
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1997	1997
CPT:	$55	$55
Ref Yr CPT:	$75	$75
Control Efficiency:	30.0	30.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0

Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	3.6	3.6
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500706	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Kilns

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Cement Manufacturing," EPA,-453/R-94-004, Research Triangle Park, NC, March 1994.
- EC/R, 2000: EC/R Incorporated, "NOx Control Technologies for the Cement Industry," prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC, September 2000.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Cost equations for cement plants NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). Capital and annual cost information was obtained from a NOx control technologies for the cement industry report (EC/R, 2000). Cost for low-NOx burners were developed using model plants. A discount rate of 10% and an equipment life of 15 years was assumed. O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in the EC/R report, Tables 6-3, 6-9 and 6-10. The breakdown was obtained using the average costs for furnaces having capacities of 113 and 180 MMBTU per hour. A capacity factor of 0.913 is used in estimating the O&M cost breakdown. (EC/R, 2000) Maintenance labor: $24.33 per hour Fuel (tires): -$42.50 per ton
CPTON_H:	$730/ton
CPTON_L:	$-460/ton
CPTON_TEXT:	The default cost effectiveness value is $55 per ton NOx reduced from both uncontrolled and RACT baselines (1997$). The cost effectiveness range is from a savings of $460 to a cost of $720 per ton NOx reduced.
CTRL_EFF_T:	25%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	25%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$24.33/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	65.74%

Summary:

Control Measure Name: Natural Gas Reburn; External Combustion Boilers, Elec Gen, Nat Gas (1)

Abbreviation: NNGRECBNG1

Description: Application: Natural gas reburning (NGR) involves add-on controls to reduce NOx emissions. NGR is a combustion control technology in which part of the main fuel heat input is diverted to locations above the main burners, called the reburn zone. As flue gas passes through the reburn zone, a portion of the NOx formed in the main combustion zone is reduced by hydrocarbon radicals and converted to molecular nitrogen (N2).

This control applies to non-tangentially fired Natural Gas external combustion boilers with capacity of at least 100 Million BTU/hr.

Discussion: In a reburn boiler, fuel is injected into the upper furnace region to convert the NOx formed in the primary combustion zone to molecular N2 and H2O. In general, the overall process occurs within three zones of the boiler; the combustion zone, the gas reburning zone, and the burnout zone (ERG, 2000). In the combustion zone the amount of fuel is reduced and the burners may be operated at the lowest excess air level. In the gas reburning zone the fuel not used in the combustion zone is injected to create a fuel-rich region where radicals can react with NOx to form molecular Nitrogen. In the burnout zone a separate overfire air system redirects air from the primary combustion zone to ensure complete combustion of unreacted fuel leaving the reburning zone.

Operational parameters that affect the performance of reburn include reburn zone stoichiometry, residence time in the reburn zone, reburn fuel carrier gas and temperature and O2 levels in the burnout zone (ERG, 2000).

Class: Known

Pollutant: NOX

Equipment Life: N/A years

Control Technology: Natural Gas Reburn

Source Group: External Combustion Boilers, Elec Gen, Nat Gas (1)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,951
Ref Yr CPT:	$2,606
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	

Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,951
Ref Yr CPT:	$2,606
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

Summary:

Control Measure Name:	Natural Gas Reburn; External Combustion Boilers, Elec Gen, Nat Gas (2)
Abbreviation:	NNGRECBNG2
Description:	Application: Natural gas reburning (NGR) involves add-on controls to reduce NOx emissions. NGR is a combustion control technology in which part of the main fuel heat input is diverted to locations above the main burners, called the reburn zone. As flue gas passes through the reburn zone, a portion of the NOx formed in the main combustion zone is reduced by hydrocarbon radicals and converted to molecular nitrogen (N2). This control applies to non-tangentially fired Natural Gas external combustion boilers with capacity of less than 100 Million BTU/hr. Discussion: In a reburn boiler, fuel is injected into the upper furnace region to convert the NOx formed in the primary combustion zone to molecular N2 and H2O. In general, the overall process occurs within three zones of the boiler; the combustion zone, the gas reburning zone, and the burnout zone (ERG, 2000). In the combustion zone the amount of fuel is reduced and the burners may be operated at the lowest excess air level. In the gas reburning zone the fuel not used in the combustion zone is injected to create a fuel-rich region where radicals can react with NOx to form molecular Nitrogen. In the burnout zone a separate overfire air system redirects air from the primary combustion zone to ensure complete combustion of unreacted fuel leaving the reburning zone. Operational parameters that affect the performance of reburn include reburn zone stoichiometry, residence time in the reburn zone, reburn fuel carrier gas and temperature and O2 levels in the burnout zone (ERG, 2000).
Class:	Known
Pollutant:	NOX
Equipment Life:	N/A years
Control Technology:	Natural Gas Reburn
Source Group:	External Combustion Boilers, Elec Gen, Nat Gas (2)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,951
Ref Yr CPT:	$2,606
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	

Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,951
Ref Yr CPT:	$2,606
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

Summary:

Control Measure Name:	Natural Gas Reburn; External Combustion Boilers, Elec Gen, Nat Gas (3)
Abbreviation:	NNGRECBNG3
Description:	Application: Natural gas reburning (NGR) involves add-on controls to reduce NOx emissions. NGR is a combustion control technology in which part of the main fuel heat input is diverted to locations above the main burners, called the reburn zone. As flue gas passes through the reburn zone, a portion of the NOx formed in the main combustion zone is reduced by hydrocarbon radicals and converted to molecular nitrogen (N2). This control applies to tangentially fired Natural Gas external combustion boilers. Discussion: In a reburn boiler, fuel is injected into the upper furnace region to convert the NOx formed in the primary combustion zone to molecular N2 and H2O. In general, the overall process occurs within three zones of the boiler; the combustion zone, the gas reburning zone, and the burnout zone (ERG, 2000). In the combustion zone the amount of fuel is reduced and the burners may be operated at the lowest excess air level. In the gas reburning zone the fuel not used in the combustion zone is injected to create a fuel-rich region where radicals can react with NOx to form molecular Nitrogen. In the burnout zone a separate overfire air system redirects air from the primary combustion zone to ensure complete combustion of unreacted fuel leaving the reburning zone. Operational parameters that affect the performance of reburn include reburn zone stoichiometry, residence time in the reburn zone, reburn fuel carrier gas and temperature and O2 levels in the burnout zone (ERG, 2000).
Class:	Known
Pollutant:	NOX
Equipment Life:	N/A years
Control Technology:	Natural Gas Reburn
Source Group:	External Combustion Boilers, Elec Gen, Nat Gas (3)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,951
Ref Yr CPT:	$2,606
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	

Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,951
Ref Yr CPT:	$2,606
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

Summary:

Control Measure Name:	Non-Selective Catalytic Reduction; Industrial NG ICE, 4cycle (rich)
Abbreviation:	NNSCRINGI4
Description:	Application: NSCR is achieved by placing a catalyst in the exhaust stream of the engine. The exhaust passes over the catalyst, usually a noble metal (platinum, rhodium or palladium) which reduces the reactants to N2, CO2 and H20 (NJDEP, 2003). Typical exhaust temperatures for effective removal of NOx are 800-1200 degrees Fahrenheit. An oxidation catalyst using additional air can be installed downstream of the NSCR catalyst for additional CO and VOC control. This includes 4-cycle naturally aspirated engines and some 4-cycle turbocharged engines. Engines operating with NSCR require air/fuel control to maintain high reduction effectiveness.
Class:	Known
Pollutant:	NOX
Equipment Life:	N/A years
Control Technology:	Non-Selective Catalytic Reduction
Source Group:	Industrial NG ICE, 4cycle (rich)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$422
Ref Yr CPT:	$564
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$422
Ref Yr CPT:	$564
Control Efficiency:	90.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2310021351	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Lateral Compressors 4 Cycle Rich Burn
2310021302	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Rich Burn Compressor Engines 50 To 499 HP
2310021301	Industrial Processes; Oil and Gas Exploration and Production; On-Shore Gas Production; Natural Gas Fired 4Cycle Rich Burn Compressor Engines <50 HP
20200253	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Rich Burn

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

Summary:

Control Measure Name: Non-Selective Catalytic Reduction; Industrial NG ICE, 4cycle (rich), SCCs w technology not specified

Abbreviation: NNSCRINGNS

Description: Note: This control measure is for SCCs where the firing technology is not specified as to Rich Burn or Lean Burn. Therefore, the Rich Burn control of NSCR is applied using a Penetration Rate equal to the ratio of Rich Burn emissions in the 2011 NEI for SCCs where it is specified (23%). Application: NSCR is achieved by placing a catalyst in the exhaust stream of the engine. The exhaust passes over the catalyst, usually a noble metal (platinum, rhodium or palladium) which reduces the reactants to N2, CO2 and H20 (NJDEP, 2003). Typical exhaust temperatures for effective removal of NOx are 800-1200 degrees Fahrenheit. An oxidation catalyst using additional air can be installed downstream of the NSCR catalyst for additional CO and VOC control. This includes 4-cycle naturally aspirated engines and some 4-cycle turbocharged engines. Engines operating with NSCR require air/fuel control to maintain high reduction effectiveness.

Class: Known

Pollutant: NOX

Equipment Life: N/A years

Control Technology: Non-Selective Catalytic Reduction

Source Group: Industrial NG ICE, 4cycle (rich)_SCCs w technology not specified

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$422
Ref Yr CPT:	$564
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	23.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$422

Ref Yr CPT:	$564
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	23.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
20200204	Internal Combustion Engines; Industrial; Natural Gas; Reciprocating: Cogeneration
20200202	Internal Combustion Engines; Industrial; Natural Gas; Reciprocating

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

Summary:

Control Measure Name: Non-Selective Catalytic Reduction; Nitric Acid Manufacturing

Abbreviation: NNSCRNAMF

Description: Application: NSCR is achieved by placing a catalyst in the exhaust stream of the engine. The exhaust passes over the catalyst, usually a noble metal (platinum, rhodium or palladium) which reduces the reactants to N2, CO2 and H20 (NJDEP, 2003). Typical exhaust temperatures for effective removal of NOx are 800-1200 degrees Fahrenheit. An oxidation catalyst using additional air can be installed downstream of the NSCR catalyst for additional CO and VOC control. This includes 4-cycle naturally aspirated engines and some 4-cycle turbocharged engines. Engines operating with NSCR require air/fuel control to maintain high reduction effectiveness.

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Non-Selective Catalytic Reduction

Source Group: Nitric Acid Manufacturing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$550	$550
Ref Yr CPT:	$881	$881
Control Efficiency:	98.0	98.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.4	2.4
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$550	$550
Ref Yr CPT:	$881	$881
Control Efficiency:	98.0	98.0

Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.4	2.4
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30101302	Industrial Processes; Chemical Manufacturing; Nitric Acid; Absorber Tail Gas (Post-1970 Facilities)
30101301	Industrial Processes; Chemical Manufacturing; Nitric Acid; Absorber Tail Gas (Pre-1970 Facilities)

References:

N/A

Other information:

ADMIN_PCT:	0%
CE_TEXT:	98% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:

Sources are distinguished by NOx emission levels (Pechan, 1998).

Small source = emission levels less than 1 ton per ozone season day
Large source = emission levels greater than 1 ton per ozone season day

Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1991).

O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Table 6-4 and Ch. 6 of the Nitric and Adipic Acid Manufacturing Plant ACT document. The breakdown was obtained using O&M costs for three plants having capacities of 200, 500 and 1000 tons per day.

Maintenance materials and labor: 4% of capital cost
Operating labor GÇô direct: $22 per hour
Operating labor GÇô supervision: 20% of direct operating labor
Fuel (natural gas): $4.12 per MMBTU

CPTON_H:	$710/ton
CPTON_L:	$510/ton
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $550 per ton NOx reduced (1990$).
CTRL_EFF_T:	98%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	60.67%
HG_CE_T:	98%
INSRNC_PCT:	9.15%
MNTLBR_PCT:	12.08%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$4.12/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	4.49%
OPLBR_RT:	$22/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.2%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.84%
STEAM_PCT:	0%
TDIR_PCT:	78.09%
TINDIR_PCT:	21.91%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	OXY-Firing; Glass Manufacturing - Container
Abbreviation:	NOXYFGMCN
Description:	Application: This control is the use of OXY-firing in container glass manufacturing furnaces to reduce NOx emissions. Oxygen enrichment refers to the substitution of oxygen for nitrogen in the combustion air used to burn the fuel in a glass furnace. Oxygen enrichment above 90 percent is sometimes called "oxy-firing." Discussion: The basic rationale for oxy-firing is improved efficiency, i.e., more of the theoretical heat of combustion is transferred to the glass melt and is not lost in the flue gas. Ma
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	OXY-Firing
Source Group:	Glass Manufacturing - Container
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$4,590	$4,590
Ref Yr CPT:	$7,350	$7,350
Control Efficiency:	85.0	85.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.7	2.7
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$4,590	$4,590
Ref Yr CPT:	$7,350	$7,350
Control Efficiency:	85.0	85.0

Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.7	2.7
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	85% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Cost equations for glass manufacturing NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan-Avanti, 1998). The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document. The 50 tons per day plant was assumed to be representative of pressed glass plants, the 250 tons per day plant was assumed to be representative of container glass plants, and the 500 tons per day plant was assumed to be representative of flat glass plants. Capital, and annual cost information that was obtained from control-specific cost data based on tons of glass produced. O&M costs were back calculated from annual costs. From these determinations, default cost per ton values were assigned. A capital cost to annual cost ratio was developed to estimate default capital and O&M costs. A discount rate of 10% was assumed for all sources. The equipment life of varied form3 to 10 years by control.
CPTON_TEXT:	The default cost effectiveness value is $4,590 per ton NOx reduced from both uncontrolled and RACT baselines (1990$).
CTRL_EFF_T:	85%

ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	85%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: OXY-Firing; Glass Manufacturing - Flat

Abbreviation: NOXYFGMFT

Description: Application: This control is the use of OXY-firing in flat glass manufacturing furnaces to reduce NOx emissions. Oxygen enrichment refers to the substitution of oxygen for nitrogen in the combustion air used to burn the fuel in a glass furnace. Oxygen enrichment above 90 percent is sometimes called "oxy-firing."

This control applies to flat-glass manufacturing operations with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: The basic rationale for oxy-firing is improved efficie

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: OXY-Firing

Source Group: Glass Manufacturing - Flat

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,900	$1,900
Ref Yr CPT:	$3,043	$3,043
Control Efficiency:	85.0	85.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.7	2.7
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,900	$1,900
Ref Yr CPT:	$3,043	$3,043
Control Efficiency:	85.0	85.0

Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.7	2.7
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	85% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1994). Capital and annual cost information is obtained from control-specific cost data based on tons of glass produced. O&M costs were back calculated from annual costs. From these determinations, default cost per ton values were assigned along with a capital to annual cost ratio of 2.7 (Pechan, 1998). A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment lifetime of 10 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value is $1,900 per ton NOx reduced from both uncontrolled and RACT baselines (1990$).
CTRL_EFF_T:	85%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh

FUEL_PCT:	0%
HG_CE_T:	85%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: OXY-Firing; Glass Manufacturing - General (New)

Abbreviation: NOXYFGMGN

Description: Application: This control is the use of OXY-firing in flat glass manufacturing furnaces to reduce NOx emissions. Oxygen enrichment refers to the substitution of oxygen for nitrogen in the combustion air used to burn the fuel in a glass furnace. Oxygen enrichment above 90 percent is sometimes called "oxy-firing."

This control applies to general manufacturing operations. This control applies to general glass manufacturing operations classified under SCC 30501401.

Discussion: The basic rationale for oxy-firing is improved efficiency, i.e., more of the theoretical heat of combustion is transferred to the glass melt and is not lost in the flue gas. Many other combustion modification techniques (e.g., flue gas recirculation, staged combustion, and low excess air combustion) reduce NOx formation but also reduce the combustion efficiency. Oxy-firing was originally developed to improve the combustion efficiency primarily by eliminating the sensible heat lost in heating the nitrogen present in air, which is then lost in the flue gas.

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: OXY-Firing

Source Group: Glass Manufacturing - Container

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2002	2002
CPT:	$2,353	$2,353
Ref Yr CPT:	$2,959	$2,959
Control Efficiency:	85.0	85.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.7	2.7
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A

Cost Year:	2002	2002
CPT:	$2,353	$2,353
Ref Yr CPT:	$2,959	$2,959
Control Efficiency:	85.0	85.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.7	2.7
Incremememtal CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501401	Industrial Processes; Mineral Products; Glass Manufacture; Furnace/General**

References:

- Oxygen Enriched Air Staging a Cost-effective Method For Reducing NOx Emissions. Industrial Technologies. April 2002. Available at: http://www1.eere.energy.gov/manufacturing/resources/glass/pdfs/airstaging.pdf

Other information:

Summary:

Control Measure Name:	OXY-Firing; Glass Manufacturing - Pressed
Abbreviation:	NOXYFGMPD
Description:	Application: This control is the use of OXY-firing in pressed glass manufacturing furnaces to reduce NOx emissions. Oxygen enrichment refers to the substitution of oxygen for nitrogen in the combustion air used to burn the fuel in a glass furnace. Oxygen enrichment above 90 percent is sometimes called "oxy-firing." Discussion: The basic rationale for oxy-firing is improved efficiency, i.e., more of the theoretical heat of combustion is transferred to the glass melt and is not lost in the flue gas. Many
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	OXY-Firing
Source Group:	Glass Manufacturing - Pressed
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$3,900	$3,900
Ref Yr CPT:	$6,245	$6,245
Control Efficiency:	85.0	85.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.7	2.7
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$3,900	$3,900
Ref Yr CPT:	$6,245	$6,245
Control Efficiency:	85.0	85.0

Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.7	2.7
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	85% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The basis of the costs are model plant data contained in the Alternative Control Techniques (ACT) document (EPA, 1994). Capital and annual cost information is obtained from control-specific cost data based on tons of glass produced. O&M costs were back calculated from annual costs. From these determinations, default cost per ton values were assigned along with a capital to annual cost ratio of 2.7 (Pechan, 1998). A discount rate of 10 percent and a capacity factor of 65 percent are assumed, along with an equipment lifetime of 10 years (EPA, 1994).
CPTON_TEXT:	The default cost effectiveness value is $3,900 per ton NOx reduced from both uncontrolled and RACT baselines (1990$).
CTRL_EFF_T:	85%
ELEC_PCT:	0%

ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	85%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Petroleum Refinery Gas-Fired Process Heaters; Excess O2 Control
Abbreviation:	NPRGPHEO2C
Description:	Petroleum Refinery Gas-Fired Process Heaters; Excess O2 Control
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Excess O3 Control
Source Group:	Petroleum Refinery Gas-Fired Process Heaters
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	N/A
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.2438906878232956
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremenental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	N/A
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	0.2438906878232956
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 12

Description: NOx Controls for Gas-Fired Process Heaters at Petroleum Refineries Equations

Inventory Fields: stack_flow_rate,stack_temperature

Formula: stack_flow_rate (scfm) = stack_flow_rate (acfm) x 460 / (stack_temperature + 460)
Total Capital Investment (TCI) = (Fixed TCI + Variable TCI) x (stack_flow_rate (scfm)/150,000)^.6
Annual Operating Cost (AOC) = (AOC fixed + AOC variable) x (stack_flow_rate (scfm)/150,000)
Total Annual Cost (TAC) = AOC + Capital Recovery Factor (CRF) x TCI

Variable Name	Value
Pollutant	NOX
Cost Year	2006
Total Capital Investment (TCI) Fixed Factor	20000.0
Total Capital Investment (TCI) Variable Factor	
Annual Operating Cost (AOC) Fixed Factor	4000.0
Annual Operating Cost (AOC) Variable Factor	

Affected SCCs:

Code	Description
30600108	Industrial Processes; Petroleum Industry; Process Heaters; Landfill Gas-fired
30600107	Industrial Processes; Petroleum Industry; Process Heaters; LPG-fired
30600106	Industrial Processes; Petroleum Industry; Process Heaters; Process Gas-fired
30600105	Industrial Processes; Petroleum Industry; Process Heaters; Natural Gas-fired
30600104	Industrial Processes; Petroleum Industry; Process Heaters; Gas-fired
30600102	Industrial Processes; Petroleum Industry; Process Heaters; Gas-fired **

References:

- Cost estimates from MACTEC BART Analysis Report, 2005, for gas-fired process heaters

Other information:

CEFF_EQUATION_NOX_TYPE:	Type 1 -
CEFF_EQUATION_NOX_VAR1:	46 lb/lb-mole
CEFF_EQUATION_NOX_VAR2:	80 ppmv

Summary:

Control Measure Name:	Petroleum Refinery Gas-Fired Process Heaters; SCR-95%
Abbreviation:	NPRGPHSC95
Description:	Petroleum Refinery Gas-Fired Process Heaters; SCR-95%
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	SCR-95%
Source Group:	Petroleum Refinery Gas-Fired Process Heaters
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	N/A
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09439292550086975
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	N/A
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	0.09439292550086975
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name:	Type 12
Description:	NOx Controls for Gas-Fired Process Heaters at Petroleum Refineries Equations
Inventory Fields:	stack_flow_rate,stack_temperature
Formula:	stack_flow_rate (scfm) = stack_flow_rate (acfm) x 460 / (stack_temperature + 460) Total Capital Investment (TCI) = (Fixed TCI + Variable TCI) x (stack_flow_rate (scfm)/150,000)^.6 Annual Operating Cost (AOC) = (AOC fixed + AOC variable) x (stack_flow_rate (scfm)/150,000) Total Annual Cost (TAC) = AOC + Capital Recovery Factor (CRF) x TCI

Variable Name	Value
Pollutant	NOX
Cost Year	2006
Total Capital Investment (TCI) Fixed Factor	
Total Capital Investment (TCI) Variable Factor	8888198.0
Annual Operating Cost (AOC) Fixed Factor	121000.0
Annual Operating Cost (AOC) Variable Factor	1171507.0

Affected SCCs:

Code	Description
30600108	Industrial Processes; Petroleum Industry; Process Heaters; Landfill Gas-fired
30600107	Industrial Processes; Petroleum Industry; Process Heaters; LPG-fired
30600106	Industrial Processes; Petroleum Industry; Process Heaters; Process Gas-fired
30600105	Industrial Processes; Petroleum Industry; Process Heaters; Natural Gas-fired
30600104	Industrial Processes; Petroleum Industry; Process Heaters; Gas-fired
30600102	Industrial Processes; Petroleum Industry; Process Heaters; Gas-fired **

References:

- Cost estimates from MACTEC BART Analysis Report, 2005, for gas-fired process heaters

Other information:

CEFF_EQUATION_NOX_TYPE:	Type 1 -
CEFF_EQUATION_NOX_VAR1:	46 lb/lb-mole
CEFF_EQUATION_NOX_VAR2:	10 ppmv

Summary:

Control Measure Name: Petroleum Refinery Gas-Fired Process Heaters; SCR
Abbreviation: NPRGPHSCR
Description: Petroleum Refinery Gas-Fired Process Heaters; Selective Catalytic Reduction
Class: Known
Pollutant: NOX
Equipment Life: 15.0 years
Control Technology: Selective Catalytic Reduction
Source Group: Petroleum Refinery Gas-Fired Process Heaters
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	N/A
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09439292550086975
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	N/A
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	0.09439292550086975
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 12

Description: NOx Controls for Gas-Fired Process Heaters at Petroleum Refineries Equations

Inventory Fields: stack_flow_rate,stack_temperature

Formula: stack_flow_rate (scfm) = stack_flow_rate (acfm) x 460 / (stack_temperature + 460)
Total Capital Investment (TCI) = (Fixed TCI + Variable TCI) x (stack_flow_rate (scfm)/150,000)^.6
Annual Operating Cost (AOC) = (AOC fixed + AOC variable) x (stack_flow_rate (scfm)/150,000)
Total Annual Cost (TAC) = AOC + Capital Recovery Factor (CRF) x TCI

Variable Name	Value
Pollutant	NOX
Cost Year	2006
Total Capital Investment (TCI) Fixed Factor	
Total Capital Investment (TCI) Variable Factor	6837075.0
Annual Operating Cost (AOC) Fixed Factor	121000.0
Annual Operating Cost (AOC) Variable Factor	972483.0

Affected SCCs:

Code	Description
30600108	Industrial Processes; Petroleum Industry; Process Heaters; Landfill Gas-fired
30600107	Industrial Processes; Petroleum Industry; Process Heaters; LPG-fired
30600106	Industrial Processes; Petroleum Industry; Process Heaters; Process Gas-fired
30600105	Industrial Processes; Petroleum Industry; Process Heaters; Natural Gas-fired
30600104	Industrial Processes; Petroleum Industry; Process Heaters; Gas-fired
30600102	Industrial Processes; Petroleum Industry; Process Heaters; Gas-fired **

References:

- Cost estimates from MACTEC BART Analysis Report, 2005, for gas-fired process heaters

Other information:

CEFF_EQUATION_NOX_TYPE:	Type 1 -
CEFF_EQUATION_NOX_VAR1:	46 lb/lb-mole
CEFF_EQUATION_NOX_VAR2:	20 ppmv

Summary:

Control Measure Name: Petroleum Refinery Gas-Fired Process Heaters; Ultra Low NOX Burners
Abbreviation: NPRGPHULNB
Description: Petroleum Refinery Gas-Fired Process Heaters; Ultra Low NOX Burners
Class: Known
Pollutant: NOX
Equipment Life: 15.0 years
Control Technology: Ultra-Low NOx Burner
Source Group: Petroleum Refinery Gas-Fired Process Heaters
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	N/A
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09439292550086975
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	N/A
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	0.09439292550086975
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 12

Description: NOx Controls for Gas-Fired Process Heaters at Petroleum Refineries Equations

Inventory Fields: stack_flow_rate,stack_temperature

Formula: stack_flow_rate (scfm) = stack_flow_rate (acfm) x 460 / (stack_temperature + 460)
Total Capital Investment (TCI) = (Fixed TCI + Variable TCI) x (stack_flow_rate (scfm)/150,000)^.6
Annual Operating Cost (AOC) = (AOC fixed + AOC variable) x (stack_flow_rate (scfm)/150,000)
Total Annual Cost (TAC) = AOC + Capital Recovery Factor (CRF) x TCI

Variable Name	Value
Pollutant	NOX
Cost Year	2006
Total Capital Investment (TCI) Fixed Factor	
Total Capital Investment (TCI) Variable Factor	1154000.0
Annual Operating Cost (AOC) Fixed Factor	56000.0
Annual Operating Cost (AOC) Variable Factor	74702.0

Affected SCCs:

Code	Description
30600108	Industrial Processes; Petroleum Industry; Process Heaters; Landfill Gas-fired
30600107	Industrial Processes; Petroleum Industry; Process Heaters; LPG-fired
30600106	Industrial Processes; Petroleum Industry; Process Heaters; Process Gas-fired
30600105	Industrial Processes; Petroleum Industry; Process Heaters; Natural Gas-fired
30600104	Industrial Processes; Petroleum Industry; Process Heaters; Gas-fired
30600102	Industrial Processes; Petroleum Industry; Process Heaters; Gas-fired **

References:

- Cost estimates from MACTEC BART Analysis Report, 2005, for gas-fired process heaters

Other information:

CEFF_EQUATION_NOX_TYPE:	Type 1 -
CEFF_EQUATION_NOX_VAR1:	46 lb/lb-mole
CEFF_EQUATION_NOX_VAR2:	40 ppmv

Summary:

Control Measure Name: RACT to 25 tpy (Low NOx Burner) (base year = 1996);Industrial Coal Combustion
Abbreviation: NR25COL96
Description: Application: The RACT control technology used is the addition of a low NOx burner to reduce NOx emissions.

This standard applies to sources with boilers fueled by coal that emit over 25 tpy NOx (classified under SCCs 2102001000 and 2102002000).
Class: Known
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: RACT to 25 tpy (Low NOx Burner)
Source Group: Industrial Coal Combustion
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$1,350
Ref Yr CPT:	$2,162
Control Efficiency:	21.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	80.0
Rule Penetration:	45.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$1,350
Ref Yr CPT:	$2,162
Control Efficiency:	21.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	80.0
Rule Penetration:	45.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2102002000	Stationary Source Fuel Combustion; Industrial; Bituminous/Subbituminous Coal; Total: All Boiler Types
2102001000	Stationary Source Fuel Combustion; Industrial; Anthracite Coal; Total: All Boiler Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.
- Pechan, 1996: E.H. Pechan & Associates, "The Emission Reduction and Cost Analysis Model for NOx (ECRAM-NOx)," Revised Documentation, prepared for U.S. Environmental Protection Agency, Ozone Policy and Strategies Group, Research Triangle Park, NC, September 1996.

Other information:

ADMIN_PCT:	0%
SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Reasonably Available Control Technology - 25 tpy
STEAM_PCT:	0%

TDIR_PCT:	0%
CTRL_EFF_T:	21%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	21% from uncontrolled
COST_BASIS:	Cost per ton (CPT) values are based on applying the cost equations developed for the point source ICI boilers to small sources. For coal, costs are based on a 50 MMBtu/hr boiler operating at 33% capacity. Costs are based on a 10-year equipment life and a 5% discount rate (Pechan, 1998). Annual Cost (AC) = CPT * Emissions *(Control Efficiency *Rule Effectiveness*Rule Penetration) Cost Effectiveness = AC / Tons NOx Reduced Per Year
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $1,350 per ton NOx reduced (1990$).
OTHR_PCT:	0%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	21%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OVRHD_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: RACT to 25 tpy (Low NOx Burner) (base year = 1996);Industrial NG Combustion
Abbreviation: NR25NGC96
Description: Application: The RACT control technology used is the addition of a low NOx burner to reduce NOx emissions.

This standard applies to sources with boilers fueled by natural gas that emit over 50 tpy NOx (classified under SCCs 2102006000, 2102006001, 2102006002, 2102007000, and 2102010000).

Class: Known
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: RACT to 25 tpy (Low NOx Burner)
Source Group: Industrial NG Combustion
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$770
Ref Yr CPT:	$1,233
Control Efficiency:	31.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	80.0
Rule Penetration:	22.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$770
Ref Yr CPT:	$1,233
Control Efficiency:	31.0
Min Emis:	25.0

Max Emis:	N/A
Rule Effectiveness:	80.0
Rule Penetration:	22.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrementemental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2102010000	Stationary Source Fuel Combustion; Industrial; Process Gas; Total: All Boiler Types
2102007000	Stationary Source Fuel Combustion; Industrial; Liquified Petroleum Gas (LPG); Total: All Boiler Types
2102006002	Stationary Source Fuel Combustion; Industrial; Natural Gas; All IC Engine Types
2102006001	Stationary Source Fuel Combustion; Industrial; Natural Gas; All Boiler Types
2102006000	Stationary Source Fuel Combustion; Industrial; Natural Gas; Total: Boilers and IC Engines

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.
- Pechan, 1996: E.H. Pechan & Associates, "The Emission Reduction and Cost Analysis Model for NOx (ECRAM-NOx)," Revised Documentation, prepared for U.S. Environmental Protection Agency, Ozone Policy and Strategies Group, Research Triangle Park, NC, September 1996.

Other information:

ADMIN_PCT:	0%
SPVLBR_PCT:	0%

RPLMTL_PCT:	0%
RULE:	Reasonably Available Control Technology - 25 tpy
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	31%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	31% from uncontrolled
COST_BASIS:	Cost per ton (CPT) values are based on applying the cost equations developed for the point source ICI boilers to small sources. For gas and oil, costs are based on a 25 MMBtu/hour boiler operating at 33 percent of capacity, an equipment lifetime of 10 years, and a 5 percent discount rate (Pechan, 1998). Annual Cost (AC) = CPT * Emissions *(Control Efficiency *Rule Effectiveness*Rule Penetration) Cost Effectiveness = AC / Tons NOx Reduced Per Year
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $770 per ton NOx reduced (1990$).
OTHR_PCT:	0%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	31%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OVRHD_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: RACT to 25 tpy (Low NOx Burner) (base year = 1996);Industrial Oil Combustion
Abbreviation: NR25OIL96
Description: Application: The RACT control technology used is the addition of a low NOx burner to reduce NOx emissions.

This standard applies to sources with boilers fueled by coal that emit over 25 tpy NOx (classified under SCCs 2102004000, 2102005000, 2102011000, and 2102012000).

Class: Known
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: RACT to 25 tpy (Low NOx Burner)
Source Group: Industrial Oil Combustion
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$1,180
Ref Yr CPT:	$1,890
Control Efficiency:	36.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	80.0
Rule Penetration:	16.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$1,180
Ref Yr CPT:	$1,890
Control Efficiency:	36.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	80.0
Rule Penetration:	16.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2102012000	Stationary Source Fuel Combustion; Industrial; Waste oil; Total
2102011000	Stationary Source Fuel Combustion; Industrial; Kerosene; Total: All Boiler Types
2102005000	Stationary Source Fuel Combustion; Industrial; Residual Oil; Total: All Boiler Types
2102004000	Stationary Source Fuel Combustion; Industrial; Distillate Oil; Total: Boilers and IC Engines

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.
- Pechan, 1996: E.H. Pechan & Associates, "The Emission Reduction and Cost Analysis Model for NOx (ECRAM-NOx)," Revised Documentation, prepared for U.S. Environmental Protection Agency, Ozone Policy and Strategies Group, Research Triangle Park, NC, September 1996.

Other information:

ADMIN_PCT:	0%
SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Reasonably Available Control Technology - 25 tpy

STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	36%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	36% from uncontrolled
COST_BASIS:	Cost per ton (CPT) values are based on applying the cost equations developed for the point source ICI boilers to small sources. For gas and oil, costs are based on a 25 MMBtu/hour boiler operating at 33 percent of capacity, an equipment lifetime of 10 years, and a 5 percent discount rate (Pechan, 1998). Annual Cost (AC) = CPT * Emissions *(Control Efficiency *Rule Effectiveness*Rule Penetration) Cost Effectiveness = AC / Tons NOx Reduced Per Year
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $1,180 per ton NOx reduced (1990$).
OTHR_PCT:	0%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	36%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OVRHD_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: RACT to 50 tpy (Low NOx Burner) (base year = 1996);Industrial Coal Combustion

Abbreviation: NR50COL96

Description: Application: The RACT control technology used is the addition of a low NOx burner to reduce NOx emissions.

This standard applies to sources with boilers fueled by coal that emit over 50 tpy NOx (classified under SCCs 2102001000 and 2102002000).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: RACT to 50 tpy (Low NOx Burner)

Source Group: Industrial Coal Combustion

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$1,350
Ref Yr CPT:	$2,162
Control Efficiency:	21.0
Min Emis:	50.0
Max Emis:	N/A
Rule Effectiveness:	80.0
Rule Penetration:	23.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$1,350
Ref Yr CPT:	$2,162
Control Efficiency:	21.0
Min Emis:	50.0
Max Emis:	N/A

Rule Effectiveness:	80.0
Rule Penetration:	23.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2102002000	Stationary Source Fuel Combustion; Industrial; Bituminous/Subbituminous Coal; Total: All Boiler Types
2102001000	Stationary Source Fuel Combustion; Industrial; Anthracite Coal; Total: All Boiler Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.
- Pechan, 1996: E.H. Pechan & Associates, "The Emission Reduction and Cost Analysis Model for NOx (ECRAM-NOx)," Revised Documentation, prepared for U.S. Environmental Protection Agency, Ozone Policy and Strategies Group, Research Triangle Park, NC, September 1996.

Other information:

ADMIN_PCT:	0%
SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Reasonably Available Control Technology - 50 tpy
STEAM_PCT:	0%

TDIR_PCT:	0%
CTRL_EFF_T:	21%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	21% from uncontrolled
COST_BASIS:	Cost per ton (CPT) values are based on applying the cost equations developed for the point source ICI boilers to small sources. For coal, costs are based on a 50 MMBtu/hr boiler operating at 33% capacity. Costs are based on a 10-year equipment life and a 5% discount rate (Pechan, 1998). Annual Cost (AC) = CPT * Emissions *(Control Efficiency *Rule Effectiveness*Rule Penetration) Cost Effectiveness = AC / Tons NOx Reduced Per Year
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $1,350 per ton NOx reduced (1990$).
OTHR_PCT:	0%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	21%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OVRHD_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: RACT to 50 tpy (Low NOx Burner) (base year = 1996);Industrial NG Combustion
Abbreviation: NR50NGC96
Description: Application: The RACT control technology used is the addition of a low NOx burner to reduce NOx emissions.

This standard applies to sources with boilers fueled by natural gas that emit over 50 tpy NOx (classified under SCCs 2102006000 and 2102006002).
Class: Known
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: RACT to 50 tpy (Low NOx Burner)
Source Group: Industrial NG Combustion
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$770
Ref Yr CPT:	$1,233
Control Efficiency:	31.0
Min Emis:	50.0
Max Emis:	N/A
Rule Effectiveness:	80.0
Rule Penetration:	11.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$770
Ref Yr CPT:	$1,233
Control Efficiency:	31.0
Min Emis:	50.0
Max Emis:	N/A

Rule Effectiveness:	80.0
Rule Penetration:	11.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2102006002	Stationary Source Fuel Combustion; Industrial; Natural Gas; All IC Engine Types
2102006000	Stationary Source Fuel Combustion; Industrial; Natural Gas; Total: Boilers and IC Engines

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.
- Pechan, 1996: E.H. Pechan & Associates, "The Emission Reduction and Cost Analysis Model for NOx (ECRAM-NOx)," Revised Documentation, prepared for U.S. Environmental Protection Agency, Ozone Policy and Strategies Group, Research Triangle Park, NC, September 1996.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Reasonably Available Control Technology - 50 tpy
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	31%

OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
ADMIN_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	31% from uncontrolled
COST_BASIS:	Cost per ton (CPT) values are based on applying the cost equations developed for the point source ICI boilers to small sources. For gas and oil, costs are based on a 25 MMBtu/hour boiler operating at 33 percent of capacity, an equipment lifetime of 10 years, and a 5 percent discount rate (Pechan, 1998). Annual Cost (AC) = CPT * Emissions *(Control Efficiency *Rule Effectiveness*Rule Penetration) Cost Effectiveness = AC / Tons NOx Reduced Per Year
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $770 per ton NOx reduced (1990$).
OTHR_PCT:	0%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	31%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OVRHD_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: RACT to 50 tpy (Low NOx Burner) (base year = 1996);Industrial Oil Combustion
Abbreviation: NR50OIL96
Description: Application: The RACT control technology used is the addition of a low NOx burner to reduce NOx emissions.

This standard applies to sources with boilers fueled by coal that emit over 50 tpy NOx (classified under SCCs 2102004000 and 2102005000).

Class: Known
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: RACT to 50 tpy (Low NOx Burner)
Source Group: Industrial Oil Combustion
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$1,180
Ref Yr CPT:	$1,890
Control Efficiency:	36.0
Min Emis:	50.0
Max Emis:	N/A
Rule Effectiveness:	80.0
Rule Penetration:	8.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrementental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	1996-01-01 00:00:00.0
Cost Year:	1990
CPT:	$1,180
Ref Yr CPT:	$1,890
Control Efficiency:	36.0
Min Emis:	50.0
Max Emis:	N/A

Rule Effectiveness:	80.0
Rule Penetration:	8.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2102005000	Stationary Source Fuel Combustion; Industrial; Residual Oil; Total: All Boiler Types
2102004000	Stationary Source Fuel Combustion; Industrial; Distillate Oil; Total: Boilers and IC Engines

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.
- Pechan, 1996: E.H. Pechan & Associates, "The Emission Reduction and Cost Analysis Model for NOx (ECRAM-NOx)," Revised Documentation, prepared for U.S. Environmental Protection Agency, Ozone Policy and Strategies Group, Research Triangle Park, NC, September 1996.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Reasonably Available Control Technology - 50 tpy
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	36%

OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
ADMIN_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	36% from uncontrolled
COST_BASIS:	Cost per ton (CPT) values are based on applying the cost equations developed for the point source ICI boilers to small sources. For gas and oil, costs are based on a 25 MMBtu/hour boiler operating at 33 percent of capacity, an equipment lifetime of 10 years, and a 5 percent discount rate (Pechan, 1998). Annual Cost (AC) = CPT * Emissions *(Control Efficiency *Rule Effectiveness*Rule Penetration) Cost Effectiveness = AC / Tons NOx Reduced Per Year
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $1,180 per ton NOx reduced (1990$).
OTHR_PCT:	0%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	36%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OVRHD_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Catalytic Reduction; Utility Boiler - Coal/Tangential - 25 to 99 MW

Abbreviation: NSCR_UBCT1

Description: Application: This control is the use of selective catalytic reduction add-on controls to tangentially coal-fired utility boilers for the reduction of NOx emissions. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

This control applies to bituminous/subbituminous coal-fired electricity generation sources, including sources with atmospheric fluidized bed combustion with nameplate capacity greater than 100 MW.

Discussion: Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

Selective Catalytic Reduction (SCR) systems are among the post-combustion NOx control systems that can be effective in controlling mercury. This is based on recent pilot-scale tests that indicate that SNCR and SCR systems may enhance Hg capture under some conditions by oxidizing Hg0 (Massachusetts, 2002).

Researches are investigating the possibility of Hg0 to Hg2+ conversion in SCR systems as a possible result of ammonia on fly ash mercury reactions. In the SCR process, a catalyst (such as vanadium, titanium, platinum, or zeolite) is used in a bed reactor, and the NOx reduction occurs at the surface of the catalyst bed with the help of a reducing agent (diluted ammonia or urea, which generates ammonia in the process). The ammonia mixture is injected into the flue gas upstream of the metal catalyst bed reactor, which is located upstream of a PM or SO2 control device (usually between the economizer outlet and air heater inlet, where temperatures range from 230 to 400oC).

Recent pilot-scale tests indicate that SCR systems can enhance Hg capture under some conditions by oxidizing Hg0. On the plant-size scale, only one set of tests have been performed to measure the effectiveness of SCR systems. Application of SCR system, combined with spray dryer absorber was tested at a plant which was firing bituminous coal. The test results indicated greater than 95 percent mercury removal for the combined co-control systems (Massachusetts, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Utility Boiler - Coal/Tangential (25 to 99 MW)

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:

Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	349.0
Fixed O&M Cost Multiplier	1.86
Variable O&M Cost Multiplier	1.3
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker

10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler

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References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air and Radiation, "Analyzing Electric Power Generation Under the CAAA," Washington, DC, March 1998.
- EPA, 2001: U.S. Environmental Protection, Office of Research and Development, "Cost of Selective Catalytic Reduction (SCR) Application for NOx Control on Coal-Fired Boilers," EPA-600/R-01-087, Research Triangle Park, NC, October 2001.
- EPA, 2004: U.S Environmental Protection Agency, Clean Air Market Division, "Updating Performance and Cost of NOx Control Technologies in the Integrated Planning Model" Paper # 137
- Massachusetts, 2002: Commonwealth of Massachusetts, Department of Environmental Protection, Executive Office of Environmental Affairs, Division of Planning and Evaluation, Bureau of Waste Prevention, "Evaluation Of The Technological and Economic Feasibility of Controlling and Eliminating Mercury Emissions from the Combustion of Solid Fossil Fuel, Pursuant To 310 CMR 7.29 - Emissions Standards For Power Plants," Downloaded from http://www.state.ma.us/dep/bwp/daqc/daqcpubs.htm#other, December 2002.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; Utility Boiler - Coal/Tangential - 100 to 299 MW

Abbreviation: NSCR_UBCT2

Description: Application: This control is the use of selective catalytic reduction add-on controls to tangentially coal-fired utility boilers for the reduction of NOx emissions. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

This control applies to bituminous/subbituminous coal-fired electricity generation sources, including sources with atmospheric fluidized bed combustion with nameplate capacity greater than 100 MW.

Discussion: Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

Selective Catalytic Reduction (SCR) systems are among the post-combustion NOx control systems that can be effective in controlling mercury. This is based on recent pilot-scale tests that indicate that SNCR and SCR systems may enhance Hg capture under some conditions by oxidizing Hg0 (Massachusetts, 2002).

Researches are investigating the possibility of Hg0 to Hg2+ conversion in SCR systems as a possible result of ammonia on fly ash mercury reactions. In the SCR process, a catalyst (such as vanadium, titanium, platinum, or zeolite) is used in a bed reactor, and the NOx reduction occurs at the surface of the catalyst bed with the help of a reducing agent (diluted ammonia or urea, which generates ammonia in the process). The ammonia mixture is injected into the flue gas upstream of the metal catalyst bed reactor, which is located upstream of a PM or SO2 control device (usually between the economizer outlet and air heater inlet, where temperatures range from 230 to 400oC).

Recent pilot-scale tests indicate that SCR systems can enhance Hg capture under some conditions by oxidizing Hg0. On the plant-size scale, only one set of tests have been performed to measure the effectiveness of SCR systems. Application of SCR system, combined with spray dryer absorber was tested at a plant which was firing bituminous coal. The test results indicated greater than 95 percent mercury removal for the combined co-control systems (Massachusetts, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Utility Boiler - Coal/Tangential (100 to 299 MW)

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:

Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	287.0
Fixed O&M Cost Multiplier	0.81
Variable O&M Cost Multiplier	1.3
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker

10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air and Radiation, "Analyzing Electric Power Generation Under the CAAA," Washington, DC, March 1998.
- EPA, 2001: U.S. Environmental Protection, Office of Research and Development, "Cost of Selective Catalytic Reduction (SCR) Application for NOx Control on Coal-Fired Boilers," EPA-600/R-01-087, Research Triangle Park, NC, October 2001.
- EPA, 2004: U.S Environmental Protection Agency, Clean Air Market Division, "Updating Performance and Cost of NOx Control Technologies in the Integrated Planning Model" Paper # 137
- Massachusetts, 2002: Commonwealth of Massachusetts, Department of Environmental Protection, Executive Office of Environmental Affairs, Division of Planning and Evaluation, Bureau of Waste Prevention, "Evaluation Of The Technological and Economic Feasibility of Controlling and Eliminating Mercury Emissions from the Combustion of Solid Fossil Fuel, Pursuant To 310 CMR 7.29 - Emissions Standards For Power Plants," Downloaded from http://www.state.ma.us/dep/bwp/daqc/daqcpubs.htm#other, December 2002.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; Utility Boiler - Coal/Tangential - 300 to 499 MW

Abbreviation: NSCR_UBCT3

Description: Application: This control is the use of selective catalytic reduction add-on controls to tangentially coal-fired utility boilers for the reduction of NOx emissions. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

This control applies to bituminous/subbituminous coal-fired electricity generation sources, including sources with atmospheric fluidized bed combustion with nameplate capacity greater than 100 MW.

Discussion: Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

Selective Catalytic Reduction (SCR) systems are among the post-combustion NOx control systems that can be effective in controlling mercury. This is based on recent pilot-scale tests that indicate that SNCR and SCR systems may enhance Hg capture under some conditions by oxidizing Hg0 (Massachusetts, 2002).

Researches are investigating the possibility of Hg0 to Hg2+ conversion in SCR systems as a possible result of ammonia on fly ash mercury reactions. In the SCR process, a catalyst (such as vanadium, titanium, platinum, or zeolite) is used in a bed reactor, and the NOx reduction occurs at the surface of the catalyst bed with the help of a reducing agent (diluted ammonia or urea, which generates ammonia in the process). The ammonia mixture is injected into the flue gas upstream of the metal catalyst bed reactor, which is located upstream of a PM or SO2 control device (usually between the economizer outlet and air heater inlet, where temperatures range from 230 to 400oC).

Recent pilot-scale tests indicate that SCR systems can enhance Hg capture under some conditions by oxidizing Hg0. On the plant-size scale, only one set of tests have been performed to measure the effectiveness of SCR systems. Application of SCR system, combined with spray dryer absorber was tested at a plant which was firing bituminous coal. The test results indicated greater than 95 percent mercury removal for the combined co-control systems (Massachusetts, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Utility Boiler - Coal/Tangential (300 to 499 MW)

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	266.0
Fixed O&M Cost Multiplier	0.69
Variable O&M Cost Multiplier	1.3
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker

10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air and Radiation, "Analyzing Electric Power Generation Under the CAAA," Washington, DC, March 1998.
- EPA, 2001: U.S. Environmental Protection, Office of Research and Development, "Cost of Selective Catalytic Reduction (SCR) Application for NOx Control on Coal-Fired Boilers," EPA-600/R-01-087, Research Triangle Park, NC, October 2001.
- EPA, 2004: U.S Environmental Protection Agency, Clean Air Market Division, "Updating Performance and Cost of NOx Control Technologies in the Integrated Planning Model" Paper # 137
- Massachusetts, 2002: Commonwealth of Massachusetts, Department of Environmental Protection, Executive Office of Environmental Affairs, Division of Planning and Evaluation, Bureau of Waste Prevention, "Evaluation Of The Technological and Economic Feasibility of Controlling and Eliminating Mercury Emissions from the Combustion of Solid Fossil Fuel, Pursuant To 310 CMR 7.29 - Emissions Standards For Power Plants," Downloaded from http://www.state.ma.us/dep/bwp/daqc/daqcpubs.htm#other, December 2002.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; Utility Boiler - Coal/Tangential - 500 to 699 MW
Abbreviation:	NSCR_UBCT4
Description:	Application: This control is the use of selective catalytic reduction add-on controls to tangentially coal-fired utility boilers for the reduction of NOx emissions. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control applies to bituminous/subbituminous coal-fired electricity generation sources, including sources with atmospheric fluidized bed combustion with nameplate capacity greater than 100 MW. Discussion: Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. Selective Catalytic Reduction (SCR) systems are among the post-combustion NOx control systems that can be effective in controlling mercury. This is based on recent pilot-scale tests that indicate that SNCR and SCR systems may enhance Hg capture under some conditions by oxidizing Hg0 (Massachusetts, 2002). Researches are investigating the possibility of Hg0 to Hg2+ conversion in SCR systems as a possible result of ammonia on fly ash mercury reactions. In the SCR process, a catalyst (such as vanadium, titanium, platinum, or zeolite) is used in a bed reactor, and the NOx reduction occurs at the surface of the catalyst bed with the help of a reducing agent (diluted ammonia or urea, which generates ammonia in the process). The ammonia mixture is injected into the flue gas upstream of the metal catalyst bed reactor, which is located upstream of a PM or SO2 control device (usually between the economizer outlet and air heater inlet, where temperatures range from 230 to 400oC). Recent pilot-scale tests indicate that SCR systems can enhance Hg capture under some conditions by oxidizing Hg0. On the plant-size scale, only one set of tests have been performed to measure the effectiveness of SCR systems. Application of SCR system, combined with spray dryer absorber was tested at a plant which was firing bituminous coal. The test results indicated greater than 95 percent mercury removal for the combined co-control systems (Massachusetts, 2002).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Utility Boiler - Coal/Tangential (500 to 699 MW)
Sectors:	ptipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:

Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	255.0
Fixed O&M Cost Multiplier	0.63
Variable O&M Cost Multiplier	1.3
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker

10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air and Radiation, "Analyzing Electric Power Generation Under the CAAA," Washington, DC, March 1998.
- EPA, 2001: U.S. Environmental Protection, Office of Research and Development, "Cost of Selective Catalytic Reduction (SCR) Application for NOx Control on Coal-Fired Boilers," EPA-600/R-01-087, Research Triangle Park, NC, October 2001.
- EPA, 2004: U.S Environmental Protection Agency, Clean Air Market Division, "Updating Performance and Cost of NOx Control Technologies in the Integrated Planning Model" Paper # 137
- Massachusetts, 2002: Commonwealth of Massachusetts, Department of Environmental Protection, Executive Office of Environmental Affairs, Division of Planning and Evaluation, Bureau of Waste Prevention, "Evaluation Of The Technological and Economic Feasibility of Controlling and Eliminating Mercury Emissions from the Combustion of Solid Fossil Fuel, Pursuant To 310 CMR 7.29 - Emissions Standards For Power Plants," Downloaded from http://www.state.ma.us/dep/bwp/daqc/daqcpubs.htm#other, December 2002.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; Utility Boiler - Coal/Tangential - Over 700 MW
Abbreviation:	NSCR_UBCT5
Description:	Application: This control is the use of selective catalytic reduction add-on controls to tangentially coal-fired utility boilers for the reduction of NOx emissions. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control applies to bituminous/subbituminous coal-fired electricity generation sources, including sources with atmospheric fluidized bed combustion with nameplate capacity greater than 100 MW. Discussion: Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. Selective Catalytic Reduction (SCR) systems are among the post-combustion NOx control systems that can be effective in controlling mercury. This is based on recent pilot-scale tests that indicate that SNCR and SCR systems may enhance Hg capture under some conditions by oxidizing Hg0 (Massachusetts, 2002). Researches are investigating the possibility of Hg0 to Hg2+ conversion in SCR systems as a possible result of ammonia on fly ash mercury reactions. In the SCR process, a catalyst (such as vanadium, titanium, platinum, or zeolite) is used in a bed reactor, and the NOx reduction occurs at the surface of the catalyst bed with the help of a reducing agent (diluted ammonia or urea, which generates ammonia in the process). The ammonia mixture is injected into the flue gas upstream of the metal catalyst bed reactor, which is located upstream of a PM or SO2 control device (usually between the economizer outlet and air heater inlet, where temperatures range from 230 to 400oC). Recent pilot-scale tests indicate that SCR systems can enhance Hg capture under some conditions by oxidizing Hg0. On the plant-size scale, only one set of tests have been performed to measure the effectiveness of SCR systems. Application of SCR system, combined with spray dryer absorber was tested at a plant which was firing bituminous coal. The test results indicated greater than 95 percent mercury removal for the combined co-control systems (Massachusetts, 2002).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Utility Boiler - Coal/Tangential (Over 700 MW)
Sectors:	ptipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:

Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	244.0
Fixed O&M Cost Multiplier	0.57
Variable O&M Cost Multiplier	1.3
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker

10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air and Radiation, "Analyzing Electric Power Generation Under the CAAA," Washington, DC, March 1998.
- EPA, 2001: U.S. Environmental Protection, Office of Research and Development, "Cost of Selective Catalytic Reduction (SCR) Application for NOx Control on Coal-Fired Boilers," EPA-600/R-01-087, Research Triangle Park, NC, October 2001.
- EPA, 2004: U.S Environmental Protection Agency, Clean Air Market Division, "Updating Performance and Cost of NOx Control Technologies in the Integrated Planning Model" Paper # 137
- Massachusetts, 2002: Commonwealth of Massachusetts, Department of Environmental Protection, Executive Office of Environmental Affairs, Division of Planning and Evaluation, Bureau of Waste Prevention, "Evaluation Of The Technological and Economic Feasibility of Controlling and Eliminating Mercury Emissions from the Combustion of Solid Fossil Fuel, Pursuant To 310 CMR 7.29 - Emissions Standards For Power Plants," Downloaded from http://www.state.ma.us/dep/bwp/daqc/daqcpubs.htm#other, December 2002.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; Utility Boiler - Oil-Gas/Tangential
Abbreviation:	NSCR_UBOT
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls to tangentially fired (oil/gas) utility boilers. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control applies to tangentially natural-gas fired electricity generation sources with nameplate capacity greater than 100 MW. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Utility Boiler - Oil-Gas/Tangential
Sectors:	ptipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	

Ref Yr CPT:	
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name:	Type 1
Description:	EGU
Inventory Fields:	design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:

Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	80.0
Fixed O&M Cost Multiplier	1.2
Variable O&M Cost Multiplier	0.13
Scaling Factor - Model Size (MW)	200.0
Scaling Factor - Exponent	0.35
Capacity Factor	1.0

Affected SCCs:

Code	Description
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

References:

- US EPA, 2010: Clean Air Markets Division. "Documentation for EPA Base Case 2010 (V4.1), Using the Integrated Planning Model," Washington, DC., August 2010.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air and Radiation, "Analyzing Electric Power Generation Under the CAAA," Washington, DC, March 1998.

- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	80% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The cost equations used in this analysis are based on cost equations from EPA's IPM (EPA, 2004). In the IPM, model plants applying SCR had capacities of 200 MW. The equations were scaled to develop costs for smaller or larger boilers than the model plant. The cost equations also assume a high NOx rate (>=0.5 pounds per MMBtu) and a capacity utilization factor of 65% were assumed for the utility boilers, as well as a 7% discount rate and 20-year lifetime of the controls. Capital Costs (CC): Nameplate Capacity: netdc [=] MW Total Capital Costs: TCC = $32.20 per kW Scaling Factor: SF = (sfn / netdc)^sfe = (200 / MW)^0.35 CC (for netdc < 500) = TCC * netdc * 1000 * SF CC (for netdc > 500) = TCC * netdc * 1000 Operating & Maintenance (O&M): Fixed O&M: omf = $0.99 per kW per year Variable O&M: omv = $0.11 mills per kW-hr Capacity Factor: capfac = 0.65 O&M = (omf * netdc * 1000) + (omv * netdc * 1000 * capfac * 8760 / 1000) Equipment Life in Years = Equiplife Interest Rate = I Capital Recovery Factor: CRF = [I (1 + I) ^ Equiplife] / [((1 + I)^ Equiplife) - 1] Total Cost = (CRF * CC) + O&M Note: All costs are in 2004 dollars.
ELEC_RT:	$0.03/kWh
CPTON_TEXT:	Cost effectiveness is variable and based on plant size (nameplate capacity in MW) and the following factors: the total capital cost of $32.20 per kW; the fixed O&M cost of $0.99 per kW per year; and the variable O&M cost of $0.11 mills per kW-hr (2004$).
ELEC_PCT:	0%
CTRL_EFF_T:	80%
FUEL_PCT:	0%
HG_CE_T:	80%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X

NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Selective Catalytic Reduction; Utility Boiler - Oil-Gas/Wall
Abbreviation:	NSCR_UBOW
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls to wall fired (oil/gas) utility boilers. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Applies to large (>100 million Btu/hr) natural-gas fired electricity generation sources with nameplate capacity greater than 100 MW, excluding tangentially fired sources. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Utility Boiler - Oil-Gas/Wall
Sectors:	ptipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	

Ref Yr CPT:	
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	80.0
Fixed O&M Cost Multiplier	1.2
Variable O&M Cost Multiplier	0.13
Scaling Factor - Model Size (MW)	200.0
Scaling Factor - Exponent	0.35
Capacity Factor	1.0

Affected SCCs:

Code	Description
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr

References:

- US EPA, 2010: Clean Air Markets Division. "Documentation for EPA Base Case 2010 (V4.1), Using the Integrated Planning Model," Washington, DC., August 2010.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air and Radiation, "Analyzing Electric Power Generation Under the CAAA," Washington, DC, March 1998.

• EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	80% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The cost equations used in this analysis are based on cost equations from EPA's IPM (EPA, 2004). In the IPM, model plants applying SCR had capacities of 200 MW. The equations were scaled to develop costs for smaller or larger boilers than the model plant. The cost equations also assume a high NOx rate (>=0.5 pounds per MMBtu) and a capacity utilization factor of 65% were assumed for the utility boilers, as well as a 7% discount rate and 20-year lifetime of the controls. Capital Costs (CC): Nameplate Capacity: netdc [=] MW Total Capital Costs: TCC = $32.20 per kW Scaling Factor: SF = (sfn / netdc)^sfe = (200 / MW)^0.35 CC (for netdc < 500) = TCC * netdc * 1000 * SF CC (for netdc > 500) = TCC * netdc * 1000 Operating & Maintenance (O&M): Fixed O&M: omf = $0.99 per kW per year Variable O&M: omv = $0.11 mills per kW-hr Capacity Factor: capfac = 0.65 O&M = (omf * netdc * 1000) + (omv * netdc * 1000 * capfac * 8760 / 1000) Equipment Life in Years = Equiplife Interest Rate = i Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1] Total Cost = (CRF * CC) + O&M Note: All costs are in 2004 dollars.
ELEC_RT:	$0.03/kWh
CPTON_TEXT:	Cost effectiveness is variable and based on plant size (nameplate capacity in MW) and the following factors: the total capital cost of $32.20 per kW; the fixed O&M cost of $0.99 per kW per year; and the variable O&M cost of $0.11 mills per kW-hr (2004$).
ELEC_PCT:	0%
CTRL_EFF_T:	80%
FUEL_PCT:	0%
HG_CE_T:	80%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X

NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Selective Catalytic Reduction; Cement Manufacturing - Dry2
Abbreviation:	NSCRCMDY
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control applies to dry-process cement manufacturing (SCC 30500606) and Natural Gas Cement Kilns (SCC 39000602) with uncontrolled NOx emissions greater than 10 tons per year. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Emerging
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Cement Manufacturing - Dry2
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$3,370	$3,370

Ref Yr CPT:	$4,501	$4,501
Control Efficiency:	80.0	80.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.4	4.4
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$3,370	$3,370
Ref Yr CPT:	$4,501	$4,501
Control Efficiency:	80.0	80.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.4	4.4
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln
30500602	The SCC entry is not found in the reference.scc table

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; Ammonia - NG-Fired Reformers

Abbreviation: NSCRFRNG

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

Applies to natural-gas fired reformers involved in the production of ammonia (SCC 30100306) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Ammonia - NG-Fired Reformers

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$2,366	$2,366
Ref Yr CPT:	$3,160	$3,160

Control Efficiency:	90.0	90.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	10.0	9.6
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$2,366	$2,366
Ref Yr CPT:	$3,160	$3,160
Control Efficiency:	90.0	90.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	10.0	9.6
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30100306	Industrial Processes; Chemical Manufacturing; Ammonia Production; Primary Reformer: Natural Gas Fired

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 2007: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards Health and Environmental Impact Division, Air Benefit-Cost Group "Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone," EPA-452/R-07-008, Research Triangle Park, North Carolina, July 2007.
- Sorrels, 2007: Larry Sorrels, Air Benefit and Cost Group, Office of Air Quality Planning & Standards, EPA, personal communication with Frank Divita, E.H. Pechan & Associates as documented in "Control Measure Cost Calculation SummaryforSCRsrevLS13007.xls," November 15, 2007 (via email).
- US EPA, 2010: Clean Air Markets Division. "Documentation for EPA Base Case 2010 (V4.1), Using the Integrated Planning Model," Washington, DC., August 2010.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	2.61%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Efficiencies for stationary source NOx control were updated for a 2020 base year based on analysis performed by the EPA for the Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone (EPA, 2007).-á Default cost per ton was increased by 11.4% to account for a change in -áSCR efficiency from 80% to 90%.-á This cost in 1990$ was then converted to 1999$ by applying a growth factor of 1.235 (Sorrels, 2007).
CPTON_H:	$2860/ton
CPTON_L:	$2230/ton
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $12,378 per ton NOx reduced from both uncontrolled and RACT baseline (1999$).
CTRL_EFF_T:	80%
ELEC_PCT:	1.72%
ELEC_RT:	$0.05/kWh

FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	0%
MNTLBR_PCT:	1.35%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	57.2%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	22.83%
UTIL_PCT:	0%
WSTDSP_PCT:	14.3%

Summary:

Control Measure Name: Selective Catalytic Reduction; Ammonia - Oil-Fired Reformers

Abbreviation: NSCRFROL

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

Applies to oil fired reformers involved in the production of ammonia with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Ammonia - Oil-Fired Reformers

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,480	$810
Ref Yr CPT:	$2,370	$1,297

Control Efficiency:	80.0	80.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	10.0	9.6
Incremental CPT:	1910.0	940.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,480	$810
Ref Yr CPT:	$2,370	$1,297
Control Efficiency:	80.0	80.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	10.0	9.6
Incremental CPT:	1910.0	940.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30100306	Industrial Processes; Chemical Manufacturing; Ammonia Production; Primary Reformer: Natural Gas Fired

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; Glass Manufacturing - Container
Abbreviation:	NSCRGMCN
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Applies to glass-container manufacturing processes, classified under SCC 30501402 and uncontrolled NOx emissions greater than 10 tons per year. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Glass Manufacturing - Container
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2007	2007
CPT:	$1,684	$2,169
Ref Yr CPT:	$1,850	$2,383

Control Efficiency:	75.0	75.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.2	4.5
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2007	2007
CPT:	$1,684	$2,169
Ref Yr CPT:	$1,850	$2,383
Control Efficiency:	75.0	75.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.2	4.5
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 2a

Description: Non-EGU NOx

Inventory Fields:

Formula: Annual Cost = Annual Cost = Annual Cost Multiplier x (Emissions Reduction [in tons/day]) ^ Exponent + Base
Capital Coat = Capital Cost Multiplier x (Emissions Reduction [in tons/day]) ^ Exponent + Base

Variable Name	Value
Pollutant	NOX
Cost Year	2007
Capital Cost Multiplier	79415.0
Capital Cost Exponent	0.51
Annual Cost Multiplier	643.0
Annual Cost Exponent	1.0
Incremental Capital Cost Multiplier	
Incremental Capital Cost Exponent	
Incremental Annual Cost Multiplier	
Incremental Annual Cost Exponent	
Capital Cost Base	
Annual Cost Base	135302.0
Incremental Capital Cost Base	
Incremental Annual Cost Base	

Affected SCCs:

Code	Description
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.
- US EPA, 2010: Clean Air Markets Division. "Documentation for EPA Base Case 2010 (V4.1), Using the Integrated Planning Model," Washington, DC., August 2010.
- Best Available Techniques (BAT) Reference Document for the Manufacture of Glass. European Commission 2013. Available at: http://eippcb.jrc.ec.europa.eu/reference/BREF/GLS_Adopted_03_2012.pdf

Other information:

ADMIN_PCT:	0%
CE_TEXT:	75% from uncontrolled
CHEM_PCT:	15.56%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001).
CPTON_TEXT:	The cost effectiveness values (for both small and large sources) used in AirControlNET are $2,200 per ton NOx reduced from both uncontrolled and RACT baselines (1990$).
CTRL_EFF_T:	75%
ELEC_PCT:	0%
ELEC_RT:	$0.06/kWh
FUEL_PCT:	10.11%
HG_CE_T:	75%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	58.79%
NG_RT:	$2/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	15.54%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	100%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Catalytic Reduction; Glass Manufacturing - Flat

Abbreviation: NSCRGMFT

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

Applies to large(>1 ton NOx per OSD) flat-glass manufacturing operations (SCC 30501403) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Glass Manufacturing - Flat

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2007	2007
CPT:	$855	$957
Ref Yr CPT:	$939	$1,051

Control Efficiency:	75.0	75.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	3.7	3.4
Incremental CPT:	710.0	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	2007	2007
CPT:	$855	$957
Ref Yr CPT:	$939	$1,051
Control Efficiency:	75.0	75.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	3.7	3.4
Incremental CPT:	710.0	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 2a

Description: Non-EGU NOx

Inventory Fields:

Formula: Annual Cost = Annual Cost = Annual Cost Multiplier x (Emissions Reduction [in tons/day]) ^ Exponent + Base
Capital Coat = Capital Cost Multiplier x (Emissions Reduction [in tons/day]) ^ Exponent + Base

Variable Name	Value
Pollutant	NOX
Cost Year	2007
Capital Cost Multiplier	3681.0
Capital Cost Exponent	1.0
Annual Cost Multiplier	842.0
Annual Cost Exponent	1.0
Incremental Capital Cost Multiplier	
Incremental Capital Cost Exponent	
Incremental Annual Cost Multiplier	
Incremental Annual Cost Exponent	
Capital Cost Base	1000000.0
Annual Cost Base	424930.0
Incremental Capital Cost Base	
Incremental Annual Cost Base	

Affected SCCs:

Code	Description
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- US EPA, 2010: Clean Air Markets Division. "Documentation for EPA Base Case 2010 (V4.1), Using the Integrated Planning Model," Washington, DC., August 2010.
- Best Available Techniques (BAT) Reference Document for the Manufacture of Glass. European Commission 2013. Available at: http://eippcb.jrc.ec.europa.eu/reference/BREF/GLS_Adopted_03_2012.pdf

Other information:

ADMIN_PCT:	0%
CE_TEXT:	75% from uncontrolled
CHEM_PCT:	15.56%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated by applying percentages of O&M breakdown for SCR as applied to process heaters, using detailed information found in Table 6-3 and Chapter 6 of the Process Heater ACT document. The breakdown was obtained using the O&M costs for a 750 ton per day furnace. Electricity: $0.06 per kw-hr Fuel (nat gas): $2.00 per MMBTU Ammonia: $0.125 per lb
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated by applying percentages of O&M breakdown for SCR as applied to process heaters, using detailed information found in Table 6-3 and Chapter 6 of the Process Heater ACT document. The breakdown was obtained using the O&M costs for a 750 ton per day furnace. Electricity: $0.06 per kw-hr Fuel (nat gas): $2.00 per MMBTU Ammonia: $0.125 per lb
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $710 per ton NOx reduced from both uncontrolled and RACT baselines (1990$).
CTRL_EFF_T:	75%
ELEC_PCT:	0%
ELEC_RT:	$0.06/kWh
FUEL_PCT:	10.11%
HG_CE_T:	75%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	58.79%
NG_RT:	$2/cf

NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	15.54%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	100%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Catalytic Reduction; Glass Manufacturing - Pressed

Abbreviation: NSCRGMPD

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

Applies to pressed-glass manufacturing operations, classified under SCC 30101404 and uncontrolled NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Glass Manufacturing - Pressed

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,530	$2,530
Ref Yr CPT:	$4,051	$4,051

Control Efficiency:	75.0	75.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	1.3	1.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,530	$2,530
Ref Yr CPT:	$4,051	$4,051
Control Efficiency:	75.0	75.0
Min Emis:	365.0	0.0
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	1.3	1.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Glass Manufacturing," EPA,-453/R-94-037, Research Triangle Park, NC, June 1994.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- US EPA, 2010: Clean Air Markets Division. "Documentation for EPA Base Case 2010 (V4.1), Using the Integrated Planning Model," Washington, DC., August 2010.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	75% from uncontrolled
CHEM_PCT:	15.56%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values and a capital to annual cost ratio of 1.3 are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated by applying percentages of O&M breakdown for SCR as applied to process heaters, using detailed information found in Table 6-3 and Chapter 6 of the Process Heater ACT document. The breakdown was obtained using the O&M costs for a 50 ton per day furnace. Electricity: $0.06 per kw-hr Fuel (nat gas): $2.00 per MMBTU Ammonia: $0.125 per lb
CPTON_TEXT:	The cost effectiveness value (for both small and large sources) used in AirControlNET is $2,530 per ton NOx reduced from both uncontrolled and RACT baselines (1990$).
CTRL_EFF_T:	75%
ELEC_PCT:	0%
ELEC_RT:	$0.06/kWh

FUEL_PCT:	10.11%
HG_CE_T:	75%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	58.79%
NG_RT:	$2/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	15.54%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	100%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Selective Catalytic Reduction; ICI Boilers - Coal/Cyclone
Abbreviation:	NSCRIBCC
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001). A SCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor, reactor pressure loss, and steam i.e., sootblowing (NESCAUM 2009).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	ICI Boilers - Coal/Cyclone
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula:

Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	41040.93
Capital Cost Exponent No. 1	0.59
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	471911.2
O&M Cost Size Multiplier No. 1	1641.64
O&M Cost Exponent No. 1	0.59
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300223	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Cyclone Furnace
10200203	External Combustion Boilers; Industrial; Bituminous Coal; Cyclone Furnace

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).

- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	80% from uncontrolled
CHEM_PCT:	18.98%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values and a capital to annual cost ratio of 7.0 are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the Chapter 4 costing algorithms in EPA, 2001. The fixed O&M cost is the sum of the annual maintenance material and labor cost, and is estimated to be 0.66 percent of the capital cost. This portion of the O&M cost is included in the database as maintenance labor. The NH3 use cost equation is used to estimate chemicals costs. The annual replacement cost equation is used to estimate replacement materials costs. The energy requirement cost equation is used to estimate electricity costs. Electricity cost = $0.03/kW-hr Ammonia cost = $225/ton The above O&M component costs are in 2000 dollars. The model plant size used to estimate ICI boiler O&M cost components is 400 MMBtu/hr.
CPTON_TEXT:	The default cost effectiveness value is $820 per ton NOx reduced from both uncontrolled and RACT baselines (1990$).
CTRL_EFF_T:	80%
ELEC_PCT:	7.45%
ELEC_RT:	$0.03/kWh
FUEL_PCT:	0%
HG_CE_T:	80%
INSRNC_PCT:	0%
MNTLBR_PCT:	8%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*

OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	9.3%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	55.87%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Catalytic Reduction; ICI Boilers - Coal/Wall

Abbreviation: NSCRIBCW

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.
Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).
Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.
The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.
The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).
The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

A SCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor, reactor pressure loss, and steam i.e., sootblowing (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: ICI Boilers - Coal/Wall

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	41040.93
Capital Cost Exponent No. 1	0.59
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	471911.2
O&M Cost Size Multiplier No. 1	1641.64
O&M Cost Exponent No. 1	0.59
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300222	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Pulverized Coal: Dry Bottom
10300221	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Pulverized Coal: Wet Bottom
10300206	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom
10300205	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Wet Bottom
10300103	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Hand-fired
10300101	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Pulverized Coal
10200301	External Combustion Boilers; Industrial; Lignite; Pulverized Coal: Dry Bottom, Wall Fired
10200229	External Combustion Boilers; Industrial; Subbituminous Coal; Cogeneration
10200222	External Combustion Boilers; Industrial; Subbituminous Coal; Pulverized Coal: Dry Bottom

10200219	External Combustion Boilers; Industrial; Bituminous Coal; Cogeneration
10200213	External Combustion Boilers; Industrial; Bituminous Coal; Wet Slurry
10200212	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom (Tangential)
10200202	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom
10200201	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Wet Bottom
10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	70% from uncontrolled
CHEM_PCT:	18.98%

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Large source = emission levels greater than 1 ton per ozone season day Where information was available in the Alternative Control Techniques (ACT) document (EPA, 1994), capacity-based equations are used to calculate costs. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). The following equations, based primarily on information in the Air Pollution Cost Manual (EPA, 2002), are used for large NOx sources as defined above: From Uncontrolled: Capital Cost = 82,400.9 * Capacity (MMBtu/hr)^0.65 Annual Cost = 5,555.6 * Capacity (MMBtu/hr)^0.7885 From RACT Baseline: Capital Cost = 79,002.2 * Capacity (MMBtu/hr)^0.65 Annual Cost = 8,701.5 * Capacity (MMBtu/hr)^0.6493 Note: All costs are in 1990 dollars. O&M Cost Components: The O&M cost breakdown is estimated using the Chapter 4 costing algorithms in EPA, 2001. The fixed O&M cost is the sum of the annual maintenance material and labor cost, and is estimated to be 0.66 percent of the capital cost. This portion of the O&M cost is included in the database as maintenance labor. The NH3 use cost equation is used to estimate chemicals costs. The annual replacement cost equation is used to estimate replacement materials costs. The energy requirement cost equation is used to estimate electricity costs. Electricity cost = $0.03/kW-hr Ammonia cost = $225/ton The above O&M component costs are in 2000 dollars. The model plant size used to estimate ICI boiler O&M cost components is 400 MMBtu/hr.
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values and a capital to annual cost ratio of 7.1 are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_TEXT:	The default cost effectiveness value is $1,260 per ton NOx reduced from both uncontrolled and RACT baselines (1990$).
CPTON_TEXT:	When capacity is available and within the applicable range of 0 to 2,000 MMBTU/hr the cost equations are used to calculate cost effectiveness. The default cost effectiveness values, used when capacity information is not available, are $1,070 per ton NOx reduced from uncontrolled and $700 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	70%
ELEC_PCT:	7.45%
ELEC_RT:	$0.03/kWh
FUEL_PCT:	0%
HG_CE_T:	70%
INSRNC_PCT:	0%

MNTLBR_PCT:	8%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	9.3%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	55.87%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Selective Catalytic Reduction; ICI Boilers - Distillate Oil
Abbreviation:	NSCRIBDO
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001). A SCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor, reactor pressure loss, and steam i.e., sootblowing (NESCAUM 2009).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	ICI Boilers - Distillate Oil
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	41040.93
Capital Cost Exponent No. 1	0.59
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	471911.2
O&M Cost Size Multiplier No. 1	1641.64
O&M Cost Exponent No. 1	0.59
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	2.61%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Efficiencies for stationary source NOx control were updated for a 2020 base year based on analysis performed by the EPA for the Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone (EPA, 2007).-á Default cost per ton was increased by 11.4% to account for a change in -áSCR efficiency from 80% to 90%.-á This cost in 1990$ was then converted to 1999$ by applying a growth factor of 1.235 (Sorrels, 2007). O&M Cost Components: The O&M cost breakdown for SCR is estimated using information from Appendix E of the ACT document (pages E-53 to E-60). This appendix provides O&M costs for 100, 150, 200, and 250 MMBtu/hour natural gas-fired boilers. The costs by category were averaged for the four boiler sizes to establish a representative O&M cost breakdown for this source category/control measure combination. A capacity factor of 0.5 was used in this evaluation. Electricity cost: $0.05/kW-hr Ammonia cost: $250/ton
CPTON_H:	$3570/ton
CPTON_L:	$2780/ton
CPTON_TEXT:	The default cost effectiveness value used in AirControlNET is $2,958 per ton NOx reduced from both uncontrolled and RACT baselines (1999$).
CTRL_EFF_T:	80%
ELEC_PCT:	1.72%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	90%

INSRNC_PCT:	0%
MNTLBR_PCT:	1.35%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	57.2%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	22.83%
UTIL_PCT:	0%
WSTDSP_PCT:	14.3%

Summary:

Control Measure Name: Selective Catalytic Reduction; ICI Boilers - Natural Gas

Abbreviation: NSCRIBNG

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.
Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).
Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.
The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.
The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).
The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

A SCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor, reactor pressure loss, and steam i.e., sootblowing (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: ICI Boilers - Natural Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name:	Type 13
Description:	ICI Boiler Cost Equations
Inventory Fields:	design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	41040.93
Capital Cost Exponent No. 1	0.59
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	471911.2
O&M Cost Size Multiplier No. 1	1641.64
O&M Cost Exponent No. 1	0.59
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	2.61%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Efficiencies for stationary source NOx control were updated for a 2020 base year based on analysis performed by the EPA for the Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone (EPA, 2007).-á Default cost per ton was increased by 11.4% to account for a change in -áSCR efficiency from 80% to 90%.-á This cost in 1990$ was then converted to 1999$ by applying a growth factor of 1.235 (Sorrels, 2007). O&M Cost Components: The O&M cost breakdown for SCR is estimated using information from Appendix E of the ACT document (pages E-53 to E-60). This appendix provides O&M costs for 100, 150, 200, and 250 MMBtu/hour natural gas-fired boilers. The costs by category were averaged for the four boiler sizes to establish a representative O&M cost breakdown for this source category/control measure combination. A capacity factor of 0.5 was used in this evaluation. Electricity cost: $0.05/kW-hr Ammonia cost: $250/ton
CPTON_H:	$2860/ton
CPTON_L:	$2230/ton
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $2,366 per ton NOx reduced from both uncontrolled and RACT baselines (1999$).
CTRL_EFF_T:	80%
ELEC_PCT:	1.72%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	0%
MNTLBR_PCT:	1.35%

MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	57.2%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	22.83%
UTIL_PCT:	0%
WSTDSP_PCT:	14.3%

Summary:

Control Measure Name: Selective Catalytic Reduction; ICI Boilers - Gas

Abbreviation: NSCRICBG

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.
Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).
Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.
The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.
The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).
The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

A SCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor, reactor pressure loss, and steam i.e., sootblowing (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: ICI Boilers - Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	41040.93
Capital Cost Exponent No. 1	0.59
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	471911.2
O&M Cost Size Multiplier No. 1	1641.64
O&M Cost Exponent No. 1	0.59
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10201402	External Combustion Boilers; Industrial; CO Boiler; Process Gas
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10200799	External Combustion Boilers; Industrial; Process Gas; Other: Specify in Comments
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas

10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; ICI Boilers - Oil
Abbreviation:	NSCRICBO
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001). A SCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor, reactor pressure loss, and steam i.e., sootblowing (NESCAUM 2009).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	ICI Boilers - Oil
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,250
Ref Yr CPT:	$2,424
Control Efficiency:	80.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	41040.93
Capital Cost Exponent No. 1	0.59
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	471911.2
O&M Cost Size Multiplier No. 1	1641.64
O&M Cost Exponent No. 1	0.59
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	43.96
O&M Emissions Multiplier	139.54

Affected SCCs:

Code	Description
39990002	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Residual Oil: Process Heaters
39990001	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Distillate Oil (No. 2): Process Heaters
31000403	Industrial Processes; Oil and Gas Production; Process Heaters; Crude Oil
31000401	Industrial Processes; Oil and Gas Production; Process Heaters; Distillate Oil (No. 2)
30790002	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Residual Oil: Process Heaters
30790001	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30600111	Industrial Processes; Petroleum Industry; Process Heaters; Oil-fired (No. 6 Oil) : 100 Million Btu Capacity
30600103	Industrial Processes; Petroleum Industry; Process Heaters; Oil-fired

30600101	Industrial Processes; Petroleum Industry; Process Heaters; Oil-fired **
30590002	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Process Heaters
30590001	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30490002	Industrial Processes; Secondary Metal Production; Fuel Fired Equipment; Residual Oil: Process Heaters
30490001	Industrial Processes; Secondary Metal Production; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30190002	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Residual Oil: Process Heaters
30190001	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; Lean Burn ICE 4 Stroke - NG
Abbreviation: NSCRICE4SNG
Description: SCR can be used on Lean Burn, NG engines. Assumed SCR can meet NOx emissions of 0.89 g/bh-hr. This is a Known technology, however there is indication that applicability is engine/unit specific.
Class: Known
Pollutant: NOX
Equipment Life: 10.0 years
Control Technology: Selective Catalytic Reduction
Source Group: Lean Burn ICE - NG
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2001
CPT:	$2,900
Ref Yr CPT:	$3,702
Control Efficiency:	96.0
Min Emis:	0.0
Max Emis:	365.0
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.14000000059604645
Discount Rate:	7.0
Cap Ann Ratio:	1.4
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2001
CPT:	$2,900
Ref Yr CPT:	$3,702
Control Efficiency:	96.0
Min Emis:	0.0
Max Emis:	365.0
Rule Effectiveness:	100.0

Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.14000000059604645
Discount Rate:	7.0
Cap Ann Ratio:	1.4
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 2

Description: Non-EGU NOx

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Annual Cost = Annual Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base
Capital Coat = Capital Cost Multiplier x (Boiler Capacity [in MMBtu/hr]) ^ Exponent + Base

Variable Name	Value
Pollutant	NOX
Cost Year	2001
Capital Cost Multiplier	42091.8828225676
Capital Cost Exponent	1.0
Annual Cost Multiplier	32871.7561090528
Annual Cost Exponent	1.0
Incremental Capital Cost Multiplier	
Incremental Capital Cost Exponent	
Incremental Annual Cost Multiplier	
Incremental Annual Cost Exponent	
Capital Cost Base	27186.0
Annual Cost Base	14718.0
Incremental Capital Cost Base	
Incremental Annual Cost Base	

Affected SCCs:

Code	Description
20200256	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Clean Burn
20200255	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Clean Burn
20200254	Internal Combustion Engines; Industrial; Natural Gas; 4-cycle Lean Burn
20200252	Internal Combustion Engines; Industrial; Natural Gas; 2-cycle Lean Burn

References:

- OTC 2012. Technical Information Oil and Gas Sector, Significant Stationary Sources of NOx Emissions. Final. October 17, 2012.
- SJVAPCD 2003. RULE 4702—Internal Combustion Engines—Phase 2. Appendix B, Cost Effectiveness Analysis for Rule 4702 (Internal Combustion Engines—Phase 2). San Joaquin Valley Air Pollution Control District. July 17, 2003. www.arb.ca.gov/pm/pmmeasures/ceffect/rules/sjvapcd_4702.pdf
- CARB 2001. Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Stationary Spark-Ignited Internal Combustion Engines. California Environmental Protection Agency, Air Resources Board, Stationary Source Division, Emissions Assessment Branch, Process Evaluation Section. November 2001.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; ICE - Diesel
Abbreviation: NSCRICEDS
Description: SCR can be used on Diesel engines.
Class: Known
Pollutant: NOX
Equipment Life: 7.0 years
Control Technology: Selective Catalytic Reduction
Source Group: ICE - Diesel
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2005
CPT:	$9,300
Ref Yr CPT:	$10,811
Control Efficiency:	90.0
Min Emis:	0.0
Max Emis:	365.0
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10999999940395355
Discount Rate:	7.0
Cap Ann Ratio:	2.45
Incrementental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2005
CPT:	$9,300
Ref Yr CPT:	$10,811
Control Efficiency:	90.0
Min Emis:	0.0
Max Emis:	365.0
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	0.10999999940395355
Discount Rate:	7.0
Cap Ann Ratio:	2.45
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
20200107	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Exhaust
20200102	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating

References:

- EPA 2010. Alternative Control Techniques Document: Stationary Diesel Engines. March 5, 2010.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; Internal Combustion Engines - Oil

Abbreviation: NSCRICOL

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

Applies to oil-fired internal combustion engines with NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Internal Combustion Engines - Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$920	$2,340
Ref Yr CPT:	$1,473	$3,747

Control Efficiency:	80.0	80.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.2	1.8
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$920	$2,340
Ref Yr CPT:	$1,473	$3,747
Control Efficiency:	80.0	80.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.2	1.8
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
20400408	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Residual Oil/Crude Oil
20400403	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Distillate Oil
20400402	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Diesel/Kerosene

20300107	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating: Exhaust
20300105	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating: Crankcase Blowby
20300101	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating
20200501	Internal Combustion Engines; Industrial; Residual/Crude Oil; Reciprocating
20200107	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Exhaust
20200104	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Cogeneration
20200102	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating
20100107	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating: Exhaust
20100105	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating: Crankcase Blowby
20100102	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating

References:

- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Stationary Reciprocating Internal Combustion Engines," EPA,-453/R-93-032, Research Triangle Park, NC, July 1993.
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 2001: U.S. Environmental Protection, Office of Research and Development, "Cost of Selective Catalytic Reduction (SCR) Application for NOx Control on Coal-Fired Boilers," EPA-600/R-01-087, Research Triangle Park, NC, October 2001.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	80% from uncontrolled
CHEM_PCT:	5.31%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1993). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 25% (Pechan, 2001).

CPTON_TEXT:	The cost effectiveness value (for both small and large sources) used in AirControlNET is $2,340 per ton NOx reduced from both uncontrolled and RACT baselines (1990$).
CTRL_EFF_T:	80%
ELEC_PCT:	0%
ELEC_RT:	$0.06/kWh
FUEL_PCT:	0%
HG_CE_T:	80%
INSRNC_PCT:	0%
MNTLBR_PCT:	4.53%
MNTLBR_RT:	$26.23/hr
MNTMTL_PCT:	0%
NG_RT:	$5.83/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	30.1%
OPLBR_RT:	$26.23/hr
OTHR_PCT:	2.32%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	28.39%
TDIR_PCT:	0%
TINDIR_PCT:	16.01%
UTIL_PCT:	0.91%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Catalytic Reduction; Iron & Steel Mills - Annealing2

Abbreviation: NSCRISAN

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

Applies to iron and steel annealing operations with NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Iron & Steel Mills - Annealing2

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$5,296	$5,296
Ref Yr CPT:	$7,073	$7,073

Control Efficiency:	90.0	99.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.0	5.0
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$5,296	$5,296
Ref Yr CPT:	$7,073	$7,073
Control Efficiency:	90.0	99.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	5.0	5.0
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- Sorrels, 2007: Larry Sorrels, Air Benefit and Cost Group, Office of Air Quality Planning & Standards, EPA, personal communication with Frank Divita, E.H. Pechan & Associates as documented in "Control Measure Cost Calculation SummaryforSCRsrevLS13007.xls," November 15, 2007 (via email).
- EPA, 2007: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards Health and Environmental Impact Division, Air Benefit-Cost Group "Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone," EPA-452/R-07-008, Research Triangle Park, North Carolina, July 2007.
- EPA, 2001: U.S. Environmental Protection, Office of Research and Development, "Cost of Selective Catalytic Reduction (SCR) Application for NOx Control on Coal-Fired Boilers," EPA-600/R-01-087, Research Triangle Park, NC, October 2001.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	15.56%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Efficiencies for stationary source NOx control were updated for a 2020 base year based on analysis performed by the EPA for the Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone (EPA, 2007).-á Default cost per ton was increased by 11.4% to account for a change in -áSCR efficiency from 80% to 90%.-á This cost in 1990$ was then converted to 1999$ by applying a growth factor of 1.235 (Sorrels, 2007). O&M Cost Components: The O&M cost breakdown is estimated by applying percentages of O&M breakdown for SCR as applied to process heaters, using detailed information found in Table 6-4 and Chapter 6 of the Process Heater ACT document. The breakdown was obtained using the average O&M costs for 3 annealing furnaces having capacities of 100, 200 and 300 MMBTU per hour. Electricity: $0.06 per kw-hr Fuel (nat gas): $2.00 per MMBTU Ammonia: $0.125 per lb

CPTON_TEXT:	The cost effectiveness value (for both small and large sources) used in AirControlNET is $5,269 per ton NOx reduced from both uncontrolled and RACT baselines (1999$).
CTRL_EFF_T:	85%
ELEC_PCT:	0%
ELEC_RT:	$0.06/kWh
FUEL_PCT:	0%
HG_CE_T:	85%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	58.79%
NG_RT:	$2/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	15.54%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	100%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Catalytic Reduction; Iron & Steel - In-Process Combustion - Bituminous Coal

Abbreviation: NSCRISIPCC

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control is applicable to operations with in-process combustion (Bituminous Coal) in the Iron & Steel industry with uncontrolled NOx emissions greater than 10 tons per year.

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Iron & Steel - In-Process Combustion - Bituminous Coal

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,027
Ref Yr CPT:	$4,043
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$3,027
Ref Yr CPT:	$4,043
Control Efficiency:	90.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30301524	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Hot Metal Transfer
30301523	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Tapping
30301522	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Melting and Refining
30301521	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Charging
30301520	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Basic Oxygen Furnace (BOF)
30301514	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Taphole and Trough Only
30301513	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Casting, Furnace with Local Evacuation
30301512	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Casting, Uncontrolled Casthouse Roof Monitor
30301511	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Charging
30301510	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Slip
30301506	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Cold Screen
30301505	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Cooler
30301504	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Discharge End
30301503	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Windbox

30301502	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Raw Materials Handling
30300914	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Closed Hood-Stack
30300913	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Open Hood-Stack
30300829	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Taphole and Trough
30300828	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Local Evacuation
30300826	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace Slips
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300820	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Conveyor: Transfer Station
30300819	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Process (Combined Code includes 15,16,17,18)

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.
- EPA, 2010: "NOX CONTROL STRATEGIES IN THE IRON AND STEEL INDUSTRY (11-11-10).pdf", pdf document provided by Donnalee Jones (jones.donnalee@epamail.epa.gov) via email to Amy Vasu 11/16/10.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; Iron & Steel - In-Process Combustion - Natural Gas and Process Gas - Coke Oven Gas
Abbreviation:	NSCRISIPCG
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control is applicable to operations with in-process combustion (Natural Gas and Process Gas - Coke Oven Gas) in the Iron & Steel industry.
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Iron & Steel - In-Process Combustion - Natural Gas and Process Gas - Coke Oven Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,953
Ref Yr CPT:	$6,615
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,953
Ref Yr CPT:	$6,615
Control Efficiency:	90.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30301524	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Hot Metal Transfer
30301523	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Tapping
30301522	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Melting and Refining
30301521	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Charging
30301520	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Basic Oxygen Furnace (BOF)
30301514	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Taphole and Trough Only
30301513	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Casting, Furnace with Local Evacuation
30301512	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Casting, Uncontrolled Casthouse Roof Monitor
30301511	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Charging
30301510	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Slip
30301506	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Cold Screen
30301505	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Cooler
30301504	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Discharge End
30301503	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Windbox

30301502	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Raw Materials Handling
30300914	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Closed Hood-Stack
30300913	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Open Hood-Stack
30300829	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Taphole and Trough
30300828	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Local Evacuation
30300826	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace Slips
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300820	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Conveyor: Transfer Station
30300819	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Process (Combined Code includes 15,16,17,18)

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.
- EPA, 2010: "NOX CONTROL STRATEGIES IN THE IRON AND STEEL INDUSTRY (11-11-10).pdf", pdf document provided by Donnalee Jones (jones.donnalee@epamail.epa.gov) via email to Amy Vasu 11/16/10.

Other information:

Summary:

Control Measure Name: Selective Catalytic Reduction; Iron & Steel - In-Process Combustion - Residual Oil
Abbreviation: NSCRISIPCO
Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. This control is applicable to operations with in-process combustion (Residual Oil) in the Iron & Steel industry with uncontrolled NOx emissions greater than 10 tons per year.
Class: Known
Pollutant: NOX
Equipment Life: 15.0 years
Control Technology: Selective Catalytic Reduction
Source Group: Iron & Steel - In-Process Combustion - Residual Oil
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,458
Ref Yr CPT:	$5,954
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,458
Ref Yr CPT:	$5,954
Control Efficiency:	90.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30301524	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Hot Metal Transfer
30301523	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Tapping
30301522	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Melting and Refining
30301521	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); BOF, Top Blown Furnace: Charging
30301520	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Basic Oxygen Furnace (BOF)
30301514	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Taphole and Trough Only
30301513	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Casting, Furnace with Local Evacuation
30301512	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Casting, Uncontrolled Casthouse Roof Monitor
30301511	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Charging
30301510	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Blast Furnace: Slip
30301506	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Cold Screen
30301505	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Cooler
30301504	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Discharge End
30301503	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Windbox

30301502	Industrial Processes; Primary Metal Production; Integrated Iron and Steel Manufacturing (See also 3-03-008 & 3-03-009); Sintering: Raw Materials Handling
30300914	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Closed Hood-Stack
30300913	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Open Hood-Stack
30300829	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Taphole and Trough
30300828	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Local Evacuation
30300826	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace Slips
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300820	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Conveyor: Transfer Station
30300819	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Process (Combined Code includes 15,16,17,18)

References:

- "Control Measure Cost Calculation SummaryforNonEGUpointNOxcontrolsozoneRIA.xls" spreadsheet provided by Larry Sorrels (Sorrels.Larry@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 04-Sep-2007.
- EPA, 2010: "NOX CONTROL STRATEGIES IN THE IRON AND STEEL INDUSTRY (11-11-10).pdf", pdf document provided by Donnalee Jones (jones.donnalee@epamail.epa.gov) via email to Amy Vasu 11/16/10.

Other information:

Summary:

Control Measure Name:	Selective Catalytic Reduction; Nitric Acid Manufacturing2
Abbreviation:	NSCRNAMF
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Applies to nitric acid manufacturing operations with NOx emissions greater than 10 tons per year. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Nitric Acid Manufacturing2
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$812	$812
Ref Yr CPT:	$1,084	$1,084

Control Efficiency:	90.0	90.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.5	2.5
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$812	$812
Ref Yr CPT:	$1,084	$1,084
Control Efficiency:	90.0	90.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.5	2.5
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30101302	Industrial Processes; Chemical Manufacturing; Nitric Acid; Absorber Tail Gas (Post-1970 Facilities)
30101301	Industrial Processes; Chemical Manufacturing; Nitric Acid; Absorber Tail Gas (Pre-1970 Facilities)

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1991: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- Nitric and Adipic Acid Manufacturing Plants," EPA-450/3-91-026, Research Triangle Park, NC, January 1991.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- Sorrels, 2007: Larry Sorrels, Air Benefit and Cost Group, Office of Air Quality Planning & Standards, EPA, personal communication with Frank Divita, E.H. Pechan & Associates as documented in "Control Measure Cost Calculation SummaryforSCRsrevLS13007.xls," November 15, 2007 (via email).
- EPA, 2007: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards Health and Environmental Impact Division, Air Benefit-Cost Group "Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone," EPA-452/R-07-008, Research Triangle Park, North Carolina, July 2007.
- EPA, 2001: U.S. Environmental Protection, Office of Research and Development, "Cost of Selective Catalytic Reduction (SCR) Application for NOx Control on Coal-Fired Boilers," EPA-600/R-01-087, Research Triangle Park, NC, October 2001.

Other information:

ADMIN_PCT:	2.13%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	68.87%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Efficiencies for stationary source NOx control were updated for a 2020 base year based on analysis performed by the EPA for the Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone (EPA, 2007). The costs were calculated by assuming that default costs double from SNCR costs to reach 80% efficiency. The cost per ton was increased by 11.4% to account for a change in SCR efficiency from 80% to 90%. This cost in 1990$ was then converted to 1999$ by applying a growth factor of 1.235 (Sorrels, 2007). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in Table 6-7 and Ch. 6 of the Nitric and Adipic Acid Manufacturing Plant ACT document. The breakdown was obtained using the average O&M costs for three plants having capacities of 200, 500 and 1000 tons per day. (EPA, 1991) Maintenance materials and labor: 4% of capital cost
CPTON_TEXT:	The cost effectiveness value (for both small and large sources) used in AirControlNET is $812 per ton NOx reduced from both uncontrolled and RACT baselines (1999$).

CTRL_EFF_T:	97%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	97%
INSRNC_PCT:	1.06%
MNTLBR_PCT:	8.95%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	2.56%
PROPTX_PCT:	1.06%
RPLMTL_PCT:	8.19%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	86.02%
TINDIR_PCT:	13.98%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Selective Catalytic Reduction; Space Heaters - Distillate Oil
Abbreviation:	NSCRSHDO
Description:	Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures. Applies to distillate oil-fired space heaters with NOx emissions greater than 10 tons per year. Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002). Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx. The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required. The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002). The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).
Class:	Known
Pollutant:	NOX
Equipment Life:	20.0 years
Control Technology:	Selective Catalytic Reduction
Source Group:	Space Heaters - Distillate Oil
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,780	$1,510
Ref Yr CPT:	$4,452	$2,418

Control Efficiency:	80.0	80.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	10.0	9.6
Incremental CPT:	3570.0	1750.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,780	$1,510
Ref Yr CPT:	$4,452	$2,418
Control Efficiency:	80.0	80.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	10.0	9.6
Incremental CPT:	3570.0	1750.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10500205	External Combustion; Space Heaters; Commercial/Institutional; Distillate Oil
10500105	External Combustion; Space Heaters; Industrial; Distillate Oil

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 2001: U.S. Environmental Protection, Office of Research and Development, "Cost of Selective Catalytic Reduction (SCR) Application for NOx Control on Coal-Fired Boilers," EPA-600/R-01-087, Research Triangle Park, NC, October 2001.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	80% from uncontrolled
CHEM_PCT:	2.61%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_H:	$3570/ton
CPTON_L:	$2780/ton
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $2,780 per ton NOx reduced from uncontrolled and $3,570 per ton NOx reduced from RACT baseline (1990$).
CTRL_EFF_T:	80%
ELEC_PCT:	1.72%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	80%
INSRNC_PCT:	0%
MNTLBR_PCT:	1.35%
MNTLBR_RT:	$0/hr

MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	57.2%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	22.83%
UTIL_PCT:	0%
WSTDSP_PCT:	14.3%

Summary:

Control Measure Name: Selective Catalytic Reduction; Space Heaters - Natural Gas

Abbreviation: NSCRSHNG

Description: Application: This control is the selective catalytic reduction of NOx through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). The SCR utilizes a catalyst to increase the NOx removal efficiency, which allows the process to occur at lower temperatures.

Applies to natural gas fired space heaters with NOx emissions greater than 10 tons per year.

Discussion: Selective Catalytic Reduction (SCR) has been widely applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. SCR is typically implemented on units requiring a higher level of NOx control than achievable by SNCR or other combustion controls (EPA, 2002).

Like SNCR, SCR is based on the chemical reduction of the NOx molecule. The primary difference between SNCR and SCR is that SCR uses a metal-based catalyst to increase the rate of reaction (EPA, 2002). A nitrogen based reducing reagent, such as ammonia or urea, is injected into the flue gas. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx.

The use of a catalyst results in two advantages of the SCR process over SNCR, the higher NOx reduction efficiency and the lower and broader temperature ranges. However, the decrease in reaction temperature and increase in efficiency is accompanied by a significant increase in capital and operating costs (EPA, 2002). The cost increase is due to the large amount of catalyst required.

The SCR system can utilize either aqueous or anhydrous ammonia as the reagent. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Today, catalyst formulations include single component, multi-component, or active phase with a support structure. Most catalyst formulations contain additional compounds or sup-ports, providing thermal and structural stability or to increase surface area (EPA, 2002).

The rate of reaction determines the amount of NOx removed from the flue gas. The important design and operational factors that affect the rate of reduction include: reaction temperature range; residence time available in the optimum temperature range; degree of mixing between the injected reagent and the combustion gases; uncontrolled NOx concentration level; molar ratio of injected reagent to uncontrolled NOx; ammonia slip; catalyst activity; catalyst selectivity; pressure drop across the catalyst; catalyst pitch; catalyst deactivation; and catalyst management (EPA, 2001).

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Catalytic Reduction

Source Group: Space Heaters - Natural Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,210	$2,860
Ref Yr CPT:	$1,938	$4,580

Control Efficiency:	80.0	80.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	9.6	10.0
Incremental CPT:	1410.0	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,210	$2,860
Ref Yr CPT:	$1,938	$4,580
Control Efficiency:	80.0	80.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	9.6	10.0
Incremental CPT:	1410.0	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10500206	External Combustion; Space Heaters; Commercial/Institutional; Natural Gas
10500106	External Combustion; Space Heaters; Industrial; Natural Gas

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 2001: U.S. Environmental Protection, Office of Research and Development, "Cost of Selective Catalytic Reduction (SCR) Application for NOx Control on Coal-Fired Boilers," EPA-600/R-01-087, Research Triangle Park, NC, October 2001.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	80% from uncontrolled
CHEM_PCT:	2.61%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_H:	$2860/ton
CPTON_L:	$2230/ton
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $2,230 per ton NOx reduced from uncontrolled and $2,860 per ton NOx reduced from RACT baseline (1990$).
CTRL_EFF_T:	80%
ELEC_PCT:	1.72%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	0%
MNTLBR_PCT:	1.35%
MNTLBR_RT:	$0/hr

MNTMTL_PCT:	0%
NG_RT:	$3.63/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	57.2%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	22.83%
UTIL_PCT:	0%
WSTDSP_PCT:	14.3%

Summary:

Control Measure Name:	Selective Non-Catalytic Reduction - Ammonia; Cement Manufacturing - Dry
Abbreviation:	NSNCNCMDY
Description:	Application: This control is the reduction of NOx emission through ammonia based selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). This control applies to dry-process cement manufacturing operations (SCC 30500606) with uncontrolled NOx emissions greater than 10 tons per year. Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002). Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Non-Catalytic Reduction - Ammonia
Source Group:	Cement Manufacturing - Dry
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$850	$850
Ref Yr CPT:	$1,361	$1,361
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.1000000149011612	0.1000000149011612
Discount Rate:	N/A	N/A

Cap Ann Ratio:	3.3	3.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$850	$850
Ref Yr CPT:	$1,361	$1,361
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	3.3	3.3
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000602	Industrial Processes; In-process Fuel Use; Natural Gas; Cement Kiln/Dryer
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research

Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Cement Manufacturing," EPA,-453/R-94-004, Research Triangle Park, NC, March 1994.

Other information:

ADMIN_PCT:	7.18%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	64.49%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1994). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in . The breakdown was obtained using the average O&M costs for having capacities of per hour. A capacity factor of is used in estimating the O&M cost breakdown. Operating labor: $28.22 per hour Fuel (natural gas): $5.00 per MMBTU
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $850 per ton NOx reduced (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	3.85%
HG_CE_T:	50%
INSRNC_PCT:	3.59%
MNTLBR_PCT:	6.29%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$5/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	6.28%
OPLBR_RT:	$28.22/hr
OTHR_PCT:	0%
OVRHD_PCT:	3.77%
PROPTX_PCT:	3.59%

RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.94%
STEAM_PCT:	0%
TDIR_PCT:	81.86%
TINDIR_PCT:	18.14%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; In-Process; Bituminous Coal; Cement Kiln

Abbreviation: NSNCRBCCK

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to bituminous coal-fired cement kilns (SCC 39000201) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: In-Process; Bituminous Coal; Cement Kiln

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$770	$770
Ref Yr CPT:	$1,028	$1,028
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A

Cap Ann Ratio:	1.6	1.6
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$770	$770
Ref Yr CPT:	$1,028	$1,028
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	1.6	1.6
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000288	Industrial Processes; In-process Fuel Use; Bituminous Coal; General (Subbituminous)
39000201	Industrial Processes; In-process Fuel Use; Bituminous Coal; Cement Kiln/Dryer (Bituminous Coal)

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research

Triangle Park, NC, January 2002.

- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Cement Manufacturing," EPA,-453/R-94-004, Research Triangle Park, NC, March 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001).
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $770 per ton NOx reduced (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable

SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; In-Process Fuel Use;Bituminous Coal; Gen

Abbreviation: NSNCRBCGN

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to small (<1 ton NOx emissions per OSD) operations with general (in process) bituminous coal use and uncontrolled NOx emissions greater than 10 tons per year. These sources are classified under SCC 39000289.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: In-Process Fuel Use;Bituminous Coal; Gen

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$940	$1,260
Ref Yr CPT:	$1,505	$2,018
Control Efficiency:	40.0	40.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.0900000357627869	0.0900000357627869
Discount Rate:	N/A	N/A

Cap Ann Ratio:	1.2	1.2
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$940	$1,260
Ref Yr CPT:	$1,505	$2,018
Control Efficiency:	40.0	40.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	1.2	1.2
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000289	Industrial Processes; In-process Fuel Use; Bituminous Coal; General (Bituminous)
39000288	Industrial Processes; In-process Fuel Use; Bituminous Coal; General (Subbituminous)

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions

from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	40% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001).
CPTON_TEXT:	The cost effectiveness used in AirControlNET for both reductions from baseline and reductions from RACT is $1,260 per ton NOx reduced (1990$).
CTRL_EFF_T:	40%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	40%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable

SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; In-Process; Bituminous Coal; Lime Kiln

Abbreviation: NSNCRBCLK

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to bituminous coal-fired lime kilns (SCC 39000203) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: In-Process; Bituminous Coal; Lime Kiln

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$770	$770
Ref Yr CPT:	$1,233	$1,233
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A

Cap Ann Ratio:	1.6	1.6
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$770	$770
Ref Yr CPT:	$1,233	$1,233
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	1.6	1.6
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000288	Industrial Processes; In-process Fuel Use; Bituminous Coal; General (Subbituminous)
39000203	Industrial Processes; In-process Fuel Use; Bituminous Coal; Lime Kiln (Bituminous)

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research

Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Cement Manufacturing," EPA,-453/R-94-004, Research Triangle Park, NC, March 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001).
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $770 per ton NOx reduced (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable

SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; Comm./Inst. Incinerators

Abbreviation: NSNCRCIIN

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to commercial/institutional incinerators with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Comm./Inst. Incinerators

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,130	$1,130
Ref Yr CPT:	$1,810	$1,810
Control Efficiency:	45.0	45.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.0900000357627869	0.0900000357627869
Discount Rate:	N/A	N/A

Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,130	$1,130
Ref Yr CPT:	$1,810	$1,810
Control Efficiency:	45.0	45.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
50200520	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: High Pressure, Wet Oxidation
50200519	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: Rotary Kiln
50200518	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: Single Hearth Cyclone
50200517	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: Electric Infrared
50200516	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: Fluidized Bed
50200515	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: Multiple Hearth
50200507	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; VOC Contaminated Soil

50200506	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sludge
50200504	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Medical Waste Incinerator, unspecified type (use 502005-01, -02, -03)
50200503	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Medical Waste Rotary Kiln Incinerator
50200502	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Med Waste Excess Air Incin - aka Batch, Multiple Chamber, or Retort
50200501	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Med Waste Controlled Air Incin-aka Starved air, 2-stg, or Modular comb
50200105	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration; Conical Design (Tee Pee) Wood Refuse
50200104	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration; Conical Design (Tee Pee) Municipal Refuse
50200103	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration; Controlled Air
50200102	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration; Single Chamber
50200101	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration; Multiple Chamber

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Radian Corporation, "Alternative Control Techniques Document-- NOx Emissions from Municipal Waste Combustion," EPA-600/R-94-208, Research Triangle Park, NC, December 1994.

Other information:

ADMIN_PCT:	4.91%
CE_TEXT:	45% from uncontrolled
CHEM_PCT:	12.19%

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the information in Chapter and Appendix A of the MWC ACT document. The cost outputs for conventional SNCR applied to the 400 ton per day model combustor (Table 3-3) are used to estimate the O&M cost breakdown. The tipping fee ($1.47 per ton) is included as a waste disposal cost (direct annual cost). Electricity Cost: 0.046 $/kW-hr
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $1,130 per ton NOx reduced (1990$).
CTRL_EFF_T:	45%
ELEC_PCT:	0.64%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	45%
INSRNC_PCT:	0%
MNTLBR_PCT:	2.25%
MNTLBR_RT:	$20/hr
MNTMTL_PCT:	3.2%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	14.12%
OPLBR_RT:	$20/hr
OTHR_PCT:	0.64%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.05%
TDIR_PCT:	0%
TINDIR_PCT:	4.91%
UTIL_PCT:	0%

WSTDSP_PCT: 62%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; Cement Manufacturing - Dry

Abbreviation: NSNCRCMDY

Description: Application: This control is the reduction of NOx emission through urea based selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to dry-process cement manufacturing (SCC 30500606) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Cement Manufacturing - Dry

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$770	$770
Ref Yr CPT:	$1,233	$1,233
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.1	2.1
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$770	$770
Ref Yr CPT:	$1,233	$1,233
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.1	2.1
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
39000602	Industrial Processes; In-process Fuel Use; Natural Gas; Cement Kiln/Dryer
39000201	Industrial Processes; In-process Fuel Use; Bituminous Coal; Cement Kiln/Dryer (Bituminous Coal)
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Cement Manufacturing," EPA,-453/R-94-004, Research Triangle Park, NC, March 1994.

Other information:

ADMIN_PCT:	7.18%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	64.49%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 15 years (EPA, 1994). O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in the ACT document Table 6-11. The breakdown was obtained using the average O&M costs for furnaces having capacities of 152, 266, 330 and 495 MMBTU per hour. A capacity factor of 0.913 is used in estimating the O&M cost breakdown. Operating labor: $28.22 per hour Maintenance labor: $24.33 per hour times 0.5 hours per 8 hour shift
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $770 per ton NOx reduced (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	3.85%
HG_CE_T:	50%
INSRNC_PCT:	3.59%
MNTLBR_PCT:	6.29%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$5/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	6.28%
OPLBR_RT:	$28.22/hr
OTHR_PCT:	0%
OVRHD_PCT:	3.77%
PROPTX_PCT:	3.59%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.94%
STEAM_PCT:	0%

TDIR_PCT:	81.86%
TINDIR_PCT:	18.14%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; By-Product Coke Mfg; Oven Underfiring

Abbreviation: NSNCRCMOU

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to all by-product coke manufacturing operations with oven underfiring (SCC 30300306) and uncontrolled NOx emissions greater than 10 tons per year.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 10.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: By-Product Coke Mfg; Oven Underfiring

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,640	$1,640
Ref Yr CPT:	$2,626	$2,626
Control Efficiency:	60.0	60.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.1400000059604645	0.1400000059604645
Discount Rate:	N/A	N/A

Cap Ann Ratio:	2.7	2.7
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,640	$1,640
Ref Yr CPT:	$2,626	$2,626
Control Efficiency:	60.0	60.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.7	2.7
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300306	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Oven Underfiring

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.

- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001).
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $1,640 per ton NOx reduced (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%

STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Selective Non-Catalytic Reduction; External Combustion Boilers, Elec Gen, Anth Coal
Abbreviation:	NSNCRECBAN
Description:	Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls to wall fired (coal) utility boilers. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O). This control applies to pulverized anthracite coal-fired electricity generation sources with a nameplate capacity between 25 and 100 MW. Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).
Class:	Known
Pollutant:	NOX
Equipment Life:	N/A years
Control Technology:	Selective Non-Catalytic Reduction
Source Group:	External Combustion Boilers, Elec Gen, Anth Coal
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,136
Ref Yr CPT:	$1,517
Control Efficiency:	40.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,136
Ref Yr CPT:	$1,517
Control Efficiency:	40.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

Summary:

Control Measure Name:	Selective Non-Catalytic Reduction; External Combustion Boilers, Elec Gen, Dis Oil
Abbreviation:	NSNCRECBDO
Description:	Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls to wall fired (coal) utility boilers. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O). This control applies to distillate oil external combustion boilers. Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).
Class:	Known
Pollutant:	NOX
Equipment Life:	N/A years
Control Technology:	Selective Non-Catalytic Reduction
Source Group:	External Combustion Boilers, Elec Gen, Dis Oil
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,038
Ref Yr CPT:	$5,393
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,038
Ref Yr CPT:	$5,393
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; External Combustion Boilers, Elec Gen, Res Oil

Abbreviation: NSNCRECBR

Description: Application: This control is the use of selective non-catalytic reduction add-on controls to wall fired (oil/gas) utility boilers for the reduction of NOx emissions. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O).

The control applies to Residual Oil (Grade 6 oil) burning electricity generation sources, excluding tangentially fired sources.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: N/A years

Control Technology: Selective Non-Catalytic Reduction

Source Group: External Combustion Boilers, Elec Gen, Res Oil (1)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,235
Ref Yr CPT:	$2,985
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,235
Ref Yr CPT:	$2,985
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; External Combustion Boilers, Elec Gen, Sub/Bit Coal

Abbreviation: NSNCRECBSB

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls to wall fired (coal) utility boilers. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O).

This control applies to coal-fired electricity generation sources with a nameplate capacity between 25 and 100 MW.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: N/A years

Control Technology: Selective Non-Catalytic Reduction

Source Group: External Combustion Boilers, Elec Gen, Sub/Bit Coal (3)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,136
Ref Yr CPT:	$1,517
Control Efficiency:	40.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,136
Ref Yr CPT:	$1,517
Control Efficiency:	40.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; External Combustion Boilers, Elec Gen, Solid Waste

Abbreviation: NSNCRECBSW

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls to wall fired (coal) utility boilers. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O).

This control applies to pulverized-dry bottom coal-fired electricity generation sources with a nameplate capacity between 25 and 100 MW.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: N/A years

Control Technology: Selective Non-Catalytic Reduction

Source Group: External Combustion Boilers, Elec Gen, Solid Waste

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,235
Ref Yr CPT:	$2,985
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,235
Ref Yr CPT:	$2,985
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10101202	External Combustion Boilers; Electric Generation; Solid Waste; Refuse Derived Fuel

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

CE_TEXT:	40% from uncontrolled
COMMENTS_NEW:	This control is being newly applied to this source, and so retrofit data specific to this source was unavailable. (Sorrels, 2008) Therefore, in order to not underestimate cost, the highest costs associated with applying this control to utility boilers was used. This is a potential over-estimate of the control cost.

COST_BASIS:	The cost equations used in this analysis are based on cost equations from EPA's IPM (EPA, 1998). In the IPM, model plants applying SNCR had capacities of 100 MW. The equations were scaled to develop costs for smaller or larger boilers than the model plant. The cost equations also assume a high NOx rate (>=0.5 pounds per MMBtu) and a capacity utilization factor of 65% were assumed for the utility boilers, as well as a 7% discount rate and 20-year lifetime of the controls. Capital Costs (CC): Nameplate Capacity: netdc [=] MW Total Capital Costs: TCC = $15.80 per kW Scaling Factor: SF = (sfn / netdc)^sfe = (100 / MW)^0.681 CC (for netdc < 500) = TCC * netdc * 1000 * SF CC (for netdc > 500) = TCC * netdc * 1000 Operating & Maintenance (O&M): Fixed O&M: omf = $0.24 per kW per year Variable O&M: omv = $0.73 mills per kW-hr Capacity Factor: capfac = 0.65 O&M = (omf * netdc * 1000) + (omv * netdc * 1000 * capfac * 8760 / 1000) Equipment Life in Years = Equiplife Interest Rate = I Capital Recovery Factor: CRF = [I (1 + I) ^ Equiplife] / [((1 + I)^ Equiplife) - 1] Total Cost = (CRF * CC) + O&M O&M Cost Components: The O&M cost breakdown is estimated using the detailed information in the OAQPS Control Cost Manual-Section 4-NOx Controls. The example problem in subsection 1.5 is used as an example for computing typical capital and annual costs of a retrofit SNCR system being applied to a 1,000 MMBtu/hour wall-fired, industrial boiler firing sub-bituminous coal. In this analysis, the SNCR system is assumed to operate for 5 months of the year with a capacity factor of 65 percent, resulting in a total capacity factor of 27 percent. The total variable direct annual cost is the sum of the cost of the reagent, electricity, water, coal, and ash. Indirect annual costs are zero. Electricity Cost: $0.05 $/kW-hr Coal Cost: $1.60/MMBtu Note: All costs are in 1990 dollars.
CPTON_TEXT:	Cost effectiveness is variable and based on plant size (nameplate capacity in MW) and the following factors: the total capital cost of $15.80; the fixed O&M costs of $0.24 per kW per year; and variable O&M costs of $0.98 mills per kW-hr (2004$).
CTRL_EFF_T:	40%
NH3:	X
NOX:	Co*
RULE:	Not Applicable

Summary:

Control Measure Name: Selective Non-Catalytic Reduction - Ammonia; NG-Fired Reformers

Abbreviation: NSNCRFRNG

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to small (<1 ton NOx per OSD) ammonia production natural gas fired reformers (SCC 30100306) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Ammonia - NG-Fired Reformers

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$3,870	$1,570
Ref Yr CPT:	$6,197	$2,514
Control Efficiency:	50.0	50.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.0900000357627869	0.0900000357627869
Discount Rate:	N/A	N/A

Cap Ann Ratio:	9.4	8.2
Incremental CPT:	2900.0	840.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$3,870	$1,570
Ref Yr CPT:	$6,197	$2,514
Control Efficiency:	50.0	50.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	9.4	8.2
Incremental CPT:	2900.0	840.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30100306	Industrial Processes; Chemical Manufacturing; Ammonia Production; Primary Reformer: Natural Gas Fired

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

• EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	51.39%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_H:	$3870/ton
CPTON_L:	$2900/ton
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $3,780 per ton NOx reduced from uncontrolled and $2,900 per ton NOx reduced from RACT baseline (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	2.57%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	38.61%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	7.16%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%

RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.11%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0.19%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction - Ammonia; Oil-Fired Reformers

Abbreviation: NSNCRFROL

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to ammonia production natural gas fired reformers (SCC 30100306) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Ammonia - Oil-Fired Reformers

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,580	$1,050
Ref Yr CPT:	$4,132	$1,681
Control Efficiency:	50.0	50.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A

Cap Ann Ratio:	9.4	8.2
Incremental CPT:	1940.0	560.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$2,580	$1,050
Ref Yr CPT:	$4,132	$1,681
Control Efficiency:	50.0	50.0
Min Emis:	0.0	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	9.4	8.2
Incremental CPT:	1940.0	560.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30100306	Industrial Processes; Chemical Manufacturing; Ammonia Production; Primary Reformer: Natural Gas Fired

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name:	Selective Non-Catalytic Reduction; ICI Boilers - Coal/Cyclone
Abbreviation:	NSNCRIBCC
Description:	Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). SNCR operates in the upper furnace region of the boiler at a temperature between 1600 ? 2100 F (MACTEC 2005). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002). Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications. A SNCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor power (air atomization/mixing), steam (if steam atomization/mixing), dry gas loss (air injection into furnace), and water evaporation loss (NESCAUM 2009).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Non-Catalytic Reduction
Source Group:	ICI Boilers - Coal/Cyclone
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0

Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	208706.86
Capital Cost Exponent No. 1	0.21
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	133401.0
O&M Cost Size Multiplier No. 1	8348.3
O&M Cost Exponent No. 1	0.21
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10300223	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Cyclone Furnace
10200203	External Combustion Boilers; Industrial; Bituminous Coal; Cyclone Furnace

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	35% from uncontrolled

CHEM_PCT:	51.39%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the example problem in the OAQPS Control Cost Manual chapter on SNCR. This example was for a 1,000 MMBtu/hr boiler burning sub-bituminous coal. Electricity cost: $0.05/kW-hr Coal cost: $1.60/MMBtu
CPTON_TEXT:	The cost effectiveness used in AirControlNET for both reductions from baseline and reductions from RACT is $840 per ton NOx reduced (1990$).
CTRL_EFF_T:	35%
ELEC_PCT:	2.57%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	35%
INSRNC_PCT:	0%
MNTLBR_PCT:	38.61%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	7.16%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.11%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

WSTDSP_PCT:	0.19%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; ICI Boilers - Coal/Stoker

Abbreviation: NSNCRIBCS

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).
Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). SNCR operates in the upper furnace region of the boiler at a temperature between 1600 ? 2100 F (MACTEC 2005).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).
Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

A SNCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor power (air atomization/mixing), steam (if steam atomization/mixing), dry gas loss (air injection into furnace), and water evaporation loss (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: ICI Boilers - Coal/Stoker

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0

Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula:

Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	208706.86
Capital Cost Exponent No. 1	0.21
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	133401.0
O&M Cost Size Multiplier No. 1	8348.3
O&M Cost Exponent No. 1	0.21
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10200210	External Combustion Boilers; Industrial; Bituminous Coal; Overfeed Stoker **
10200206	External Combustion Boilers; Industrial; Bituminous Coal; Underfeed Stoker
10200205	External Combustion Boilers; Industrial; Bituminous Coal; Overfeed Stoker
10200204	External Combustion Boilers; Industrial; Bituminous Coal; Spreader Stoker
10200104	External Combustion Boilers; Industrial; Anthracite Coal; Traveling Grate (Overfeed) Stoker
10300309	External Combustion Boilers; Commercial/Institutional; Lignite; Spreader Stoker
10300225	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Traveling Grate (Overfeed) Stoker
10300224	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Spreader Stoker
10300211	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Overfeed Stoker **
10300209	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Spreader Stoker
10300208	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Underfeed Stoker
10300207	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Overfeed Stoker
10300102	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Traveling Grate (Overfeed) Stoker
10200306	External Combustion Boilers; Industrial; Lignite; Spreader Stoker
10200225	External Combustion Boilers; Industrial; Subbituminous Coal; Traveling Grate (Overfeed) Stoker
10200224	External Combustion Boilers; Industrial; Subbituminous Coal; Spreader Stoker

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	40% from uncontrolled
CHEM_PCT:	51.39%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Large source = emission levels greater than 1 ton per ozone season day Where information was available in the Alternative Control Techniques (ACT) document (EPA, 1994), capacity-based equations are used to calculate costs. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, incremental cost equations (or defaults cost) are used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). The following equations, based primarily on information in the Air Pollution Cost Manual (EPA, 2002), are used for large NOx sources as defined above: From Uncontrolled: Capital Cost = 110,487.6 * Capacity (MMBtu/hr)^0.423 Annual Cost = 3,440.9 * Capacity (MMBtu/hr)^0.7337 From RACT Baseline: Capital Cost = 67,093.8 * Capacity (MMBtu/hr)^0.423 Annual Cost = 7,514.2 * Capacity (MMBtu/hr)^0.4195 Note: All costs are in 1990 dollars. O&M Cost Components: The O&M cost breakdown is estimated using the example problem in the OAQPS Control Cost Manual chapter on SNCR. This example was for a 1,000 MMBtu/hr boiler burning sub-bituminous coal. Electricity cost: $0.05/kW-hr Coal cost: $1.60/MMBtu

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the example problem in the OAQPS Control Cost Manual chapter on SNCR. This example was for a 1,000 MMBtu/hr boiler burning sub-bituminous coal. Electricity cost: $0.05/kW-hr Coal cost: $1.60/MMBtu
CPTON_H:	$1015/ton
CPTON_L:	$873/ton
CPTON_TEXT:	When capacity is available and within the applicable range of 0 to 2,000 MMBTU/hr the cost equations are used to calculate cost effectiveness. The default cost effectiveness value, used when capacity information is not available, is $817 per ton NOx reduced from uncontrolled and $703 per ton NOx reduced from RACT (1990$).
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $1,015 per ton NOx reduced from uncontrolled and $873 per ton NOx reduced from RACT baseline (1990$).
CTRL_EFF_T:	40%
ELEC_PCT:	2.57%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	40%
INSRNC_PCT:	0%
MNTLBR_PCT:	38.61%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	7.16%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.11%

TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0.19%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; ICI Boilers - Coal/Wall

Abbreviation: NSNCRIBCW

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).
Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). SNCR operates in the upper furnace region of the boiler at a temperature between 1600 ? 2100 F (MACTEC 2005).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).
Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

A SNCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor power (air atomization/mixing), steam (if steam atomization/mixing), dry gas loss (air injection into furnace), and water evaporation loss (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: ICI Boilers - Coal/Wall

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0

Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	208706.86
Capital Cost Exponent No. 1	0.21
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	133401.0
O&M Cost Size Multiplier No. 1	8348.3
O&M Cost Exponent No. 1	0.21
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10300222	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Pulverized Coal: Dry Bottom
10300221	External Combustion Boilers; Commercial/Institutional; Subbituminous Coal; Pulverized Coal: Wet Bottom
10300206	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom
10300205	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Wet Bottom
10300103	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Hand-fired
10300101	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Pulverized Coal
10200301	External Combustion Boilers; Industrial; Lignite; Pulverized Coal: Dry Bottom, Wall Fired
10200229	External Combustion Boilers; Industrial; Subbituminous Coal; Cogeneration
10200222	External Combustion Boilers; Industrial; Subbituminous Coal; Pulverized Coal: Dry Bottom
10200219	External Combustion Boilers; Industrial; Bituminous Coal; Cogeneration
10200213	External Combustion Boilers; Industrial; Bituminous Coal; Wet Slurry
10200212	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom (Tangential)
10200202	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom
10200201	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Wet Bottom
10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	40% from uncontrolled
CHEM_PCT:	51.39%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the example problem in the OAQPS Control Cost Manual chapter on SNCR. This example was for a 1,000 MMBtu/hr boiler burning sub-bituminous coal. Electricity cost: $0.05/kW-hr Coal cost: $1.60/MMBtu

COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Large source = emission levels greater than 1 ton per ozone season day Where information was available in the Alternative Control Techniques (ACT) document (EPA, 1994), capacity-based equations are used to calculate costs. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). The following equations, based primarily on information in the Air Pollution Cost Manual (EPA, 2002), are used for large NOx sources as defined above: From Uncontrolled: Capital Cost = 110,487.6 * Capacity (MMBtu/hr)^0.423 Annual Cost = 3,440.9 * Capacity (MMBtu/hr)^0.7337 From RACT Baseline: Capital Cost = 67,093.8 * Capacity (MMBtu/hr)^0.423 Annual Cost = 7,514.2 * Capacity (MMBtu/hr)^0.4195 Note: All costs are in 1990 dollars. O&M Cost Components: The O&M cost breakdown is estimated using the example problem in the OAQPS Control Cost Manual chapter on SNCR. This example was for a 1,000 MMBtu/hr boiler burning sub-bituminous coal. Electricity cost: $0.05/kW-hr Coal cost: $1.60/MMBtu
CPTON_H:	$1040/ton
CPTON_L:	$400/ton
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $1,040 per ton NOx reduced from uncontrolled and $400 per ton NOx reduced from RACT baseline (1990$).
CPTON_TEXT:	When capacity is available and within the applicable range of 0 to 2,000 MMBTU/hr the cost equations are used to calculate cost effectiveness. The default cost effectiveness value, used when capacity information is not available, is $840 per ton NOx reduced from uncontrolled and $260 per ton NOx reduced from RACT (1990$).
CTRL_EFF_T:	40%
ELEC_PCT:	2.57%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	40%
INSRNC_PCT:	0%
MNTLBR_PCT:	38.61%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	7.16%
OPLBR_PCT:	0%

OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.11%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0.19%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; ICI Boilers - Distillate Oil

Abbreviation: NSNCRIBDO

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).
Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). SNCR operates in the upper furnace region of the boiler at a temperature between 1600 ? 2100 F (MACTEC 2005).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).
Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

A SNCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor power (air atomization/mixing), steam (if steam atomization/mixing), dry gas loss (air injection into furnace), and water evaporation loss (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: ICI Boilers - Distillate Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0

Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	208706.86
Capital Cost Exponent No. 1	0.21
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	133401.0
O&M Cost Size Multiplier No. 1	8348.3
O&M Cost Exponent No. 1	0.21
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.

• Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	51.39%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the example problem in the OAQPS Control Cost Manual chapter on SNCR. This example was for a 1,000 MMBtu/hr boiler burning sub-bituminous coal. Electricity cost: $0.05/kW-hr Coal cost: $1.60/MMBtu
CPTON_H:	$4640/ton
CPTON_L:	$3470/ton
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $4,640 per ton NOx reduced from uncontrolled and $3,470 per ton NOx reduced from RACT baseline (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	2.57%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	38.61%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	7.16%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%

OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.11%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0.19%

Summary:

Control Measure Name:	Selective Non-Catalytic Reduction; ICI Boilers - Natural Gas
Abbreviation:	NSNCRIBNG
Description:	Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). SNCR operates in the upper furnace region of the boiler at a temperature between 1600 ? 2100 F (MACTEC 2005). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002). Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications. A SNCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor power (air atomization/mixing), steam (if steam atomization/mixing), dry gas loss (air injection into furnace), and water evaporation loss (NESCAUM 2009).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Non-Catalytic Reduction
Source Group:	ICI Boilers - Natural Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0

Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	208706.86
Capital Cost Exponent No. 1	0.21
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	133401.0
O&M Cost Size Multiplier No. 1	8348.3
O&M Cost Exponent No. 1	0.21
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	51.39%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Large source = emission levels greater than 1 ton per ozone season day Where information was available in the Alternative Control Techniques (ACT) document (EPA, 1994), capacity-based equations are used to calculate costs. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). The following equations, based primarily on information in the Air Pollution Cost Manual (EPA, 2002), are used for large NOx sources as defined above: From Uncontrolled: Capital Cost = 62,148.8 * Capacity (MMBtu/hr)^0.423 Annual Cost = 2,012.4 * Capacity (MMBtu/hr)^0.7229 O&M Cost Components: The O&M cost breakdown is estimated using the example problem in the OAQPS Control Cost Manual chapter on SNCR. This example was for a 1,000 MMBtu/hr boiler burning sub-bituminous coal. Electricity cost: $0.05/kW-hr Coal cost: $1.60/MMBtu From RACT Baseline: Capital Cost = 48,002.6 * Capacity (MMBtu/hr)^0.423 Annual Cost = 5,244.4 * Capacity (MMBtu/hr)^0.4238 Note: All costs are in 1990 dollars.
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the example problem in the OAQPS Control Cost Manual chapter on SNCR. This example was for a 1,000 MMBtu/hr boiler burning sub-bituminous coal. Electricity cost: $0.05/kW-hr Coal cost: $1.60/MMBtu
CPTON_H:	$3870/ton
CPTON_L:	$2900/ton
CPTON_TEXT:	When capacity is available and within the applicable range of 0 to 2,000 MMBTU/hr the cost equations are used to calculate cost effectiveness. The default cost effectiveness value, used when capacity information is not available, is $1,570 per ton NOx reduced from uncontrolled and $840 per ton NOx reduced from RACT (1990$).

CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $3,870 per ton NOx reduced from uncontrolled and $2,900 per ton NOx reduced from RACT baseline (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	2.57%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	38.61%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	7.16%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.11%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0.19%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; ICI Boilers - Residual Oil

Abbreviation: NSNCRIBRO

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).
Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). SNCR operates in the upper furnace region of the boiler at a temperature between 1600 ? 2100 F (MACTEC 2005).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).
Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

A SNCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor power (air atomization/mixing), steam (if steam atomization/mixing), dry gas loss (air injection into furnace), and water evaporation loss (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: ICI Boilers - Residual Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0

Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	208706.86
Capital Cost Exponent No. 1	0.21
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	133401.0
O&M Cost Size Multiplier No. 1	8348.3
O&M Cost Exponent No. 1	0.21
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10300404	External Combustion Boilers; Commercial/Institutional; Residual Oil; Grade 5 Oil
10300402	External Combustion Boilers; Commercial/Institutional; Residual Oil; 10-100 Million BTU/hr **
10300401	External Combustion Boilers; Commercial/Institutional; Residual Oil - Grade 6; Boiler
10201404	External Combustion Boilers; Industrial; CO Boiler; Residual Oil
10200405	External Combustion Boilers; Industrial; Residual Oil; Cogeneration
10200404	External Combustion Boilers; Industrial; Residual Oil; Grade 5 Oil
10200403	External Combustion Boilers; Industrial; Residual Oil; < 10 Million BTU/hr
10200402	External Combustion Boilers; Industrial; Residual Oil; 10-100 Million BTU/hr
10200401	External Combustion Boilers; Industrial; Residual Oil; Grade 6 oil

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.

- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	51.39%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Large source = emission levels greater than 1 ton per ozone season day Where information was available in the Alternative Control Techniques (ACT) document (EPA, 1994), capacity-based equations are used to calculate costs. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). The following equations, based primarily on information in the Air Pollution Cost Manual (EPA, 2002), are used for large NOx sources as defined above: From Uncontrolled: Capital Cost = 62,148.8 * Capacity (MMBtu/hr)^0.423 Annual Cost = 2,012.4 * Capacity (MMBtu/hr)^0.7229 From RACT Baseline: Capital Cost = 48,002.6 * Capacity (MMBtu/hr)^0.423 Annual Cost = 5,244.4 * Capacity (MMBtu/hr)^0.4238 Note: All costs are in 1990 dollars. O&M Cost Components: The O&M cost breakdown is estimated using the example problem in the OAQPS Control Cost Manual chapter on SNCR. This example was for a 1,000 MMBtu/hr boiler burning sub-bituminous coal. Electricity cost: $0.05/kW-hr Coal cost: $1.60/MMBtu
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the example problem in the OAQPS Control Cost Manual chapter on SNCR. This example was for a 1,000 MMBtu/hr boiler burning sub-bituminous coal. Electricity cost: $0.05/kW-hr Coal cost: $1.60/MMBtu
CPTON_H:	$2580/ton

CPTON_L:	$1940/ton
CPTON_TEXT:	When capacity is available and within the applicable range of 0 to 2,000 MMBTU/hr the cost equations are used to calculate cost effectiveness. The default cost effectiveness value, used when capacity information is not available, is $1,050 per ton NOx reduced from uncontrolled and $560 per ton NOx reduced from RACT (1990$).
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $2,580 per ton NOx reduced from uncontrolled and $ 1,940 per ton NOx reduced from RACT baseline (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	2.57%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	38.61%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	7.16%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.11%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0.19%

Summary:

Control Measure Name:	Selective Non-Catalytic Reduction; ICI Boilers - Gas
Abbreviation:	NSNCRICBG
Description:	Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). SNCR operates in the upper furnace region of the boiler at a temperature between 1600 ? 2100 F (MACTEC 2005). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002). Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications. A SNCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor power (air atomization/mixing), steam (if steam atomization/mixing), dry gas loss (air injection into furnace), and water evaporation loss (NESCAUM 2009).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Non-Catalytic Reduction
Source Group:	ICI Boilers - Gas
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0

Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula: Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	208706.86
Capital Cost Exponent No. 1	0.21
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	133401.0
O&M Cost Size Multiplier No. 1	8348.3
O&M Cost Exponent No. 1	0.21
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10201402	External Combustion Boilers; Industrial; CO Boiler; Process Gas
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10200799	External Combustion Boilers; Industrial; Process Gas; Other: Specify in Comments
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.

- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; ICI Boilers - Oil

Abbreviation: NSNCRICBO

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).
Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). SNCR operates in the upper furnace region of the boiler at a temperature between 1600 ? 2100 F (MACTEC 2005).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).
Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.
Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

A SNCR will impose an energy impact on the host boiler. The losses attributable to this technology include: compressor power (air atomization/mixing), steam (if steam atomization/mixing), dry gas loss (air injection into furnace), and water evaporation loss (NESCAUM 2009).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: ICI Boilers - Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0

Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$2,430
Ref Yr CPT:	$2,618
Control Efficiency:	45.0
Min Emis:	25.0
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	0.12999999523162842
Discount Rate:	10.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 13

Description: ICI Boiler Cost Equations

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator, stack_flow_rate, stack_velocity, stack_diameter

Formula:
Capital Cost = var1*input1^var2+var3*input1^var4
O&M Cost = var5+var6*input1^var7+var8*input1^var9+var10*input3+var11*input2

where

input1 = boiler size in MMBtu/hr
input2 = boiler emissions in ton/yr
input3 = boiler exhaust flowrate in ft3/sec
var1 = Capital cost size multiplier No.1
var2 = Capital cost exponent No. 1
var3 = Capital cost size multiplier No.2
var4 = Capital cost exponent No. 2
var5 = O&M known costs
var6 = O&M cost size multiplier No.1
var7 = O&M cost size exponent No. 1
var8 = O&M cost size multiplier No. 2
var9 = O&M cost size exponent No. 2
var10 = O&M cost flowrate multiplier
var11 = O&M cost emissions multiplier

Variable Name	Value
Pollutant	NOX
Cost Year	2008
Capital Cost Size Multiplier No. 1	208706.86
Capital Cost Exponent No. 1	0.21
Capital Cost Size Multiplier No. 2	0.0
Capital Cost Exponent No. 2	0.0
O&M Known Costs	133401.0
O&M Cost Size Multiplier No. 1	8348.3
O&M Cost Exponent No. 1	0.21
O&M Cost Size Multiplier No. 2	0.0
O&M Cost Exponent No. 2	0.0
O&M Flowrate Multiplier	19.24
O&M Emissions Multiplier	425.3

Affected SCCs:

Code	Description
39990002	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Residual Oil: Process Heaters
39990001	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Distillate Oil (No. 2): Process Heaters
31000403	Industrial Processes; Oil and Gas Production; Process Heaters; Crude Oil
31000401	Industrial Processes; Oil and Gas Production; Process Heaters; Distillate Oil (No. 2)
30790002	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Residual Oil: Process Heaters
30790001	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30600111	Industrial Processes; Petroleum Industry; Process Heaters; Oil-fired (No. 6 Oil) : 100 Million Btu Capacity
30600103	Industrial Processes; Petroleum Industry; Process Heaters; Oil-fired
30600101	Industrial Processes; Petroleum Industry; Process Heaters; Oil-fired **
30590002	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Process Heaters
30590001	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30490002	Industrial Processes; Secondary Metal Production; Fuel Fired Equipment; Residual Oil: Process Heaters
30490001	Industrial Processes; Secondary Metal Production; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30190002	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Residual Oil: Process Heaters
30190001	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters

References:

- Bodnarik, Andy. September 29, 2011. Personal Communication with Andy Bodnarik of Ozone Transport Commission to Bryan Lange of ERG.
- MACTEC Engineering and Consulting, Inc. March 30, 2005. Midwest Regional Planning Organization - Boiler Best Available Retrofit Technology Engineering Analysis
- US EPA. Coal Utility Environmental Cost, CUECost Model Version 1.0. http://www.epa.gov/ttn/catc/products.html#software (accessed November 18, 2011).
- Ozone Transport Commission & Lake Michigan Air Directors Consortium. May 25, 2010. Draft - Evaluation of Control Options for Industrial, Commercial and Institutional Boilers, Technical Support Document.
- Northeast States for Coordinated Air Use Management. November 2008 (revised January 2009). Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional Boilers.

Other information:

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; Indust. Incinerators

Abbreviation: NSNCRIDIN

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to industrial incinerators IC boilers with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Indust. Incinerators

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,130	$1,130
Ref Yr CPT:	$1,810	$1,810
Control Efficiency:	45.0	45.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A

Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,130	$1,130
Ref Yr CPT:	$1,810	$1,810
Control Efficiency:	45.0	45.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30190011	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Distillate Oil (No. 2): Incinerators
30190012	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Residual Oil: Incinerators
30190013	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Natural Gas: Incinerators
30190014	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Process Gas: Incinerators
30490013	Industrial Processes; Secondary Metal Production; Fuel Fired Equipment; Natural Gas: Incinerators
30590013	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Incinerators
30790011	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Distillate Oil (No. 2): Incinerators
30790012	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Residual Oil: Incinerators

30790013	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Natural Gas: Incinerators
30790014	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Process Gas: Incinerators
30790021	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Distillate Oil (No. 2): Flares
30790022	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Residual Oil: Flares
30790023	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Natural Gas: Flares
30790024	Industrial Processes; Pulp and Paper and Wood Products; Fuel Fired Equipment; Process Gas: Flares
30890001	Industrial Processes; Rubber and Miscellaneous Plastics Products; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30890002	Industrial Processes; Rubber and Miscellaneous Plastics Products; Fuel Fired Equipment; Residual Oil: Process Heaters
30890004	Industrial Processes; Rubber and Miscellaneous Plastics Products; Fuel Fired Equipment; Liquified Petroleum Gas (LPG): Process Heaters
30890011	Industrial Processes; Rubber and Miscellaneous Plastics Products; Fuel Fired Equipment; Distillate Oil (No. 2): Incinerators
30890012	Industrial Processes; Rubber and Miscellaneous Plastics Products; Fuel Fired Equipment; Residual Oil: Incinerators
30890013	Industrial Processes; Rubber and Miscellaneous Plastics Products; Fuel Fired Equipment; Natural Gas: Incinerators
30890021	Industrial Processes; Rubber and Miscellaneous Plastics Products; Fuel Fired Equipment; Distillate Oil (No. 2): Flares
30890022	Industrial Processes; Rubber and Miscellaneous Plastics Products; Fuel Fired Equipment; Residual Oil: Flares
30890023	Industrial Processes; Rubber and Miscellaneous Plastics Products; Fuel Fired Equipment; Natural Gas: Flares
39990011	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Distillate Oil (No. 2): Incinerators
39990012	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Residual Oil: Incinerators
39990013	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Natural Gas: Incinerators
39990014	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Process Gas: Incinerators
39990021	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Distillate Oil (No. 2 Oil): Flares
39990022	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Residual Oil: Flares
39990023	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Natural Gas: Flares
39990024	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Manufacturing Industries; Process Gas: Flares
50300101	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Multiple Chamber
50300102	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Single Chamber
50300103	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Controlled Air

50300104	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Conical Design (Tee Pee) Municipal Refuse
50300105	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Conical Design (Tee Pee) Wood Refuse
50300106	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Trench Burner: Wood
50300107	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Trench Burner: Tires
50300108	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Auto Body Components
50300109	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Trench Burner: Refuse
50300111	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Mass Burn Refractory Wall Combustor
50300112	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Mass Burn Waterwall Combustor
50300113	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Mass Burn Rotary Waterwall Combustor
50300114	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Modular Starved-air Combustor
50300115	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Modular Excess-air Combustor
50300501	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Hazardous Waste
50300502	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Hazardous Waste Incinerators: Fluidized Bed
50300503	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Hazardous Waste Incinerators: Liquid Injection
50300504	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Hazardous Waste Incinerators: Rotary Kiln
50300505	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Hazardous Waste Incinerators: Multiple Hearth
50300506	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Sludge
50300515	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Sewage Sludge Incinerator: Multiple Hearth
50300516	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Sewage Sludge Incinerator: Fluidized Bed
50300517	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Sewage Sludge Incinerator: Electric Infrared
50300518	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Sewage Sludge Incinerator: Single Hearth Cyclone
50300519	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Sewage Sludge Incinerator: Rotary Kiln
50300520	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Sewage Sludge Incinerator: High Pressure, Wet Oxidation
50300599	Waste Disposal; Solid Waste Disposal - Industrial; Incineration; Fuel Not Classified

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.

- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Radian Corporation, "Alternative Control Techniques Document-- NOx Emissions from Municipal Waste Combustion," EPA-600/R-94-208, Research Triangle Park, NC, December 1994.

Other information:

ADMIN_PCT:	4.91%
CE_TEXT:	45% from uncontrolled
CHEM_PCT:	12.19%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated using the information in Chapter and Appendix A of the MWC ACT document. The cost outputs for conventional SNCR applied to the 400 ton per day model combustor (Table 3-3) are used to estimate the O&M cost breakdown. The tipping fee ($1.47 per ton) is included as a waste disposal cost (direct annual cost). Electricity Cost: 0.046 $/kW-hr
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $1,130 per ton NOx reduced (1990$).
CTRL_EFF_T:	45%
ELEC_PCT:	0.64%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	45%
INSRNC_PCT:	0%
MNTLBR_PCT:	2.25%
MNTLBR_RT:	$20/hr
MNTMTL_PCT:	3.2%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	14.12%

OPLBR_RT:	$20/hr
OTHR_PCT:	0.64%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.05%
TDIR_PCT:	0%
TINDIR_PCT:	4.91%
UTIL_PCT:	0%
WSTDSP_PCT:	62%

Summary:

Control Measure Name:	Selective Non-Catalytic Reduction; Iron & Steel Mills - Annealing
Abbreviation:	NSNCRISAN
Description:	Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). This control applies to iron and steel mill annealing operations with uncontrolled NOx emissions greater than 10 tons per year, classified under SCC 30300934. Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002). Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	Selective Non-Catalytic Reduction
Source Group:	Iron & Steel Mills - Annealing
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,640	$1,640
Ref Yr CPT:	$2,626	$2,626
Control Efficiency:	60.0	60.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A

Cap Ann Ratio:	2.7	2.7
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,640	$1,640
Ref Yr CPT:	$2,626	$2,626
Control Efficiency:	60.0	60.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.7	2.7
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Process Heaters," EPA-453/R-93-034, Research Triangle Park, NC, September 1993.

- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions from Iron and Steel Mills," EPA-453/R-94-065, Research Triangle Park, NC, September 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	60% from uncontrolled
CHEM_PCT:	15.56%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 10 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 55% (Pechan, 2001). O&M Cost Components: The O&M cost breakdown is estimated by applying percentages of O&M breakdown for SCR as applied to process heaters, using detailed information found in Table 6-3 and Chapter 6 of the Process Heater ACT document. The breakdown was obtained using the average O&M costs for 3 annealing furnaces having capacities of 100, 200 and 300 MMBTU per hour. Electricity: $0.06 per kw-hr Fuel (nat gas): $2.00 per MMBTU Ammonia: $0.125 per lb
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $1,640 per ton NOx reduced (1990$).
CTRL_EFF_T:	60%
ELEC_PCT:	0%
ELEC_RT:	$0.06/kWh
FUEL_PCT:	0%
HG_CE_T:	60%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	58.79%
NG_RT:	$2/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%

OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	15.54%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	100%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; Municipal Waste Combustors

Abbreviation: NSNCRMWCB

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to municipal waste combustors with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Municipal Waste Combustors

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,130	$1,130
Ref Yr CPT:	$1,810	$1,810
Control Efficiency:	45.0	45.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A

Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,130	$1,130
Ref Yr CPT:	$1,810	$1,810
Control Efficiency:	45.0	45.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
50100103	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Refuse Derived Fuel
50100102	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Mass Burn: Single Chamber
50100101	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Starved Air: Multiple Chamber

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.

- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Radian Corporation, "Alternative Control Techniques Document-- NOx Emissions from Municipal Waste Combustion," EPA-600/R-94-208, Research Triangle Park, NC, December 1994.

Other information:

ADMIN_PCT:	4.91%
CE_TEXT:	45% from uncontrolled
CHEM_PCT:	12.19%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). O&M Cost Components: The O&M cost breakdown is estimated using the information in Chapter and Appendix A of the MWC ACT document. The cost outputs for conventional SNCR applied to the 400 ton per day model combustor (Table 3-3) are used to estimate the O&M cost breakdown. The tipping fee ($1.47 per ton) is included as a waste disposal cost (direct annual cost). Electricity Cost: 0.046 $/kW-hr
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $1,130 per ton NOx reduced (1990$).
CTRL_EFF_T:	45%
ELEC_PCT:	0.64%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	45%
INSRNC_PCT:	0%
MNTLBR_PCT:	2.25%
MNTLBR_RT:	$20/hr
MNTMTL_PCT:	3.2%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	14.12%
OPLBR_RT:	$20/hr
OTHR_PCT:	0.64%

OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.05%
TDIR_PCT:	0%
TINDIR_PCT:	4.91%
UTIL_PCT:	0%
WSTDSP_PCT:	62%

Summary:

Control Measure Name:	Selective Non-Catalytic Reduction; Medical Waste Incinerators
Abbreviation:	NSNCRMWIN
Description:	Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O). This control applies to medical waste incinerators (SCC 50200505) with uncontrolled NOx emissions greater than 10 tons per year. Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002). Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water. Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.
Class:	Known
Pollutant:	NOX
Equipment Life:	20.0 years
Control Technology:	Selective Non-Catalytic Reduction
Source Group:	Medical Waste Incinerators
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$4,510	$4,510
Ref Yr CPT:	$7,222	$7,222
Control Efficiency:	45.0	45.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A

Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$4,510	$4,510
Ref Yr CPT:	$7,222	$7,222
Control Efficiency:	45.0	45.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
50200520	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: High Pressure, Wet Oxidation
50200519	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: Rotary Kiln
50200518	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: Single Hearth Cyclone
50200517	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: Electric Infrared
50200516	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: Fluidized Bed
50200515	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Sewage Sludge Incinerator: Multiple Hearth
50200507	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; VOC Contaminated Soil

50200505	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Medical Waste Incinerator, unspecified type, Infectious wastes only
50200504	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Medical Waste Incinerator, unspecified type (use 502005-01, -02, -03)
50200503	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Medical Waste Rotary Kiln Incinerator
50200502	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Med Waste Excess Air Incin - aka Batch, Multiple Chamber, or Retort
50200501	Waste Disposal; Solid Waste Disposal - Commercial/Institutional; Incineration: Special Purpose; Med Waste Controlled Air Incin-aka Starved air, 2-stg, or Modular comb

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- STAPPA/ALAPCO, 1994: State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Officials, "Controlling Nitrogen Oxides Under the Clean Air Act: A Menu of Options," Washington, DC, July 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	45% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (STAPPA/ALAPCO, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001).
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $4,510 per ton NOx reduced (1990$).
CTRL_EFF_T:	45%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	45%

INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; Space Heaters - Distillate Oil

Abbreviation: NSNCRSHDO

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to small (<1 ton NOx emissions per OSD) distillate oil-fired space heaters with uncontrolled NOx emissions greater than 10 tons per year, classified under SCCs 10500105 and 10500205.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Space Heaters - Distillate Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,890	$4,640
Ref Yr CPT:	$3,027	$7,430
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A

Cap Ann Ratio:	8.2	9.4
Incremental CPT:	1010.0	3470.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,890	$4,640
Ref Yr CPT:	$3,027	$7,430
Control Efficiency:	50.0	50.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	8.2	9.4
Incremental CPT:	1010.0	3470.0
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10500205	External Combustion; Space Heaters; Commercial/Institutional; Distillate Oil
10500105	External Combustion; Space Heaters; Industrial; Distillate Oil

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions

from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	51.39%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_H:	$4640/ton
CPTON_L:	$3470/ton
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $4,640 per ton NOx reduced from uncontrolled and $3,470 per ton NOx reduced from RACT baseline (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	2.57%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	38.61%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	7.16%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%

RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.11%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0.19%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; Space Heaters - Natural Gas

Abbreviation: NSNCRSHNG

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to small (<1 ton NOx emissions per OSD) natural gas fired space heaters with uncontrolled NOx emissions greater than 10 tons per year, classified under SCCs 10500106 and 10500206.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Space Heaters - Natural Gas

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$3,870	$1,570
Ref Yr CPT:	$6,197	$2,514
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A

Cap Ann Ratio:	9.4	8.2
Incremental CPT:	2900.0	840.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$3,870	$1,570
Ref Yr CPT:	$6,197	$2,514
Control Efficiency:	50.0	50.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	9.4	8.2
Incremental CPT:	2900.0	840.0
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
10500206	External Combustion; Space Heaters; Commercial/Institutional; Natural Gas
10500106	External Combustion; Space Heaters; Industrial; Natural Gas

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 1994: U.S. Environmental Protection Agency, Emissions Standard Division, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document-- NOx Emissions

from Industrial/Commercial/Institutional (ICI) Boilers," EPA-453/R-94-022, Research Triangle Park, NC, June 1994.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	50% from uncontrolled
CHEM_PCT:	51.39%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than or equal to 70% (Pechan, 2001).
CPTON_H:	$3870/ton
CPTON_L:	$2900/ton
CPTON_TEXT:	The cost effectiveness values used in AirControlNET are $3,870 per ton NOx reduced from uncontrolled and $ 2,900 per ton NOx reduced from RACT baseline (1990$).
CTRL_EFF_T:	50%
ELEC_PCT:	2.57%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	38.61%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	7.16%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%

RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0.11%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0.19%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; Solid Waste Disp;Gov;Other Incin;Sludge

Abbreviation: NSNCRSWIN

Description: Application: This control is the reduction of NOx emission through selective non-catalytic reduction add-on controls. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) into molecular nitrogen (N2) and water vapor (H2O).

This control applies to solid waste disposal operations (classified under SCC 50100506) with uncontrolled NOx emissions greater than 10 tons per year.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Ammonia can be utilized in either aqueous or anhydrous form. Anhydrous ammonia is a gas at atmospheric pressure and normal temperatures. There are safety issues with the use of anhydrous ammonia, as it must be transported and stored under pressure (EPA, 2002). Aqueous ammonia is generally transported and stored at a concentration of 29.4% ammonia in water.

Urea based systems have several advantages, including several safety aspects. Urea is a nontoxic, less volatile liquid that can be stored and handled more safely than ammonia. Urea solution droplets can penetrate farther into the flue gas when injected into the boiler, enhancing mixing (EPA, 2002). Because of these advantages, urea is more commonly used than ammonia in large boiler applications.

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Solid Waste Disp;Gov;Other Incin;Sludge

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,130	$1,130
Ref Yr CPT:	$1,810	$1,810
Control Efficiency:	45.0	45.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A

Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$1,130	$1,130
Ref Yr CPT:	$1,810	$1,810
Control Efficiency:	45.0	45.0
Min Emis:	365.0	N/A
Max Emis:	N/A	365.0
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A
Cap Ann Ratio:	4.1	4.1
Incremental CPT:	N/A	N/A
Details:	Applied to large source types	Applied to small source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
50100520	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Sewage Sludge Incinerator: High Pressure, Wet Oxidation
50100519	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Sewage Sludge Incinerator: Rotary Kiln
50100518	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Sewage Sludge Incinerator: Single Hearth Cyclone
50100517	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Sludge: Electric Infrared
50100516	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Sludge: Fluidized Bed
50100515	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Sludge: Multiple Hearth
50100512	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Trench Burner: Refuse
50100511	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Trench Burner: Tires
50100510	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Trench Burner: Wood

50100508	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Conical Design (Tee Pee) Wood Refuse
50100507	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Conical Design (Tee Pee) Municipal Refuse
50100506	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Sludge
50100505	Waste Disposal; Solid Waste Disposal - Government; Other Incineration; Medical Waste Incinerator, unspecified type, Infectious wastes only

References:

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Ozone Transport Rulemaking Non-Electricity Generating Unit Cost Analysis," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, September 1998.
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1994: U.S. Environmental Protection Agency, Radian Corporation, "Alternative Control Techniques Document-- NOx Emissions from Municipal Waste Combustion," EPA-600/R-94-208, Research Triangle Park, NC, December 1994.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	45% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Sources are distinguished by NOx emission levels (Pechan, 1998). Small source = emission levels less than 1 ton per ozone season day Large source = emission levels greater than 1 ton per ozone season day Costs for stationary source NOx control are based on an analysis of EPA's NOx State Implementation Plan (SIP) Call (Pechan, 1998). From this analysis, default cost per ton values are assigned for small sources. A discount rate of 7 percent and a capacity factor of 65 percent are assumed, along with an equipment life of 20 years (EPA, 1994). In general, the incremental default cost is used for sources where there are existing controls (RACT baseline), with efficiencies less than 70% (Pechan, 2001).
CPTON_TEXT:	The cost effectiveness (for both small and large sources) used in AirControlNET for both reductions from baseline and reductions from RACT is $1,130 per ton NOx reduced (1990$).
CTRL_EFF_T:	45%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	45%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%

MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	X
NOX:	Co*
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; Utility Boiler - Coal/Tangential - 25 to 99 MW

Abbreviation: NSNCRUBCT1

Description: Application: This control is the use of selective non-catalytic reduction add-on controls to reduce NOx emissions from tangentially coal-fired utility boilers. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O).

This control applies to bituminous/subbituminous coal-fired electricity generation sources, including sources with atmospheric fluidized bed combustion.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Utility Boiler - Coal/Tangential (25 to 99 MW)

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:

Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	56.0
Fixed O&M Cost Multiplier	0.5
Variable O&M Cost Multiplier	1.2
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0

Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom

10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

References:

- EPA, 2006: U.S. Environmental Protection Agency, Clean Air Markets Division, "Documentation for EPA Base Case 2006 (V.3.0) Using the Integrated Planning Model," Washington, DC, November 2006.

Other information:

Summary:

Control Measure Name:	Selective Non-Catalytic Reduction; Utility Boiler - Coal/Tangential - 100 to 299 MW
Abbreviation:	NSNCRUBCT2
Description:	Application: This control is the use of selective non-catalytic reduction add-on controls to reduce NOx emissions from tangentially coal-fired utility boilers. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O). This control applies to bituminous/subbituminous coal-fired electricity generation sources, including sources with atmospheric fluidized bed combustion. Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Non-Catalytic Reduction
Source Group:	Utility Boiler - Coal/Tangential (100 to 299 MW)
Sectors:	ptipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:

Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	30.0
Fixed O&M Cost Multiplier	0.27
Variable O&M Cost Multiplier	1.2
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0

Capacity Factor	1.0

Affected SCCs:

Code	Description
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom

10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All

References:

- EPA, 2006: U.S. Environmental Protection Agency, Clean Air Markets Division, "Documentation for EPA Base Case 2006 (V.3.0) Using the Integrated Planning Model," Washington, DC, November 2006.

Other information:

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; Utility Boiler - Coal/Tangential - 300 to 499 MW

Abbreviation: NSNCRUBCT3

Description: Application: This control is the use of selective non-catalytic reduction add-on controls to reduce NOx emissions from tangentially coal-fired utility boilers. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O).

This control applies to bituminous/subbituminous coal-fired electricity generation sources, including sources with atmospheric fluidized bed combustion.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Utility Boiler - Coal/Tangential (300 to 499 MW)

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incrementemal CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	23.0
Fixed O&M Cost Multiplier	0.2
Variable O&M Cost Multiplier	1.2
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0

Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker

10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All

References:

- EPA, 2006: U.S. Environmental Protection Agency, Clean Air Markets Division, "Documentation for EPA Base Case 2006 (V.3.0) Using the Integrated Planning Model," Washington, DC, November 2006.

Other information:

Summary:

Control Measure Name:	Selective Non-Catalytic Reduction; Utility Boiler - Coal/Tangential - 500 to 699 MW
Abbreviation:	NSNCRUBCT4
Description:	Application: This control is the use of selective non-catalytic reduction add-on controls to reduce NOx emissions from tangentially coal-fired utility boilers. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O). This control applies to bituminous/subbituminous coal-fired electricity generation sources, including sources with atmospheric fluidized bed combustion. Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002). Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).
Class:	Known
Pollutant:	NOX
Equipment Life:	15.0 years
Control Technology:	Selective Non-Catalytic Reduction
Source Group:	Utility Boiler - Coal/Tangential (500 to 699 MW)
Sectors:	ptipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:

Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	19.0
Fixed O&M Cost Multiplier	0.17
Variable O&M Cost Multiplier	1.2
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0

Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom

10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

References:

- EPA, 2006: U.S. Environmental Protection Agency, Clean Air Markets Division, "Documentation for EPA Base Case 2006 (V.3.0) Using the Integrated Planning Model," Washington, DC, November 2006.

Other information:

Summary:

Control Measure Name: Selective Non-Catalytic Reduction; Utility Boiler - Coal/Tangential - Over 700 MW

Abbreviation: NSNCRUBCT5

Description: Application: This control is the use of selective non-catalytic reduction add-on controls to reduce NOx emissions from tangentially coal-fired utility boilers. SNCR controls are post-combustion control technologies based on the chemical reduction of nitrogen oxides (NOx) with a nitrogen based reducing reagent, such as ammonia or urea, to reduce the NOx into molecular nitrogen (N2) and water vapor (H2O).

This control applies to bituminous/subbituminous coal-fired electricity generation sources, including sources with atmospheric fluidized bed combustion.

Discussion: SNCR is the reduction of NOx in flue gas to N2 and water vapor. This reduction is done with a nitrogen based reducing reagent, such as ammonia or urea. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored for a specific temperature range and in the presence of oxygen (EPA, 2002).

Both ammonia and urea are used as reagents. The cost of the reagent represents a large part of the annual costs of an SNCR system. Ammonia is generally less expensive than urea. However, the choice of reagent is also based on physical properties and operational considerations (EPA, 2002).

Class: Known

Pollutant: NOX

Equipment Life: 15.0 years

Control Technology: Selective Non-Catalytic Reduction

Source Group: Utility Boiler - Coal/Tangential (Over 700 MW)

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	NOX
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.09000000357627869
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:

Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	NOX
Cost Year	2011
Capital Cost Multiplier	15.0
Fixed O&M Cost Multiplier	0.14
Variable O&M Cost Multiplier	1.2
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0

Capacity Factor	1.0

Affected SCCs:

Code	Description
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed

10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

References:

- EPA, 2006: U.S. Environmental Protection Agency, Clean Air Markets Division, "Documentation for EPA Base Case 2006 (V.3.0) Using the Integrated Planning Model," Washington, DC, November 2006.

Other information:

Summary:

Control Measure Name:	Thermal Reduction; Adipic Acid Manufacturing
Abbreviation:	NTHRDADMF
Description:	Application: This control is the application of Thermal Reduction controls to Adipic Acid Manufacturing sources to reduce NOx emissions.
Class:	Known
Pollutant:	NOX
Equipment Life:	10.0 years
Control Technology:	Thermal Reduction
Source Group:	Adipic Acid Manufacturing
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$420	$420
Ref Yr CPT:	$673	$673
Control Efficiency:	81.0	81.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.3	2.3
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	NOX	NOX
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1990	1990
CPT:	$420	$420
Ref Yr CPT:	$673	$673
Control Efficiency:	81.0	81.0
Min Emis:	N/A	365.0
Max Emis:	365.0	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0

Equation Type:	cpton	cpton
Capital Rec Fac:	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A
Cap Ann Ratio:	2.3	2.3
Incremental CPT:	N/A	N/A
Details:	Applied to small source types	Applied to large source types
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30100101	Industrial Processes; Chemical Manufacturing; Adipic Acid; General

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Water heater replacement (base year = 1999);Commercial/Institutional - NG
Abbreviation: NWHCMNGC99
Description: Application: This control would replace existing water heaters with new water heaters. New water heaters would be required to emit less than or equal to 40 ng NOx per Joule heat output.

This control applies to all natural gas burning water heaters classified under SCC 2103006000.

Discussion: EPA (1995) noted a life expectancy of both conventional and low-NOx units ranging from 10 to 15 years. Thus, rule penetration is based on an average water heater equipment life of 13 years (Pechan, 1996).
Class: Known
Pollutant: NOX
Equipment Life: 13.0 years
Control Technology: Water heater replacement
Source Group: Commercial/Institutional - NG
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX	NOX	NOX
Locale:				
Effective Date:	1999-01-01 00:00:00.0	2000-01-01 00:00:00.0	2005-01-01 00:00:00.0	2007-01-01 00:00:00.0
Cost Year:	1990	1990	1990	1990
CPT:				
Ref Yr CPT:				
Control Efficiency:	7.0	10.0	28.0	35.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	23.0	23.0	23.0	23.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	2008-01-01 00:00:00.0	2010-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:		
Ref Yr CPT:		

Control Efficiency:	38.0	45.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	23.0	23.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2103007010	Stationary Source Fuel Combustion; Commercial/Institutional; Liquified Petroleum Gas (LPG); Asphalt Kettle Heaters
2103007005	Stationary Source Fuel Combustion; Commercial/Institutional; Liquified Petroleum Gas (LPG); All Boiler Types
2103007000	Stationary Source Fuel Combustion; Commercial/Institutional; Liquified Petroleum Gas (LPG); Total: All Combustor Types
2103006000	Stationary Source Fuel Combustion; Commercial/Institutional; Natural Gas; Total: Boilers and IC Engines

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- EPA, 1995: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Costs for the California Federal Implementation Plans for Attainment of the Ozone National Ambient Air Quality Standard," Final Draft, February 1995. Document No. 05.09.009/9010.463 III-526 Report
- Pechan, 1996: E.H. Pechan & Associates, "The Emission Reduction and Cost Analysis Model for NOx (ECRAM-NOx)," Revised Documentation, prepared for U.S. Environmental Protection Agency, Ozone Policy and Strategies Group, Research Triangle Park, NC, September 1996.
- Pechan, 1997: E.H. Pechan & Associates, "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality

Standards, and Regional Haze Program," prepared for U.S. Environmental Protection Agency, July 1997.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	7%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
ADMIN_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	7% from uncontrolled
ELEC_PCT:	0%
COST_BASIS:	In 1994, EPA conducted an analysis of the emission reductions and costs for a Federal Implementation Plan residential water heater rule for the Sacramento, California ozone nonattainment area (EPA, 1995). This analysis found that a rule based on an emission limit of 40 nanograms per joule (ng/j) of heat output for natural gas heaters with a heat input rating less than 75,000 Btu/hr would not result in an increase in the cost of natural gas water heaters. The cost-effectiveness of NOx reductions resulting from low-NOx residential water heaters is, therefore, zero dollar-per-ton of NOx removed. It is assumed that the technology for residential water and space heaters can be transferred to commercial installation at a similar cost to achieve the same percentage reduction (Pechan, 1997).
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $0 per ton NOx reduced (1990$).
OMATL_PCT:	0%
OTHR_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	7%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OVRHD_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%

UTIL_PCT:	0%

Summary:

Control Measure Name: Water heater replacement (base year = 1999);Residential NG
Abbreviation: NWHRSNGC99
Description: Application: This control would replace existing water heaters with new water heaters. New water heaters would be required to emit less than or equal to 40 ng NOx per Joule heat output.

This control applies to all natural gas burning water heaters classified under SCC 2104006000.

Discussion: EPA (1995) noted a life expectancy of both conventional and low-NOx units ranging from 10 to 15 years. Thus, rule penetration is based on an average water heater equipment life of 13 years (Pechan, 1996).

Class: Known
Pollutant: NOX
Equipment Life: 13.0 years
Control Technology: Water heater replacement
Source Group: Residential NG
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX	NOX	NOX
Locale:				
Effective Date:	1999-01-01 00:00:00.0	2000-01-01 00:00:00.0	2005-01-01 00:00:00.0	2007-01-01 00:00:00.0
Cost Year:	1990	1990	1990	1990
CPT:				
Ref Yr CPT:				
Control Efficiency:	7.0	10.0	28.0	35.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	23.0	23.0	23.0	23.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	2008-01-01 00:00:00.0	2010-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:		
Ref Yr CPT:		

Control Efficiency:	38.0	45.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	23.0	23.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104007000	Stationary Source Fuel Combustion; Residential; Liquified Petroleum Gas (LPG); Total: All Combustor Types
2104006010	Stationary Source Fuel Combustion; Residential; Natural Gas; Residential Furnaces
2104006000	Stationary Source Fuel Combustion; Residential; Natural Gas; Total: All Combustor Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- EPA, 1995: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Costs for the California Federal Implementation Plans for Attainment of the Ozone National Ambient Air Quality Standard," Final Draft, February 1995. Document No. 05.09.009/9010.463 III-526 Report
- Pechan, 1996: E.H. Pechan & Associates, "The Emission Reduction and Cost Analysis Model for NOx (ECRAM-NOx)," Revised Documentation, prepared for U.S. Environmental Protection Agency, Ozone Policy and Strategies Group, Research Triangle Park, NC, September 1996.
- Pechan, 1997: E.H. Pechan & Associates, "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for U.S. Environmental Protection Agency, July 1997.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	7%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
ADMIN_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	7% from uncontrolled
ELEC_PCT:	0%
COST_BASIS:	In 1994, EPA conducted an analysis of the emission reductions and costs for a Federal Implementation Plan residential water heater rule for the Sacramento, California ozone nonattainment area (EPA, 1995). This analysis found that a rule based on an emission limit of 40 nanograms per joule (ng/j) of heat output for natural gas heaters with a heat input rating less than 75,000 Btu/hr would not result in an increase in the cost of natural gas water heaters. The cost-effectiveness of NOx reductions resulting from low-NOx residential water heaters is, therefore, zero dollar-per-ton of NOx removed.
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $0 per ton NOx reduced (1990$).
OTHR_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	7%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OVRHD_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name: Water heater + Low NOx Burner Space heaters (base year = 1999);Commercial/Institutional - NG

Abbreviation: NWLCMNGC99

Description: Application: The South Coast and Bay Area AQMDs set emission limits for water heaters and space heaters. This control is based on the installation of low-NOx space heaters and water heaters in commercial and institutional sources for the reduction of NOx emissions.

The control applies to natural gas burning sources classified under SCC 2103006000.

Class: Known

Pollutant: NOX

Equipment Life: 20.0 years

Control Technology: Water heater + Low NOx Burner Space heaters

Source Group: Commercial/Institutional - NG

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX	NOX	NOX
Locale:				
Effective Date:	1999-01-01 00:00:00.0	2000-01-01 00:00:00.0	2005-01-01 00:00:00.0	2007-01-01 00:00:00.0
Cost Year:	1990	1990	1990	1990
CPT:	$1,230	$1,230	$1,230	$1,230
Ref Yr CPT:	$1,970	$1,970	$1,970	$1,970
Control Efficiency:	7.0	17.0	27.0	34.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	2008-01-01 00:00:00.0	2010-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:	$1,230	$1,230
Ref Yr CPT:	$1,970	$1,970
Control Efficiency:	38.0	44.0

Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2103006000	Stationary Source Fuel Combustion; Commercial/Institutional; Natural Gas; Total: Boilers and IC Engines

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1997: E.H. Pechan & Associates, "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for U.S. Environmental Protection Agency, July 1997.
- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan - Appendix IV-A. Stationary and Mobile Source Control Measures," August 1996.

Other information:

COST_BASIS:	The 1997 South Coast AQMP estimates a cost savings for new commercial and residential water heaters meeting a low-NOx standard. The cost savings is based on capital costs associated with installation of energy efficient equipment existing demand-side management programs, energy savings, associated emission reductions, and the prevailing emission credit price (SCAQMD, 1996). Costs for the space heaters are based on the low-NOx limits established for the South Coast and Bay Area Air Quality Management Districts for space heaters of 0.009 lbs NOx per million Btu. The cost effectiveness estimate for the low-NOx space heater regulation is $1,600 per ton NOx (STAPPA/ALAPCO, 1994). For this analysis a 75% reduction in commercial space heater NOx emissions is assumed, based on a 20-year equipment life (Pechan, 1997). The water heater savings and LNB space heater costs are combined to achieve an overall cost effectiveness of $1,230 per ton NOx reduced.
SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	South Coast and Bay Area AQMD Limits
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	7%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
ADMIN_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	7% from uncontrolled
ELEC_PCT:	0%
CPTON_TEXT:	The cost effectiveness is $1,230 per ton NOx reduced (1990$).
OTHR_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	7%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OVRHD_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Water heater + Low NOx Burner Space heaters (base year = 1999);Residential NG
Abbreviation:	NWLRSNGC99
Description:	Application: The South Coast and Bay Area AQMDs set emission limits for water heaters and space heaters. This control is based on the installation of low-NOx space heaters and water heaters in commercial and institutional sources for the reduction of NOx emissions. The control applies to natural gas burning sources classified under SCC 2104006000.
Class:	Known
Pollutant:	NOX
Equipment Life:	20.0 years
Control Technology:	Water heater + Low NOx Burner Space heaters
Source Group:	Residential NG
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	NOX	NOX	NOX
Locale:				
Effective Date:	1999-01-01 00:00:00.0	2000-01-01 00:00:00.0	2005-01-01 00:00:00.0	2007-01-01 00:00:00.0
Cost Year:	1990	1990	1990	1990
CPT:	$1,230	$1,230	$1,230	$1,230
Ref Yr CPT:	$1,970	$1,970	$1,970	$1,970
Control Efficiency:	7.0	17.0	27.0	34.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremenental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	NOX	NOX
Locale:		
Effective Date:	2008-01-01 00:00:00.0	2010-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:	$1,230	$1,230
Ref Yr CPT:	$1,970	$1,970
Control Efficiency:	38.0	44.0
Min Emis:	N/A	N/A

Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104006000	Stationary Source Fuel Combustion; Residential; Natural Gas; Total: All Combustor Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1997: E.H. Pechan & Associates, "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for U.S. Environmental Protection Agency, July 1997.
- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan - Appendix IV-A. Stationary and Mobile Source Control Measures," August 1996.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	South Coast and Bay Area AQMD Limits
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	7%

OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
ADMIN_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	7% from uncontrolled
ELEC_PCT:	0%
COST_BASIS:	The 1997 South Coast AQMP estimates a cost savings for new commercial and residential water heaters meeting a low-NOx standard. The cost savings is based on capital costs associated with installation of energy efficient equipment existing demand-side management programs, energy savings, associated emission reductions, and the prevailing emission credit price (SCAQMD, 1996). Costs for the space heaters are based on the low-NOx limits established for the South Coast and Bay Area Air Quality Management Districts for space heaters of 0.009 lbs NOx per million Btu. The cost effectiveness estimate for the low-NOx space heater regulation is $1,600 per ton NOx (STAPPA/ALAPCO, 1994). For this analysis a 75% reduction in commercial space heater NOx emissions is assumed, based on a 20-year equipment life (Pechan, 1997). The water heater savings and LNB space heater costs are combined to achieve an overall cost effectiveness of $1,230 per ton NOx reduced.
CPTON_TEXT:	The cost effectiveness is $1,230 per ton NOx reduced (1990$).
OTHR_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	7%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co*
OVRHD_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

VOC Control Measures

There are 78 VOC control measures included in this report

Summary:

Control Measure Name:	SCAQMD Proposed Rule 1148.1; Oil and Natural Gas Production - Fugitiv
Abbreviation:	V1148ONGPF
Description:	Application: The purpose of this rule is to reduce emissions of volatile organic compounds (VOCs) from the wellheads, the well cellars and the handling of produced gas at oil and gas production facilities. This rule applies to onshore oil producing wells, well cellars and produced gas handling activities at onshore facilities where petroleum and processed gas are produced, gathered, separated, processed and stored. This rule was adopted March 5, 2004.
Class:	Known
Pollutant:	VOC
Equipment Life:	3.0 years
Control Technology:	SCAQMD Proposed Rule 1148.1
Source Group:	Oil and Natural Gas Production - Fugitiv
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	$2,483
Ref Yr CPT:	$2,979
Control Efficiency:	14.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.36000001430511475
Discount Rate:	4.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	$2,483
Ref Yr CPT:	$2,979
Control Efficiency:	14.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.36000001430511475
Discount Rate:	4.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
31000199	Industrial Processes; Oil and Gas Production; Crude Oil Production; Processing Operations: Not Classified
31000160	Industrial Processes; Oil and Gas Production; Crude Oil Production; Flares
31000146	Industrial Processes; Oil and Gas Production; Crude Oil Production; Gathering Lines
31000145	Industrial Processes; Oil and Gas Production; Crude Oil Production; Waste Sumps: Tertiary Heavy Crude
31000144	Industrial Processes; Oil and Gas Production; Crude Oil Production; Waste Sumps: Tertiary Light Crude
31000143	Industrial Processes; Oil and Gas Production; Crude Oil Production; Waste Sumps: Secondary Heavy Crude
31000142	Industrial Processes; Oil and Gas Production; Crude Oil Production; Waste Sumps: Secondary Light Crude
31000141	Industrial Processes; Oil and Gas Production; Crude Oil Production; Waste Sumps: Primary Heavy Crude
31000140	Industrial Processes; Oil and Gas Production; Crude Oil Production; Waste Sumps: Primary Light Crude
31000132	Industrial Processes; Oil and Gas Production; Crude Oil Production; Atmospheric Wash Tank (2nd Stage of Gas-Oil Separation): Flashing Loss
31000131	Industrial Processes; Oil and Gas Production; Crude Oil Production; Fugitives: Drains

31000130	Industrial Processes; Oil and Gas Production; Crude Oil Production; Fugitives: Compressor Seals
31000129	Industrial Processes; Oil and Gas Production; Crude Oil Production; Gas/Liquid Separation
31000128	Industrial Processes; Oil and Gas Production; Crude Oil Production; Oil Heating
31000127	Industrial Processes; Oil and Gas Production; Crude Oil Production; Flanges and Connections
31000126	Industrial Processes; Oil and Gas Production; Crude Oil Production; Pump Seals
31000125	Industrial Processes; Oil and Gas Production; Crude Oil Production; Relief Valves
31000124	Industrial Processes; Oil and Gas Production; Crude Oil Production; Valves: General
31000123	Industrial Processes; Oil and Gas Production; Crude Oil Production; Well Casing Vents
31000122	Industrial Processes; Oil and Gas Production; Crude Oil Production; Well Drilling
31000121	Industrial Processes; Oil and Gas Production; Crude Oil Production; Site Preparation
31000108	Industrial Processes; Oil and Gas Production; Crude Oil Production; Evaporation from Liquid Leaks into Oil Well Cellars
31000107	Industrial Processes; Oil and Gas Production; Crude Oil Production; Oil/Gas/Water/Separation
31000106	Industrial Processes; Oil and Gas Production; Crude Oil Production; Enhanced Wells, Water Reinjection
31000105	Industrial Processes; Oil and Gas Production; Crude Oil Production; Crude Oil Pits
31000104	Industrial Processes; Oil and Gas Production; Crude Oil Production; Crude Oil Sumps
31000103	Industrial Processes; Oil and Gas Production; Crude Oil Production; Wells: Rod Pumps
31000102	Industrial Processes; Oil and Gas Production; Crude Oil Production; Miscellaneous Well: General
31000101	Industrial Processes; Oil and Gas Production; Crude Oil Production; Well Completion

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Reformulation-Process Modification;Aircraft Surface Coating
Abbreviation: VAIRCOTC
Description: Application: This control includes the use of reformulated products and the modification of processes associated with aircraft surface coating to reduce the fugitive VOC emissions.
Class: Emerging
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Reformulation-Process Modification
Source Group: Aircraft Surface Coating
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,534
Ref Yr CPT:	$3,384
Control Efficiency:	61.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,534
Ref Yr CPT:	$3,384
Control Efficiency:	61.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0

Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401075000	Solvent Utilization; Surface Coating; Aircraft: SIC 372; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 2001: E.H. Pechan & Associates, Inc., "Control Measure Development Support - Analysis of Ozone Transport Commission Model Rules," prepared for Ozone Transport Commission, March, 2001.

Other information:

Summary:

Control Measure Name: Reformulation (Phase I); Architectural, Industrial Maintenance, and Traffic Coatings

Abbreviation: VAITCSCPH1

Description: Application: The Phase I rule is an amendment to SCAQMD's existing architectural coatings rule that establishes more stringent VOC content limits for flat, multi-color, traffic, and lacquer coatings. These VOC limits in the SCAQMD for multi-color, traffic, and lacquer coatings took effect on January 1, 1998, while the Phase I limits for flat coating took effect on January 1, 2001.
Reductions in VOC emissions from these coatings are achieved through the use of product reformulation and product substitution.
This control replaces controls VARCTSCPH1, VINCTSCPH1, and VTMSCPH1.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Reformulation (Phase I)

Source Group: Architectural, Industrial Maintenance, and Traffic Coatings

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1998-01-01 00:00:00.0
Cost Year:	1990
CPT:	$1,443
Ref Yr CPT:	$2,311
Control Efficiency:	34.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1998-01-01 00:00:00.0
Cost Year:	1990
CPT:	$1,443
Ref Yr CPT:	$2,311
Control Efficiency:	34.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401008000	Solvent Utilization; Surface Coating; Traffic Markings; Total: All Solvent Types
2401100000	Solvent Utilization; Surface Coating; Industrial Maintenance Coatings; Total: All Solvent Types
2401990000	Solvent Utilization; Surface Coating; All Surface Coating Categories; Total: All Solvent Types
2401001000	Solvent Utilization; Surface Coating; Architectural Coatings; Total: All Solvent Types
2401001999	Solvent Utilization; Surface Coating; Architectural Coatings; Solvents: NEC

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- EPA, 1996: U.S. Environmental Protection Agency, Emission Standards Division, Office of Air and Radiation, "Architectural Coatings - Background for Proposed Standards, Draft Report," EPA-453/R-95-009a, March 1996.
- CARB, 1989: California Air Resources Board, Stationary Source Division, "ARB-CAPCOA Suggested Control Measure for Architectural Coatings, Technical Support Document," July 1989.
- SCAQMD, 1996: South Coast Air Quality Management District, "Proposed Modifications to the Appendices of the Draft 1997 Air Quality Management Plan," October 1996.

Other information:

Summary:

Control Measure Name: Reformulation (Phase II); Architectural, Industrial Maintenance, and Traffic Coatings

Abbreviation: VAITCSCPH2

Description: Application: Phase II represents an effort to lower the VOC content limits for non-flat industrial maintenance primers and topcoats, sealers, undercoaters, and quick-dry enamels. The rule requires manufacturers of the coatings sold in the SCAQMD to meet the VOC limit requirements provided in the rule between 2002 and 2006.
Reductions in VOC emissions from these coatings are achieved through the use of product reformulation and product substitution.
This control replaces controls VARCTSCPH2, VINCTSCPH2, and VTMSCPH2.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Reformulation (Phase II)

Source Group: Architectural, Industrial Maintenance, and Traffic Coatings

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	2002-01-01 00:00:00.0
Cost Year:	1990
CPT:	$4,017
Ref Yr CPT:	$6,433
Control Efficiency:	47.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	2002-01-01 00:00:00.0
Cost Year:	1990
CPT:	$4,017
Ref Yr CPT:	$6,433
Control Efficiency:	47.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401008000	Solvent Utilization; Surface Coating; Traffic Markings; Total: All Solvent Types
2401100000	Solvent Utilization; Surface Coating; Industrial Maintenance Coatings; Total: All Solvent Types
2401990000	Solvent Utilization; Surface Coating; All Surface Coating Categories; Total: All Solvent Types
2401001000	Solvent Utilization; Surface Coating; Architectural Coatings; Total: All Solvent Types
2401001999	Solvent Utilization; Surface Coating; Architectural Coatings; Solvents: NEC

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Berry, 1997: N. Berry, South Coast Air Quality Management District, personal communication with D. Crocker, E.H. Pechan & Associates, Inc., March 4, 1997.
- SCAQMD, 1999: South Coast Air Quality Management District, "Addendum to Staff Report: Final Socioeconomic Impact Assessment, Proposed Amendments to Rule 1113," May 1999.

Other information:

Summary:

Control Measure Name:	Reformulation (Phase III); Architectural, Industrial Maintenance, and Traffic Coatings
Abbreviation:	VAITCSCPH3
Description:	Application: Phase III applies to additional consumer products that are not affected by Phase I or II. The rule requires manufacturers to limit VOC content of the specified coatings sold in the SCAQMD using a phased-in approach specifying compliance dates that depend on the coating type. Compliance dates range from 1/1/03 to 7/1/08. Reductions in VOC emissions from these coatings are achieved through the use of product reformulation and product substitution. This control replaces controls VARCTSCPH3, VINCTSCPH3, and VTMSCPH3.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Reformulation (Phase III)
Source Group:	Architectural, Industrial Maintenance, and Traffic Coatings
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	2003-01-01 00:00:00.0
Cost Year:	1990
CPT:	$10,059
Ref Yr CPT:	$16,108
Control Efficiency:	73.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	2003-01-01 00:00:00.0
Cost Year:	1990
CPT:	$10,059
Ref Yr CPT:	$16,108
Control Efficiency:	73.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401008000	Solvent Utilization; Surface Coating; Traffic Markings; Total: All Solvent Types
2401100000	Solvent Utilization; Surface Coating; Industrial Maintenance Coatings; Total: All Solvent Types
2401990000	Solvent Utilization; Surface Coating; All Surface Coating Categories; Total: All Solvent Types
2401001000	Solvent Utilization; Surface Coating; Architectural Coatings; Total: All Solvent Types
2401001999	Solvent Utilization; Surface Coating; Architectural Coatings; Solvents: NEC

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999

Other information:

Summary:

Control Measure Name:	Add-on controls, work practices, and material reformulation/substitution; Flexible Package Printing
Abbreviation:	VAOCFPP
Description:	Application: EPA issued a CTG for Flexible Package Printing in 2006 that includes recommended control techniques. EPA's recommended emission limits are based on the 1978 CTG for graphic arts (which included rotogravure printing and flexographic printing) and on the 1996 NESHAP. This CTG provides control recommendations for reducing VOC emissions from (1) inks, coatings, adhesives and (2) cleaning materials used in flexible packaging printing. EPA recommends applying the recommendations for operations that emit at least (1) 25 tpy of VOC from inks, and for operations that emit at least (2) 15 lb/day of VOC due to fountain solutions and cleaning materials (before consideration of controls). The approach to reducing VOC emissions from inks, coatings, and adhesives includes adding/improving add-on controls with an overall emission reduction of 65 to 80 percent (depending on the first installation date of the equipment) and material reformulation/substitution (low- and no-VOC inks, coatings, and adhesives) with an 80 percent overall emissions reduction level. The recommended approach to reduce VOC emissions from cleaning materials includes use of work practices (keeping solvent containers closed, conducting cleaning operations, conveying cleaning materials in closed containers, etc.)
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Add-on controls, work practices, and material reformulation/substitution
Source Group:	Flexible Package Printing
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$2,800
Ref Yr CPT:	$3,158
Control Efficiency:	67.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	

Effective Date:	N/A
Cost Year:	2006
CPT:	$2,800
Ref Yr CPT:	$3,158
Control Efficiency:	67.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40500514	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Cleanup Solvent
40500510	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Ink Thinning Solvent, Toluene
40500507	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Ink Thinning Solvent, Methyl Isobutyl Ketone
40500506	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Ink Thinning Solvent, Methyl Ethyl Ketone
40500503	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Ink Thinning Solvent, Ethyl Acetate
40500502	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Ink Thinning Solvent, Dimethylformamide
40500414	Petroleum and Solvent Evaporation; Printing/Publishing; General; Flexographic: Propyl Alcohol Cleanup
40500319	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Steam: Water-based Ink Storage
40500318	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Steam: Water-based in Ink
40500315	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Steam: Water-based
40500314	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Propyl Alcohol Cleanup
40500307	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Naphtha

40500306	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, n-Propyl Alcohol
40500305	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Isopropyl Alcohol
40500304	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Ethyl Alcohol
40500303	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Cellosolve
40500302	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Carbitol
40500301	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Printing

References:

- EPA, 2006: U.S. Environmental Protection Agency, "Control Techniques Guidelines for Flexible Package Printing," Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA 453/R-06-003, September 2006.

Other information:

Summary:

Control Measure Name: Add-on controls, work practices, and material reformulation/substitution; Lithographic Printing & Letterpress Printing

Abbreviation: VAOCLPLP

Description: Application: EPA issued a CTG for Lithographic Printing & Letterpress Printing in 2006 that includes recommended control techniques (although offset lithographic printing and letterpress printing are two distinct product categories, they have many similarities in the types of materials used, sources of VOC emissions, and controls available). EPA's recommended emission limits are based on the 1993 draft CTG and 1994 ACT. This CTG provides control recommendations for reducing VOC emissions from (1) evaporation of VOC from the inks, (2) evaporation of VOC from the fountain solution (offset lithographic printing only), and (3) evaporation of VOC from the cleaning materials. EPA recommends applying the recommendations for operations that emit at least (1) 25 tpy of VOC from inks, and for operations that emit at least (2) 15 lb/day of VOC due to fountain solutions and cleaning materials (before consideration of controls). The approach to reducing VOC emissions from heatset web offset lithographic and heatset letterpress inks and dryers consists of installing control devices with an overall emission reduction of 90 to 95 percent (depending on the first installation date of the equipment). The recommended approach to reduce VOC emissions from the fountain solution focuses on controlling the concentration of alcohol in the fountain solution at less than 5% (weight) of alcohol. Finally, EPA recommends using cleaning materials with a VOC composite vapor pressure less than 10 mm Hg at 20 C and proposes using work practices (keeping cleaning materials and used shop towels in closed containers).

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Add-on controls, work practices, and material reformulation/substitution

Source Group: Lithographic Printing & Letterpress Printing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$155
Ref Yr CPT:	$175
Control Efficiency:	75.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$155
Ref Yr CPT:	$175
Control Efficiency:	75.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40500431	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Nonheated Lithographic Inks
40500422	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Heatset Solvent Storage
40500421	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Heatset Ink Mixing
40500418	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Dampening Solution with Isopropyl Alcohol
40500417	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Cleaning Solution: Water-based
40500416	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Dampening Solution with High Solvent Content
40500415	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Dampening Solution with Alcohol Substitute
40500413	Petroleum and Solvent Evaporation; Printing/Publishing; Lithographic; Isopropyl Alcohol Cleanup
40500401	Petroleum and Solvent Evaporation; Printing/Publishing; Lithographic; Printing
40500215	Petroleum and Solvent Evaporation; Printing/Publishing; Letter Press; Cleaning Solution
40500201	Petroleum and Solvent Evaporation; Printing/Publishing; Letter Press; Printing

References:

- EPA, 2006: U.S. Environmental Protection Agency, "Control Techniques Guidelines for Offset Lithographic Printing and Letterpress Printing," Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA 453/R-06-002, September 2006.

Other information:

Summary:

Control Measure Name:	Reformulation (OTC Rule);Architectural Coatings
Abbreviation:	VARCTAIMOT
Description:	Application: This control requires manufacturers to reformulate coatings to meet specified VOC contents limits, which are specified in grams per liter. The VOC content limits contained in the AIM OTC Model Rule are based on the Suggested Control Measure (SCM) adopted by ARB, and the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) model rule for AIM Coatings.
Class:	Emerging
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Reformulation (OTC Rule)
Source Group:	Architectural Coatings
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2000
CPT:	$6,628
Ref Yr CPT:	$8,655
Control Efficiency:	55.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2000
CPT:	$6,628
Ref Yr CPT:	$8,655
Control Efficiency:	55.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401001999	Solvent Utilization; Surface Coating; Architectural Coatings; Solvents: NEC
2401001000	Solvent Utilization; Surface Coating; Architectural Coatings; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- ARB, 2000: California Air Resources Board, "Staff Report for the Proposed Suggested Control Measure for the Architectural Coatings, Volume II, Technical Support Document, Section VIII, Economic Impacts," June 2000.
- Pechan, 2001: E.H. Pechan & Associates, Inc., "Control Measure Development Support - Analysis of Ozone Transport Commission Model Rules," prepared for Ozone Transport Commission, March, 2001.

Other information:

Summary:

Control Measure Name:	Reformulation;Aerosol Paints
Abbreviation:	VARPTTIER2
Description:	Application: This control is the use of product reformulation and product substitution for aerosol paints to achieve VOC emissions reductions.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Reformulation
Source Group:	Aerosol Paints
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$2,732
Ref Yr CPT:	$4,375
Control Efficiency:	42.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$2,732
Ref Yr CPT:	$4,375
Control Efficiency:	42.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2460510000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; Coatings and Related Products: Aerosol Spray Paints; Total: All Solvent Types

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Reformulation-Process Modification;Cutback Asphalt
Abbreviation: VASPHREFRM
Description: Application: This control includes the use of reformulated products and the modification of processes associated with cutback asphalt manufacturing to reduce the fugitive VOC emissions.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Reformulation-Process Modification
Source Group: Cutback Asphalt
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$15
Ref Yr CPT:	$24
Control Efficiency:	100.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	cost on CD is $0
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$15
Ref Yr CPT:	$24
Control Efficiency:	100.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0

Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	cost on CD is $0
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2461021000	Solvent Utilization; Miscellaneous Non-industrial: Commercial; Cutback Asphalt; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1997: E.H. Pechan & Associates, Inc., " Control Measure Evaluations Prepared for Southeast Pennsylvania Ozone Stakeholders Group."

Other information:

Summary:

Control Measure Name: BARCT;Automobile Refinishing

Abbreviation: VATRFBARCT

Description: Application: The CARB BARCT rule establishes VOC content limits for automobile refinishing coatings, the use of equipment that achieves a 65% transfer efficiency, cleanup of spray equipment in an enclosed system, and specifies other housekeeping procedures.

These limits apply to any coating applied to motor vehicles. Emissions from auto body refinishing can be classified in three categories (and percentage contribution): surface preparation (1.6%), "Application: The CARB BARCT rule establishes VOC co

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: BARCT

Source Group: Automobile Refinishing

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$750
Ref Yr CPT:	$1,201
Control Efficiency:	47.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$750
Ref Yr CPT:	$1,201
Control Efficiency:	47.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401005000	Solvent Utilization; Surface Coating; Auto Refinishing: SIC 7532; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1994: E.H. Pechan & Associates, Inc., "Analysis of Incremental Emission Reductions and Costs of VOC and NOx Control Measures - Draft Report," prepared for U.S. Environmental Protection Agency, Ambient Standards Branch, Research Triangle Park, NC, September 1994.

Other information:

Summary:

Control Measure Name:	Reformulation;Automobile Refinishing
Abbreviation:	VATRFFR1
Description:	Application: This control is the use of product reformulation and product substitution for automobile refinishing to achieve VOC emissions reductions.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Reformulation
Source Group:	Automobile Refinishing
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1996-04-30 00:00:00.0
Cost Year:	1990
CPT:	$118
Ref Yr CPT:	$189
Control Efficiency:	37.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1996-04-30 00:00:00.0
Cost Year:	1990
CPT:	$118
Ref Yr CPT:	$189
Control Efficiency:	37.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401005000	Solvent Utilization; Surface Coating; Auto Refinishing: SIC 7532; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.
- EPA, 1995: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Volatile Organic Compound Emissions from Automobile Refinishing-Background Information for Proposed Standards," Research Triangle Park, NC, EPA-453/D-95-005a, August 1995.

Other information:

Summary:

Control Measure Name:	Reformulation-Process Modification (Fed Rule);Automobile Refinishing
Abbreviation:	VATRFFR2
Description:	Application: This control is based on EPA proposed standards to reduce emissions of volatile organic compounds (VOC) from the use of automobile refinish coatings. This rule applies to automobile refinish coatings that are manufactured or imported for sale or distribution in the United States. Coatings that are currently used for automobile refinishing are also used outside the automobile refinish industry (Pechan, 1998).
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Reformulation-Process Modification (Fed Rule)
Source Group:	Automobile Refinishing
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$7,200
Ref Yr CPT:	$11,530
Control Efficiency:	89.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$7,200
Ref Yr CPT:	$11,530
Control Efficiency:	89.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401005000	Solvent Utilization; Surface Coating; Auto Refinishing: SIC 7532; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- CARB, 1991: California Air Resources Board Criteria Pollutants Branch, Stationary Source Division, "Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Automotive Refinishing Operations," January 1991.
- Radian, 1994: Radian Corporation, "Technical Support Document for Proposed FIP Automotive Refinishing Operations Rule 52.961(c)," prepared for U.S. Environmental Protection Agency, February 1994.
- SCAQMD, 1991: South Coast Air Quality Management District, Rule Development Division, "Supplemental Staff Report, Proposed Amended Rule 1151 - Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations," August 1991.

Other information:

Summary:

Control Measure Name: Reformulation-Process Modification (OTC Rule);Automobile Refinishing

Abbreviation: VATRFOTC

Description: Application: The rule includes VOC limits for paints used in the industry that are consistent with the Federal limits for the mobile equipment refinishing materials. The rule also establishes requirements for using improved transfer efficiency application equipment and enclosed spray gun cleaning, and requires minimal training.

In addition to requiring that refinishing materials meet the Federal VOC limits, the model rule proposes a number of pollution prevention initiatives. For example, the coating application requirements specify using improved transfer efficiency spray equipment such as high volume-low pressure (HVLP) equipment.

Class: Emerging

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Reformulation-Process Modification (OTC Rule)

Source Group: Automobile Refinishing

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,534
Ref Yr CPT:	$3,384
Control Efficiency:	61.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,534
Ref Yr CPT:	$3,384
Control Efficiency:	61.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401005000	Solvent Utilization; Surface Coating; Auto Refinishing: SIC 7532; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 2001: E.H. Pechan & Associates, Inc., "Control Measure Development Support - Analysis of Ozone Transport Commission Model Rules," prepared for Ozone Transport Commission, March, 2001.

Other information:

Summary:

Control Measure Name: Incineration;Bakery Products
Abbreviation: VBAKEINC
Description: Application: The control measure is based on the regulation adopted by the BAAQMD, which assumes emissions reductions from the use of catalytic incinerators. These incinerators use a catalyst to achieve very high control efficiencies at relatively low operating temperatures (320 to 650 C).

The BAAQMD control requirements affect only large, commercial bread bakeries, classified under SCC 2302050000.

Discussion: The BAAQMD regulation was estimated to achieve an overall source category control level of 39.9 percent in 1993 (Schultz, 1997). The BAAQMD's regulation was selected as the basis for the control measure because their regulation limits control requirements to large, commercial bread bakeries.

Class: Known
Pollutant: VOC
Equipment Life: 10.0 years
Control Technology: Incineration
Source Group: Bakery Products
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$1,470
Ref Yr CPT:	$2,354
Control Efficiency:	40.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$1,470

Ref Yr CPT:	$2,354
Control Efficiency:	40.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2302050000	Industrial Processes; Food and Kindred Products: SIC 20; Bakery Products; Total

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- EPA, 1990: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual, Fourth Edition," EPA-450/3-90-006, Research Triangle Park, NC, January 1990.
- EPA, 1992: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Alternative Control Technology Document for Bakery Oven Emissions," Research Triangle Park, NC, December 1992.
- EPA, 1995: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Escalation Indices for Air Pollution Control Costs," EPA-452/R-95-006, Research Triangle Park, NC, October 1995.
- M&S, 1991: "Chemical Engineering, Marshall & Swift Equipment Cost Indices," February 1991.
- Schultz, 1997: Schultz, S., BAAQMD, San Francisco, CA, personal communication with M. Cohen, E.H. Pechan & Associates, Inc. February 20, 1997.

Other information:

Summary:

Control Measure Name: MACT;Cold Cleaning
Abbreviation: VCLDMACT
Description: Application: The MACT standard requires the use of low-VOC solvents for cold cleaning to control VOC emissions.

Sources affected by this control measure are all Cold cleaning degreasing facilities.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: MACT
Source Group: Cold Cleaning
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1994-01-01 00:00:00.0
Cost Year:	1990
CPT:	-$69
Ref Yr CPT:	-$110
Control Efficiency:	63.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost - 35% in base year (HDDV)
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1994-01-01 00:00:00.0
Cost Year:	1990
CPT:	-$69
Ref Yr CPT:	-$110
Control Efficiency:	63.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0

Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost - 35% in base year (HDDV)
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2415365000	Solvent Utilization; Degreasing; Miscellaneous Repair Services (SIC 76): Cold Cleaning; Total: All Solvent Types
2415360000	Solvent Utilization; Degreasing; Auto Repair Services (SIC 75): Cold Cleaning; Total: All Solvent Types
2415355000	Solvent Utilization; Degreasing; Automotive Dealers (SIC 55): Cold Cleaning; Total: All Solvent Types
2415345000	Solvent Utilization; Degreasing; Miscellaneous Manufacturing (SIC 39): Cold Cleaning; Total: All Solvent Types
2415340000	Solvent Utilization; Degreasing; Instruments and Related Products (SIC 38): Cold Cleaning; Total: All Solvent Types
2415335000	Solvent Utilization; Degreasing; Transportation Equipment (SIC 37): Cold Cleaning; Total: All Solvent Types
2415330000	Solvent Utilization; Degreasing; Electronic and Other Elec. (SIC 36): Cold Cleaning; Total: All Solvent Types
2415325000	Solvent Utilization; Degreasing; Industrial Machinery and Equipment (SIC 35): Cold Cleaning; Total: All Solvent Types
2415320000	Solvent Utilization; Degreasing; Fabricated Metal Products (SIC 34): Cold Cleaning; Total: All Solvent Types
2415310000	Solvent Utilization; Degreasing; Primary Metal Industries (SIC 33): Cold Cleaning; Total: All Solvent Types
2415305000	Solvent Utilization; Degreasing; Furniture and Fixtures (SIC 25): Cold Cleaning; Total: All Solvent Types
2415300000	Solvent Utilization; Degreasing; All Industries: Cold Cleaning; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf

- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.
- EPA, 1993: U.S. Environmental Protection Agency, "Halogenated Solvent Cleaning National Emission standards for Hazardous Air Pollutants: Background Information Document," Research Triangle Park, NC, November 4, 1993.
- 59FR61801, 1994: Federal Register, "National Emission Standards for Hazardous Air Pollutants: Halogenated Solvent Cleaning; Final Rule," December 2, 1994.

Other information:

Summary:

Control Measure Name: Reformulation-Process Modification (OTC Rule);Cold Cleaning
Abbreviation: VCLDOTC
Description: Application: This control establishes hardware and operating requirements for specified vapor cleaning machines, as well as solvent volatility limits and operating practices for cold cleaners.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Reformulation-Process Modification (OTC Rule)
Source Group: Cold Cleaning
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,400
Ref Yr CPT:	$1,870
Control Efficiency:	66.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,400
Ref Yr CPT:	$1,870
Control Efficiency:	66.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0

Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2415365000	Solvent Utilization; Degreasing; Miscellaneous Repair Services (SIC 76): Cold Cleaning; Total: All Solvent Types
2415360000	Solvent Utilization; Degreasing; Auto Repair Services (SIC 75): Cold Cleaning; Total: All Solvent Types
2415355000	Solvent Utilization; Degreasing; Automotive Dealers (SIC 55): Cold Cleaning; Total: All Solvent Types
2415345000	Solvent Utilization; Degreasing; Miscellaneous Manufacturing (SIC 39): Cold Cleaning; Total: All Solvent Types
2415340000	Solvent Utilization; Degreasing; Instruments and Related Products (SIC 38): Cold Cleaning; Total: All Solvent Types
2415335000	Solvent Utilization; Degreasing; Transportation Equipment (SIC 37): Cold Cleaning; Total: All Solvent Types
2415330000	Solvent Utilization; Degreasing; Electronic and Other Elec. (SIC 36): Cold Cleaning; Total: All Solvent Types
2415325000	Solvent Utilization; Degreasing; Industrial Machinery and Equipment (SIC 35): Cold Cleaning; Total: All Solvent Types
2415320000	Solvent Utilization; Degreasing; Fabricated Metal Products (SIC 34): Cold Cleaning; Total: All Solvent Types
2415310000	Solvent Utilization; Degreasing; Primary Metal Industries (SIC 33): Cold Cleaning; Total: All Solvent Types
2415305000	Solvent Utilization; Degreasing; Furniture and Fixtures (SIC 25): Cold Cleaning; Total: All Solvent Types
2415300000	Solvent Utilization; Degreasing; All Industries: Cold Cleaning; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf

- SCAQMD, 1997: South Coast Air Quality Management District, "Final Staff Report for Proposed Amendments to Rule 1122 - Solvent Degreasers," June 6, 1997.
- Pechan, 2001: E.H. Pechan & Associates, Inc., "Control Measure Development Support - Analysis of Ozone Transport Commission Model Rules," prepared for Ozone Transport Commission, March, 2001.

Other information:

Summary:

Control Measure Name: Reformulation-Process Modification;Cold Cleaning
Abbreviation: VCLDS1122A
Description: Application: This control includes the use of reformulated products and the modification of processes associated with cold cleaning to reduce the fugitive VOC emissions.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Reformulation-Process Modification
Source Group: Cold Cleaning
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1997-06-06 00:00:00.0
Cost Year:	1990
CPT:	$1,249
Ref Yr CPT:	$2,000
Control Efficiency:	76.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	35% in base year (HDDV)
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1997-06-06 00:00:00.0
Cost Year:	1990
CPT:	$1,249
Ref Yr CPT:	$2,000
Control Efficiency:	76.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremenental CPT:	N/A
Details:	35% in base year (HDDV)
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2415365000	Solvent Utilization; Degreasing; Miscellaneous Repair Services (SIC 76): Cold Cleaning; Total: All Solvent Types
2415360000	Solvent Utilization; Degreasing; Auto Repair Services (SIC 75): Cold Cleaning; Total: All Solvent Types
2415355000	Solvent Utilization; Degreasing; Automotive Dealers (SIC 55): Cold Cleaning; Total: All Solvent Types
2415345000	Solvent Utilization; Degreasing; Miscellaneous Manufacturing (SIC 39): Cold Cleaning; Total: All Solvent Types
2415340000	Solvent Utilization; Degreasing; Instruments and Related Products (SIC 38): Cold Cleaning; Total: All Solvent Types
2415335000	Solvent Utilization; Degreasing; Transportation Equipment (SIC 37): Cold Cleaning; Total: All Solvent Types
2415330000	Solvent Utilization; Degreasing; Electronic and Other Elec. (SIC 36): Cold Cleaning; Total: All Solvent Types
2415325000	Solvent Utilization; Degreasing; Industrial Machinery and Equipment (SIC 35): Cold Cleaning; Total: All Solvent Types
2415320000	Solvent Utilization; Degreasing; Fabricated Metal Products (SIC 34): Cold Cleaning; Total: All Solvent Types
2415310000	Solvent Utilization; Degreasing; Primary Metal Industries (SIC 33): Cold Cleaning; Total: All Solvent Types
2415305000	Solvent Utilization; Degreasing; Furniture and Fixtures (SIC 25): Cold Cleaning; Total: All Solvent Types
2415300000	Solvent Utilization; Degreasing; All Industries: Cold Cleaning; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf

- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan - Appendix IV-A. Stationary and Mobile Source Control Measures," August 1996.
- SCAQMD, 1997: South Coast Air Quality Management District, Draft Staff Report for Proposed Amendments to Rule 1122 - Solvent Degreasers, June 3, 1997.

Other information:

Summary:

Control Measure Name:	Process Modification;Cold Cleaning
Abbreviation:	VCLDS1122B
Description:	Application: This control is modifications to the cold cleaning process to reduce the fugitive VOC emissions.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Process Modification
Source Group:	Cold Cleaning
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1997-06-06 00:00:00.0
Cost Year:	1990
CPT:	$9,784
Ref Yr CPT:	$15,668
Control Efficiency:	98.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	35% in base year (HDDV)
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1997-06-06 00:00:00.0
Cost Year:	1990
CPT:	$9,784
Ref Yr CPT:	$15,668
Control Efficiency:	98.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremenental CPT:	N/A
Details:	35% in base year (HDDV)
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2415365000	Solvent Utilization; Degreasing; Miscellaneous Repair Services (SIC 76): Cold Cleaning; Total: All Solvent Types
2415360000	Solvent Utilization; Degreasing; Auto Repair Services (SIC 75): Cold Cleaning; Total: All Solvent Types
2415355000	Solvent Utilization; Degreasing; Automotive Dealers (SIC 55): Cold Cleaning; Total: All Solvent Types
2415345000	Solvent Utilization; Degreasing; Miscellaneous Manufacturing (SIC 39): Cold Cleaning; Total: All Solvent Types
2415340000	Solvent Utilization; Degreasing; Instruments and Related Products (SIC 38): Cold Cleaning; Total: All Solvent Types
2415335000	Solvent Utilization; Degreasing; Transportation Equipment (SIC 37): Cold Cleaning; Total: All Solvent Types
2415330000	Solvent Utilization; Degreasing; Electronic and Other Elec. (SIC 36): Cold Cleaning; Total: All Solvent Types
2415325000	Solvent Utilization; Degreasing; Industrial Machinery and Equipment (SIC 35): Cold Cleaning; Total: All Solvent Types
2415320000	Solvent Utilization; Degreasing; Fabricated Metal Products (SIC 34): Cold Cleaning; Total: All Solvent Types
2415310000	Solvent Utilization; Degreasing; Primary Metal Industries (SIC 33): Cold Cleaning; Total: All Solvent Types
2415305000	Solvent Utilization; Degreasing; Furniture and Fixtures (SIC 25): Cold Cleaning; Total: All Solvent Types
2415300000	Solvent Utilization; Degreasing; All Industries: Cold Cleaning; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf

- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan - Appendix IV-A. Stationary and Mobile Source Control Measures," August 1996.
- SCAQMD, 1997: South Coast Air Quality Management District, Draft Staff Report for Proposed Amendments to Rule 1122 - Solvent Degreasers, June 3, 1997.

Other information:

Summary:

Control Measure Name:	Reformulation (ARB Phase I);Consumer Adhesives
Abbreviation:	VCSADARB1
Description:	Application: CARB rules included in this control are Phase I and Phase II Consumer Products and Mid-Term I and Mid-Term II Consumer Products regulations. The CARB Mid-Term (and Near-Term) limits set VOC content standards for various consumer products. The regulations were implemented over a time period from 1993 to 2005. These regulations assume that emissions will be reduced through product reformulation (CARB, 1990). Consumer products affected by this control measure include, but are not limited to, personal care products, household cleaners and disinfectants, automotive aftermarket products, adhesives and sealants, lawn and garden products, and household insecticides.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Reformulation (ARB Phase I)
Source Group:	Consumer Adhesives
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1993-01-01 00:00:00.0
Cost Year:	1990
CPT:	$2,192
Ref Yr CPT:	$3,510
Control Efficiency:	55.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1993-01-01 00:00:00.0
Cost Year:	1990
CPT:	$2,192
Ref Yr CPT:	$3,510

Control Efficiency:	55.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2465600000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Adhesives and Sealants; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- CARB, 1990: California Air Resources Board, Stationary Source Division, "Proposed Regulation to Reduce Volatile Organic Compound Emissions from Consumer Products - Technical Support Document," August 1990.

Other information:

Summary:

Control Measure Name: Reformulation (ARB Phase II);Consumer Adhesives

Abbreviation: VCSADARB2

Description: Application: The CARBs long-term measures depend on future technological innovation and market incentive methods that can be developed and implemented before 2010.

Consumer products affected by this control measure include, but are not limited to, personal care products, household cleaners and disinfectants, automotive aftermarket products, adhesives and sealants, lawn and garden products, and household insecticides.

Class: Emerging

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Reformulation (ARB Phase II)

Source Group: Consumer Adhesives

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$2,880
Ref Yr CPT:	$4,612
Control Efficiency:	85.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$2,880
Ref Yr CPT:	$4,612
Control Efficiency:	85.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2465600000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Adhesives and Sealants; Total: All Solvent Types

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Reformulation (Fed Rule);Consumer Adhesives

Abbreviation: VCSADFR

Description: Application: This Federal rule provides uniformity over the state-level content limits that commercial adhesives must meet. The rule sets maximum allowable VOC content limits for 24 consumer product categories. The final rule was promulgated in 1998.
The proposed Federal rule covers those consumer products that EPA determined to be most amenable to regulation, and were capable of achieving significant VOC reductions without significant effects on product quality or price (EPA, 1995). Affected adhesives are used in a wide variety of industrial applications, including product manufacturing, packaging, construction, and installation of metal, wood and plastic materials. For most adhesives, VOC emissions occur as the result of evaporation of solvents during transfer, drying, surface preparation, and clean-up operations.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Reformulation (Fed Rule)

Source Group: Consumer Adhesives

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1996-04-02 00:00:00.0
Cost Year:	1990
CPT:	$232
Ref Yr CPT:	$372
Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1996-04-02 00:00:00.0
Cost Year:	1990
CPT:	$232
Ref Yr CPT:	$372

Control Efficiency:	25.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2465600000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Adhesives and Sealants; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- BLS, 1996: Bureau of Labor Statistics, U.S. Department of Labor, "Producer Price Indices," Washington, DC, 1996.
- EPA, 1995: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Study of Volatile Organic Compound Emissions from Consumer and Commercial Products, Report to Congress," EPA-453/R-94-066-A, Research Triangle Park, NC, March 1995.
- EPA, 1996: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Economic Impact and Regulatory Flexibility Analysis of the Regulation of VOCs from Consumer Products, Draft Report, EPA-453/R-96-014, Research Triangle Park, NC, October 1996.

Other information:

Summary:

Control Measure Name:	Reformulation (OTC Rule);Consumer Adhesives
Abbreviation:	VCSADOTC
Description:	Application: The OTC model rule regulates approximately 80 consumer product categories, and uses more stringent VOC content limits then the Federal rule. Examples include aerosol adhesives, floor wax strippers, dry cleaning fluids, and general purpose cleaners. It also contains administrative requirements for labeling, reporting, codedating, and a most restrictive limit scenario. There is a reporting requirement, such that manufacturers may be required to submit information to the State upon written notice.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Reformulation (OTC Rule)
Source Group:	Consumer Adhesives
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,032
Ref Yr CPT:	$1,378
Control Efficiency:	39.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,032
Ref Yr CPT:	$1,378
Control Efficiency:	39.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2465600000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Adhesives and Sealants; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 2001: E.H. Pechan & Associates, Inc., "Control Measure Development Support - Analysis of Ozone Transport Commission Model Rules," prepared for Ozone Transport Commission, March, 2001.
- ARB, 1999: California Air Resources Board, "Initial Statement of Reasons for Proposed Amendments to the California Consumer Products Regulation," Stationary Source Division, September 1999.

Other information:

Summary:

Control Measure Name: Reformulation (ARB Phase I);Consumer Solvents

Abbreviation: VCSOLVARB1

Description: Application: CARB rules included in this control are Phase I and Phase II Consumer Products and Mid-Term I and Mid-Term II Consumer Products regulations. The CARB Mid-Term (and Near-Term) limits set VOC content standards for various consumer products. The regulations were implemented over a time period from 1993 to 2005. These regulations assume that emissions will be reduced through product reformulation (CARB, 1990).

Consumer products affected by this control measure include, but are not limited to, personal care products, household cleaners and disinfectants, automotive aftermarket products, adhesives and sealants, lawn and garden products, and household insecticides.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Reformulation (ARB Phase I)

Source Group: Consumer Solvents

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1993-01-01 00:00:00.0
Cost Year:	1990
CPT:	$2,192
Ref Yr CPT:	$3,510
Control Efficiency:	55.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1993-01-01 00:00:00.0
Cost Year:	1990
CPT:	$2,192
Ref Yr CPT:	$3,510

Control Efficiency:	55.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2465400000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Automotive Aftermarket Products; Total: All Solvent Types
2465200000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Household Products; Total: All Solvent Types
2465100000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Personal Care Products; Total: All Solvent Types
2465000000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; All Products/Processes; Total: All Solvent Types

References:

- ARB, 2010: California Air Resources Board, "Initial Statement of Reasons: Proposed Amendments to the California Regulation for Reducing Emissions from Consumer Products and Test Method 310: Determination of Volatile Organic Compounds in Consumer Products and Reactive Organic Compounds in Aerosol Coating Products," September 2010.
- ARB, 2007: Technical Support Document for Regulation for Reducing the Ozone Formed from Aerosol Coating Product Emissions, .

Other information:

Summary:

Control Measure Name: Reformulation (ARB Phase II);Consumer Solvents

Abbreviation: VCSOLVARB2

Description: Application: The CARBs long-term measures depend on future technological innovation and market incentive methods that can be developed and implemented before 2010.

Consumer products affected by this control measure include, but are not limited to, personal care products, household cleaners and disinfectants, automotive aftermarket products, adhesives and sealants, lawn and garden products, and household insecticides.

Class: Emerging

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Reformulation (ARB Phase II)

Source Group: Consumer Solvents

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$2,880
Ref Yr CPT:	$4,612
Control Efficiency:	85.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$2,880
Ref Yr CPT:	$4,612
Control Efficiency:	85.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2465400000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Automotive Aftermarket Products; Total: All Solvent Types
2465200000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Household Products; Total: All Solvent Types
2465100000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Personal Care Products; Total: All Solvent Types
2465000000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; All Products/Processes; Total: All Solvent Types

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name:	Reformulation (OTC Rule);Consumer Solvents
Abbreviation:	VCSOLVOTC
Description:	Application: The OTC model rule regulates approximately 80 consumer product categories, and uses more stringent VOC content limits then the Federal rule. Examples include aerosol adhesives, floor wax strippers, dry cleaning fluids, and general purpose cleaners. It also contains administrative requirements for labeling, reporting, codedating, and a most restrictive limit scenario. There is a reporting requirement, such that manufacturers may be required to submit information to the State upon written notice.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Reformulation (OTC Rule)
Source Group:	Consumer Solvents
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,032
Ref Yr CPT:	$1,378
Control Efficiency:	39.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,032
Ref Yr CPT:	$1,378
Control Efficiency:	39.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremenental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2465400000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Automotive Aftermarket Products; Total: All Solvent Types
2465200000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Household Products; Total: All Solvent Types
2465100000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Personal Care Products; Total: All Solvent Types
2465000000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; All Products/Processes; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 2001: E.H. Pechan & Associates, Inc., "Control Measure Development Support - Analysis of Ozone Transport Commission Model Rules," prepared for Ozone Transport Commission, March, 2001.
- ARB, 1999: California Air Resources Board, "Initial Statement of Reasons for Proposed Amendments to the California Consumer Products Regulation," Stationary Source Division, September 1999.

Other information:

Summary:

Control Measure Name: Coating Reformulation; Miscellaneous Metal and Plastic Parts Coatings

Abbreviation: VCTRMMPPC

Description: Application: In the 2008 EPA CTG for miscellaneous metal and plastic parts coatings three options were recommended for controlling VOC emissions: (1) VOC content limits for each coating category based on the use of low-VOC content coatings and specified application methods to achieve good transfer efficiency; (2) equivalent VOC emission rate limits based on the use of a combination of low-VOC coatings, specified application methods, and add-on controls; or (3) an overall VOC control efficiency of 90 percent for facilities that choose to use add-on controls instead of low-VOC Content coatings and specified application methods. EPA expects that in practice, facilities will choose the low-VOC coating materials alternative. In addition, EPA recommended work practices to further reduce VOC emissions from coatings as well as to minimize emissions from cleaning materials used in miscellaneous metal product and plastic part surface coating processes. The recommendations in this CTG are similar to the South Coast regulations governing miscellaneous metal product and plastic part surface coating operations, and Michigan Rule 336.1632.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Coating Reformulation

Source Group: Miscellaneous Metal and Plastic Parts Coatings

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$1,758
Ref Yr CPT:	$1,983
Control Efficiency:	35.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006

CPT:	$1,758
Ref Yr CPT:	$1,983
Control Efficiency:	35.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40200712	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Roll-on
40200711	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Spray
40200710	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: General
40200707	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Solvent Storage
40200706	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Solvent Mixing
40200701	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive Application

References:

- EPA, 2008: U.S. Environmental Protection Agency, "Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings," Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA-453/R-08-003, September 2008.

Other information:

Summary:

Control Measure Name: MACT;Dry Cleaning - Perchloroethyl
Abbreviation: VDCPERMACT
Description: Application: The MACT standard requires the use of low-VOC chemicals for dry cleaning to control VOC emissions.

Sources affected by this control measure are dry cleaning facilities using Perchloroethyl.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: MACT
Source Group: Dry Cleaning - Perchloroethyl
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$528
Ref Yr CPT:	$846
Control Efficiency:	44.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremememtal CPT:	N/A
Details:	44% in base year (HDDV) - need cost info
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$528
Ref Yr CPT:	$846
Control Efficiency:	44.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	44% in base year (HDDV) - need cost info
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2420010055	Solvent Utilization; Dry Cleaning; Commercial/Industrial Cleaners; Perchloroethylene

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Reformulation-Process Modification;Open Top Degreasing

Abbreviation: VDEGS1122A

Description: Application: VOC emissions from degreasing operations can be reduced by the use of low-VOC content solvents, and by changes in operating practices. This rule was originally adopted in 1979, but has since been amended to specify maximum ventilating conditions, minimize drag-out losses, eliminate some rule exemptions, expand the rule to smaller cold degreasers, and further limit the solvent content of waste materials. This rule was most recently amended in 1997.

Discussion: Open-top vapor degreasers include a tank for holding the solvent and a heating system to heat and vaporize the liquid solvent. As the liquid solvent vaporizes, a vapor layer is formed above the liquid solvent. The cleaning action is provided by the solvent vapor condensing on the cooler (dirty) parts and either dissolving or flushing contaminants from the parts. The cleaning operation is complete when the temperature of the parts reaches that of the vapor, thereby ending the condensation process (SCAQMD, 1996). The soiled solvent is periodically removed and replaced with fresh solvent.

Additional research is needed to determine the fixed versus recurring cost breakout for open top degreasing control regulations. In general, if new degreasing agents are used, little or no capital expenditures would be required. For the more stringent options such as this one, new equipment is required.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Reformulation-Process Modification

Source Group: Open Top Degreasing

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1997-06-06 00:00:00.0
Cost Year:	1990
CPT:	$1,248
Ref Yr CPT:	$1,999
Control Efficiency:	76.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	VOC
Locale:	
Effective Date:	1997-06-06 00:00:00.0
Cost Year:	1990
CPT:	$1,248
Ref Yr CPT:	$1,999
Control Efficiency:	76.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2415145000	Solvent Utilization; Degreasing; Miscellaneous Manufacturing (SIC 39): Open Top Degreasing; Total: All Solvent Types
2415140000	Solvent Utilization; Degreasing; Instruments and Related Products (SIC 38): Open Top Degreasing; Total: All Solvent Types
2415135000	Solvent Utilization; Degreasing; Transportation Equipment (SIC 37): Open Top Degreasing; Total: All Solvent Types
2415130000	Solvent Utilization; Degreasing; Electronic and Other Elec. (SIC 36): Open Top Degreasing; Total: All Solvent Types
2415125000	Solvent Utilization; Degreasing; Industrial Machinery and Equipment (SIC 35): Open Top Degreasing; Total: All Solvent Types
2415120000	Solvent Utilization; Degreasing; Fabricated Metal Products (SIC 34): Open Top Degreasing; Total: All Solvent Types
2415110000	Solvent Utilization; Degreasing; Primary Metal Industries (SIC 33): Open Top Degreasing; Total: All Solvent Types
2415105000	Solvent Utilization; Degreasing; Furniture and Fixtures (SIC 25): Open Top Degreasing; Total: All Solvent Types
2415100000	Solvent Utilization; Degreasing; All Industries: Open Top Degreasing; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan - Appendix IV-A. Stationary and Mobile Source Control Measures," August 1996.
- SCAQMD, 1997: South Coast Air Quality Management District, Draft Staff Report for Proposed Amendments to Rule 1122 - Solvent Degreasers, June 3, 1997.

Other information:

Summary:

Control Measure Name: Process Modification;Open Top Degreasing
Abbreviation: VDEGS1122B
Description: Application: This control is modifications to the open top degreasing process to reduce the fugitive VOC emissions.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Process Modification
Source Group: Open Top Degreasing
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1997-06-06 00:00:00.0
Cost Year:	1990
CPT:	$9,789
Ref Yr CPT:	$15,676
Control Efficiency:	98.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrementental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1997-06-06 00:00:00.0
Cost Year:	1990
CPT:	$9,789
Ref Yr CPT:	$15,676
Control Efficiency:	98.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2415145000	Solvent Utilization; Degreasing; Miscellaneous Manufacturing (SIC 39): Open Top Degreasing; Total: All Solvent Types
2415140000	Solvent Utilization; Degreasing; Instruments and Related Products (SIC 38): Open Top Degreasing; Total: All Solvent Types
2415135000	Solvent Utilization; Degreasing; Transportation Equipment (SIC 37): Open Top Degreasing; Total: All Solvent Types
2415130000	Solvent Utilization; Degreasing; Electronic and Other Elec. (SIC 36): Open Top Degreasing; Total: All Solvent Types
2415125000	Solvent Utilization; Degreasing; Industrial Machinery and Equipment (SIC 35): Open Top Degreasing; Total: All Solvent Types
2415120000	Solvent Utilization; Degreasing; Fabricated Metal Products (SIC 34): Open Top Degreasing; Total: All Solvent Types
2415110000	Solvent Utilization; Degreasing; Primary Metal Industries (SIC 33): Open Top Degreasing; Total: All Solvent Types
2415105000	Solvent Utilization; Degreasing; Furniture and Fixtures (SIC 25): Open Top Degreasing; Total: All Solvent Types
2415100000	Solvent Utilization; Degreasing; All Industries: Open Top Degreasing; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan - Appendix IV-A. Stationary and Mobile Source Control Measures," August 1996.
- SCAQMD, 1997: South Coast Air Quality Management District, Draft Staff Report for Proposed Amendments to Rule 1122 - Solvent Degreasers, June 3, 1997.

Other information:

Summary:

Control Measure Name: Reformulation-Process Modification;Electrical/Electronic Coating

Abbreviation: VEECTS1164

Description: SCAQMD Rule 1116 requires: a fully covered area, low/no-VOC solvents, or an approved emissions control system for solvent cleaning operations, photoresist operations and solvent clean-up operations. An alternative emission control plan pursuant to Rule 108 may be submitted in place of the measures listed above (SCAQMD, 1995).

This control applies to the miscellaneous electronic equipment coating source category, including VOC emissions resulting from the manufacture of circuit boards and components, including resistors, transistors, semiconductors, coils, and transformers. Emissions for this source category are classified under SCC 2401065000.

Discussion: This control measure proposes to reduce VOC emissions from electronic components manufacturing operations through the application of several control methods. These control methods include installation of add-on control equipment, material reformulations, and improved operating procedures. Such control methods are currently required for semiconductor manufacturing operations and are also expected to be applicable to this source category due to the similarity in operations.

Add-on control devices such as carbon adsorption, and thermal and catalytic incinerators could be used to capture and/or eliminate organic compound emissions from the operation exhaust streams. In addition, development of low-VOC, high-solids content, and water-based formulations could provide another alternative for reducing VOC emissions from this source category. Further emission reductions could also be expected through adoption of improved procedures resulting in lower solvent usage and/or evaporation (SCAQMD, 1988).

Assuming that the proposed control methods would have the same control efficiency as achieved in semiconductor manufacturing operations, implementation of this control measure is expected to be 70 percent efficient in reducing VOC emissions from this source category.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Reformulation-Process Modification

Source Group: Electrical/Electronic Coating

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1988-04-01 00:00:00.0
Cost Year:	1990
CPT:	$5,976
Ref Yr CPT:	$9,570
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A

Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1988-04-01 00:00:00.0
Cost Year:	1990
CPT:	$5,976
Ref Yr CPT:	$9,570
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401065000	Solvent Utilization; Surface Coating; Electronic and Other Electrical: SIC 36 - 363; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1997: E.H. Pechan & Associates, "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for U.S. Environmental Protection Agency,

July 1997.

- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan, Appendix IV-A: Stationary and Mobile Source Control Measures." August 1996.
- Pechan, 1994: E.H. Pechan & Associates, Inc., "Analysis of Incremental Emission Reductions and Costs of VOC and NOx Control Measures - Draft Report," prepared for U.S. Environmental Protection Agency, Ambient Standards Branch, Research Triangle Park, NC, September 1994.
- SCAQMD, 1988: South Coast Air Quality Management District, Rule Development Division, "Staff Report on the Proposed Rule 1164 - Semiconductor Manufacturing," April 1988.
- SCAQMD, 1995: South Coast Air Quality Management District, "Rule 1164 - Semiconductor Manufacturing," January 1993.

Other information:

Summary:

Control Measure Name:	Flare; Petroleum Flare
Abbreviation:	VFLAFLA
Description:	Application: This control is the application of improved flaring technology to reduce VOC emissions at petroleum flares.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Flare
Source Group:	Petroleum Flare
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,700
Ref Yr CPT:	$3,606
Control Efficiency:	98.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,700
Ref Yr CPT:	$3,606
Control Efficiency:	98.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30600999	Industrial Processes; Petroleum Industry; Flares; Not Classified **

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

Summary:

Control Measure Name:	Process Modification;SOCMI Fugitives
Abbreviation:	VFUGEQMAN1
Description:	Application: This control is modifications to the synthetic organic chemical manufacturing process to reduce the fugitive VOC emissions.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Process Modification
Source Group:	SOCMI Fugitives
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	-$303
Ref Yr CPT:	-$485
Control Efficiency:	60.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	cost on CD is -$303 - 37% in base year (HDDV)
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	-$303
Ref Yr CPT:	-$485
Control Efficiency:	60.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	cost on CD is -$303 - 37% in base year (HDDV)
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2301040000	Industrial Processes; Chemical Manufacturing: SIC 28; Fugitive Emissions from Synthetic Organic Chem Manuf (NAPAP cat. 102); Total

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Process Modification;Petroleum Refinery Fugitives
Abbreviation: VFUGEQMAN2
Description: Application: This control is modifications to the petroleum refining process to reduce the fugitive VOC emissions.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Process Modification
Source Group: Petroleum Refinery Fugitives
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$804
Ref Yr CPT:	$1,288
Control Efficiency:	78.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	43% in base year (HDDV)
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$804
Ref Yr CPT:	$1,288
Control Efficiency:	78.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	43% in base year (HDDV)
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2306000000	Industrial Processes; Petroleum Refining: SIC 29; All Processes; Total

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: RACT;Graphic Arts

Abbreviation: VGARTRACT

Description: Application: This control measure calls for the application of RACT-level controls to small graphic arts sources. This control measure, based on one developed by STAPPA/ALAPCO, requires the use of low or no-VOC materials to reduce VOC emissions from graphic arts sources.
This control applies to lithography, letterpress, rotogravure, and flexography graphic, and other graphic arts applications.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: RACT

Source Group: Graphic Arts

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1993
CPT:	$4,150
Ref Yr CPT:	$6,142
Control Efficiency:	65.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1993
CPT:	$4,150
Ref Yr CPT:	$6,142
Control Efficiency:	65.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2425040000	Solvent Utilization; Graphic Arts; Flexography; Total: All Solvent Types
2425030000	Solvent Utilization; Graphic Arts; Rotogravure; Total: All Solvent Types
2425020000	Solvent Utilization; Graphic Arts; Letterpress; Total: All Solvent Types
2425010000	Solvent Utilization; Graphic Arts; Lithography; Total: All Solvent Types
2425000000	Solvent Utilization; Graphic Arts; All Processes; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- STAPPA/ALAPCO, 1993: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Meeting the 15 Percent Rate of Progress Requirement Under the Clean Air Act: A Menu of Options," September 1993.

Other information:

Summary:

Control Measure Name: Reformulation;Adhesives - Industrial
Abbreviation: VINADS1168
Description: Application: This control is the use of product reformulation and product substitution for industrial adhesives to achieve VOC emissions reductions.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Reformulation
Source Group: Adhesives - Industrial
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1991-10-01 00:00:00.0
Cost Year:	1990
CPT:	$2,202
Ref Yr CPT:	$3,526
Control Efficiency:	73.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1991-10-01 00:00:00.0
Cost Year:	1990
CPT:	$2,202
Ref Yr CPT:	$3,526
Control Efficiency:	73.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2440020000	Solvent Utilization; Miscellaneous Industrial; Adhesive (Industrial) Application; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1997: E.H. Pechan & Associates, "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for U.S. Environmental Protection Agency, July 1997.
- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan - Appendix IV-A. Stationary and Mobile Source Control Measures," August 1996.

Other information:

Summary:

Control Measure Name: Low-VOC materials coatings and Add-On Controls; Flat Wood Paneling Coatings

Abbreviation: VLVMAFWPC

Description: Application: EPA issued a new CTG for flat wood paneling coating facilities in 2006. The 2006 CTG recommends emission limits for the inks, coatings and adhesives used by the flat wood paneling coating facilities and work practices for cleaning materials used. The low-VOC materials recommendation for inks, coatings and adhesives include an emission limit of 2.1 lbs. per gallon of materials. Should product performance requirements or other needs dictate the use of higher-VOC Coatings than this, a facility could choose to use add-on control equipment to meet an overall control efficiency of 90 percent. Add-on devices include oxidizers and solvent recovery systems. The CTG also recommends work practices for use in all flat wood paneling coating facilities meeting the 15 lb per day threshold. The new CTG emission limits for this source category are based on the rules in Placer County (Rule 238) and SCAQMD (Rule 1104) in California.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Low-VOC materials coatings and Add-On Controls

Source Group: Flat Wood Paneling Coatings

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$2,600
Ref Yr CPT:	$2,932
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$2,600

Ref Yr CPT:	$2,932
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40202199	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Other Not Classified
40202133	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Ultraviolet Coating
40202132	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Solvent-borne Coating
40202131	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Water-borne Coating
40202111	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Stain Application
40202110	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Grove Coat Application
40202109	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Inks
40202106	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Topcoat
40202104	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Coating Storage
40202103	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Coating Mixing
40202101	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Base Coat

References:

- EPA, 2006: U.S. Environmental Protection Agency, "Control Techniques Guidelines for Flat Wood Paneling Coatings," EPA 453/R-06-004, September 2006.

Other information:

Summary:

Control Measure Name: Low-VOC coating materials and/or add-on controls; Paper Film and Foil Coatings

Abbreviation: VLVMAPFFC

Description: EPA issued a 2007 CTG for paper, film and foil coatings. Previous federal actions that affected this source category included a 1977 CTG for controlling VOC emissions from surface coating of paper, the 1983 NSPS for surface coating of pressure sensitive tape and labels (a subset of this category), and a 2002 NESHAP for paper and other web coating. EPA recommends applying the control recommendations for coatings only o individual paper, film and foil surface coating lines with the potential to emit at least 25 tpy of VOC from coatings, prior to controls. EPA recommends an overall VOC control efficiency of 90% as RACT for each coating line. This level of control is based on current rules in San Diego and Ventura air districts in California, as well as the NSPS. The CTG does not recommend the 95 percent control level that is currently required by the NESHAP and seven State's regulations.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Low-VOC coating materials and/or add-on controls

Source Group: Paper Film and Foil Coatings

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$1,200
Ref Yr CPT:	$1,353
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$1,200
Ref Yr CPT:	$1,353

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40201330	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Application: Rotogravure Printer
40201320	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Application: Reverse Roll Coater
40201310	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Application: Knife Coater
40201305	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Equipment Cleanup
40201303	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Mixing
40201301	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Operation

References:

- EPA, 2007: U.S. Environmental Protection Agency, "Control Techniques Guidelines for Paper, Film, and Foil Coatings," Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA 453/R-07-003, September 2007.

Other information:

Summary:

Control Measure Name:	Low-VOC materials coatings; Flat Wood Paneling Coatings
Abbreviation:	VLVMFWPC
Description:	EPA issued a new CTG for flat wood paneling coating facilities in 2006. The 2006 CTG recommends emission limits for the inks, coatings and adhesives used by the flat wood paneling coating facilities and work practices for cleaning materials used. The low-VOC materials recommendation for inks, coatings and adhesives include an emission limit of 2.1 lbs. per gallon of materials. The CTG also recommends work practices for use in all flat wood paneling coating facilities meeting the 15 lb per day threshold. The new CTG emission limits for this source category are based on the rules in Placer County (Rule 238) and SCAQMD (Rule 1104) in California.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Low-VOC materials coatings
Source Group:	Flat Wood Paneling Coatings
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$1,900
Ref Yr CPT:	$2,143
Control Efficiency:	60.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$1,900
Ref Yr CPT:	$2,143
Control Efficiency:	60.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40202199	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Other Not Classified
40202133	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Ultraviolet Coating
40202132	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Solvent-borne Coating
40202131	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Water-borne Coating
40202111	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Stain Application
40202110	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Grove Coat Application
40202109	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Inks
40202106	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Topcoat
40202104	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Coating Storage
40202103	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Coating Mixing
40202101	Petroleum and Solvent Evaporation; Surface Coating Operations; Flatwood Products; Base Coat

References:

- EPA, 2006: U.S. Environmental Protection Agency, "Control Techniques Guidelines for Flat Wood Paneling Coatings," EPA 453/R-06-004, September 2006.

Other information:

Summary:

Control Measure Name: Low-VOC coating materials; Large Appliance Surface Coating

Abbreviation: VLVMLASC

Description: Application: In 2007, EPA issued a CTG for large appliance coatings. EPA developed this new CTG after considering the 1977 CTG, the 1982 NSPS, the 2002 NESHAP, and existing State and local VOC emission reduction approaches for this category. The new CTG applies to facilities with 15 lbs per day or more of VOC emissions from large appliance coating operations. There are two main sources of VOC emissions from large appliance coating operations: (1) evaporation of VOC from the coatings; and (2) evaporation of VOC from the cleaning materials. To control VOC emissions from large appliance coatings, EPA recommended three alternatives: (1) emission limits that can be achieved through the use of low-VOC coatings; (2) equivalent emission limits that can be achieved through the use of low-VOC coatings or a combination of coatings and add-on controls; and (3) an overall control efficiency of 90 percent for add-on controls. EPA expects that in practice, facilities will choose the low-VOC coating materials alternative. EPA recommends work practices to reduce VOC emissions. The recommendations in this CTG are similar to the South Coast regulations for this source category (SCAQMD Rule 1107).

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Low-VOC coating materials

Source Group: Large Appliance Surface Coating

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$500
Ref Yr CPT:	$564
Control Efficiency:	30.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A

Cost Year:	2006
CPT:	$500
Ref Yr CPT:	$564
Control Efficiency:	30.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40201499	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Other Not Classified
40201438	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Top Electrostatic Spray
40201437	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Top Air Spray
40201436	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Electro-deposition
40201435	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Dip Coat
40201434	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Flow Coat
40201433	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Electrostatic Spray
40201432	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Air Spray
40201431	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Coating Line: General
40201411	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Topcoat Flashoff
40201410	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Coat Flashoff
40201406	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Topcoat Spray

40201405	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Equipment Cleanup
40201404	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Coating Storage
40201403	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Coating Mixing
40201402	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Cleaning/Pretreatment
40201401	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Coating Operation

References:

- EPA, 2007: U.S. Environmental Protection Agency, "Control Techniques Guidelines for Large Appliance Coatings," Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA 453/R-07-004, September 2007.

Other information:

Summary:

Control Measure Name: Low-VOC coating materials; Metal Furniture Coatings
Abbreviation: VLVMMFC
Description: Application: EPA issued a 2007 CTG for metal furniture coatings. Previous federal actions that affected this source category include a 1977 CTG, a 1982 NSPS and a 2003 NESHAP (Surface Coating of Metal Furniture). In the 2007 CTG, EPA recommended three alternatives: (1) emission limits that can be achieved through the use of low VOC Coatings; (2) equivalent emission limits that can be achieved through the use of low-VOC coatings and add-on controls, (3) an overall control efficiency of 90 percent for add-on controls. The low-VOC coatings recommendation consists of emission limits in terms of mass of VOC per volume of coating, excluding water and exempt compounds, as applied and the use of specified application methods. The equivalent emission limit recommendation consists of emission limits in terms of mass of VOC per volume of coating solids, as applied, and the use of specific add-on controls. EPA expects that in practice, facilities will choose the low-VOC coating materials alternative. The CTG recommendations are similar to the South Coast regulations governing metal furniture surface coating operations.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Low-VOC coating materials
Source Group: Metal Furniture Coatings
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$200
Ref Yr CPT:	$226
Control Efficiency:	35.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006

CPT:	$200
Ref Yr CPT:	$226
Control Efficiency:	35.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40202099	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Other Not Classified
40202039	Chemical Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Coat Application: Flashoff
40202038	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Coat Application: Flow Coat
40202037	Chemical Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Coat Application: Dip
40202036	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Coat Application: Spray, Water-borne
40202035	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Coat Application: Spray, High Solids
40202034	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Spray Water-borne Coating ** (Use 4-02-020-36)
40202033	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Spray High Solids Coating ** (Use 4-02-020-35)
40202032	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Spray Dip Line: General ** (Use 4-02-020-37)
40202031	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Spray Line: General
40202025	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application: Flashoff
40202024	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application: Flow Coat

40202023	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application: Dip
40202022	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application: Spray, Water-borne
40202021	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application: Spray, High Solids
40202020	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application
40202015	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application: Flashoff
40202014	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application: Flow Coat
40202013	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application: Dip
40202012	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application: Spray, Water-borne
40202011	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application: Spray, High Solids
40202010	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application
40202005	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Equipment Cleanup
40202004	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Coating Storage
40202003	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Coating Mixing
40202002	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Cleaning/Pretreatment
40202001	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Coating Operation

References:

- EPA, 2007: U.S. Environmental Protection Agency, "Control Techniques Guidelines for Metal Furniture Coatings," Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA 453/R-07-005, September 2007.

Other information:

Summary:

Control Measure Name: Low VOC Adhesives and Improved Application Methods; Miscellaneous Industrial Adhesives

Abbreviation: VLVMMIA

Description: Application: This control is based on EPA's 2008 Control Techniques Guidelines for Miscellaneous Industrial Adhesives. It recommends 85 percent VOC reduction through the use of low-VOC content adhesives and specified application methods with good adhesive transfer efficiency; or through the use of a combination of low-VOC adhesives, specified application methods, and add-on controls. The control efficiency is not 85 percent because there are a number of exceptions for certain types of adhesives and adhesives primer application processes. Because the exceptions are for types of processes are at a sub-SCC level, the modeled reduction is lower than 85 percent.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Low VOC Adhesives and Improved Application Methods

Source Group: Miscellaneous Industrial Adhesives

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$263
Ref Yr CPT:	$297
Control Efficiency:	64.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$263
Ref Yr CPT:	$297

Control Efficiency:	64.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40200712	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Roll-on
40200711	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Spray
40200710	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: General
40200707	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Solvent Storage
40200706	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Solvent Mixing
40200701	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive Application

References:

- EPA, 2008: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques Guidelines for Miscellaneous Industrial Adhesives," Research Triangle Park, NC, September 2008.
- EPA, 1995: U.S. Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants: Printing and Publishing Industry Background Information for Proposed Standards, February 1995.

Other information:

Summary:

Control Measure Name:	Incineration;Marine Surface Coating
Abbreviation:	VMARCINC
Description:	Application: This is a generic control measure based on the use of incineration to reduce VOC emissions from marine surface coating facilities. It represents potential add-on controls including thermal incinerators, catalytic incinerators, and a combination of carbon absorbers and incinerators. Sources affected by this control measure are all major facilities involved in shipbuilding or ship repair.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Incineration
Source Group:	Marine Surface Coating
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$8,937
Ref Yr CPT:	$14,312
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$8,937
Ref Yr CPT:	$14,312
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401080000	Solvent Utilization; Surface Coating; Marine: SIC 373; Total: All Solvent Types

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.
- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.

Other information:

Summary:

Control Measure Name:	Process Modification;Metal Coil Coating
Abbreviation:	VMCLCBAQMD
Description:	Application: This control includes modifications to the metal can coating process to reduce the fugitive VOC emissions. This control measure is based on the 1997 amendment to the San Francisco Bay Area AQMD rule which defined VOC content limits for body spray coatings for both two and three piece cans and set VOC limits for end sealing compounds for non-food products; and set limits for interior and exterior body sprays used on drums, pails, and lids (BAAQMD, 1999).
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Process Modification
Source Group:	Metal Coil Coating
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1997-01-01 00:00:00.0
Cost Year:	1990
CPT:	$2,007
Ref Yr CPT:	$3,214
Control Efficiency:	42.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1997-01-01 00:00:00.0
Cost Year:	1990
CPT:	$2,007
Ref Yr CPT:	$3,214
Control Efficiency:	42.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401050000	Solvent Utilization; Surface Coating; Miscellaneous Finished Metals: SIC 34 - (341 + 3498); Total: All Solvent Types
2401045000	Solvent Utilization; Surface Coating; Metal Coils: SIC 3498; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- BAAQMD, 1999: Bay Area Air Quality Management District, "San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard, Appendix B - Control Measure Descriptions," June 1999.

Other information:

Summary:

Control Measure Name: Incineration;Metal Coil Coating
Abbreviation: VMCLCINC
Description: Application: This control measure based on the use of incineration to reduce VOC emissions from metal can coating facilities. Coatings are applied to metal cans to improve appearance and prevent corrosion. This rule is assumed to cover both two and three piece can coating. This control applies to area source VOC emissions for the metal can coating source category. The option presented here has applicability to processes that use "high" VOC content materials (solvent-borne materials).
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Incineration
Source Group: Metal Coil Coating
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$8,937
Ref Yr CPT:	$14,312
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$8,937
Ref Yr CPT:	$14,312
Control Efficiency:	90.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401050000	Solvent Utilization; Surface Coating; Miscellaneous Finished Metals: SIC 34 - (341 + 3498); Total: All Solvent Types
2401045000	Solvent Utilization; Surface Coating; Metal Coils: SIC 3498; Total: All Solvent Types

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.
- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.

Other information:

Summary:

Control Measure Name: Process Modification;Metal Can Coating

Abbreviation: VMCNCBAQMD

Description: Application: This control includes modifications to the metal can coating process to reduce the fugitive VOC emissions. This control measure is based on the 1997 amendment to the San Francisco Bay Area AQMD rule which defined VOC content limits for body spray coatings for both two and three piece cans and set VOC limits for end sealing compounds for non-food products; and set limits for interior and exterior body sprays used on drums, pails, and lids (BAAQMD, 1999).

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Process Modification

Source Group: Metal Can Coating

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1997-01-01 00:00:00.0
Cost Year:	1990
CPT:	$2,007
Ref Yr CPT:	$3,214
Control Efficiency:	42.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1997-01-01 00:00:00.0
Cost Year:	1990
CPT:	$2,007
Ref Yr CPT:	$3,214
Control Efficiency:	42.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401040000	Solvent Utilization; Surface Coating; Metal Cans: SIC 341; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- BAAQMD, 1999: Bay Area Air Quality Management District, "San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard, Appendix B - Control Measure Descriptions," June 1999.

Other information:

Summary:

Control Measure Name: Incineration;Metal Can Coating
Abbreviation: VMCNCINC
Description: Application: This control measure based on the use of incineration to reduce VOC emissions from metal can coating facilities. Coatings are applied to metal cans to improve appearance and prevent corrosion. This rule is assumed to cover both two and three piece can coating. This control applies to area source VOC emissions for the metal can coating source category. The option presented here has applicability to processes that use "high" VOC content materials (solvent-borne materials).
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Incineration
Source Group: Metal Can Coating
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$8,937
Ref Yr CPT:	$14,312
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$8,937
Ref Yr CPT:	$14,312
Control Efficiency:	90.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremememtal CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401040000	Solvent Utilization; Surface Coating; Metal Cans: SIC 341; Total: All Solvent Types

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.
- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.

Other information:

Summary:

Control Measure Name: MACT;Machn, Electric, Railroad Ctng

Abbreviation: VMERCMACT

Description: Application: The MACT standard requires the use of low-VOC coatings and work practices that would minimize evaporative emissions from all affected Machine, Electric, and Railroad coating sources.

Sources affected by this control measure are all major facilities involved MER coatings.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: MACT

Source Group: Machn, Electric, Railroad Ctng

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	2002-08-01 00:00:00.0
Cost Year:	1990
CPT:	$1,000
Ref Yr CPT:	$1,601
Control Efficiency:	36.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	2002-08-01 00:00:00.0
Cost Year:	1990
CPT:	$1,000
Ref Yr CPT:	$1,601
Control Efficiency:	36.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401085000	Solvent Utilization; Surface Coating; Railroad: SIC 374; Total: All Solvent Types
2401055000	Solvent Utilization; Surface Coating; Machinery and Equipment: SIC 35; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1997: E.H. Pechan & Associates, "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for U.S. Environmental Protection Agency, July 1997.
- 67FR52799, 2002: Federal Register, "National Emission Standards for Hazardous Air Pollutants: Surface Coating of Miscellaneous Metal Parts and Products - Proposed Rule," Washington, DC, August 2002.

Other information:

Summary:

Control Measure Name: Reformulation-Process Modification (OTC Rule);Machn, Electric, Railroad Ctng
Abbreviation: VMERCOTC
Description: Application: The rule includes VOC limits for paints used in the industry that are consistent with the Federal limits for the mobile equipment refinishing materials. The rule also establishes requirements for using improved transfer efficiency application equipment and enclosed spray gun cleaning, and requires minimal training.

In addition to requiring that refinishing materials meet the Federal VOC limits, the model rule proposes a number of pollution prevention initiatives. For example, the coating application requirements specify using improved transfer efficiency spray equipment such as high volume-low pressure (HVLP) equipment.

Class: Emerging
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Reformulation-Process Modification (OTC Rule)
Source Group: Machn, Electric, Railroad Ctng
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,534
Ref Yr CPT:	$3,384
Control Efficiency:	61.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,534
Ref Yr CPT:	$3,384
Control Efficiency:	61.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	Costs and $ from Uncontrolled
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401085000	Solvent Utilization; Surface Coating; Railroad: SIC 374; Total: All Solvent Types
2401055000	Solvent Utilization; Surface Coating; Machinery and Equipment: SIC 35; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 2001: E.H. Pechan & Associates, Inc., "Control Measure Development Support - Analysis of Ozone Transport Commission Model Rules," prepared for Ozone Transport Commission, March, 2001.

Other information:

Summary:

Control Measure Name:	Reformulation-Process Modification; Metal Part and Products Coating
Abbreviation:	VMERCS1107
Description:	Application: The SCAQMD amended rule 1107 sets stringent VOC emission limits for metal coatings. VOC emissions can be reduced by using reformulated low-VOC content compliant coatings, powder coating for both general and high gloss coatings, UV curable coatings, high transfer efficiency coating applications, and increased effectiveness of add-on control equipment (SCAQMD, 1996). The metal coating source category classifies emissions that result from the coating of metal parts and products including machinery and equipment (SCC 2401055000) and railroad rolling stock (SCC 2401085000). Discussion: The SCAQMD originally adopted its Rule 1107 - Coating of Metal Parts and Products - in 1979, as part of California's SIP. Since 1979, SCAQMD amended the rule several times to adjust the compliance schedule, and to modify provisions due to delayed progress in the development and use of compliant coatings. The SCAQMD notes that add-on control equipment is considerably more expensive than low-VOC coating reformulation.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Reformulation-Process Modification
Source Group:	Metal Part and Products Coating
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	2001-11-01 00:00:00.0
Cost Year:	1990
CPT:	$2,027
Ref Yr CPT:	$3,246
Control Efficiency:	55.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	

Effective Date:	2001-11-01 00:00:00.0
Cost Year:	1990
CPT:	$2,027
Ref Yr CPT:	$3,246
Control Efficiency:	55.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401085000	Solvent Utilization; Surface Coating; Railroad: SIC 374; Total: All Solvent Types
2401055000	Solvent Utilization; Surface Coating; Machinery and Equipment: SIC 35; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan - Appendix IV-A. Stationary and Mobile Source Control Measures," August 1996.
- SCAQMD, 2001: South Coast Air Quality Management District, "Rule 1107 - Coating of Metal Parts and Products," November 2001. Retrieved April 29, 2003 from www.aqmd.gov/rules/html/r1107.html.

Other information:

Summary:

Control Measure Name:	Reformulation-Process Modification;Metal Furn, Appliances, Parts
Abbreviation:	VMTFNS1107
Description:	Application: SCAQMD Rule 1107 establishes VOC content limits for metal coatings along with application procedures and equipment requirements. The rule also mentions several options for reducing VOC emissions, including using reformulated low-VOC content compliant coatings, powder coating for both general and high gloss coatings, UV curable coatings, high transfer efficiency coating applications, and increased effectiveness of add-on control equipment. The original rule was promulgated in 1979 and has been amended several times, most recently in November 2001. This rule applies to emissions that result from the coating of metal parts and products including furniture (SCC 2401025000), appliances (SCC 2401060000), and miscellaneous manufacturing (SCC 2401090000).
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Reformulation-Process Modification
Source Group:	Metal Furn, Appliances, Parts
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	2001-11-01 00:00:00.0
Cost Year:	1990
CPT:	$2,027
Ref Yr CPT:	$3,246
Control Efficiency:	55.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	2001-11-01 00:00:00.0
Cost Year:	1990
CPT:	$2,027
Ref Yr CPT:	$3,246

Control Efficiency:	55.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401090000	Solvent Utilization; Surface Coating; Miscellaneous Manufacturing; Total: All Solvent Types
2401060000	Solvent Utilization; Surface Coating; Large Appliances: SIC 363; Total: All Solvent Types
2401025000	Solvent Utilization; Surface Coating; Metal Furniture: SIC 25; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan - Appendix IV-A. Stationary and Mobile Source Control Measures," August 1996.
- EPA, 1995: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Volatile Organic Compound Emissions from Automobile Refinishing-Background Information for Proposed Standards," Research Triangle Park, NC, EPA-453/D-95-005a, August 1995.

Other information:

Summary:

Control Measure Name:	MACT;Motor Vehicle Coating
Abbreviation:	VMVCTMACT
Description:	Application: The MACT regulation is based on best available controls, as defined under the Clean Air Act, and sets specific VOC content limits on 7 categories of automobile refinish coatings (generally classified as primers and topcoats). VOC limits would be met by product reformulation, requiring the use of coatings with lower VOC content than the coatings currently in use. Most manufacturers already produce low-VOC coatings. EPA's rule would affect approximately 5 large automobile refinish coating component manufacturers and importers and an additional 10-15 smaller manufacturers.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	MACT
Source Group:	Motor Vehicle Coating
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1996-04-30 00:00:00.0
Cost Year:	1990
CPT:	$118
Ref Yr CPT:	$189
Control Efficiency:	36.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1996-04-30 00:00:00.0
Cost Year:	1990
CPT:	$118
Ref Yr CPT:	$189
Control Efficiency:	36.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401070000	Solvent Utilization; Surface Coating; Motor Vehicles: SIC 371; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- EPA, 1995: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Volatile Organic Compound Emissions from Automobile Refinishing-Background Information for Proposed Standards," Research Triangle Park, NC, EPA-453/D-95-005a, August 1995.
- 61FR19005, 1996: Federal Register, "National Volatile Organic Compound Emission Standards for Automobile Refinish Coatings; Proposed Rule," Volume 61, Number 84, April 30, 1996.

Other information:

Summary:

Control Measure Name: Process Modification;Oil and Natural Gas Production
Abbreviation: VOGSEQMAN
Description: Application: This control is modifications to the oil and natural gas production process to reduce the fugitive VOC emissions.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Process Modification
Source Group: Oil and Natural Gas Production
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$317
Ref Yr CPT:	$508
Control Efficiency:	37.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$317
Ref Yr CPT:	$508
Control Efficiency:	37.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2310030000	Industrial Processes; Oil and Gas Exploration and Production; Natural Gas Liquids; Total: All Processes
2310020000	Industrial Processes; Oil and Gas Exploration and Production; Natural Gas; Total: All Processes
2310010000	Industrial Processes; Oil and Gas Exploration and Production; Crude Petroleum; Total: All Processes
2310000000	Industrial Processes; Oil and Gas Exploration and Production; All Processes; Total: All Processes

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.
- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf

Other information:

Summary:

Control Measure Name: Reformulation;Pesticide Application

Abbreviation: VPESTFR

Description: Application: The California Federal Implementation Plan (FIP) rule intends to reach the VOC limits by switching to and/or encouraging the use of low-VOC pesticides and better Integrated Pest Management (IPM) practices.

All types of pesticide applications are affected by this rule.

Discussion: CARB formed the Department of Pesticide Regulation (DPR) in 1991 to regulate all aspects of pesticide sales and use. The DPR has implemented a faster registration process so that new pesticide products can be more quickly integrated. The DPR also encourages better IPM practices by working with local agricultural agencies and rewarding those who demonstrate good practice or innovation.

No new regulations have been developed for pesticides as the DPR believes that the reduction goals will be met through reformulation (which is occurring without specific air regulations) and better IPM practices (CDPR, 1999).

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Reformulation

Source Group: Pesticide Application

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1991-01-01 00:00:00.0
Cost Year:	1990
CPT:	$9,300
Ref Yr CPT:	$14,893
Control Efficiency:	20.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1991-01-01 00:00:00.0

Cost Year:	1990
CPT:	$9,300
Ref Yr CPT:	$14,893
Control Efficiency:	20.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2465800000	Solvent Utilization; Miscellaneous Non-industrial: Consumer; Pesticide Application; Total: All Solvent Types
2461850000	Solvent Utilization; Miscellaneous Non-industrial: Commercial; Pesticide Application: Agricultural; All Processes
2461800000	Solvent Utilization; Miscellaneous Non-industrial: Commercial; Pesticide Application: All Processes; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Radian, 1994: Radian Corporation, "Technical Support Document: Proposed FIP Pesticides Measure 52.2960," prepared for the U.S. Environmental Protection Agency, February 1994.

Other information:

Summary:

Control Measure Name:	Permanent Total Enclosure (PTE; Flexographic Printing)
Abbreviation:	VPTENFLPR
Description:	Application: A permanent total enclosure (PTE) completely surrounds a source of emissions such that all VOC emissions are captured and contained for discharge to a control device. Flexographic printing is classified into two categories: wide-web and narrow-web flexographic printing. Wide-web flexographic printing is used to print flexible and rigid paper, plastic and aluminum foil packaging, newspapers, magazines, directories, paper towels, etc. Narrow-web flexographic printing is primarily used for printing and adhesive application on paper, foil and film tags and labels. The EPA evaluated VOC emission control options for the flexographic printing industry including the use of a PTE in conjunction with a thermal oxidizer in the MACT standard-setting process for this source category. The option presented here has applicability to flexographic printing that uses "high" VOC content materials.
Class:	Known
Pollutant:	VOC
Equipment Life:	15.0 years
Control Technology:	Permanent Total Enclosure (PTE)
Source Group:	Flexographic Printing
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1993
CPT:	$9,947
Ref Yr CPT:	$14,722
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1993
CPT:	$9,947

Ref Yr CPT:	$14,722
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40500433	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Nonheated Lithographic Inks
40500432	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Nonheated Lithographic Inks
40500431	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Nonheated Lithographic Inks
40500422	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Heatset Solvent Storage
40500421	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Heatset Ink Mixing
40500418	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Dampening Solution with Isopropyl Alcohol
40500417	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Cleaning Solution: Water-based
40500416	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Dampening Solution with High Solvent Content
40500415	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Dampening Solution with Alcohol Substitute
40500414	Petroleum and Solvent Evaporation; Printing/Publishing; General; Flexographic: Propyl Alcohol Cleanup
40500413	Petroleum and Solvent Evaporation; Printing/Publishing; Lithographic; Isopropyl Alcohol Cleanup
40500412	Petroleum and Solvent Evaporation; Printing/Publishing; Lithographic; Lithographic: 2752
40500411	Petroleum and Solvent Evaporation; Printing/Publishing; Lithographic; Lithographic: 2752
40500401	Petroleum and Solvent Evaporation; Printing/Publishing; Lithographic; Printing

40500319	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Steam: Water-based Ink Storage
40500318	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Steam: Water-based in Ink
40500317	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Steam: Water-based
40500316	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Steam: Water-based
40500315	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Steam: Water-based
40500314	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Propyl Alcohol Cleanup
40500312	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Printing: Flexographic
40500311	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Printing: Flexographic
40500307	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Naphtha
40500306	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, n-Propyl Alcohol
40500305	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Isopropyl Alcohol
40500304	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Ethyl Alcohol
40500303	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Cellosolve
40500302	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Carbitol
40500301	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Printing

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Permanent Total Enclosure (PTE; Fabric Printing, Coating and Dyeing)

Abbreviation: VPTENFPCD

Description: Application: A permanent total enclosure (PTE) completely surrounds a source of emissions such that all VOC emissions are captured and contained for discharge to a control device.
Fabric printing and coating is performed in the textile manufacturing industry in order to:
--prepare fiber and subsequently manufacture yarn, threads, braids, twine, and cordage
--manufacture broadwoven fabrics, narrow woven fabrics, knit fabrics, and carpets and rugs from yarn
-- finish fiber, yarn, fabrics, and knit apparel
--coat, waterproof, or otherwise treat fabrics
--perform integrated manufacturing of knit apparel and other finished articles from yarn
--manufacture felt goods, lace goods, nonwoven fabrics, and miscellaneous textiles.
The EPA evaluated VOC emission control options for the fabric printing and coating industry including the use of a PTE in conjunction with a thermal oxidizer in the MACT standard-setting process for this source category. The option presented here has applicability to fabric printing/coating processes that use "high" VOC content materials.

Class: Known

Pollutant: VOC

Equipment Life: 15.0 years

Control Technology: Permanent Total Enclosure (PTE)

Source Group: Fabric Printing/ Coating and Dyeing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1997
CPT:	$1,343
Ref Yr CPT:	$1,841
Control Efficiency:	97.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A

Cost Year:	1997
CPT:	$1,343
Ref Yr CPT:	$1,841
Control Efficiency:	97.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
33000201	Industrial Processes; Textile Products; Rubberized Fabrics; General
33000202	Industrial Processes; Textile Products; Rubberized Fabrics; Wet Coating: General **
33000203	Industrial Processes; Textile Products; Rubberized Fabrics; Hot Melt Coating: General **
33000211	Industrial Processes; Textile Products; Rubberized Fabrics; Impregnation
33000212	Industrial Processes; Textile Products; Rubberized Fabrics; Wet Coating
33000213	Industrial Processes; Textile Products; Rubberized Fabrics; Hot Melt Coating
33000214	Industrial Processes; Textile Products; Rubberized Fabrics; Wet Coating Mixing
33000297	Industrial Processes; Textile Products; Rubberized Fabrics; Other Not Classified
33000298	Industrial Processes; Textile Products; Rubberized Fabrics; Other Not Classified
33000299	Industrial Processes; Textile Products; Rubberized Fabrics; Other Not Classified
40201101	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Coating Operation (Also See Specific Coating Method Codes 4-02-04X)
40201103	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Coating Mixing (Also See Specific Coating Method Codes 4-02-04X)
40201104	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Coating Storage (Also See Specific Coating Method Codes 4-02-04X)
40201105	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Equipment Cleanup:Fabric Coating(Also Spec Coat Method Codes 4-02-04X)
40201111	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Fabric Printing: Roller (Also See New Codes Under 4-02-040-XX)

40201112	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Fabric Printing: Roller (Also See New Codes Under 4-02-040-XX)
40201113	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Fabric Printing: Rotary Screen (Also See New Codes Under 4-02-040-XX)
40201114	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Fabric Printing: Rotary Screen (Also See New Codes Under 4-02-040-XX)
40201115	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Fabric Printing: Flat Screen (Also See New Codes Under 4-02-040-XX)
40201116	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Fabric Printing: Flat Screen (Also See New Codes Under 4-02-040-XX)
40201121	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Fabric Print:Dryer: Steam Coil (Also See New Codes Under 4-02-040-XX)
40201122	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Fabric Print:Dryer: Fuel-fired (Also See New Codes Under 4-02-040- XX)
40201197	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Misc. Fugitives: Specify in Comments (Also New Codes 4-02-040-XX)
40201198	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Misc. Fugitives: Specify in Comments (Also New Codes 4-02-040-XX)
40201199	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating/Printing; Other Not Classified (Also See New Codes Under 4-02-040-XX)
40204001	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Printing; Roller: Print Paste
40204002	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Printing; Roller: Application
40204003	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Printing; Roller: Transfer
40204004	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Printing; Roller: Steam Cans/Drying
40204010	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Printing; Rotary Screen: Print Paste
40204011	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Printing; Rotary Screen: Application
40204012	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Printing; Rotary Screen: Transfer
40204013	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Printing; Rotary Screen: Drying/Curing
40204020	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Printing; Flat Screen: Print Paste
40204021	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Printing; Flat Screen: Application
40204022	Chemical Evaporation; Surface Coating Operations; Fabric Printing; Flat Screen: Transfer
40204023	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Printing; Flat Screen: Drying/Curing
40204121	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Knife Coating; Mixing Tanks
40204130	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Knife Coating; Coating Application
40204140	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Knife Coating; Drying/Curing
40204150	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Knife Coating; Cleanup

40204151	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Knife Coating; Cleanup: Coating Application Equipment
40204152	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Knife Coating; Cleanup: Empty Coating Drums
40204160	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Knife Coating; Waste
40204161	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Knife Coating; Waste: Cleaning Rags
40204162	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Knife Coating; Waste: Waste Ink Disposal
40204221	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Roller Coating; Mixing Tanks
40204230	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Roller Coating; Coating Application
40204240	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Roller Coating; Drying/Curing
40204250	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Roller Coating; Cleanup
40204251	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Roller Coating; Cleanup: Coating Application Equipment
40204252	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Roller Coating; Cleanup: Empty Coating Drums
40204260	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Roller Coating; Waste
40204261	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Roller Coating; Waste: Cleaning Rags
40204262	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Roller Coating; Waste: Waste Ink Disposal
40204321	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Dip Coating; Mixing Tanks
40204330	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Dip Coating; Coating Application
40204340	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Dip Coating; Drying/Curing
40204350	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Dip Coating; Cleanup
40204351	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Dip Coating; Cleanup: Coating Application Equipment
40204352	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Dip Coating; Cleanup: Empty Coating Drums
40204360	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Dip Coating; Waste
40204361	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Dip Coating; Waste: Cleaning Rags
40204362	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Dip Coating; Waste: Waste Ink Disposal
40204421	Chemical Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Mixing Tanks
40204430	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Coating Application

40204431	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Coating Application: First Roll Applicator
40204432	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Coating Application: Second Roll Applicator
40204435	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Lamination: Laminating Device
40204440	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Drying/Curing
40204441	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Drying/Curing: First Predrier
40204442	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Drying/Curing: Second Predrier
40204443	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Drying/Curing: Main Drying Tunnel
40204450	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Cooler
40204455	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Winding
40204460	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Cleanup
40204461	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Cleanup: Coating Application Equipment
40204462	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Cleanup: Empty Coating Drums
40204470	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Waste
40204471	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Waste: Cleaning Rags
40204472	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Transfer Coating; Waste: Waste Ink Disposal
40204521	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Mixing Tanks
40204530	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Coating Application
40204531	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Coating Application: Extruder
40204532	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Coating Application: Coating Die
40204550	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Cooling Cylinder
40204555	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Winding
40204560	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Cleanup
40204561	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Cleanup: Coating Application Equipment
40204562	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Cleanup: Empty Coating Drums
40204570	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Waste

40204571	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Waste: Cleaning Rags
40204572	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Extrusion Coating; Waste: Waste Ink Disposal
40204621	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Mixing Tanks
40204630	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Coating Application
40204631	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Coating Application: Calendar Rolls
40204632	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Coating Application: Pick Up Roll
40204650	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Cooling Rolls
40204655	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Winding
40204660	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Cleanup
40204661	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Cleanup: Coating Application Equipment
40204662	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Cleanup: Empty Coating Drums
40204670	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Waste
40204671	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Waste: Cleaning Rags
40204672	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Melt Roll Coating; Waste: Waste Ink Disposal
40204721	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Mixing Tanks
40204730	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Coating Application
40204735	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Coagulation Baths and Solvent Separation
40204740	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Solvent Recovery
40204750	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Drying
40204755	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Winding
40204760	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Cleanup
40204761	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Cleanup: Coating Application Equipment
40204762	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Cleanup: Empty Coating Drums
40204770	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Waste
40204771	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Waste: Cleaning Rags

40204772	Petroleum and Solvent Evaporation; Surface Coating Operations; Fabric Coating, Coagulation Coating; Waste: Waste Ink Disposal

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Permanent Total Enclosure (PTE; Metal Can Surface Coating)

Abbreviation: VPTENMCSC

Description: Application: A permanent total enclosure (PTE) completely surrounds a source of emissions such that all VOC emissions are captured and contained for discharge to a control device.
A metal can is defined as a usually cylindrical metal container, but governmental agencies and industry groups use differing criteria to identify cans including shape, materials, capacity, phase of product contained, and material thickness (gauge). Decorative tins, bottle caps and jar lids are also included in the can coating category since many of these items are coated on the same line where can coating takes place. Cans consist of can bodies and can ends. Metal can surface coating facilities include two-piece beverage can body facilities, twopiece food can body facilities, one-piece aerosol can body facilities, sheetcoating facilities, three-piece food can body assembly facilities, three-piece non-food can body assembly facilities, and end lining facilities. EPA evaluated VOC emission control options for the two-piece beverage can, twopiece food can and sheetcoating facilities using a PTE in conjunction with a thermal oxidizer in the MACT standard-setting process for this source category. The option presented here has applicability to processes that use "high" VOC content materials (solvent-borne materials).

Class: Known

Pollutant: VOC

Equipment Life: 15.0 years

Control Technology: Permanent Total Enclosure (PTE)

Source Group: Metal Can Surface Coating

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$8,469
Ref Yr CPT:	$10,649
Control Efficiency:	95.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	

Effective Date:	N/A
Cost Year:	2002
CPT:	$8,469
Ref Yr CPT:	$10,649
Control Efficiency:	95.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40201799	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Other Not Classified
40201739	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Three Piece Can Coating Line (All Coating Solvent Emission Points)
40201738	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Two Piece Can Lithographic Coating Line
40201737	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Three Piece Can End Sealing Compound
40201736	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Two-piece Can End Sealing Compound
40201735	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Two-piece Can Coating Line
40201734	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Three-piece Can Interior Body Spray Coat
40201733	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Three-piece Can-side Seam Spray Coating
40201732	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Three-piece Can Sheet Lithographic Coating Line
40201731	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Three-piece Can Sheet Base Coating
40201729	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Exterior End Coating

40201728	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Over Varnish
40201727	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Lithography
40201726	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; End Sealing Compound (Also See 4-02-017-36 & -37)
40201725	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Side Seam Spray Coating
40201724	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Sheet Base Coating (Exterior)
40201723	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Sheet Base Coating (Interior)
40201722	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Interior Spray Coating
40201721	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Two Piece Exterior Base Coating
40201706	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Solvent Storage
40201705	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Equipment Cleanup
40201704	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Coating Storage
40201703	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Coating Mixing
40201702	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Can Coating; Cleaning/Pretreatment

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name:	Permanent Total Enclosure (PTE; Metal Furniture Surface Coating)
Abbreviation:	VPTENMFSC
Description:	Application: A permanent total enclosure (PTE) completely surrounds a source of emissions such that all VOC emissions are captured and contained for discharge to a control device. Metal furniture surface coating operations involve: --Surface preparation of the metal furniture prior to coating application --Preparation of a coating for application (e.g., mixing in additives, dissolving resins) --Application of a coating to metal furniture --Flashoff, drying, and curing following coating application --Cleaning of equipment used in the coating application operation --Storage of coatings, additives, and cleaning materials --Conveyance of coatings, additives, and cleaning materials from storage areas to mixing areas or to coating application areas, either manually or by automated means --Handling and conveyance of waste materials generated by the surface coating operation. The EPA evaluated VOC emission control options for the metal furniture coating industry including the use of a PTE in conjunction with a thermal oxidizer in the MACT standard-setting process for this source category. The option presented here has applicability to processes that use "high" VOC content materials (solvent-borne materials).
Class:	Known
Pollutant:	VOC
Equipment Life:	15.0 years
Control Technology:	Permanent Total Enclosure (PTE)
Source Group:	Metal Furniture Surface Coating
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1998
CPT:	$19,321
Ref Yr CPT:	$26,198
Control Efficiency:	95.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1998
CPT:	$19,321
Ref Yr CPT:	$26,198
Control Efficiency:	95.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40202599	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Other Not Classified
40202546	Chemical Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Single Coat Application: Flashoff
40202545	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Single Coat Application: Flow Coat
40202544	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Single Coat Application: Dip
40202543	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Single Coat Application: Spray, Water-borne
40202542	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Single Coat Application: Spray, High Solids
40202537	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Manual Two Coat, Spray and Air Dry
40202536	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Conveyor Two Coat, Spray
40202535	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Conveyor Two Coat, Dip and Spray
40202534	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Conveyor Two Coat, Flow and Spray

40202533	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Conveyor Single Spray
40202532	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Conveyor Single Dip
40202531	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Conveyor Single Flow
40202525	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Topcoat Application: Flashoff
40202524	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Topcoat Application: Flow Coat
40202523	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Topcoat Application: Dip
40202522	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Topcoat Application: Spray, Water-borne
40202521	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Topcoat Application: Spray, High Solids
40202520	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Topcoat Application
40202515	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Prime Coat Application: Flashoff
40202512	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Prime Coat Application: Spray, Water-borne
40202511	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Prime Coat Application: Spray, High Solids
40202510	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Prime Coat Application
40202505	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Equipment Cleanup
40202504	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Coating Storage
40202503	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Coating Mixing
40202502	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Cleaning/Pretreatment
40202501	Petroleum and Solvent Evaporation; Surface Coating Operations; Miscellaneous Metal Parts; Coating Operation

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Permanent Total Enclosure (PTE; Paper and Other Web Coating)

Abbreviation: VPTENPOWC

Description: Application: A permanent total enclosure (PTE) completely surrounds a source of emissions such that all VOC emissions are captured and contained for discharge to a control device. The paper and other web coating category includes the surface coating of pressure sensitive tapes and labels, photographic film, industrial and decorative laminates, flexible vinyl products, flexible packaging, abrasive products and folding paperboard boxes (flexible packaging, flexible vinyl products and folding paperboard boxes emissions are also treated in the paper printing source category). The EPA evaluated VOC emission control options for the paper and other web coating industry including the use of a PTE in conjunction with a regenerative thermal oxidizer in the MACT standard-setting process for this source category.

Class: Known

Pollutant: VOC

Equipment Life: 15.0 years

Control Technology: Permanent Total Enclosure (PTE)

Source Group: Paper and Other Web Coating

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1998
CPT:	$1,503
Ref Yr CPT:	$2,038
Control Efficiency:	95.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1998
CPT:	$1,503
Ref Yr CPT:	$2,038

Control Efficiency:	95.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30701199	Industrial Processes; Pulp and Paper and Wood Products; Paper Coating and Glazing; Extrusion Coating Line with Solvent Free Resin/Wax
31605001	Industrial Processes; Photographic Film Manufacturing; Product Manufacturing - Surface Treatments; Surface Coating Operations
31605002	Industrial Processes; Photographic Film Manufacturing; Product Manufacturing - Surface Treatments; Grid Ionizers
31605003	Industrial Processes; Photographic Film Manufacturing; Product Manufacturing - Surface Treatments; Corona Discharge Treatment
31605004	Industrial Processes; Photographic Film Manufacturing; Product Manufacturing - Surface Treatments; Photographic Drying Operations
31616001	Industrial Processes; Photographic Film Manufacturing; Support Activities - Other Operations; General Ventillation - Manufacturing Areas
31616002	Industrial Processes; Photographic Film Manufacturing; Support Activities - Other Operations; General Process Tank Operations
31616003	Industrial Processes; Photographic Film Manufacturing; Support Activities - Other Operations; Miscellaneous Manufacturing Operations
31616004	Industrial Processes; Photographic Film Manufacturing; Support Activities - Other Operations; Paint Spraying Operations
31616005	Industrial Processes; Photographic Film Manufacturing; Support Activities - Other Operations; General Maintenance Operations
31616006	Industrial Processes; Photographic Film Manufacturing; Support Activities - Other Operations; Chemical Weighing Operations
40201301	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Operation
40201303	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Mixing
40201304	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Storage

40201305	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Equipment Cleanup
40201310	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Application: Knife Coater
40201320	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Application: Reverse Roll Coater
40201330	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Application: Rotogravure Printer
40201399	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Other Not Classified
40202201	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Coating Operation
40202202	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Cleaning/Pretreatment
40202203	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Coating Mixing
40202204	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Coating Storage
40202205	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Equipment Cleanup
40202206	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Business: Baseline Coating Mix
40202207	Chemical Evaporation; Surface Coating Operations; Plastic Parts; Business: Low Solids Solvent-borne Coating
40202208	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Business: Medium Solids Solvent-borne Coating
40202209	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Business: High Solids Coating (25% Efficiency)
40202210	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Business: High Solids Solvent-borne Coating (40% Efficiency)
40202211	Chemical Evaporation; Surface Coating Operations; Plastic Parts; Business: Water-borne Coating
40202212	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Business: Low Solids Solvent-borne EMI/RFI Shielding Coating
40202213	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Business: Higher Solids Solvent-borne EMI/RFI Shielding Coating
40202214	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Business: Water-borne EMI/RFI Shielding Coating
40202215	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Business: Zinc Arc Spray
40202220	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Prime Coat Application
40202229	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Prime Coat Flashoff
40202230	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Color Coat Application
40202239	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Color Coat Flashoff
40202240	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Topcoat/Texture Coat Application
40202249	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Topcoat/Texture Coat Flashoff
40202250	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; EMI/RFI Shielding Coat Application

40202259	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; EMI/RFI Shielding Coat Flashoff
40202270	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Sanding/Grit Blasting Prior to EMI/RFI Shielding Coat Application
40202280	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Maskant Application
40202299	Petroleum and Solvent Evaporation; Surface Coating Operations; Plastic Parts; Other Not Classified

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Permanent Total Enclosure (PTE; Product and Packaging Rotogravure)
Abbreviation: VPTENPPRS
Description: Application: A permanent total enclosure (PTE) completely surrounds a source of emissions such that all VOC emissions are captured and contained for discharge to a control device. Product and packaging rotogravure includes folding cartons, flexible packaging, labels and wrappers, gift wraps, wall coverings, vinyl printing, decorative laminates, floor coverings, tissue products and miscellaneous specialty products such as cigarette tipping paper. The EPA evaluated VOC emission control options for the Product and Package rotogravure printing industry including the use of a PTE in conjunction with a solvent concentrator in the MACT standard-setting process for this source category.
Class: Known
Pollutant: VOC
Equipment Life: 15.0 years
Control Technology: Permanent Total Enclosure (PTE)
Source Group: Product and Package Rotogravure Printing
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1993
CPT:	$12,770
Ref Yr CPT:	$18,900
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1993
CPT:	$12,770
Ref Yr CPT:	$18,900
Control Efficiency:	96.0

Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40201330	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Application: Rotogravure Printer

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name:	Permanent Total Enclosure (PTE; Publication Rotogravure Printing)
Abbreviation:	VPTENPRPG
Description:	Application: A permanent total enclosure (PTE) completely surrounds a source of emissions such that all VOC emissions are captured and contained for discharge to a control device. Publication rotogravure primarily involves the printing of magazines, catalogs and advertising inserts. The EPA evaluated VOC emission control options for the Publication rotogravure printing industry, including the use of a PTE in conjunction with a solvent concentrator in the MACT standard-setting process for this source category.
Class:	Known
Pollutant:	VOC
Equipment Life:	15.0 years
Control Technology:	Permanent Total Enclosure (PTE)
Source Group:	Publication Rotogravure Printing
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1993
CPT:	$2,422
Ref Yr CPT:	$3,585
Control Efficiency:	95.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1993
CPT:	$2,422
Ref Yr CPT:	$3,585
Control Efficiency:	95.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremementall CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40201330	Petroleum and Solvent Evaporation; Surface Coating Operations; Paper Coating; Coating Application: Rotogravure Printer

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Reformulation-Process Modification;Rubber/Plastics Coating
Abbreviation: VRBPLS1145
Description: Application: SCAQMD Rule 1145 - Plastic, Rubber, and Glass Coatings was adopted to reduce VOC emissions from plastic, rubber, and glass operations. Since its adoption, this rule has been amended numerous times incorporating more stringent VOC limits as the technology and low VOC coatings have become available. The last amendment in March 1996 was to exempt aerosol coatings and to provide rule consistency with the recently adopted ARB Aerosol Coating Products Rule.

There are a variety of control methods to reduce VOCs from plastic, rubber, and glass coatings operations. VOC emissions can be reduced by using reformulated low-VOC content compliant coatings, UV curable coatings, high transfer efficiency coating applications and increased effectiveness of add-on control equipment.

Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Reformulation-Process Modification
Source Group: Rubber/Plastics Coating
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1996-03-01 00:00:00.0
Cost Year:	1993
CPT:	$4,850
Ref Yr CPT:	$7,178
Control Efficiency:	60.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1996-03-01 00:00:00.0
Cost Year:	1993
CPT:	$4,850
Ref Yr CPT:	$7,178

Control Efficiency:	60.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2430000000	Solvent Utilization; Rubber/Plastics; All Processes; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan - Appendix IV-A. Stationary and Mobile Source Control Measures," August 1996.

Other information:

Summary:

Control Measure Name:	Solvent Recovery System; Printing/Publishing
Abbreviation:	VREEVPRPU
Description:	Application: This control is the implementation of reduced petroleum and solvent evaporation to reduce VOC emissions from printing and publishing operations. This is achieved through the use of solvent recovery systems incorporating activated carbon adsorption and steam regeneration. The recovered solvent is blended with purchased ink to maintain the proper viscosity for printing. Excess solvent is resold to the ink manufacturers.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Solvent Recovery System
Source Group:	Printing/Publishing
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$1,200
Ref Yr CPT:	$1,353
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$1,200
Ref Yr CPT:	$1,353
Control Efficiency:	90.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40500701	Petroleum and Solvent Evaporation; Printing/Publishing; Printing; Solvent Storage
40500601	Petroleum and Solvent Evaporation; Printing/Publishing; Printing; Ink Mixing
40500599	Petroleum and Solvent Evaporation; Printing/Publishing; Printing; Ink Thinning Solvent
40500598	Petroleum and Solvent Evaporation; Printing/Publishing; General; Ink Thinning Solvent: Other Not Specified
40500597	Petroleum and Solvent Evaporation; Printing/Publishing; General; Other Not Classified
40500514	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Cleanup Solvent
40500513	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Gravure: 2754
40500512	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Gravure: 2754
40500511	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Printing
40500510	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Ink Thinning Solvent, Toluene
40500507	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Ink Thinning Solvent, Methyl Isobutyl Ketone
40500506	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Ink Thinning Solvent, Methyl Ethyl Ketone
40500503	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Ink Thinning Solvent, Ethyl Acetate
40500502	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Ink Thinning Solvent, Dimethylformamide
40500501	Petroleum and Solvent Evaporation; Printing/Publishing; Gravure; Gravure: 2754
40500422	Petroleum and Solvent Evaporation; Printing/Publishing; Offset Lithography; Heatset Solvent Storage
40500412	Petroleum and Solvent Evaporation; Printing/Publishing; Lithographic; Lithographic: 2752
40500411	Petroleum and Solvent Evaporation; Printing/Publishing; Lithographic; Lithographic: 2752
40500401	Petroleum and Solvent Evaporation; Printing/Publishing; Lithographic; Printing

40500314	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Propyl Alcohol Cleanup
40500312	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Printing: Flexographic
40500311	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Printing: Flexographic
40500307	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Naphtha
40500306	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, n-Propyl Alcohol
40500305	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Isopropyl Alcohol
40500304	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Ethyl Alcohol
40500303	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Cellosolve
40500302	Petroleum and Solvent Evaporation; Printing/Publishing; Flexographic; Ink Thinning Solvent, Carbitol
40500211	Petroleum and Solvent Evaporation; Printing/Publishing; Letter Press; Letter Press: 2751
40500203	Petroleum and Solvent Evaporation; Printing/Publishing; Letter Press; Ink Thinning Solvents, Mineral Solvents
40500202	Petroleum and Solvent Evaporation; Printing/Publishing; Letter Press; Ink Thinning Solvent, Kerosene

References:

- EPA, 1995: U.S. Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants: Printing and Publishing Industry Background Information for Proposed Standards, February 1995.

Other information:

Summary:

Control Measure Name: Reduced Evaporation; Surface Coating Operations; Large Appliances
Abbreviation: VREEVSCOL
Description: Application: This control is the implementation of reduced petroleum and solvent evaporation to reduce VOC emissions from surface coating operations.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Petroleum and Solvent Evaporation
Source Group: Surface Coating Operations
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$500
Ref Yr CPT:	$564
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$500
Ref Yr CPT:	$564
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40201499	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Other Not Classified
40201438	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Top Electrostatic Spray
40201437	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Top Air Spray
40201436	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Electro-deposition
40201435	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Dip Coat
40201434	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Flow Coat
40201433	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Electrostatic Spray
40201432	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Air Spray
40201431	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Coating Line: General
40201411	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Topcoat Flashoff
40201410	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Coat Flashoff
40201406	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Topcoat Spray
40201405	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Equipment Cleanup
40201404	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Coating Storage
40201403	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Coating Mixing
40201402	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Cleaning/Pretreatment

40201401	Petroleum and Solvent Evaporation; Surface Coating Operations; Large Appliances; Prime Coating Operation

References:

- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan - Appendix IV-A. Stationary and Mobile Source Control Measures," August 1996.

Other information:

Summary:

Control Measure Name:	Reduced Evaporation; Surface Coating Operations; Metal Furniture Operation
Abbreviation:	VREEVSCOM
Description:	Application: This control is the implementation of reduced petroleum and solvent evaporation to reduce VOC emissions from surface coating operations.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Petroleum and Solvent Evaporation
Source Group:	Surface Coating Operations
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$118
Ref Yr CPT:	$133
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$118
Ref Yr CPT:	$133
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40202099	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Other Not Classified
40202039	Chemical Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Coat Application: Flashoff
40202038	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Coat Application: Flow Coat
40202037	Chemical Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Coat Application: Dip
40202036	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Coat Application: Spray, Water-borne
40202035	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Coat Application: Spray, High Solids
40202034	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Spray Water-borne Coating ** (Use 4-02-020-36)
40202033	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Spray High Solids Coating ** (Use 4-02-020-35)
40202032	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Spray Dip Line: General ** (Use 4-02-020-37)
40202031	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Single Spray Line: General
40202025	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application: Flashoff
40202024	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application: Flow Coat
40202023	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application: Dip
40202022	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application: Spray, Water-borne
40202021	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application: Spray, High Solids
40202020	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Topcoat Application

40202015	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application: Flashoff
40202014	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application: Flow Coat
40202013	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application: Dip
40202012	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application: Spray, Water-borne
40202011	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application: Spray, High Solids
40202010	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Prime Coat Application
40202005	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Equipment Cleanup
40202004	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Coating Storage
40202003	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Coating Mixing
40202002	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Cleaning/Pretreatment
40202001	Petroleum and Solvent Evaporation; Surface Coating Operations; Metal Furniture Operations; Coating Operation

References:

N/A

Other information:

Summary:

Control Measure Name:	Solvent substitution, non-atomized resin application methods; Fiberglass Boat Manufacturing
Abbreviation:	VSOLSFBM
Description:	Application: EPA issued a CTG during 2008 that provides control recommendations for reducing VOC emissions from the use of gel coats, resins, and materials used to clean application equipment in fiberglass boat manufacturing operations. The CTG recommends the use of low-VOC content (monomer and non-monomer VOC) resin and gel coats with specified application methods. The CTG recommends the use of covers on mixing containers to further reduce VOC emissions from gel coats and resins. The CTG also recommends the use of low-VOC and low vapor pressure cleaning materials. Because the CTG recommendations are based on the 2001 NESHAP for boat manufacturing, those facilities that are major sources of HAP are already complying with the 2001 NESHAP and have already adopted these control measures. Because the 2001 NESHAP does not apply to area sources, area source fiberglass boat manufacturing facilities are not currently required to implement the measures provided in the NESHAP and recommended in the CTG. There are boat manufacturing facilities in ozone nonattainment areas that meet the applicability threshold in the CTG and would provide VOC emission reductions when the CTG recommended controls are applied. These control approaches are recommended for all fiberglass boat manufacturing facilities where total actual VOC emissions from all fiberglass boat manufacturing operations are equal to or exceed 15 lb/day.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Solvent substitution, non-atomized resin application methods
Source Group:	Fiberglass Boat Manufacturing
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$4,200
Ref Yr CPT:	$4,737
Control Efficiency:	35.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$4,200
Ref Yr CPT:	$4,737
Control Efficiency:	35.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrementemal CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
31401518	Industrial Processes; Transportation Equipment; Boat Manufacturing; Open Contact Molding: Resin/Laminate Curing
31401517	Industrial Processes; Transportation Equipment; Boat Manufacturing; Open Contact Molding: Resin Spray Layup
31401516	Industrial Processes; Transportation Equipment; Boat Manufacturing; Open Contact Molding: Resin Hand Layup
31401515	Industrial Processes; Transportation Equipment; Boat Manufacturing; Open Contact Molding: Resin/Laminate Application, Hand Layup,Spraying
31401514	Industrial Processes; Transportation Equipment; Boat Manufacturing; Open Contact Molding: Resin/Laminate Application, Machine Layup
31401513	Industrial Processes; Transportation Equipment; Boat Manufacturing; Open Contact Molding: Gel Coat Curing
31401512	Industrial Processes; Transportation Equipment; Boat Manufacturing; Open Contact Molding: Spray Gel Coat Application
31401511	Industrial Processes; Transportation Equipment; Boat Manufacturing; Open Contact Molding: Manual Gel Coat Application
31401504	Industrial Processes; Transportation Equipment; Boat Manufacturing; Resin Transfer
31401503	Industrial Processes; Transportation Equipment; Boat Manufacturing; Resin Storage

References:

- EPA, 2008: U.S. Environmental Protection Agency, "Control Techniques for Fiberglass Boat Manufacturing Materials," EPA-453/R-08-004, September 2008.

Other information:

Summary:

Control Measure Name:	Solvent Substitution; Miscellaneous Industrial Adhesives
Abbreviation:	VSOLSMIA
Description:	Application: EPA issued a CTG for miscellaneous industrial adhesives in 2008. This provides information for states to consider in determining RACT. EPA's recommended emission limits are based on the OTC Model Rule for Adhesives and Sealants. The emission limits in the OTC rule were the same as California ARB RACT standards, which were based on numerous California district rules. EPA recommends that the control approaches suggested apply to each miscellaneous industrial adhesive application process at a facility where the total actual VOC emissions from all application processes, including related cleaning activities at that facility are equal to or exceed 15 lbs per day before consideration of controls. EPA recommends specific VOC emission limits based on application processes. There are two options for achieving recommended emission limits: (1) through the use of low-VOC content adhesives and specified application methods with good adhesive transfer efficiency; or (2) through the use of a combination of low-VOC adhesives, specified methods and add-on controls. As an alternative to the emission limits, an overall 85 percent control efficiency is recommended. EPA expects that in practice, facilities will choose the low-VOC materials alternative.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Solvent Substitution
Source Group:	Miscellaneous Industrial Adhesives
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$265
Ref Yr CPT:	$299
Control Efficiency:	64.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A

Cost Year:	2006
CPT:	$265
Ref Yr CPT:	$299
Control Efficiency:	64.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40200712	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Roll-on
40200711	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Spray
40200710	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: General
40200707	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Solvent Storage
40200706	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: Solvent Mixing
40200701	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive Application

References:

- EPA, 2008: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques Guidelines for Miscellaneous Industrial Adhesives," Research Triangle Park, NC, September 2008.

Other information:

Summary:

Control Measure Name: Reduced Solvent Utilization; Coating; Arts; Miscellaneous
Abbreviation: VSOLUTIL1
Description: Application: This control is the implementation of reduced solvent utilization to reduce VOC emissions from art coatings.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Solvent Utilization
Source Group: Coating; Arts; Miscellaneous
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$1,200
Ref Yr CPT:	$1,353
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$1,200
Ref Yr CPT:	$1,353
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2425040000	Solvent Utilization; Graphic Arts; Flexography; Total: All Solvent Types
2461050000	Solvent Utilization; Miscellaneous Non-industrial: Commercial; Film Roofing: All Processes; Total: All Solvent Types
2425030000	Solvent Utilization; Graphic Arts; Rotogravure; Total: All Solvent Types
2401030000	Solvent Utilization; Surface Coating; Paper: SIC 26; Total: All Solvent Types

References:

- STAPPA/ALAPCO, 1993: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Meeting the 15 Percent Rate of Progress Requirement Under the Clean Air Act: A Menu of Options," September 1993.

Other information:

Summary:

Control Measure Name: Reduced Solvent Utilization; Coating; Arts
Abbreviation: VSOLUTIL2
Description: Application: This control is the implementation of reduced solvent utilization to reduce VOC emissions from art coatings.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Solvent Utilization
Source Group: Coating; Arts
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$500
Ref Yr CPT:	$564
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	$500
Ref Yr CPT:	$564
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401060000	Solvent Utilization; Surface Coating; Large Appliances: SIC 363; Total: All Solvent Types
2425010000	Solvent Utilization; Graphic Arts; Lithography; Total: All Solvent Types

References:

- STAPPA/ALAPCO, 1993: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Meeting the 15 Percent Rate of Progress Requirement Under the Clean Air Act: A Menu of Options," September 1993.

Other information:

Summary:

Control Measure Name:	LPV Relief Valve;Stage II Service Stations
Abbreviation:	VSTGIILPV1
Description:	Application: This control measure is the addition of low pressure/vacuum (LP/V) relief valves to gasoline storage tanks at service stations with Stage II control systems. LP/V relief valves prevent breathing emissions from gasoline storage tank vent pipes. This control measure applies to all gasoline service stations with Stage II control systems, classified under SCC 2501060100.
Class:	Known
Pollutant:	VOC
Equipment Life:	10.0 years
Control Technology:	LPV Relief Valve
Source Group:	Stage II Service Stations
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1995-01-01 00:00:00.0
Cost Year:	1991
CPT:	$1,080
Ref Yr CPT:	$1,674
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1995-01-01 00:00:00.0
Cost Year:	1991
CPT:	$1,080
Ref Yr CPT:	$1,674
Control Efficiency:	92.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2501060103	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 2: Spillage
2501060101	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 2: Displacement Loss/Uncontrolled
2501060100	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 2: Total

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- EPA, 1995: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stage II Comparability Study for the Northeast Ozone Transport Region," Research Triangle Park, NC, January 1995.
- SCAQMD, 1995: South Coast Air Quality Management District, "Staff Report for: Proposed Amendments to Rule 461 - Gasoline Transfer and Dispensing," August 1995.

Other information:

Summary:

Control Measure Name: LPV Relief Valve;Stage II Service Stations - Underground Tanks

Abbreviation: VSTGIILPV2

Description: Application: This control measure is the addition of low pressure/vacuum (LP/V) relief valves to underground gasoline storage tanks at service stations with Stage II control systems. LP/V relief valves prevent breathing emissions from gasoline storage tank vent pipes.

This control measure applies to all gasoline service stations with underground gasoline storage tanks, classified under SCC 2501060201.

Class: Known

Pollutant: VOC

Equipment Life: 10.0 years

Control Technology: LPV Relief Valve

Source Group: Stage II Service Stations - Underground Tanks

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1995-01-01 00:00:00.0
Cost Year:	1991
CPT:	$1,080
Ref Yr CPT:	$1,674
Control Efficiency:	73.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1995-01-01 00:00:00.0
Cost Year:	1991
CPT:	$1,080
Ref Yr CPT:	$1,674
Control Efficiency:	73.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2501060201	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Underground Tank: Breathing and Emptying

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- EPA, 1995: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stage II Comparability Study for the Northeast Ozone Transport Region," Research Triangle Park, NC, January 1995.
- SCAQMD, 1995: South Coast Air Quality Management District, "Staff Report for: Proposed Amendments to Rule 461 - Gasoline Transfer and Dispensing," August 1995.

Other information:

Summary:

Control Measure Name: Gas Recovery;Municipal Solid Waste Landfill
Abbreviation: VSWASRECOV
Description: Application: This control is the application of gas capture systems to cappable landfills to reduce the VOC emissions from decaying organic matter. The majority of the VOC captured is methane.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Gas Recovery
Source Group: Municipal Solid Waste Landfill
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1984-05-01 00:00:00.0
Cost Year:	1992
CPT:	$700
Ref Yr CPT:	$1,061
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1984-05-01 00:00:00.0
Cost Year:	1992
CPT:	$700
Ref Yr CPT:	$1,061
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0

Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2620030000	Waste Disposal, Treatment, and Recovery; Landfills; Municipal; Total
2620000000	Waste Disposal, Treatment, and Recovery; Landfills; All Categories; Total

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.
- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- CDPR, 1999: California Department of Pesticide Regulation website: www.cdpr.ca.gov.

Other information:

Summary:

Control Measure Name: Add-On Controls;Wood Furniture Surface Coating

Abbreviation: VWDCTADDON

Description: Application: This control measure is generic in that it represents potential add-on controls available for this source category. Add-on controls include thermal incinerators, catalytic incinerators, and a combination of carbon absorbers and catalytic incinerators. This control applies to all wood furniture coating applications.

Discussion: Where facilities can achieve comparable reductions through the use of hybrid waterborne systems, full waterborne systems or other alternative coatings, reductions may be higher and costs may be lower than those estimated based on this add-on control measure. For some of the smallest facilities, add-on controls may not be feasible (Pechan, 1999).

There are control options that were evaluated, but not selected, in EPA's estimates of preemptive RACT requirements for this source category.

Class: Known

Pollutant: VOC

Equipment Life: 10.0 years

Control Technology: Add-On Controls

Source Group: Wood Furniture Surface Coating

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$20,000
Ref Yr CPT:	$32,028
Control Efficiency:	75.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$20,000

Ref Yr CPT:	$32,028
Control Efficiency:	75.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrementental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401020000	Solvent Utilization; Surface Coating; Wood Furniture: SIC 25; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- EPA, 1996: U.S. Environmental Protection Agency, "Control of Volatile Organic Compound Emissions from Wood Furniture Manufacturing Operations," April 1996.

Other information:

Summary:

Control Measure Name: Control Technology Guidelines;Wood Furniture Surface Coating
Abbreviation: VWDCTCTG
Description: Application: The wood furniture coating CTG, published in 1996, applies to ozone nonattainment areas and the Ozone Transport Region (OTR).   This will affect facilities emitting 25 tons per year or more.

The Wood furniture coating industry covers 10 SIC codes including: Wood Kitchen Cabinets; Wood Household Furniture (except upholstered); Wood Household Furniture (upholstered); Wood Television, Radios, Phonograph, and Sewing Machine Cabinets; Household Furniture Not Classified Elsewhere; Wood Office Furniture; Public Building and Related Furniture; Wood Office and Store Fixtures; Furniture and Fixtures Not Elsewhere Classified; and Custom Kitchen Cabinets.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Control Technology Guidelines
Source Group: Wood Furniture Surface Coating
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$967
Ref Yr CPT:	$1,549
Control Efficiency:	47.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$967
Ref Yr CPT:	$1,549

Control Efficiency:	47.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401020000	Solvent Utilization; Surface Coating; Wood Furniture: SIC 25; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- EPA, 1996: U.S. Environmental Protection Agency, "Control of Volatile Organic Compound Emissions from Wood Furniture Manufacturing Operations," April 1996.

Other information:

Summary:

Control Measure Name:	Incineration;Wood Product Surface Coating
Abbreviation:	VWDCTINC
Description:	Application: This is a generic control measure based on the use of incineration to reduce VOC emissions from wood product surface coating facilities. This control measure applies to sources classified as factory finished wood producers, SCC 2401015000.
Class:	Known
Pollutant:	VOC
Equipment Life:	N/A years
Control Technology:	Incineration
Source Group:	Wood Product Surface Coating
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,202
Ref Yr CPT:	$5,612
Control Efficiency:	86.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$4,202
Ref Yr CPT:	$5,612
Control Efficiency:	86.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401015000	Solvent Utilization; Surface Coating; Factory Finished Wood: SIC 2426 thru 242; Total: All Solvent Types

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Reformulation;Wood Product Surface Coating
Abbreviation: VWDCTS1104
Description: Application: This control is the use of product reformulation and product substitution for wood product surface coatings to achieve VOC emissions reductions.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Reformulation
Source Group: Wood Product Surface Coating
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	1999-08-01 00:00:00.0
Cost Year:	1990
CPT:	$881
Ref Yr CPT:	$1,411
Control Efficiency:	53.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	1999-08-01 00:00:00.0
Cost Year:	1990
CPT:	$881
Ref Yr CPT:	$1,411
Control Efficiency:	53.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	not verified cost
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2401015000	Solvent Utilization; Surface Coating; Factory Finished Wood: SIC 2426 thru 242; Total: All Solvent Types

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- SCAQMD, 1996: South Coast Air Quality Management District, "Proposed Modifications to the Appendices of the Draft 1997 Air Quality Management Plan," October 1996.
- SCAQMD, 1999: South Coast Air Quality Management District, "Staff Report: Proposed Amended Rule 1104 - Wood Flat Stock Coating Operations," August 1999.

Other information:

Summary:

Control Measure Name: Work practice standards, solvent substitution, and add-on controls; Industrial Cleaning Solvents

Abbreviation: VWPSSAICS

Description: Application: EPA issued a CTG for industrial cleaning solvents in 2006 that includes recommended control techniques. This category includes the industrial cleaning solvents used by many industries. It includes a variety of products that are used to remove contaminants such as adhesives, inks, paint, dirt, soil, oil and grease. The recommended measures for controlling VOC emissions from the use, storage and disposal of industrial cleaning solvents includes work practice standards, limitations on VOC content of the cleaning materials, and an optional alternative limit on composite vapor pressure of the cleaning materials. They also include the use of add-on controls with an overall emission reduction of at least 85 percent by mass. The first two recommendations and the last one are based on the Bay Area AQMD rule. On average, there is a cost savings associated with replacing high-VOC cleaning materials with low-VOC, waterbased cleaning materials. Facilities may either incur minimal additional costs or realize a savings on a case-by-case basis, depending primarily on how much they currently spend to operate the high VOC content solvent-based parts cleaners, the cost of organic solvent disposal, and air emission fees levied for VOC emissions.

Class: Known

Pollutant: VOC

Equipment Life: N/A years

Control Technology: Work practice standards, solvent substitution, and add-on controls

Source Group: Industrial Cleaning Solvents

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	2006
CPT:	-$1,134
Ref Yr CPT:	-$1,279
Control Efficiency:	94.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A

Cost Year:	2006
CPT:	-$1,134
Ref Yr CPT:	-$1,279
Control Efficiency:	94.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
40100399	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Cold Solvent Cleaning/Stripping; Other Not Classified
40100336	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Cold Solvent Cleaning/Stripping; Degreaser: Entire Unit
40100335	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Cold Solvent Cleaning/Stripping; Entire Unit
40100311	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Cold Solvent Cleaning/Stripping; Glycol Ethers
40100310	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Cold Solvent Cleaning/Stripping; Acetone
40100309	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Cold Solvent Cleaning/Stripping; Freon
40100308	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Cold Solvent Cleaning/Stripping; Methyl Ethyl Ketone
40100307	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Cold Solvent Cleaning/Stripping; Isopropyl Alcohol
40100303	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Cold Solvent Cleaning/Stripping; Stoddard (Petroleum Solvent)
40100301	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Cold Solvent Cleaning/Stripping; Methanol
40100299	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Other Not Classified: Open-top Vapor Degreasing

40100298	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Other Not Classified: Conveyorized Vapor Degreasing
40100296	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Other Not Classified: General Degreasing Units
40100256	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Toluene: General Degreasing Units
40100251	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Stoddard (Petroleum Solvent): General Degreasing Units
40100236	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Entire Unit: with Non-boiling Solvent: Conveyorized Vapor Degreasing
40100235	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Entire Unit: with Vaporized Solvent: Conveyorized Vapor Degreasing
40100221	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Stoddard (Petroleum Solvent): Conveyorized Vapor Degreasing
40100215	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Entire Unit: Open-top Vapor Degreasing
40100209	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Butyl Acetate: Open-top Vapor Degreasing
40100206	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Toluene: Open-top Vapor Degreasing
40100201	Petroleum and Solvent Evaporation; Organic Solvent Evaporation; Degreasing; Stoddard (Petroleum Solvent): Open-top Vapor Degreasing

References:

- EPA, 2006: U.S. Environmental Protection Agency, "Control Techniques Guidelines: Industrial Cleaning Solvents," Research Triangle Park, NC, September 2006.

Other information:

Summary:

Control Measure Name: Wastewater; Petroleum Wastewater
Abbreviation: VWWPWW
Description: Application: This control is the application of wastewater treatment controls to petroleum wastewater sources to reduce VOC emissions.
Class: Known
Pollutant: VOC
Equipment Life: N/A years
Control Technology: Wastewater
Source Group: Petroleum Wastewater
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,750
Ref Yr CPT:	$3,673
Control Efficiency:	65.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	VOC
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,750
Ref Yr CPT:	$3,673
Control Efficiency:	65.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30600503	Industrial Processes; Petroleum Industry; Wastewater Treatment; Process Drains and Wastewater Separators

References:

- "Naess_conversion.xls" spreadsheet provided by Darryl Weatherhead (Weatherhead.Darryl@epamail.epa.gov) via email to Alison Eyth (eyth@unc.gov) 04-Jun-2007

Other information:

SO2 Control Measures

There are 68 SO2 control measures included in this report

Summary:

Control Measure Name:	Amine Scrubbing - Additional Tail Gas Step; Sulfur Recovery Plants - Elemental Sulfur (Claus: 2 Stage w/o control (92-95% removal))
Abbreviation:	SAMSCSRP95
Description:	Application: This control is the use of amine scrubbing add-on controls to reduce SO2 emissions. This control applies to stage 2 elemental sulfur recovery plants with out control, 92-95% removal. Discussion: Refinery sour gas streams are generally fed to a regenerative type of H2S removal process. The concentrated acid gas is then sent to the sulfur recovery unit. The Claus process is the most widely used method of producing sulfur from refinery H2S (Pechan, 1999). The modified Claus process is based on producing elemental sulfur by first converting one-third of the H2S feed by precise combustion with air. The combustion products are then allowed to react thermally with the remaining two-thirds of the H2S feed in the presence of a suitable catalyst to form sulfur vapor.
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Amine Scrubbing - Additional Tail Gas Step
Source Group:	Sulfur Recovery Plants - Elemental Sulfur (Claus: 2 Stage w/o control (92-95% removal))
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	98.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	5
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A

Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	98.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	5
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 5

Description: Non-EGU SO2

Inventory Fields: stack_flow_rate

Formula: Capital Cost = 2882540 + 244.74 x Min. Stack Flow Rate
O&M Cost = 749170 + 148.40 x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + O&M Cost

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30103201	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Mod. Claus: 2 Stage w/o Control (92-95% Removal)

References:

- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT: 0%

CE_TEXT: 98% from uncontrolled

CHEM_PCT: 0%

COST_BASIS:

Capital and annual costs were developed from model plant data (EPA, 1986). The costs are based on stack flowrate in cubic feet per minute.

Cost equations for amine scrubbing:

Capital cost = $2,882,540 + $244.74 * Flow rate

Operating and Maintenance (O&M) cost = $749,170 + $148.40 * Flow rate

Equipment Life in Years = Equiplife = 15 years
Interest Rate = I = 7%
Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1

Annual cost = (Capital cost * CRF) + O&M cost

O&M Cost Components: The O&M cost components for amine scrubbing of Claus system tail gas are based on three model plants as given below (EPA, 1983):

Sulfur Intake	Catalytic Recovery	Claus Recovery
10 tons per day	two-stage	95.1%
50 tons per day	three-stage	96.4%
100 tons per day	three-stage	96.4%

There are no disposal costs and a credit for the recovered product. Annual operating days are assumed to be 350 days. The following assumptions apply to the cost of utilities and disposal:

Catalyst		
a. alumina	17	$/cubic feet
b. cobalt-molybdenum	170	$/cubic feet
Reagent		
a. Diisopropanolamine	1.07	$/lb
b. Soda	300	$/ton
Steam	6.00	$/1000 lb
Steam Condensate	1.25	$/1000 lb
Water		
a. Boiler	0.05	$/1000 gal
b. Cooling	1.50	$/1000 lb
Natural Gas	3.50	$/MMBtu
Electrical energy	0.05	$/kWh
Credit for byproduct recovery	1.88	$/ton

The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.

CPTON_TEXT: The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.

CTRL_EFF_T: 98.4%

ELEC_PCT: 0%

ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	98.4%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.5/cf
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Amine Scrubbing - Additional Tail Gas Step; Sulfur Recovery Plants - Elemental Sulfur (Claus: 3 Stage w/o control (95-96% removal))
Abbreviation:	SAMSCSRP96
Description:	Application: This control is the use of amine scrubbing add-on controls to reduce SO2 emissions. This control applies to stage 3 elemental sulfur recovery plants with out control, 95-96% removal. Discussion: Refinery sour gas streams are generally fed to a regenerative type of H2S removal process. The concentrated acid gas is then sent to the sulfur recovery unit. The Claus process is the most widely used method of producing sulfur from refinery H2S (Pechan, 1999). The modified Claus process is based on producing elemental sulfur by first converting one-third of the H2S feed by precise combustion with air. The combustion products are then allowed to react thermally with the remaining two-thirds of the H2S feed in the presence of a suitable catalyst to form sulfur vapor.
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Amine Scrubbing - Additional Tail Gas Step
Source Group:	Sulfur Recovery Plants - Elemental Sulfur (Claus: 3 Stage w/o control (95-96% removal))
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	98.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	5
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A

Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	98.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	5
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 5

Description: Non-EGU SO2

Inventory Fields: stack_flow_rate

Formula: Capital Cost = 2882540 + 244.74 x Min. Stack Flow Rate
O&M Cost = 749170 + 148.40 x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + O&M Cost

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30103202	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Mod. Claus: 3 Stage w/o Control (95-96% Removal)

References:

- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Emmel, T.E., et al., 1986: "Cost of Controlling Directly Emitted Acidic Emissions from Major Sources," Radian Corporation, Research Triangle Park, NC, (EPA/600/7-88-012), July 1986.

- EPA, 1983: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Review of New Performance Standards for Petroleum Refinery Claus Sulfur Recovery Plants, EPA-450/3-83-014, Research Triangle Park, NC, August 1983.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	98% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Capital and annual costs were developed from model plant data (EPA, 1986). The costs are based on stack flowrate in cubic feet per minute. Cost equations for amine scrubbing: Capital cost = \$2,882,540 + \$244.74 * Flow rate Operating and Maintenance (O&M) cost = \$749,170 + \$148.40 * Flow rate Equipment Life in Years = Equiplife = 15 years Interest Rate = I = 7% Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1 Annual cost = (Capital cost * CRF) + O&M cost O&M Cost Components: The O&M cost components for amine scrubbing of Claus system tail gas are based on three model plants as given below (EPA, 1983): Sulfur Intake Catalytic Recovery Claus Recovery 10 tons per day two-stage 95.1% 50 tons per day three-stage 96.4% 100 tons per day three-stage 96.4% There are no disposal costs and a credit for the recovered product. Annual operating days are assumed to be 350 days. The following assumptions apply to the cost of utilities and disposal: Catalyst a. alumina 17 \$/cubic feet b. cobalt-molybdenum 170 \$/cubic feet Reagent a. Diisopropanolamine 1.07 \$/lb b. Soda 300 \$/ton Steam 6.00 \$/1000 lb Steam Condensate 1.25 \$/1000 lb Water a. Boiler 0.05 \$/1000 gal b. Cooling 1.50 \$/1000 lb Natural Gas 3.50 \$/MMBtu Electrical energy 0.05 \$/kWh Credit for byproduct recovery 1.88 \$/ton The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.
CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	97.8%
ELEC_PCT:	0%
ELEC_RT:	\$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	97.8%
INSRNC_PCT:	0%

MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.5/cf
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Amine Scrubbing - Additional Tail Gas Step; Sulfur Recovery Plants - Elemental Sulfur (Claus: 3 Stage w/o control (96-97% removal))
Abbreviation:	SAMSCSRP97
Description:	Application: This control is the use of amine scrubbing add-on controls to reduce SO2 emissions. This control applies to stage 4 elemental sulfur recovery plants with out control, 96-97% removal. Discussion: Refinery sour gas streams are generally fed to a regenerative type of H2S removal process. The concentrated acid gas is then sent to the sulfur recovery unit. The Claus process is the most widely used method of producing sulfur from refinery H2S (Pechan, 1999). The modified Claus process is based on producing elemental sulfur by first converting one-third of the H2S feed by precise combustion with air. The combustion products are then allowed to react thermally with the remaining two-thirds of the H2S feed in the presence of a suitable catalyst to form sulfur vapor.
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Amine Scrubbing - Additional Tail Gas Step
Source Group:	Sulfur Recovery Plants - Elemental Sulfur (Claus: 3 Stage w/o control (96-97% removal))
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	97.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	5
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A

Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	97.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	5
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 5

Description: Non-EGU SO2

Inventory Fields: stack_flow_rate

Formula: Capital Cost = 2882540 + 244.74 x Min. Stack Flow Rate
O&M Cost = 749170 + 148.40 x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + O&M Cost

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30103203	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Mod. Claus: 4 Stage w/o Control (96-97% Removal)

References:

- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Emmel, T.E., et al., 1986: "Cost of Controlling Directly Emitted Acidic Emissions from Major Sources," Radian Corporation, Research Triangle Park, NC, (EPA/600/7-88-012), July 1986.

- EPA, 1983: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Review of New Performance Standards for Petroleum Refinery Claus Sulfur Recovery Plants, EPA-450/3-83-014, Research Triangle Park, NC, August 1983.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	97% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Capital and annual costs were developed from model plant data (EPA, 1986). The costs are based on stack flowrate in cubic feet per minute. Cost equations for amine scrubbing: Capital cost = $2,882,540 + $244.74 * Flow rate Operating and Maintenance (O&M) cost = $749,170 + $148.40 * Flow rate Equipment Life in Years = Equiplife = 15 years Interest Rate = I = 7% Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1 Annual cost = (Capital cost * CRF) + O&M cost O&M Cost Components: The O&M cost components for amine scrubbing of Claus system tail gas are based on three model plants as given below (EPA, 1983): Sulfur Intake Catalytic Recovery Claus Recovery 10 tons per day two-stage 95.1% 50 tons per day three-stage 96.4% 100 tons per day three-stage 96.4% There are no disposal costs and a credit for the recovered product. Annual operating days are assumed to be 350 days. The following assumptions apply to the cost of utilities and disposal: Catalyst a. alumina 17 $/cubic feet b. cobalt-molybdenum 170 $/cubic feet Reagent a. Diisopropanolamine 1.07 $/lb b. Soda 300 $/ton Steam 6.00 $/1000 lb Steam Condensate 1.25 $/1000 lb Water a. Boiler 0.05 $/1000 gal b. Cooling 1.50 $/1000 lb Natural Gas 3.50 $/MMBtu Electrical energy 0.05 $/kWh Credit for byproduct recovery 1.88 $/ton The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.
CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	97.1%
ELEC_PCT:	0%
ELEC_RT:	$0.05/kWh
FUEL_PCT:	0%
HG_CE_T:	97.1%
INSRNC_PCT:	0%

MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$3.5/cf
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Catalyst Additive to Petroleum Refinery Catalytic and Thermal Cracking Units
Abbreviation:	SCATPETCRK
Description:	Application: This control is the use of catalyst additives in fuel to reduce SO2 emissions from catalytic cracking and thermal cracking units at petroleum refineries.
Class:	Known
Pollutant:	SO2
Equipment Life:	N/A years
Control Technology:	Catalyst Additive
Source Group:	Petroleum Refinery Catalytic and Thermal Cracking Units
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	$1,493
Ref Yr CPT:	$1,791
Control Efficiency:	43.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	$1,493
Ref Yr CPT:	$1,791
Control Efficiency:	43.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30600301	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Thermal Catalytic Cracking Unit
30600202	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Catalyst Handling System
30600201	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Fluid Catalytic Cracking Unit
30600200	Industrial Processes;Petroleum Industry;Catalytic Cracking Units;undefined

References:

- Assessment of Control Technology Options for Petroleum Refineries in the Mid-Atlantic Region. Draft Final Technical Support Document. Prepared by MACTEC Federal Programs, Inc. for MARAMA. October 13, 2006.
- Eagleson, Scott T., Hutter, Edward, Dharia, Dilip J., John, Ramash B. and Singhania, Sudhanshu, "Economic Advantages in Controlling Refinery FCCU Atmospheric Emissions", presented at the XII Refinery Technology Meet, September 23-25

Other information:

Summary:

Control Measure Name:	Chemical Additives to Waste;Residential Distillate Oil Combustion
Abbreviation:	SCHMADDHOM
Description:	Application: This control is the use of chemical additives to the waste produced by residential distillate oil combustion to control SO2 emissions.
Class:	Known
Pollutant:	SO2
Equipment Life:	N/A years
Control Technology:	Chemical Additives to Waste
Source Group:	Residential Nonpoint Source
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$2,350
Ref Yr CPT:	$2,955
Control Efficiency:	75.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$2,350
Ref Yr CPT:	$2,955
Control Efficiency:	75.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104004000	Stationary Source Fuel Combustion; Residential; Distillate Oil; Total: All Combustor Types

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Coke Oven Gas Desulfurization; By-Product Coke Manufacturing (Coke Oven Plants)
Abbreviation: SCOGDCOP
Description: Application: This control is the application of coke oven gas desulfurization to reduce SO2 emissions from by-product coke manufacturing.
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Coke Oven Gas Desulfurization
Source Group: By-product Coke Manufacturing (Coke Oven Plants)
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	6
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	6
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 6

Description: Non-EGU SO2

Inventory Fields: stack_flow_rate

Formula: Capital cost = 3449803 + (135.86 x Min. Stack Flow rate)
O&M Cost = 797667 + (58.84 x Min. Stack Flow Rate)
Total Cost = Capital Cost x CRF + O&M Cost

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30300306	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Oven Underfiring

References:

- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

Summary:

Control Measure Name: Dual absorption; Primary Lead Smelters - Sintering
Abbreviation: SDLABPLSS
Description: Application: This control is to increase adsorption efficiency from existing to NSPS level (99.7%) to reduce SO_2 emissions.

This control applies to primary lead smelters with contact absorption.

Discussion: The contact process is used to produce sulfuric acid from waste gas which contains SO_2. First, the waste gas must be pretreated, which usually involves dust removal, cooling, and scrubbing for further removal of particulate matter and heavy metals, mist, and moisture. After pretreatment, the gas is heated and passed through a catalytic converter (platinum mass units or units containing beds of pelletized vanadium pentoxide) to oxidize the SO_2 to SO_3. The exothermic, reversible oxidation reaction results in a conflict between high equilibrium conversions at lower temperatures and high reaction rates at high temperatures. Because of this, the gas is passed between the catalyst and two or three different heat exchangers in order to achieve conversion of SO_2 to SO_3 of about 92.5 to 98 percent. The gas leaving the final catalyst stage is cooled and introduced to an absorption tower by a stream of strong (98 to 99 percent) acid, where the SO_3 reacts with water in the acid to form additional sulfuric acid. Dilute sulfuric acid or water is added to the recirculating acid to maintain the desired concentration (EPA, 1981; EPA, 1997).

The double-contact, or double-absorption, process for making sulfuric acid from waste gas containing SO_2 is essentially the same as the single-contact process with the addition of an interpass absorption tower. The waste gas is cleaned and dried as in the single-contact process before entering the process. Upon leaving the second or third catalyst bed, depending upon the process, the gas is cooled and introduced to a packed-bed, counter-current absorption tower where it contacts 98 to 99 percent sulfuric acid. After the absorbing tower, the gas is reheated and passed to the third or fourth catalyst bed, where approximately 97 percent of the remaining SO_2 is converted to SO_3 and passed to the final absorption tower for conversion to sulfuric acid as in the single-contact process. No cost data were available for either single- or double-contact sulfuric acid plants controls (EPA, 1981; EPA, 1997).

Class: Known
Pollutant: SO_2
Equipment Life: 15.0 years
Control Technology: Dual absorption
Source Group: Primary Lead Smelters - Sintering
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	99.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A

Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	99.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 4

Description: Non-EGU SO2

Inventory Fields: stack_flow_rate

Formula: Capital Cost = 990000 + 9.836 x Min. Stack flow rate O&M Cost = 75800 + 12.82 x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Min Stack flow Rate >= 1028000 acfm
Min Stack flow Rate < 1028000 acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30301014	Industrial Processes; Primary Metal Production; Lead Production; Sintering Charge Mixing

30301007	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Dual Stream Discharge End
30301006	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Dual Stream Feed End
30301001	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Single Stream

References:

- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1981: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques for Sulfur Oxide Emissions from Stationary Sources," Second Edition, Research Triangle Park, NC, April 1981.
- EPA, 1997: U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors, Volume I, Stationary Point and Area Sources," AP-42, Fifth Edition, Research Triangle Park, NC, October 1997.

Other information:

ADMIN_PCT: 0%

CE_TEXT: 99% from uncontrolled

CHEM_PCT: 0%

COST_BASIS: Capital and annual costs were developed from model plant data (EPA, 1985). The costs are based on stack flowrate in cubic feet per minute.

Cost equations for dual absorption:

Capital cost = $990,000 + $9.836 * Flowrate

Operating cost = $75,800 + $12.82 * Flowrate

Equipment Life in Years = Equiplife = 15 years
Interest Rate = I = 7%
Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1

Annual cost = (Capital cost * CRF) + O&M cost

O&M Cost Components: The O&M cost components for dual absorbtion are based on two model plants with sulfur intake of 750 tons per day and 1,500 tons per day (EPA, 1985). There are no disposal costs and a credit for the recovered product. Annual operating days are assumed to be 350 days. The following assumptions apply to the cost of utilities and disposal:

Water	0.30	$/cubic meter
Steam	10.50	$/gJ
Catalyst	8,437,600	$/cubic meter
Credit for product	1,120	$/Mg

The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.

CPTON_TEXT: The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.

CTRL_EFF_T: 99%

ELEC_PCT: 0%

ELEC_RT:	$0/kWh
FUEL_PCT:	0%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Dual absorption; Primary Zinc Smelters - Sintering

Abbreviation: SDLABPZSS

Description: Application: This control is to increase adsorption efficiency from existing to NSPS level (99.7%) to reduce SO_2 emissions.

This control applies to primary lead smelters with contact absorption.

Discussion: The contact process is used to produce sulfuric acid from waste gas which contains SO_2. First, the waste gas must be pretreated, which usually involves dust removal, cooling, and scrubbing for further removal of particulate matter and heavy metals, mist, and moisture. After pretreatment, the gas is heated and passed through a catalytic converter (platinum mass units or units containing beds of pelletized vanadium pentoxide) to oxidize the SO_2 to SO_3. The exothermic, reversible oxidation reaction results in a conflict between high equilibrium conversions at lower temperatures and high reaction rates at high temperatures. Because of this, the gas is passed between the catalyst and two or three different heat exchangers in order to achieve conversion of SO_2 to SO_3 of about 92.5 to 98 percent. The gas leaving the final catalyst stage is cooled and introduced to an absorption tower by a stream of strong (98 to 99 percent) acid, where the SO_3 reacts with water in the acid to form additional sulfuric acid. Dilute sulfuric acid or water is added to the recirculating acid to maintain the desired concentration (EPA, 1981; EPA, 1997).

The double-contact, or double-absorption, process for making sulfuric acid from waste gas containing SO_2 is essentially the same as the single-contact process with the addition of an interpass absorption tower. The waste gas is cleaned and dried as in the single-contact process before entering the process. Upon leaving the second or third catalyst bed, depending upon the process, the gas is cooled and introduced to a packed-bed, counter-current absorption tower where it contacts 98 to 99 percent sulfuric acid. After the absorbing tower, the gas is reheated and passed to the third or fourth catalyst bed, where approximately 97 percent of the remaining SO_2 is converted to SO_3 and passed to the final absorption tower for conversion to sulfuric acid as in the single-contact process. No cost data were available for either single- or double-contact sulfuric acid plants controls (EPA, 1981; EPA, 1997).

Class: Known

Pollutant: SO_2

Equipment Life: 15.0 years

Control Technology: Dual absorption

Source Group: Primary Zinc Smelters - Sintering

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	99.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A

Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	99.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 4

Description: Non-EGU SO2

Inventory Fields: stack_flow_rate

Formula: Capital Cost = 990000 + 9.836 x Min. Stack flow rate O&M Cost = 75800 + 12.82 x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Min Stack flow Rate >= 1028000 acfm
Min Stack flow Rate < 1028000 acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30303008	Industrial Processes; Primary Metal Production; Zinc Production; Fluid Bed Roaster

30303007	Industrial Processes; Primary Metal Production; Zinc Production; Flash Roaster
30303002	Industrial Processes; Primary Metal Production; Zinc Production; Multiple Hearth Roaster

References:

- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.
- EPA, 1981: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques for Sulfur Oxide Emissions from Stationary Sources," Second Edition, Research Triangle Park, NC, April 1981.
- EPA, 1997: U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors, Volume I, Stationary Point and Area Sources," AP-42, Fifth Edition, Research Triangle Park, NC, October 1997.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	99% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Capital and annual costs were developed from model plant data (EPA, 1985). The costs are based on stack flowrate in cubic feet per minute. Cost equations for dual absorption: Capital cost = $990,000 + $9.836 * Flowrate Operating cost = $75,800 + $12.82 * Flowrate Equipment Life in Years = Equiplife = 15 years Interest Rate = I = 7% Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1 Annual cost = (Capital cost * CRF) + O&M cost O&M Cost Components: The O&M cost components for dual absorbtion are based on two model plants with sulfur intake of 750 tons per day and 1,500 tons per day (EPA, 1985). There are no disposal costs and a credit for the recovered product. Annual operating days are assumed to be 350 days. The following assumptions apply to the cost of utilities and disposal: Water 0.30 $/cubic meter Steam 10.50 $/gJ Catalyst 8,437,600 $/cubic meter Credit for product 1,120 $/Mg The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.
CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	99%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%

INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Flue Gas Desulfurization; By-Product Coke Manufacturing (Other Processes)
Abbreviation: SFGDSCMOP
Description: Application: This control is the use of vacuum carbonate to reduce SO2 emissions.

This control applies to by-product coke manufacturing operations. Emissions are classified under SCCs beginning with 303003.

Discussion: FGD scrubbers can be either wet or dry systems. In wet systems, a liquid sorbent is sprayed into the flue gas in an absorber vessel. Limestone and lime-based reagents are most frequently used in scrubbers in the United States (EPA, 2002). Dry and semi-dry FGD systems include spray dryers, and dry injection into a duct or a combustion zone.
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Flue Gas Desulfurization
Source Group: By-Product Coke Manufacturing (Other Processes)
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2	SO2
Locale:		
Effective Date:	N/A	2020-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:		
Ref Yr CPT:		
Control Efficiency:	90.0	95.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	3	3
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	SO2	SO2
Locale:		
Effective Date:	N/A	2020-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:		
Ref Yr CPT:		

Control Efficiency:	90.0	95.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	3	3
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 3

Description: Non-EGU SO2

Inventory Fields: stkflow

Formula: Capital Cost = Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack flow rate Capital Cost = ((1028000/Min. stack flow rate)^0.6)x Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack Flow rate
O&M Cost = (3.35 + (0.00729 x 8736)) x Min. stack flow rate x 0.9383
Total Cost = (Capital cost x CRF) + O&M Cost

Notes:
Min Stack Flow Rate >= 1028000 acfm
Min Stack Flow Rate < 1028000 acfm
Capital Cost factor = $192 / kw
Gas flow rate factor = 0.486 KW/acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30300306	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Oven Underfiring

References:

- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The costs are based on stack flowrate in cubic feet per minute. The equations below are simplified from the EPA Control Cost Manual (EPA, 2002). It is assumed that costs for vacuum carbonate controls are similar to costs for flue gas desulfurization. Cost equations for flue gas desulfurization: Capital cost: DEF = de-escalation factor (to convert to 1990 dollars) = 0.9383 RF = retrofit factor = 1.1 For stack flowrate less than 1,0280,000 cu. ft./min = (1,0280,000/Flowrate)^0.6)*93.3*RF*Flowrate* DEF For stack flowrate greater than or equal to 1,0280,000 cu. ft./min = 93.3*RF*Flowrate*DEF Operating and Maintenance (O&M) cost = 3.35+0.000729*8736*DEF * Flowrate Equipment Life in Years = Equiplife = 15 years Interest Rate = I = 7% Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1 Annual cost = (Capital cost * CRF) + O&M cost The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.
CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	90%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*

SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Flue Gas Desulfurization; In-process Fuel Use - Bituminous/Subbituminous Coal

Abbreviation: SFGDSIPFBC

Description: Application: This control is the use of flue gas desulfurization technologies to reduce SO2 emissions.

This control applies to operations with in-process bituminous coal use. Emissions from these sources are classified under SCCs 39000288, 39000289, and 39000299.

Discussion: FGD scrubbers can be either wet or dry systems. In wet systems, a liquid sorbent is sprayed into the flue gas in an absorber vessel. Limestone and lime-based reagents are most frequently used in scrubbers in the United States (EPA, 1981). Dry and semi-dry FGD systems include spray dryers, and dry injection into a duct or a combustion zone.

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Flue Gas Desulfurization

Source Group: In-process Fuel Use - Bituminous/Subbituminous Coal

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	3
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	3
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 3

Description: Non-EGU SO2

Inventory Fields: stkflow

Formula: Capital Cost = Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack flow rate Capital Cost = ((1028000/Min. stack flow rate)^0.6)x Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack Flow rate
O&M Cost = (3.35 + (0.00729 x 8736)) x Min. stack flow rate x 0.9383
Total Cost = (Capital cost x CRF) + O&M Cost

Notes:
Min Stack Flow Rate >= 1028000 acfm
Min Stack Flow Rate < 1028000 acfm
Capital Cost factor = $192 / kw
Gas flow rate factor = 0.486 KW/acfm

Variable Name	Value
Pollutant	SO2
Cost Year	2006

Affected SCCs:

N/A

References:

- EPA, 1981: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques for Sulfur Oxide Emissions from Stationary Sources," Second Edition, Research Triangle Park, NC, April 1981.
- Pechan, 1997: E.H. Pechan & Associates, Inc., "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, July 17,

1997.
- EPA, 2000: U.S. Environmental Protection Agency, Office of Research and Development, Coal Utility Environmental Cost (CUECost) Version 3.0 [computer program], February 2000.

Other information:

ADMIN_PCT:	11.36%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	15.38%
COST_BASIS:	The costs are based on data for FGD scrubber cost assumptions for utility boilers with a 3 percent coal sulfur content (Pechan, 1997). The assumptions apply to capacities at or above 500 megawatts (MW) [approximately 1,000,000 actual cubic feet per minute (acfm)]. For smaller sizes, the costs are scaled down using the standard 0.6 power law. The costs are based on stack flowrate in cubic feet per minute. Cost equations for flue gas desulfurization: Capital cost: DEF = de-escalation factor (to convert to 1990 dollars) = 0.9383 RF = retrofit factor = 1.1 For stack flowrate less than 1,028,000 cu. ft./min = (1,028,000/Flowrate)^0.6)*93.3*RF*Flowrate* DEF For stack flowrate greater than or equal to 1,028,000 cu. ft./min = 93.3*RF*Flowrate*DEF Operating and Maintenance (O&M) cost = 3.35+0.000729*8736*DEF * Flowrate Equipment Life in Years = Equiplife = 15 years Interest Rate = I = 7% Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1 Annual cost = (Capital cost * CRF) + O&M cost O&M Cost Components: The percentages of each O&M cost component were developed using a modified version of EPAGÇÖs CUE Cost program (EPA, 2000). O&M costs were calculated for a model plant with a flowrate of 800,000 acfm. The percentage of the total O&M cost was then calculated for each O&M cost component. A credit for the sale of by-product was subtracted from the disposal costs. A capacity factor of 65% was assumed The following assumptions apply to the cost of utilities and disposal: Calcium Carbonate 15 $/ton Dibasic acid 430 $/ton Disposal by gypsum stacking 6 $/ton Disposal by landfill 30 $/ton Credit for by-product 2 $/ton Steam 3.5 $/1000 lb Electrical energy 25 mills/kWh The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.
CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	90%
ELEC_PCT:	10.74%
ELEC_RT:	$0.03/kWh
FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	5.68%

MNTLBR_PCT:	5.32%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	5.32%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	10.28%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	14.47%
PROPTX_PCT:	5.68%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	3.19%
STEAM_PCT:	14.47%
TDIR_PCT:	62.81%
TINDIR_PCT:	37.19%
UTIL_PCT:	0%
WSTDSP_PCT:	6.41%

Summary:

Control Measure Name: Flue Gas Desulfurization; Mineral Products Industry
Abbreviation: SFGDSMIPR
Description: Application: This control is the use of flue gas desulfurization technologies to reduce SO2 emissions.

This control applies SO2 sources from the mineral products industry.

Discussion: FGD scrubbers can be either wet or dry systems. In wet systems, a liquid sorbent is sprayed into the flue gas in an absorber vessel. Limestone and lime-based reagents are most frequently used in scrubbers in the United States (EPA, 1981). Dry and semi-dry FGD systems include spray dryers, and dry injection into a duct or a combustion zone.

Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Flue Gas Desulfurization
Source Group: Mineral Products Industry
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2	SO2
Locale:		
Effective Date:	N/A	2020-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:		
Ref Yr CPT:		
Control Efficiency:	50.0	90.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	3	3
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	SO2	SO2
Locale:		
Effective Date:	N/A	2020-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:		
Ref Yr CPT:		

Control Efficiency:	50.0	90.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	3	3
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 3

Description: Non-EGU SO2

Inventory Fields: stkflow

Formula: Capital Cost = Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack flow rate Capital Cost = ((1028000/Min. stack flow rate)^0.6)x Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack Flow rate
O&M Cost = (3.35 + (0.00729 x 8736)) x Min. stack flow rate x 0.9383
Total Cost = (Capital cost x CRF) + O&M Cost

Notes:
Min Stack Flow Rate >= 1028000 acfm
Min Stack Flow Rate < 1028000 acfm
Capital Cost factor = $192 / kw
Gas flow rate factor = 0.486 KW/acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30502509	Industrial Processes; Mineral Products; Construction Sand and Gravel; Cooler ** (See 3-05-027-30 for Industrial Sand Coolers)
30502201	Industrial Processes; Mineral Products; Potash Production; Mine: Grinding/Drying
30501905	Industrial Processes; Mineral Products; Phosphate Rock; Calcining
30501604	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Rotary Kiln ** (See SCC Codes 3-05-016-18,-19,-20,-21)
30501602	Industrial Processes; Mineral Products; Lime Manufacture; Secondary Crushing/Screening
30501499	Industrial Processes; Mineral Products; Glass Manufacture; See Comment **
30501410	Industrial Processes; Mineral Products; Glass Manufacture; Raw Material Handling (All Types of Glass)

30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace
30501401	Industrial Processes; Mineral Products; Glass Manufacture; Furnace/General**
30501211	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Textile-type Fiber)
30501201	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Wool-type Fiber)
30501037	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Loading: Overburden
30501001	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Fluidized Bed Reactor
30500801	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying ** (use SCC 3-05-008-13)
30500706	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Kilns
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

ADMIN_PCT:	11.36%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	15.38%

COST_BASIS:	The costs are based on data for FGD scrubber cost assumptions for utility boilers with a 3 percent coal sulfur content (Pechan, 1997). The assumptions apply to capacities at or above 500 megawatts (MW) [approximately 1,000,000 actual cubic feet per minute (acfm)]. For smaller sizes, the costs are scaled down using the standard 0.6 power law. The costs are based on stack flowrate in cubic feet per minute. Cost equations for flue gas desulfurization: Capital cost: DEF = de-escalation factor (to convert to 1990 dollars) = 0.9383 RF = retrofit factor = 1.1 For stack flowrate less than 1,028,000 cu. ft./min = (1,028,000/Flowrate)^0.6)*93.3*RF*Flowrate* DEF For stack flowrate greater than or equal to 1,028,000 cu. ft./min = 93.3*RF*Flowrate*DEF Operating and Maintenance (O&M) cost = 3.35+0.000729*8736*DEF * Flowrate Equipment Life in Years = Equiplife = 15 years Interest Rate = I = 7% Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1 Annual cost = (Capital cost * CRF) + O&M cost O&M Cost Components: The percentages of each O&M cost component were developed using a modified version of EPAGÇÖs CUE Cost program (EPA, 2000). O&M costs were calculated for a model plant with a flowrate of 800,000 acfm. The percentage of the total O&M cost was then calculated for each O&M cost component. A credit for the sale of by-product was subtracted from the disposal costs. A capacity factor of 65% was assumed The following assumptions apply to the cost of utilities and disposal: Calcium Carbonate 15 $/ton Dibasic acid 430 $/ton Disposal by gypsum stacking 6 $/ton Disposal by landfill 30 $/ton Credit for by-product 2 $/ton Steam 3.5 $/1000 lb Electrical energy 25 mills/kWh The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.
CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	90%
ELEC_PCT:	10.74%
ELEC_RT:	$0.03/kWh
FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	5.68%
MNTLBR_PCT:	5.32%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	5.32%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	10.28%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%

OVRHD_PCT:	14.47%
PROPTX_PCT:	5.68%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	3.19%
STEAM_PCT:	14.47%
TDIR_PCT:	62.81%
TINDIR_PCT:	37.19%
UTIL_PCT:	0%
WSTDSP_PCT:	6.41%

Summary:

Control Measure Name: Flue Gas Desulfurization; Petroleum Industry
Abbreviation: SFGDSPETR
Description: Application: This control is the use of flue gas desulfurization technologies to reduce SO2 emissions.

This control applies SO2 sources from the petroleum industry.

Discussion: FGD scrubbers can be either wet or dry systems. In wet systems, a liquid sorbent is sprayed into the flue gas in an absorber vessel. Limestone and lime-based reagents are most frequently used in scrubbers in the United States (EPA, 1981). Dry and semi-dry FGD systems include spray dryers, and dry injection into a duct or a combustion zone.

Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Flue Gas Desulfurization
Source Group: Petroleum Industry
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	3
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	3
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 3

Description: Non-EGU SO2

Inventory Fields: stkflow

Formula: Capital Cost = Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack flow rate Capital Cost = ((1028000/Min. stack flow rate)^0.6)x Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack Flow rate
O&M Cost = (3.35 + (0.00729 x 8736)) x Min. stack flow rate x 0.9383
Total Cost = (Capital cost x CRF) + O&M Cost

Notes:
Min Stack Flow Rate >= 1028000 acfm
Min Stack Flow Rate < 1028000 acfm
Capital Cost factor = $192 / kw
Gas flow rate factor = 0.486 KW/acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30601201	Industrial Processes; Petroleum Industry; Fluid Coking Units; General
30600902	Industrial Processes; Petroleum Industry; Flares; Residual Oil
30600503	Industrial Processes; Petroleum Industry; Wastewater Treatment; Process Drains and Wastewater Separators
30600402	Industrial Processes; Petroleum Industry; Blowdown Systems; Blowdown System w/o Controls
30600204	The SCC entry is not found in the reference.scc table
30600201	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Fluid Catalytic Cracking Unit

References:

- EPA, 1981: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques for Sulfur Oxide Emissions from Stationary Sources," Second Edition, Research Triangle Park, NC, April 1981.
- Pechan, 1997: E.H. Pechan & Associates, Inc., "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, July 17, 1997.
- EPA, 2000: U.S. Environmental Protection Agency, Office of Research and Development, Coal Utility Environmental Cost (CUECost) Version 3.0 [computer program], February 2000.

Other information:

ADMIN_PCT:	11.36%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	15.38%

COST_BASIS:

The costs are based on data for FGD scrubber cost assumptions for utility boilers with a 3 percent coal sulfur content (Pechan, 1997). The assumptions apply to capacities at or above 500 megawatts (MW) [approximately 1,000,000 actual cubic feet per minute (acfm)]. For smaller sizes, the costs are scaled down using the standard 0.6 power law. The costs are based on stack flowrate in cubic feet per minute.

Cost equations for flue gas desulfurization:

Capital cost:

DEF = de-escalation factor (to convert to 1990 dollars) = 0.9383
RF = retrofit factor = 1.1

For stack flowrate less than 1,028,000 cu. ft./min =
(1,028,000/Flowrate)^0.6)*93.3*RF*Flowrate* DEF

For stack flowrate greater than or equal to 1,028,000 cu. ft./min = 93.3*RF*Flowrate*DEF

Operating and Maintenance (O&M) cost = 3.35+0.000729*8736*DEF * Flowrate

Equipment Life in Years = Equiplife = 15 years
Interest Rate = I = 7%
Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1

Annual cost = (Capital cost * CRF) + O&M cost

O&M Cost Components: The percentages of each O&M cost component were developed using a modified version of EPAGÇÖs CUE Cost program (EPA, 2000). O&M costs were calculated for a model plant with a flowrate of 800,000 acfm. The percentage of the total O&M cost was then calculated for each O&M cost component. A credit for the sale of by-product was subtracted from the disposal costs. A capacity factor of 65% was assumed The following assumptions apply to the cost of utilities and disposal:

Calcium Carbonate	15	$/ton
Dibasic acid	430	$/ton
Disposal by gypsum stacking	6	$/ton
Disposal by landfill	30	$/ton
Credit for by-product	2	$/ton
Steam	3.5	$/1000 lb
Electrical energy	25	mills/kWh

The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.

CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	90%
ELEC_PCT:	10.74%
ELEC_RT:	$0.03/kWh
FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	5.68%
MNTLBR_PCT:	5.32%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	5.32%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	10.28%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	14.47%
PROPTX_PCT:	5.68%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	3.19%
STEAM_PCT:	14.47%
TDIR_PCT:	62.81%
TINDIR_PCT:	37.19%
UTIL_PCT:	0%
WSTDSP_PCT:	6.41%

Summary:

Control Measure Name: Flue Gas Desulfurization; Process Heaters (Oil and Gas Production Industry)
Abbreviation: SFGDSPHOG
Description: Application: This control is the use of flue gas desulfurization technologies to reduce SO2 emissions.

This control applies to processes heaters involved in oil and gas production. Emissions from these sources are classified under SCCs beginning with 310004.

Discussion: FGD scrubbers can be either wet or dry systems. In wet systems, a liquid sorbent is sprayed into the flue gas in an absorber vessel. Limestone and lime-based reagents are most frequently used in scrubbers in the United States (EPA, 1981). Dry and semi-dry FGD systems include spray dryers, and dry injection into a duct or a combustion zone.

Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Flue Gas Desulfurization
Source Group: Process Heaters (Oil and Gas Production Industry)
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	3
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	

Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	3
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 3

Description: Non-EGU SO2

Inventory Fields: stkflow

Formula: Capital Cost = Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack flow rate Capital Cost = ((1028000/Min. stack flow rate)^0.6)x Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack Flow rate
O&M Cost = (3.35 + (0.00729 x 8736)) x Min. stack flow rate x 0.9383
Total Cost = (Capital cost x CRF) + O&M Cost

Notes:
Min Stack Flow Rate >= 1028000 acfm
Min Stack Flow Rate < 1028000 acfm
Capital Cost factor = $192 / kw
Gas flow rate factor = 0.486 KW/acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
31000413	Industrial Processes; Oil and Gas Production; Process Heaters; Crude Oil: Steam Generators
31000412	Industrial Processes; Oil and Gas Production; Process Heaters; Residual Oil: Steam Generators
31000411	Industrial Processes; Oil and Gas Production; Process Heaters; Distillate Oil (No. 2): Steam Generators
31000405	Industrial Processes; Oil and Gas Production; Process Heaters; Process Gas
31000403	Industrial Processes; Oil and Gas Production; Process Heaters; Crude Oil
31000402	Industrial Processes; Oil and Gas Production; Process Heaters; Residual Oil
31000401	Industrial Processes; Oil and Gas Production; Process Heaters; Distillate Oil (No. 2)

References:

- EPA, 1981: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques for Sulfur Oxide Emissions from Stationary Sources," Second Edition, Research Triangle Park, NC, April 1981.
- Pechan, 1997: E.H. Pechan & Associates, Inc., "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, July 17, 1997.
- EPA, 2000: U.S. Environmental Protection Agency, Office of Research and Development, Coal Utility Environmental Cost (CUECost) Version 3.0 [computer program], February 2000.

Other information:

ADMIN_PCT:	11.36%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	15.38%

COST_BASIS:

The costs are based on data for FGD scrubber cost assumptions for utility boilers with a 3 percent coal sulfur content (Pechan, 1997). The assumptions apply to capacities at or above 500 megawatts (MW) [approximately 1,000,000 actual cubic feet per minute (acfm)]. For smaller sizes, the costs are scaled down using the standard 0.6 power law. The costs are based on stack flowrate in cubic feet per minute.

Cost equations for flue gas desulfurization:

Capital cost:

DEF = de-escalation factor (to convert to 1990 dollars) = 0.9383
RF = retrofit factor = 1.1

For stack flowrate less than 1,0280,000 cu. ft./min = (1,0280,000/Flowrate)^0.6)*93.3*RF*Flowrate* DEF

For stack flowrate greater than or equal to 1,0280,000 cu. ft./min = 93.3*RF*Flowrate*DEF

Operating and Maintenance (O&M) cost = 3.35+0.000729*8736*DEF * Flowrate

Equipment Life in Years = Equiplife = 15 years
Interest Rate = I = 7%
Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1

Annual cost = (Capital cost * CRF) + O&M cost

O&M Cost Components: The percentages of each O&M cost component were developed using a modified version of EPAGÇÖs CUE Cost program (EPA, 2000). O&M costs were calculated for a model plant with a flowrate of 800,000 acfm. The percentage of the total O&M cost was then calculated for each O&M cost component. A credit for the sale of by-product was subtracted from the disposal costs. A capacity factor of 65% was assumed The following assumptions apply to the cost of utilities and disposal:

Calcium Carbonate	15	$/ton
Dibasic acid	430	$/ton
Disposal by gypsum stacking	6	$/ton
Disposal by landfill	30	$/ton
Credit for by-product	2	$/ton
Steam	3.5	$/1000 lb
Electrical energy	25	mills/kWh

The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.

CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	90%
ELEC_PCT:	10.74%
ELEC_RT:	$0.03/kWh
FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	5.68%
MNTLBR_PCT:	5.32%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	5.32%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	10.28%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	14.47%
PROPTX_PCT:	5.68%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	3.19%
STEAM_PCT:	14.47%
TDIR_PCT:	62.81%
TINDIR_PCT:	37.19%
UTIL_PCT:	0%
WSTDSP_PCT:	6.41%

Summary:

Control Measure Name: Flue Gas Desulfurization; Pulp and Paper Industry (Sulfate Pulping)
Abbreviation: SFGDSPPSP
Description: Application: This control is the use of flue gas desulfurization technologies to reduce SO2 emissions.

This control applies to sulfate pulping processes involved in the pulp and paper industry. Emissions from these sources are classified under SCCs beginning with 307001.

Discussion: FGD scrubbers can be either wet or dry systems. In wet systems, a liquid sorbent is sprayed into the flue gas in an absorber vessel. Limestone and lime-based reagents are most frequently used in scrubbers in the United States (EPA, 2002). Dry and semi-dry FGD systems include spray dryers, and dry injection into a duct or a combustion zone.
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Flue Gas Desulfurization
Source Group: Pulp and Paper Industry (Sulfate Pulping)
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2	SO2
Locale:		
Effective Date:	N/A	2020-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:		
Ref Yr CPT:		
Control Efficiency:	90.0	95.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	3	3
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	SO2	SO2
Locale:		
Effective Date:	N/A	2020-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:		

Ref Yr CPT:		
Control Efficiency:	90.0	95.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	3	3
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 3

Description: Non-EGU SO2

Inventory Fields: stkflow

Formula: Capital Cost = Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack flow rate Capital Cost = ((1028000/Min. stack flow rate)^0.6)x Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack Flow rate
O&M Cost = (3.35 + (0.00729 x 8736)) x Min. stack flow rate x 0.9383
Total Cost = (Capital cost x CRF) + O&M Cost

Notes:
Min Stack Flow Rate >= 1028000 acfm
Min Stack Flow Rate < 1028000 acfm
Capital Cost factor = $192 / kw
Gas flow rate factor = 0.486 KW/acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30700110	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Recovery Furnace/Indirect Contact Evaporator
30700104	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Recovery Furnace/Direct Contact Evaporator

References:

- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	11.36%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	15.38%
COST_BASIS:	The costs are based on stack flowrate in cubic feet per minute. The equations below are simplified from the EPA Control Cost Manual (EPA, 2002). Cost equations for flue gas desulfurization: Capital cost: DEF = de-escalation factor (to convert to 1990 dollars) = 0.9383 RF = retrofit factor = 1.1 For stack flowrate less than 1,0280,000 cu. ft./min = (1,0280,000/Flowrate)^0.6)*93.3*RF*Flowrate* DEF For stack flowrate greater than or equal to 1,0280,000 cu. ft./min = 93.3*RF*Flowrate*DEF Operating and Maintenance (O&M) cost = 3.35+0.000729*8736*DEF * Flowrate Equipment Life in Years = Equiplife = 15 years Interest Rate = I = 7% Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1 Annual cost = (Capital cost * CRF) + O&M cost The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.
CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	90%
ELEC_PCT:	10.74%
ELEC_RT:	$0.03/kWh
FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	5.68%
MNTLBR_PCT:	5.32%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	5.32%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	10.28%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	14.47%
PROPTX_PCT:	5.68%
RPLMTL_PCT:	0%
RULE:	Not Applicable

SO2:	Co*
SPVLBR_PCT:	3.19%
STEAM_PCT:	14.47%
TDIR_PCT:	62.81%
TINDIR_PCT:	37.19%
UTIL_PCT:	0%
WSTDSP_PCT:	6.41%

Summary:

Control Measure Name: Flue Gas Desulfurization; Steam Generating Unit-Coal/Oil

Abbreviation: SFGDSSGCO

Description: Application: This control is the use of flue gas desulfurization technologies to reduce SO2 emissions.

This control applies to coal and oil- fired steam generating units.

Discussion: FGD scrubbers can be either wet or dry systems. In wet systems, a liquid sorbent is sprayed into the flue gas in an absorber vessel. Limestone and lime-based reagents are most frequently used in scrubbers in the United States (EPA, 1981). Dry and semi-dry FGD systems include spray dryers, and dry injection into a duct or a combustion zone.

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Flue Gas Desulfurization

Source Group: Steam Generating Unit-Coal/Oil

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2	SO2
Locale:		
Effective Date:	N/A	2020-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:		
Ref Yr CPT:		
Control Efficiency:	90.0	95.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	3	3
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	SO2	SO2
Locale:		
Effective Date:	N/A	2020-01-01 00:00:00.0
Cost Year:	1990	1990
CPT:		
Ref Yr CPT:		

Control Efficiency:	90.0	95.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	3	3
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 3

Description: Non-EGU SO2

Inventory Fields: stkflow

Formula: Capital Cost = Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack flow rate Capital Cost = ((1028000/Min. stack flow rate)^0.6)x Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack Flow rate
O&M Cost = (3.35 + (0.00729 x 8736)) x Min. stack flow rate x 0.9383
Total Cost = (Capital cost x CRF) + O&M Cost

Notes:
Min Stack Flow Rate >= 1028000 acfm
Min Stack Flow Rate < 1028000 acfm
Capital Cost factor = $192 / kw
Gas flow rate factor = 0.486 KW/acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
10300309	External Combustion Boilers; Commercial/Institutional; Lignite; Spreader Stoker
10300307	External Combustion Boilers; Commercial/Institutional; Lignite; Traveling Grate (Overfeed) Stoker
10300306	External Combustion Boilers; Commercial/Institutional; Lignite; Pulverized Coal: Dry Bottom, Tangential Fired
10300305	External Combustion Boilers; Commercial/Institutional; Lignite; Pulverized Coal: Dry Bottom, Wall Fired
10300103	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Hand-fired
10300102	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Traveling Grate (Overfeed) Stoker
10300101	External Combustion Boilers; Commercial/Institutional; Anthracite Coal; Pulverized Coal

10299997	The SCC entry is not found in the reference.scc table
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200107	External Combustion Boilers; Industrial; Anthracite Coal; Hand-fired
10200104	External Combustion Boilers; Industrial; Anthracite Coal; Traveling Grate (Overfeed) Stoker
10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal

References:

- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT: 11.36%

CE_TEXT: 90% from uncontrolled

CHEM_PCT: 15.38%

COST_BASIS: The costs are based on data for FGD scrubber cost assumptions for utility boilers with a 3 percent coal sulfur content (Pechan, 1997). The assumptions apply to capacities at or above 500 megawatts (MW) [approximately 1,000,000 actual cubic feet per minute (acfm)]. For smaller sizes, the costs are scaled down using the standard 0.6 power law. The costs are based on stack flowrate in cubic feet per minute.

Cost equations for flue gas desulfurization:

Capital cost:

DEF = de-escalation factor (to convert to 1990 dollars) = 0.9383
RF = retrofit factor = 1.1

For stack flowrate less than 1,0280,000 cu. ft./min =
(1,0280,000/Flowrate)^0.6)*93.3*RF*Flowrate* DEF

For stack flowrate greater than or equal to 1,0280,000 cu. ft./min = 93.3*RF*Flowrate*DEF

Operating and Maintenance (O&M) cost = 3.35+0.000729*8736*DEF * Flowrate

Equipment Life in Years = Equiplife = 15 years
Interest Rate = I = 7%
Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1

Annual cost = (Capital cost * CRF) + O&M cost

O&M Cost Components: The percentages of each O&M cost component were developed using a modified version of EPAGÇÖs CUE Cost program (EPA, 2000). O&M costs were calculated for a model plant with a flowrate of 800,000 acfm. The percentage of the total O&M cost was then calculated for each O&M cost component. A credit for the sale of by-product was subtracted from the disposal costs. A capacity factor of 65% was assumed The following assumptions apply to the cost of utilities and disposal:

Calcium Carbonate	15	$/ton
Dibasic acid	430	$/ton
Disposal by gypsum stacking	6	$/ton
Disposal by landfill	30	$/ton
Credit for by-product	2	$/ton
Steam	3.5	$/1000 lb
Electrical energy	25	mills/kWh

The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.

CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	90%
ELEC_PCT:	10.74%
ELEC_RT:	$0.03/kWh
FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	5.68%
MNTLBR_PCT:	5.32%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	5.32%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	10.28%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	14.47%
PROPTX_PCT:	5.68%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	3.19%
STEAM_PCT:	14.47%
TDIR_PCT:	62.81%
TINDIR_PCT:	37.19%
UTIL_PCT:	0%
WSTDSP_PCT:	6.41%

Summary:

Control Measure Name: Fuel Switching; Stationary Source Fuel Combustion
Abbreviation: SFUELSFC
Description: Application: This control transfers a home-heating oil fuel control to industrial boilers by substituting "red dye" distillate oil for high-sulfur fuel. Distillate has 500 ppm versus 2,500 to 3,000 ppm for high-sulfur diesel.

The control applies to industrial stationary source distillate oil combustion sources.
Class: Emerging
Pollutant: SO2
Equipment Life: N/A years
Control Technology: Fuel Switching
Source Group: Stationary Source Fuel Combustion
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM2_5	PM10-PRI	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	80.0	80.0	80.0	80.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$2,350
Ref Yr CPT:	$3,138
Control Efficiency:	75.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2199004002	Stationary Source Fuel Combustion; Total Area Source Fuel Combustion; Distillate Oil; All IC Engine Types
2199004000	Stationary Source Fuel Combustion; Total Area Source Fuel Combustion; Distillate Oil; Total: Boilers and IC Engines
2103004000	Stationary Source Fuel Combustion; Commercial/Institutional; Distillate Oil; Total: Boilers and IC Engines
2102004000	Stationary Source Fuel Combustion; Industrial; Distillate Oil; Total: Boilers and IC Engines

References:

- "PMDevelopmentMeasuresList.xls" spreadsheet provided by David Misenheimer (Misenheimer.David@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 27-Aug-2007.

Other information:

Summary:

Control Measure Name: Increase % Conversion ro Meet NSPS (99.7); Sulfuric Acid Plants - Contact Absorber (93% Conversion)

Abbreviation: SNS93SACA

Description: Application: This control is to increase adsorption efficiency from existing to NSPS level (99.7%) to reduce SO2 emissions.

This control applies to sulfuric acid plants with contact absorption processes at 93% sulfur conversion efficiency.

Discussion: The contact process is used to produce sulfuric acid from waste gas which contains SO2. First, the waste gas must be pretreated, which usually involves dust removal, cooling, and scrubbing for further removal of particulate matter and heavy metals, mist, and moisture. After pretreatment, the gas is heated and passed through a catalytic converter (platinum mass units or units containing beds of pelletized vanadium pentoxide) to oxidize the SO2 to SO3. The exothermic, reversible oxidation reaction results in a conflict between high equilibrium conversions at lower temperatures and high reaction rates at high temperatures. Because of this, the gas is passed between the catalyst and two or three different heat exchangers in order to achieve conversion of SO2 to SO3 of about 92.5 to 98 percent. The gas leaving the final catalyst stage is cooled and introduced to an absorption tower by a stream of strong (98 to 99 percent) acid, where the SO3 reacts with water in the acid to form additional sulfuric acid. Dilute sulfuric acid or water is added to the recirculating acid to maintain the desired concentration (EPA, 1981; EPA, 1997).

The double-contact, or double-absorption, process for making sulfuric acid from waste gas containing SO2 is essentially the same as the single-contact process with the addition of an interpass absorption tower. The waste gas is cleaned and dried as in the single-contact process before entering the process. Upon leaving the second or third catalyst bed, depending upon the process, the gas is cooled and introduced to a packed-bed, counter-current absorption tower where it contacts 98 to 99 percent sulfuric acid. After the absorbing tower, the gas is reheated and passed to the third or fourth catalyst bed, where approximately 97 percent of the remaining SO2 is converted to SO3 and passed to the final absorption tower for conversion to sulfuric acid as in the single-contact process. No cost data were available for either single- or double-contact sulfuric acid plants controls (EPA, 1981; EPA, 1997).

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Increase % Conversion ro Meet NSPS (99.7)

Source Group: Sulfuric Acid Plants - Contact Absorber (93% Conversion)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	95.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4

Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	95.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 4

Description: Non-EGU SO2

Inventory Fields: stack_flow_rate

Formula: Capital Cost = 990000 + 9.836 x Min. Stack flow rate O&M Cost = 75800 + 12.82 x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Min Stack flow Rate >= 1028000 acfm
Min Stack flow Rate < 1028000 acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30102318	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 93.0% Conversion

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1981: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques for Sulfur Oxide Emissions from Stationary Sources," Second Edition, Research Triangle Park, NC, April 1981.
- EPA, 1985: U.S. Environmental Protection Agency, "Sulfuric Acid: Review of New Source Performance Standards for Sulfuric Acid Plants," Research Triangle Park, NC, (EPA/450/3-85/012), March 1985.

Other information:

ADMIN_PCT: 0%

CE_TEXT: 95% from uncontrolled

CHEM_PCT: 0%

COST_BASIS: Capital and annual costs were developed from model plant data (EPA, 1985). The costs are based on stack flowrate in cubic feet per minute.

Cost equations for dual absorption:

Capital cost = $990,000 + $9.836 * Flowrate

Operating cost = $75,800 + $12.82 * Flowrate

Equipment Life in Years = Equiplife = 15 years
Interest Rate = I = 7%
Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1

Annual cost = (Capital cost * CRF) + O&M cost

O&M Cost Components: The O&M cost components for dual absorbtion are based on two model plants with sulfur intake of 750 tons per day and 1,500 tons per day (EPA, 1985). There are no disposal costs and a credit for the recovered product. Annual operating days are assumed to be 350 days. The following assumptions apply to the cost of utilities and disposal:

Water	0.30	$/cubic meter
Steam	10.50	$/gJ
Catalyst	8,437,600	$/cubic meter
Credit for product	1,120	$/Mg

The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.

CPTON_TEXT: The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.

CTRL_EFF_T: 95%

ELEC_PCT: 0%

ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	95%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$17.19/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Increase % Conversion ro Meet NSPS (99.7); Sulfuric Acid Plants - Contact Absorber (97% Conversion)

Abbreviation: SNS97SACA

Description: Application: This control is to increase adsorption efficiency from existing to NSPS level (99.7%) to reduce SO2 emissions.

This control applies to sulfuric acid plants with contact absorption processes at 97% sulfur conversion efficiency.

Discussion: The contact process is used to produce sulfuric acid from waste gas which contains SO2. First, the waste gas must be pretreated, which usually involves dust removal, cooling, and scrubbing for further removal of particulate matter and heavy metals, mist, and moisture. After pretreatment, the gas is heated and passed through a catalytic converter (platinum mass units or units containing beds of pelletized vanadium pentoxide) to oxidize the SO2 to SO3. The exothermic, reversible oxidation reaction results in a conflict between high equilibrium conversions at lower temperatures and high reaction rates at high temperatures. Because of this, the gas is passed between the catalyst and two or three different heat exchangers in order to achieve conversion of SO2 to SO3 of about 92.5 to 98 percent. The gas leaving the final catalyst stage is cooled and introduced to an absorption tower by a stream of strong (98 to 99 percent) acid, where the SO3 reacts with water in the acid to form additional sulfuric acid. Dilute sulfuric acid or water is added to the recirculating acid to maintain the desired concentration (EPA, 1981; EPA, 1997).

The double-contact, or double-absorption, process for making sulfuric acid from waste gas containing SO2 is essentially the same as the single-contact process with the addition of an interpass absorption tower. The waste gas is cleaned and dried as in the single-contact process before entering the process. Upon leaving the second or third catalyst bed, depending upon the process, the gas is cooled and introduced to a packed-bed, counter-current absorption tower where it contacts 98 to 99 percent sulfuric acid. After the absorbing tower, the gas is reheated and passed to the third or fourth catalyst bed, where approximately 97 percent of the remaining SO2 is converted to SO3 and passed to the final absorption tower for conversion to sulfuric acid as in the single-contact process. No cost data were available for either single- or double-contact sulfuric acid plants controls (EPA, 1981; EPA, 1997).

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Increase % Conversion ro Meet NSPS (99.7)

Source Group: Sulfuric Acid Plants - Contact Absorber (97% Conversion)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4

Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 4

Description: Non-EGU SO2

Inventory Fields: stack_flow_rate

Formula: Capital Cost = 990000 + 9.836 x Min. Stack flow rate O&M Cost = 75800 + 12.82 x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Min Stack flow Rate >= 1028000 acfm
Min Stack flow Rate < 1028000 acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30102310	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 97.0% Conversion

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1981: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques for Sulfur Oxide Emissions from Stationary Sources," Second Edition, Research Triangle Park, NC, April 1981.
- EPA, 1985: U.S. Environmental Protection Agency, "Sulfuric Acid: Review of New Source Performance Standards for Sulfuric Acid Plants," Research Triangle Park, NC, (EPA/450/3-85/012), March 1985.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Capital and annual costs were developed from model plant data (EPA, 1985). The costs are based on stack flowrate in cubic feet per minute. Cost equations for dual absorption: Capital cost = $990,000 + $9.836 * Flowrate Operating cost = $75,800 + $12.82 * Flowrate Equipment Life in Years = Equiplife = 15 years Interest Rate = I = 7% Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1 Annual cost = (Capital cost * CRF) + O&M cost O&M Cost Components: The O&M cost components for dual absorbtion are based on two model plants with sulfur intake of 750 tons per day and 1,500 tons per day (EPA, 1985). There are no disposal costs and a credit for the recovered product. Annual operating days are assumed to be 350 days. The following assumptions apply to the cost of utilities and disposal: Water 0.30 $/cubic meter Steam 10.50 $/gJ Catalyst 8,437,600 $/cubic meter Credit for product 1,120 $/Mg The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.
CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	90%
ELEC_PCT:	0%

ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$17.19/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Increase % Conversion ro Meet NSPS (99.7); Sulfuric Acid Plants - Contact Absorber (98% Conversion)

Abbreviation: SNS98SACA

Description: Application: This control is to increase adsorption efficiency from existing to NSPS level (99.7%) to reduce SO2 emissions.

This control applies to sulfuric acid plants with contact absorption processes at 98% sulfur conversion efficiency.

Discussion: The contact process is used to produce sulfuric acid from waste gas which contains SO2. First, the waste gas must be pretreated, which usually involves dust removal, cooling, and scrubbing for further removal of particulate matter and heavy metals, mist, and moisture. After pretreatment, the gas is heated and passed through a catalytic converter (platinum mass units or units containing beds of pelletized vanadium pentoxide) to oxidize the SO2 to SO3. The exothermic, reversible oxidation reaction results in a conflict between high equilibrium conversions at lower temperatures and high reaction rates at high temperatures. Because of this, the gas is passed between the catalyst and two or three different heat exchangers in order to achieve conversion of SO2 to SO3 of about 92.5 to 98 percent. The gas leaving the final catalyst stage is cooled and introduced to an absorption tower by a stream of strong (98 to 99 percent) acid, where the SO3 reacts with water in the acid to form additional sulfuric acid. Dilute sulfuric acid or water is added to the recirculating acid to maintain the desired concentration (EPA, 1981; EPA, 1997).

The double-contact, or double-absorption, process for making sulfuric acid from waste gas containing SO2 is essentially the same as the single-contact process with the addition of an interpass absorption tower. The waste gas is cleaned and dried as in the single-contact process before entering the process. Upon leaving the second or third catalyst bed, depending upon the process, the gas is cooled and introduced to a packed-bed, counter-current absorption tower where it contacts 98 to 99 percent sulfuric acid. After the absorbing tower, the gas is reheated and passed to the third or fourth catalyst bed, where approximately 97 percent of the remaining SO2 is converted to SO3 and passed to the final absorption tower for conversion to sulfuric acid as in the single-contact process. No cost data were available for either single- or double-contact sulfuric acid plants controls (EPA, 1981; EPA, 1997).

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Increase % Conversion ro Meet NSPS (99.7)

Source Group: Sulfuric Acid Plants - Contact Absorber (98% Conversion)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	85.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4

Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	85.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4
Capital Rec Fac:	0.10000000149011612
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 4

Description: Non-EGU SO2

Inventory Fields: stack_flow_rate

Formula: Capital Cost = 990000 + 9.836 x Min. Stack flow rate O&M Cost = 75800 + 12.82 x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Min Stack flow Rate >= 1028000 acfm
Min Stack flow Rate < 1028000 acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30102308	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 98.0% Conversion

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1981: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques for Sulfur Oxide Emissions from Stationary Sources," Second Edition, Research Triangle Park, NC, April 1981.
- EPA, 1985: U.S. Environmental Protection Agency, "Sulfuric Acid: Review of New Source Performance Standards for Sulfuric Acid Plants," Research Triangle Park, NC, (EPA/450/3-85/012), March 1985.

Other information:

ADMIN_PCT: 0%

CE_TEXT: 85% from uncontrolled

CHEM_PCT: 0%

COST_BASIS: Capital and annual costs were developed from model plant data (EPA, 1985). The costs are based on stack flowrate in cubic feet per minute.

Cost equations for dual absorption:

Capital cost = $990,000 + $9.836 * Flowrate

Operating cost = $75,800 + $12.82 * Flowrate

Equipment Life in Years = Equiplife = 15 years
Interest Rate = I = 7%
Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1

Annual cost = (Capital cost * CRF) + O&M cost

O&M Cost Components: The O&M cost components for dual absorbtion are based on two model plants with sulfur intake of 750 tons per day and 1,500 tons per day (EPA, 1985). There are no disposal costs and a credit for the recovered product. Annual operating days are assumed to be 350 days. The following assumptions apply to the cost of utilities and disposal:

Water	0.30	$/cubic meter
Steam	10.50	$/gJ
Catalyst	8,437,600	$/cubic meter
Credit for product	1,120	$/Mg

The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.

CPTON_TEXT: The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.

CTRL_EFF_T: 85%

ELEC_PCT: 0%

ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	85%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$17.19/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Increase % Conversion ro Meet NSPS (99.7); Sulfuric Acid Plants - Contact Absorber (99% Conversion)

Abbreviation: SNS99SACA

Description: Application: This control is to increase adsorption efficiency from existing to NSPS level (99.7%) to reduce SO_2 emissions.

This control applies to sulfuric acid plants with contact absorption processes at 99% sulfur conversion efficiency.

Discussion: The contact process is used to produce sulfuric acid from waste gas which contains SO_2. First, the waste gas must be pretreated, which usually involves dust removal, cooling, and scrubbing for further removal of particulate matter and heavy metals, mist, and moisture. After pretreatment, the gas is heated and passed through a catalytic converter (platinum mass units or units containing beds of pelletized vanadium pentoxide) to oxidize the SO_2 to SO_3. The exothermic, reversible oxidation reaction results in a conflict between high equilibrium conversions at lower temperatures and high reaction rates at high temperatures. Because of this, the gas is passed between the catalyst and two or three different heat exchangers in order to achieve conversion of SO_2 to SO_3 of about 92.5 to 98 percent. The gas leaving the final catalyst stage is cooled and introduced to an absorption tower by a stream of strong (98 to 99 percent) acid, where the SO_3 reacts with water in the acid to form additional sulfuric acid. Dilute sulfuric acid or water is added to the recirculating acid to maintain the desired concentration (EPA, 1981; EPA, 1997).

The double-contact, or double-absorption, process for making sulfuric acid from waste gas containing SO_2 is essentially the same as the single-contact process with the addition of an interpass absorption tower. The waste gas is cleaned and dried as in the single-contact process before entering the process. Upon leaving the second or third catalyst bed, depending upon the process, the gas is cooled and introduced to a packed-bed, counter-current absorption tower where it contacts 98 to 99 percent sulfuric acid. After the absorbing tower, the gas is reheated and passed to the third or fourth catalyst bed, where approximately 97 percent of the remaining SO_2 is converted to SO_3 and passed to the final absorption tower for conversion to sulfuric acid as in the single-contact process. No cost data were available for either single- or double-contact sulfuric acid plants controls (EPA, 1981; EPA, 1997).

Class: Known

Pollutant: SO_2

Equipment Life: 15.0 years

Control Technology: Increase % Conversion ro Meet NSPS (99.7)

Source Group: Sulfuric Acid Plants - Contact Absorber (99% Conversion)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO_2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	75.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4

Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	
Ref Yr CPT:	
Control Efficiency:	75.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	4
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 4

Description: Non-EGU SO2

Inventory Fields: stack_flow_rate

Formula: Capital Cost = 990000 + 9.836 x Min. Stack flow rate O&M Cost = 75800 + 12.82 x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Min Stack flow Rate >= 1028000 acfm
Min Stack flow Rate < 1028000 acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30102306	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 99.0% Conversion

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1981: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques for Sulfur Oxide Emissions from Stationary Sources," Second Edition, Research Triangle Park, NC, April 1981.
- EPA, 1985: U.S. Environmental Protection Agency, "Sulfuric Acid: Review of New Source Performance Standards for Sulfuric Acid Plants," Research Triangle Park, NC, (EPA/450/3-85/012), March 1985.

Other information:

ADMIN_PCT: 0%

CE_TEXT: 75% from uncontrolled

CHEM_PCT: 0%

COST_BASIS: Capital and annual costs were developed from model plant data (EPA, 1985). The costs are based on stack flowrate in cubic feet per minute.

Cost equations for dual absorption:

Capital cost = $990,000 + $9.836 * Flowrate

Operating cost = $75,800 + $12.82 * Flowrate

Equipment Life in Years = Equiplife = 15 years
Interest Rate = I = 7%
Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1

Annual cost = (Capital cost * CRF) + O&M cost

O&M Cost Components: The O&M cost components for dual absorbtion are based on two model plants with sulfur intake of 750 tons per day and 1,500 tons per day (EPA, 1985). There are no disposal costs and a credit for the recovered product. Annual operating days are assumed to be 350 days. The following assumptions apply to the cost of utilities and disposal:

Water	0.30	$/cubic meter
Steam	10.50	$/gJ
Catalyst	8,437,600	$/cubic meter
Credit for product	1,120	$/Mg

The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.

CPTON_TEXT: The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.

CTRL_EFF_T: 75%

ELEC_PCT: 0%

ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	75%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$17.19/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$15.63/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Increased Caustic Injection Rate for Existing Dry Injection Control; ICI Boilers (All Other Liquid Fuels)
Abbreviation:	SICIRIBOLF
Description:	Increased Caustic Injection - This control measure involves an increase in the alkaline sorbent used for scrubbing flue gases to remove SO2. Depending on the application, the two most important sorbents are lime and sodium hydroxide (also known as caustic soda). Lime is typically used on large coal- or oil-fired boilers as found in power plants, as it is very much less expensive than caustic soda. The problem is that it results in a slurry being circulated through the scrubber instead of a solution. This makes it harder on the equipment. A spray tower is typically used for this application. The use of lime results in a slurry of calcium sulfite (CaSO3) that must be disposed of. Fortunately, calcium sulfite can be oxidized to produce by-product gypsum (CaSO4 ‚Äö†´ 2H2O) which is marketable for use in the building products industry. Caustic soda is limited to smaller combustion units because it is more expensive than lime, but it has the advantage that it forms a solution rather than a slurry. This makes it easier to operate. It produces a "spent caustic" solution of sodium sulfite/bisulfite (depending on the pH), or sodium sulfate that must be disposed of. This is not a problem in a kraft pulp mill for example, where this can be a source of makeup chemicals to the recovery cycle. Reference: Wikipedia, "Flue-Gas-Desulfurization", April 2014. http://en.wikipedia.org/wiki/Flue-gas_desulfurization
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Increased Caustic Injection Rate for Existing Dry Injection Control
Source Group:	ICI Boilers (All Other Liquid Fuels)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Cost Equations:

Name: Type 18

Description: Increased Caustic Injection Rate for Existing Dry Injection Control Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	10.52

Affected SCCs:

Code	Description
30130201	Industrial Processes; Chemical Manufacturing; Carbon Tetrachloride; General
10201303	External Combustion Boilers; Industrial; Liquid Waste; Salable Animal Fat
10201302	External Combustion Boilers; Industrial; Liquid Waste; Waste Oil
10201301	External Combustion Boilers; Industrial; Liquid Waste; Specify Waste Material in Comments
10101302	External Combustion Boilers; Electric Generation; Liquid Waste; Waste Oil
10101301	External Combustion Boilers; Electric Generation; Liquid Waste; Specify Waste Material in Comments

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Increased Caustic Injection Rate for Existing Dry Injection Control; ICI Boilers (All Other Solid Fuels)
Abbreviation:	SICIRIBOSF
Description:	Increased Caustic Injection - This control measure involves an increase in the alkaline sorbent used for scrubbing flue gases to remove SO2. Depending on the application, the two most important sorbents are lime and sodium hydroxide (also known as caustic soda). Lime is typically used on large coal- or oil-fired boilers as found in power plants, as it is very much less expensive than caustic soda. The problem is that it results in a slurry being circulated through the scrubber instead of a solution. This makes it harder on the equipment. A spray tower is typically used for this application. The use of lime results in a slurry of calcium sulfite (CaSO3) that must be disposed of. Fortunately, calcium sulfite can be oxidized to produce by-product gypsum (CaSO4 ,Äö†´ 2H2O) which is marketable for use in the building products industry. Caustic soda is limited to smaller combustion units because it is more expensive than lime, but it has the advantage that it forms a solution rather than a slurry. This makes it easier to operate. It produces a "spent caustic" solution of sodium sulfite/bisulfite (depending on the pH), or sodium sulfate that must be disposed of. This is not a problem in a kraft pulp mill for example, where this can be a source of makeup chemicals to the recovery cycle. Reference: Wikipedia, "Flue-Gas-Desulfurization", April 2014. http://en.wikipedia.org/wiki/Flue-gas_desulfurization
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Increased Caustic Injection Rate for Existing Dry Injection Control
Source Group:	ICI Boilers (All Other Solid Fuels)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Cost Equations:

Name: Type 18

Description: Increased Caustic Injection Rate for Existing Dry Injection Control Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	6.07

Affected SCCs:

Code	Description
39999999	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Industrial Processes; Other Not Classified
31100199	Industrial Processes; Building Construction; Construction: Building Contractors; Other Not Classified
30699999	Industrial Processes; Petroleum Industry; Petroleum Products - Not Classified; Not Classified **
30501021	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Removal
30500199	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; See Comment **
30500105	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; General **

10301202	External Combustion Boilers; Commercial/Institutional; Solid Waste; Refuse Derived Fuel
10301201	External Combustion Boilers; Commercial/Institutional; Solid Waste; Specify Waste Material in Comments
10201201	External Combustion Boilers; Industrial; Solid Waste; Specify Waste Material in Comments
10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal
10101204	External Combustion Boilers; Electric Generation; Solid Waste; Tire Derived Fuel : Shredded
10101202	External Combustion Boilers; Electric Generation; Solid Waste; Refuse Derived Fuel
10101201	External Combustion Boilers; Electric Generation; Solid Waste; Specify Waste Material in Comments
10100801	External Combustion Boilers; Electric Generation; Petroleum Coke; All Boiler Sizes

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Increased Caustic Injection Rate for Existing Dry Injection Control; ICI Boilers (Bituminous Coal)

Abbreviation: SICIRIBBC

Description: Increased Caustic Injection - This control measure involves an increase in the alkaline sorbent used for scrubbing flue gases to remove SO2. Depending on the application, the two most important sorbents are lime and sodium hydroxide (also known as caustic soda). Lime is typically used on large coal- or oil-fired boilers as found in power plants, as it is very much less expensive than caustic soda. The problem is that it results in a slurry being circulated through the scrubber instead of a solution. This makes it harder on the equipment. A spray tower is typically used for this application. The use of lime results in a slurry of calcium sulfite (CaSO3) that must be disposed of. Fortunately, calcium sulfite can be oxidized to produce by-product gypsum (CaSO4 ‚Äö†´ 2H2O) which is marketable for use in the building products industry.

Caustic soda is limited to smaller combustion units because it is more expensive than lime, but it has the advantage that it forms a solution rather than a slurry. This makes it easier to operate. It produces a "spent caustic" solution of sodium sulfite/bisulfite (depending on the pH), or sodium sulfate that must be disposed of. This is not a problem in a kraft pulp mill for example, where this can be a source of makeup chemicals to the recovery cycle.

Reference: Wikipedia, "Flue-Gas-Desulfurization", April 2014. http://en.wikipedia.org/wiki/Flue-gas_desulfurization

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Increased Caustic Injection Rate for Existing Dry Injection Control

Source Group: ICI Boilers (Bituminous Coal)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Cost Equations:

Name: Type 18

Description: Increased Caustic Injection Rate for Existing Dry Injection Control Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	4.68

Affected SCCs:

Code	Description
10300218	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10300217	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Bubbling Bed
10300214	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Hand-fired
10300209	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Spreader Stoker
10300208	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Underfeed Stoker
10300206	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom

10200218	External Combustion Boilers; Industrial; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10200205	External Combustion Boilers; Industrial; Bituminous Coal; Overfeed Stoker
10200204	External Combustion Boilers; Industrial; Bituminous Coal; Spreader Stoker
10200202	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Increased Caustic Injection Rate for Existing Dry Injection Control; ICI Boilers (Distillate Oil)
Abbreviation:	SICIRIBDO
Description:	Increased Caustic Injection - This control measure involves an increase in the alkaline sorbent used for scrubbing flue gases to remove SO2. Depending on the application, the two most important sorbents are lime and sodium hydroxide (also known as caustic soda). Lime is typically used on large coal- or oil-fired boilers as found in power plants, as it is very much less expensive than caustic soda. The problem is that it results in a slurry being circulated through the scrubber instead of a solution. This makes it harder on the equipment. A spray tower is typically used for this application. The use of lime results in a slurry of calcium sulfite (CaSO3) that must be disposed of. Fortunately, calcium sulfite can be oxidized to produce by-product gypsum (CaSO4 ‚Äö†´ 2H2O) which is marketable for use in the building products industry. Caustic soda is limited to smaller combustion units because it is more expensive than lime, but it has the advantage that it forms a solution rather than a slurry. This makes it easier to operate. It produces a "spent caustic" solution of sodium sulfite/bisulfite (depending on the pH), or sodium sulfate that must be disposed of. This is not a problem in a kraft pulp mill for example, where this can be a source of makeup chemicals to the recovery cycle. Reference: Wikipedia, "Flue-Gas-Desulfurization", April 2014. http://en.wikipedia.org/wiki/Flue-gas_desulfurization
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Increased Caustic Injection Rate for Existing Dry Injection Control
Source Group:	ICI Boilers (Distillate Oil)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Cost Equations:

Name: Type 18

Description: Increased Caustic Injection Rate for Existing Dry Injection Control Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	10.84

Affected SCCs:

Code	Description
30290001	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
10500205	External Combustion; Space Heaters; Commercial/Institutional; Distillate Oil
10500105	External Combustion; Space Heaters; Industrial; Distillate Oil
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler

10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Increased Caustic Injection Rate for Existing Dry Injection Control; ICI Boilers (Dry Biomass)
Abbreviation:	SICIRIBDB
Description:	Increased Caustic Injection - This control measure involves an increase in the alkaline sorbent used for scrubbing flue gases to remove SO2. Depending on the application, the two most important sorbents are lime and sodium hydroxide (also known as caustic soda). Lime is typically used on large coal- or oil-fired boilers as found in power plants, as it is very much less expensive than caustic soda. The problem is that it results in a slurry being circulated through the scrubber instead of a solution. This makes it harder on the equipment. A spray tower is typically used for this application. The use of lime results in a slurry of calcium sulfite (CaSO3) that must be disposed of. Fortunately, calcium sulfite can be oxidized to produce by-product gypsum (CaSO4 ‚Äö†´ 2H2O) which is marketable for use in the building products industry. Caustic soda is limited to smaller combustion units because it is more expensive than lime, but it has the advantage that it forms a solution rather than a slurry. This makes it easier to operate. It produces a "spent caustic" solution of sodium sulfite/bisulfite (depending on the pH), or sodium sulfate that must be disposed of. This is not a problem in a kraft pulp mill for example, where this can be a source of makeup chemicals to the recovery cycle. Reference: Wikipedia, "Flue-Gas-Desulfurization", April 2014. http://en.wikipedia.org/wiki/Flue-gas_desulfurization
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Increased Caustic Injection Rate for Existing Dry Injection Control
Source Group:	ICI Boilers (Dry Biomass)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Cost Equations:

Name: Type 18

Description: Increased Caustic Injection Rate for Existing Dry Injection Control Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	8.48

Affected SCCs:

Code	Description
10300912	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Fluidized bed combustion boilers
10300911	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Stoker boilers **
10300902	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood/Bark-fired Boiler
10200911	External Combustion Boilers; Industrial; Wood/Bark Waste; Stoker boilers **
10200910	External Combustion Boilers; Industrial; Wood/Bark Waste; Fuel cell/Dutch oven boilers **
10200908	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Dry Wood (<20% moisture)

10200907	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood Cogeneration
10200906	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler (< 50,000 Lb Steam) **
10200905	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler (< 50,000 Lb Steam) **
10200902	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler
10200901	External Combustion Boilers; Industrial; Wood/Bark Waste; Bark-fired Boiler
10100911	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Stoker boilers **
10100902	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood/Bark Fired Boiler

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Increased Caustic Injection Rate for Existing Dry Injection Control; ICI Boilers (Gaseous Fuels)

Abbreviation: SICIRIBGF

Description: Increased Caustic Injection - This control measure involves an increase in the alkaline sorbent used for scrubbing flue gases to remove SO2. Depending on the application, the two most important sorbents are lime and sodium hydroxide (also known as caustic soda). Lime is typically used on large coal- or oil-fired boilers as found in power plants, as it is very much less expensive than caustic soda. The problem is that it results in a slurry being circulated through the scrubber instead of a solution. This makes it harder on the equipment. A spray tower is typically used for this application. The use of lime results in a slurry of calcium sulfite (CaSO3) that must be disposed of. Fortunately, calcium sulfite can be oxidized to produce by-product gypsum (CaSO4 ‚Äö‚Ä¢ 2H2O) which is marketable for use in the building products industry.

Caustic soda is limited to smaller combustion units because it is more expensive than lime, but it has the advantage that it forms a solution rather than a slurry. This makes it easier to operate. It produces a "spent caustic" solution of sodium sulfite/bisulfite (depending on the pH), or sodium sulfate that must be disposed of. This is not a problem in a kraft pulp mill for example, where this can be a source of makeup chemicals to the recovery cycle.

Reference: Wikipedia, "Flue-Gas-Desulfurization", April 2014. http://en.wikipedia.org/wiki/Flue-gas_desulfurization

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Increased Caustic Injection Rate for Existing Dry Injection Control

Source Group: ICI Boilers (Gaseous Fuels)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Cost Equations:

Name: Type 18

Description: Increased Caustic Injection Rate for Existing Dry Injection Control Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	16.42

Affected SCCs:

Code	Description
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100701	External Combustion Boilers; Electric Generation; Process Gas; Boiler, >= 100 Million BTU/hr
10100702	External Combustion Boilers; Electric Generation; Process Gas; Boiler < 100 Million Btu/hr
10100703	External Combustion Boilers; Electric Generation; Petroleum Refinery Gas; Boiler
10101002	External Combustion Boilers; Electric Generation; Liquified Petroleum Gas (LPG); Propane

10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200711	External Combustion Boilers; Industrial; Process Gas; Landfill Gas
10200799	External Combustion Boilers; Industrial; Process Gas; Other: Specify in Comments
10201001	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Butane
10201002	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Propane
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300811	External Combustion Boilers; Commercial/Institutional; Landfill Gas; Landfill Gas
10301001	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane
10301002	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Propane
10301003	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane/Propane Mixture: Specify Percent Butane in Comments
10500106	External Combustion; Space Heaters; Industrial; Natural Gas
10500206	External Combustion; Space Heaters; Commercial/Institutional; Natural Gas
30290003	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Natural Gas: Process Heaters
31000203	Industrial Processes; Oil and Gas Production; Natural Gas Production; Compressors (See also 310003-12 and -13)
31000414	Industrial Processes; Oil and Gas Production; Process Heaters; Natural Gas: Steam Generators

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Increased Caustic Injection Rate for Existing Dry Injection Control; ICI Boilers (Residual Oil)

Abbreviation: SICIRIBRO

Description: Increased Caustic Injection - This control measure involves an increase in the alkaline sorbent used for scrubbing flue gases to remove SO2. Depending on the application, the two most important sorbents are lime and sodium hydroxide (also known as caustic soda). Lime is typically used on large coal- or oil-fired boilers as found in power plants, as it is very much less expensive than caustic soda. The problem is that it results in a slurry being circulated through the scrubber instead of a solution. This makes it harder on the equipment. A spray tower is typically used for this application. The use of lime results in a slurry of calcium sulfite (CaSO3) that must be disposed of. Fortunately, calcium sulfite can be oxidized to produce by-product gypsum (CaSO4 ‚Äö‚Ä¢ 2H2O) which is marketable for use in the building products industry.

Caustic soda is limited to smaller combustion units because it is more expensive than lime, but it has the advantage that it forms a solution rather than a slurry. This makes it easier to operate. It produces a "spent caustic" solution of sodium sulfite/bisulfite (depending on the pH), or sodium sulfate that must be disposed of. This is not a problem in a kraft pulp mill for example, where this can be a source of makeup chemicals to the recovery cycle.

Reference: Wikipedia, "Flue-Gas-Desulfurization", April 2014.
http://en.wikipedia.org/wiki/Flue-gas_desulfurization

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Increased Caustic Injection Rate for Existing Dry Injection Control

Source Group: ICI Boilers (Residual Oil)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremenental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Cost Equations:

Name: Type 18

Description: Increased Caustic Injection Rate for Existing Dry Injection Control Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	9.08

Affected SCCs:

Code	Description
10300404	External Combustion Boilers; Commercial/Institutional; Residual Oil; Grade 5 Oil
10300402	External Combustion Boilers; Commercial/Institutional; Residual Oil; 10-100 Million BTU/hr **
10300401	External Combustion Boilers; Commercial/Institutional; Residual Oil - Grade 6; Boiler
10200404	External Combustion Boilers; Industrial; Residual Oil; Grade 5 Oil
10200402	External Combustion Boilers; Industrial; Residual Oil; 10-100 Million BTU/hr
10200401	External Combustion Boilers; Industrial; Residual Oil; Grade 6 oil
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired

10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Increased Caustic Injection Rate for Existing Dry Injection Control; ICI Boilers (Sub-bituminous Coal)
Abbreviation:	SICIRIBSC
Description:	Increased Caustic Injection - This control measure involves an increase in the alkaline sorbent used for scrubbing flue gases to remove SO2. Depending on the application, the two most important sorbents are lime and sodium hydroxide (also known as caustic soda). Lime is typically used on large coal- or oil-fired boilers as found in power plants, as it is very much less expensive than caustic soda. The problem is that it results in a slurry being circulated through the scrubber instead of a solution. This makes it harder on the equipment. A spray tower is typically used for this application. The use of lime results in a slurry of calcium sulfite (CaSO3) that must be disposed of. Fortunately, calcium sulfite can be oxidized to produce by-product gypsum (CaSO4 ‚Äö√Ñ√∂‚Ä†¬¥ 2H2O) which is marketable for use in the building products industry. Caustic soda is limited to smaller combustion units because it is more expensive than lime, but it has the advantage that it forms a solution rather than a slurry. This makes it easier to operate. It produces a "spent caustic" solution of sodium sulfite/bisulfite (depending on the pH), or sodium sulfate that must be disposed of. This is not a problem in a kraft pulp mill for example, where this can be a source of makeup chemicals to the recovery cycle. Reference: Wikipedia, "Flue-Gas-Desulfurization", April 2014. http://en.wikipedia.org/wiki/Flue-gas_desulfurization
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Increased Caustic Injection Rate for Existing Dry Injection Control
Source Group:	ICI Boilers (Sub-bituminous Coal)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Cost Equations:

Name: Type 18

Description: Increased Caustic Injection Rate for Existing Dry Injection Control Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	5.06

Affected SCCs:

Code	Description
10200225	External Combustion Boilers; Industrial; Subbituminous Coal; Traveling Grate (Overfeed) Stoker
10200224	External Combustion Boilers; Industrial; Subbituminous Coal; Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Increased Caustic Injection Rate for Existing Dry Injection Control; ICI Boilers (Wet Biomass)
Abbreviation:	SICIRIBWB
Description:	Increased Caustic Injection - This control measure involves an increase in the alkaline sorbent used for scrubbing flue gases to remove SO2. Depending on the application, the two most important sorbents are lime and sodium hydroxide (also known as caustic soda). Lime is typically used on large coal- or oil-fired boilers as found in power plants, as it is very much less expensive than caustic soda. The problem is that it results in a slurry being circulated through the scrubber instead of a solution. This makes it harder on the equipment. A spray tower is typically used for this application. The use of lime results in a slurry of calcium sulfite (CaSO3) that must be disposed of. Fortunately, calcium sulfite can be oxidized to produce by-product gypsum (CaSO4 ‚Äö†´ 2H2O) which is marketable for use in the building products industry. Caustic soda is limited to smaller combustion units because it is more expensive than lime, but it has the advantage that it forms a solution rather than a slurry. This makes it easier to operate. It produces a "spent caustic" solution of sodium sulfite/bisulfite (depending on the pH), or sodium sulfate that must be disposed of. This is not a problem in a kraft pulp mill for example, where this can be a source of makeup chemicals to the recovery cycle. Reference: Wikipedia, "Flue-Gas-Desulfurization", April 2014. http://en.wikipedia.org/wiki/Flue-gas_desulfurization
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Increased Caustic Injection Rate for Existing Dry Injection Control
Source Group:	ICI Boilers (Wet Biomass)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	N/A
CPT:	
Ref Yr CPT:	
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	SCWSHUBCF
Existing NEI Dev:	0

Cost Equations:

Name: Type 18

Description: Increased Caustic Injection Rate for Existing Dry Injection Control Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	8.42

Affected SCCs:

Code	Description
10300903	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10200903	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10101101	External Combustion Boilers; Electric Generation; Bagasse; All Boiler Sizes
10100903	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Lime Spray Dryer; Utility Boilers - 100 to 299 MW
Abbreviation: SLSDUBC3
Description: Application: This control is the application of a Lime Spray Dryer to Utility Boilers to reduce SO2 emissions.

This control applies to Bituminous/Subbituminous Utility Boilers from 100 to 299 MW in capacity.
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Lime Spray Dryer
Source Group: Utility Boilers - Bituminous/Subbituminous Coal (100 to 299 MW)
Sectors: ptipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	SO2
Cost Year	2011
Capital Cost Multiplier	538.0
Fixed O&M Cost Multiplier	8.9
Variable O&M Cost Multiplier	2.8
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker

10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All

References:

N/A

Other information:

Summary:

Control Measure Name: Lime Spray Dryer; Utility Boilers - 25 to 49 MW

Abbreviation: SLSDUBC1

Description: Application: This control is the application of a Lime Spray Dryer to Utility Boilers to reduce SO2 emissions.

This control applies to Bituminous/Subbituminous Utility Boilers from 25 to 49 MW in capacity.

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Lime Spray Dryer

Source Group: Utility Boilers - Bituminous/Subbituminous Coal (25 to 49 MW)

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:
Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	SO2
Cost Year	2011
Capital Cost Multiplier	894.0
Fixed O&M Cost Multiplier	29.6
Variable O&M Cost Multiplier	2.8
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired

10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

References:

N/A

Other information:

Summary:

Control Measure Name: Lime Spray Dryer; Utility Boilers - 300 to 499 MW
Abbreviation: SLSDUBC4
Description: Application: This control is the application of a Lime Spray Dryer to Utility Boilers to reduce SO2 emissions.

This control applies to Bituminous/Subbituminous Utility Boilers from 300 to 499 MW in capacity.
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Lime Spray Dryer
Source Group: Utility Boilers - Bituminous/Subbituminous Coal (300 to 499 MW)
Sectors: ptipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incrementemal CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	SO2
Cost Year	2011
Capital Cost Multiplier	465.0
Fixed O&M Cost Multiplier	6.8
Variable O&M Cost Multiplier	2.8
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace

10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All

References:

N/A

Other information:

Summary:

Control Measure Name: Lime Spray Dryer; Utility Boilers - 500 to 699 MW
Abbreviation: SLSDUBC5
Description: Application: This control is the application of a Lime Spray Dryer to Utility Boilers to reduce SO2 emissions.

This control applies to Bituminous/Subbituminous Utility Boilers from 500 to 699 MW in capacity.
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Lime Spray Dryer
Source Group: Utility Boilers - Bituminous/Subbituminous Coal (500 to 699 MW)
Sectors: ptipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	SO2
Cost Year	2011
Capital Cost Multiplier	442.0
Fixed O&M Cost Multiplier	5.9
Variable O&M Cost Multiplier	2.8
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker

10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All

References:

N/A

Other information:

Summary:

Control Measure Name: Lime Spray Dryer; Utility Boilers - 50 to 99 MW
Abbreviation: SLSDUBC2
Description: Application: This control is the application of a Lime Spray Dryer to Utility Boilers to reduce SO2 emissions.

This control applies to Bituminous/Subbituminous Utility Boilers from 50 to 99 MW in capacity.
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Lime Spray Dryer
Source Group: Utility Boilers - Bituminous/Subbituminous Coal (50 to 99 MW)
Sectors: ptipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:
Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	SO2
Cost Year	2011
Capital Cost Multiplier	734.0
Fixed O&M Cost Multiplier	17.7
Variable O&M Cost Multiplier	2.8
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker

10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

References:

N/A

Other information:

Summary:

Control Measure Name: Lime Spray Dryer; Utility Boilers - Over 700 MW

Abbreviation: SLSDUBC6

Description: Application: This control is the application of a Lime Spray Dryer to Utility Boilers to reduce SO2 emissions.

This control applies to Bituminous/Subbituminous Utility Boilers over 700 MW in capacity.

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Lime Spray Dryer

Source Group: Utility Boilers - Bituminous/Subbituminous Coal (Over 700 MW)

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	92.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	SO2
Cost Year	2011
Capital Cost Multiplier	442.0
Fixed O&M Cost Multiplier	5.5
Variable O&M Cost Multiplier	2.8
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker

10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

References:

N/A

Other information:

Summary:

Control Measure Name: Limestone Forced Oxidation; Utility Boilers - 100 to 299 MW
Abbreviation: SLSFOUBC2
Description: Application: This control is the application of a Lime Spray Dryer to Utility Boilers to reduce SO2 emissions.

This control applies to Bituminous/Subbituminous Utility Boilers from 100 to 299 MW in capacity.
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Limestone Forced Oxidation
Source Group: Utility Boilers - Bituminous/Subbituminous Coal (100 to 299 MW)
Sectors: ptipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	SO2
Cost Year	2011
Capital Cost Multiplier	629.0
Fixed O&M Cost Multiplier	11.5
Variable O&M Cost Multiplier	2.3
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired

10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired

10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed

References:

N/A

Other information:

Summary:

Control Measure Name: Limestone Forced Oxidation; Utility Boilers - 25 to 99 MW
Abbreviation: SLSFOUBC1
Description: Application: This control is the application of a Lime Spray Dryer to Utility Boilers to reduce SO2 emissions.

This control applies to Bituminous/Subbituminous Utility Boilers from 25 to 99 MW in capacity.
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Limestone Forced Oxidation
Source Group: Utility Boilers - Bituminous/Subbituminous Coal (25 to 99 MW)
Sectors: ptipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:
Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	SO2
Cost Year	2011
Capital Cost Multiplier	860.0
Fixed O&M Cost Multiplier	24.2
Variable O&M Cost Multiplier	2.3
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired

10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired

10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed

References:

N/A

Other information:

Summary:

Control Measure Name:	Limestone Forced Oxidation; Utility Boilers - 300 to 499 MW
Abbreviation:	SLSFOUBC3
Description:	Application: This control is the application of a Lime Spray Dryer to Utility Boilers to reduce SO2 emissions. This control applies to Bituminous/Subbituminous Utility Boilers from 300 to 499 MW in capacity.
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Limestone Forced Oxidation
Source Group:	Utility Boilers - Bituminous/Subbituminous Coal (300 to 499 MW)
Sectors:	ptipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:
Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	SO2
Cost Year	2011
Capital Cost Multiplier	544.0
Fixed O&M Cost Multiplier	8.6
Variable O&M Cost Multiplier	2.3
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired

10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired

10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed

References:

N/A

Other information:

Summary:

Control Measure Name: Limestone Forced Oxidation; Utility Boilers - 500 to 699 MW
Abbreviation: SLSFOUBC4
Description: Application: This control is the application of a Lime Spray Dryer to Utility Boilers to reduce SO2 emissions.

This control applies to Bituminous/Subbituminous Utility Boilers from 500 to 699 MW in capacity.
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Limestone Forced Oxidation
Source Group: Utility Boilers - Bituminous/Subbituminous Coal (500 to 699 MW)
Sectors: ptipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremementał CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	SO2
Cost Year	2011
Capital Cost Multiplier	495.0
Fixed O&M Cost Multiplier	8.0
Variable O&M Cost Multiplier	2.3
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired

10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired

10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed

References:

N/A

Other information:

Summary:

Control Measure Name: Limestone Forced Oxidation; Utility Boilers - Over 700 MW
Abbreviation: SLSFOUBC5
Description: Application: This control is the application of a Lime Spray Dryer to Utility Boilers to reduce SO2 emissions.

This control applies to Bituminous/Subbituminous Utility Boilers over 700 MW in capacity.
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Limestone Forced Oxidation
Source Group: Utility Boilers - Bituminous/Subbituminous Coal (Over 700 MW)
Sectors: ptipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	
Ref Yr CPT:	
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	1
Capital Rec Fac:	0.10000000149011612
Discount Rate:	5.699999809265137
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:

Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	SO2
Cost Year	2011
Capital Cost Multiplier	447.0
Fixed O&M Cost Multiplier	6.6
Variable O&M Cost Multiplier	2.3
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired

10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired

10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed

References:

N/A

Other information:

Summary:

Control Measure Name: Low Sulfur Fuel; Residential Heating (heating oil)
Abbreviation: SLSFRESHET
Description: Application: This measure will be a switch from high-sulfur (2,500 ppm sulfur content) to low-sulfur (500 ppm) home heating oil for residential users.
Class: Known
Pollutant: SO2
Equipment Life: N/A years
Control Technology: Low Sulfur Fuel
Source Group: Residential Heating
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NOX	PM10	PM2_5	PM10-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	10.0	80.0	80.0	80.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	7.0	7.0	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	PM25-PRI	SO2
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2002
CPT:		$2,350
Ref Yr CPT:		$2,955
Control Efficiency:	80.0	75.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0

Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	7.0	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104004000	Stationary Source Fuel Combustion; Residential; Distillate Oil; Total: All Combustor Types

References:

- Low Sulfur Heating Oil in the Northeast States: An Overview of Benefits, Costs, and Implementation Issues. NESCAUM, Boston, MA. December 2005.

Other information:

CPTON_TEXT:	The cost for this measure is $2,350/ton (2002$).
WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	None
SO2:	Co
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_L:	80%
CTRL_EFF_T:	75%
OMATL_PCT:	0%
OPLBR_PCT:	0%
PM10:	Co*
PM25:	Co*
CE_TEXT:	SO2 - 75% from uncontrolled PM10 and PM2.5 - 80% from uncontrolled NOx - 10% from uncontrolled
CHEM_PCT:	0%

ADMIN_PCT:	0%
COST_BASIS:	The resulting costs are 1.5 cents/gallon. Presuming a density of 0.8 for home heating oil, 1 gallon = 0.8*8 = 6.4 lbs of oil. The costs in dollars per ton annually is thus (2000/6.4)*0.015 = $4.70/ton of home heating oil *(1 ton of oil/0.02 percent of sulfur/ton of oil) = 4.70 * 500 = $2,350/ton sulfur in home heating oil. Given that reduction of 1 part sulfur in HHO is equal to 1 part SO2 emissions, then we can say that the cost per ton of SO2 reduction due to this switch to home heating oil is also $2,350. Note: the study from which this data is taken states their is a 1:1 relationship between fuel sulfur contention reduction and SO2 emissions reduction. In addition, there is some evidence of reductions in maintenance costs for residential users due to reduced fouling of heating equipment and reduced cleaning. The costs have not been adjusted for these reductions.
OPLBR_RT:	$0/hr
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NOX:	Co
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name: Spray Dryer Absorber;Cement Kilns (dry process)
Abbreviation: SSPRADRKL
Description: Application: This control is the use of spray dry absorbers to reduce SO2 emissions from Cement kilns.
Class: Known
Pollutant: SO2
Equipment Life: N/A years
Control Technology: Spray Dry Absorber
Source Group: Cement Kilns
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$4,000
Ref Yr CPT:	$5,030
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$4,000
Ref Yr CPT:	$5,030
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln

References:

N/A

Other information:

Summary:

Control Measure Name: Spray Dryer Absorber;Cement Kilns (preheater)
Abbreviation: SSPRAPRKL
Description: Application: This control is the use of spray dry absorbers to reduce SO2 emissions from Cement kilns.
Class: Known
Pollutant: SO2
Equipment Life: N/A years
Control Technology: Spray Dry Absorber
Source Group: Cement Kilns
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$35,000
Ref Yr CPT:	$44,009
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$35,000
Ref Yr CPT:	$44,009
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln

References:

N/A

Other information:

Summary:

Control Measure Name: Spray Dryer Absorber;Cement Kilns (preheater/precalciner)
Abbreviation: SSPRAPRPR
Description: Application: This control is the use of spray dry absorbers to reduce SO2 emissions from Cement kilns.
Class: Known
Pollutant: SO2
Equipment Life: N/A years
Control Technology: Spray Dry Absorber
Source Group: Cement Kilns
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$25,000
Ref Yr CPT:	$31,435
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$25,000
Ref Yr CPT:	$31,435
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0

Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremememtal CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln

References:

N/A

Other information:

Summary:

Control Measure Name: Spray Dryer Absorber; ICI Boilers (All Other Liquid Fuels)

Abbreviation: SSDAIBOLF

Description: Spray Dryer Absorbers - In spray dryer absorbers, the flue gases are introduced into an absorbing tower (dryer) where the gases are contacted with a finely atomized alkaline slurry [usually a calcium-based sorbent such as Ca(OH)2 or CaO]. Acid gases are absorbed by the slurry mixture, and react to form solid salts. The heat of the flue gas is used to evaporate all the water droplets leaving a non-saturated (i.e. dry) flue gas exiting the absorber tower. The effect of cooling and humidifying the hot gas stream increases collection efficiency over simple dry injection. Since spray dryer absorbers only remove gases, a separate device is always required to remove particles. The particulate control devices are generally fabric filters or electrostatic precipitators (ESPs).

Reference: EPA Online Training re Installation of Wet Scrubbers, 1998. http://yosemite.epa.gov/oaqps/eogtrain.nsf/ae20ef1becae534385256b4100770781/7b32b476a8cc245285256b6c006c8db7/$FILE/si412c_lesson7.pdf

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Spray Dryer Absorber

Source Group: ICI Boilers (All Other Liquid Fuels)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$950,944
Ref Yr CPT:	$1,024,560
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$950,944
Ref Yr CPT:	$1,024,560
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 19

Description: Spray Dryer Absorber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	10.52

Affected SCCs:

Code	Description
30130201	Industrial Processes; Chemical Manufacturing; Carbon Tetrachloride; General
10201303	External Combustion Boilers; Industrial; Liquid Waste; Salable Animal Fat
10201302	External Combustion Boilers; Industrial; Liquid Waste; Waste Oil
10201301	External Combustion Boilers; Industrial; Liquid Waste; Specify Waste Material in Comments
10101302	External Combustion Boilers; Electric Generation; Liquid Waste; Waste Oil
10101301	External Combustion Boilers; Electric Generation; Liquid Waste; Specify Waste Material in Comments

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S.

Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Spray Dryer Absorber; ICI Boilers (All Other Solid Fuels)
Abbreviation:	SSDAIBOSF
Description:	Spray Dryer Absorbers - In spray dryer absorbers, the flue gases are introduced into an absorbing tower (dryer) where the gases are contacted with a finely atomized alkaline slurry [usually a calcium-based sorbent such as Ca(OH)2 or CaO]. Acid gases are absorbed by the slurry mixture, and react to form solid salts. The heat of the flue gas is used to evaporate all the water droplets leaving a non-saturated (i.e. dry) flue gas exiting the absorber tower. The effect of cooling and humidifying the hot gas stream increases collection efficiency over simple dry injection. Since spray dryer absorbers only remove gases, a separate device is always required to remove particles. The particulate control devices are generally fabric filters or electrostatic precipitators (ESPs). Reference: EPA Online Training re Installation of Wet Scrubbers, 1998. http://yosemite.epa.gov/oaqps/eogtrain.nsf/ae20ef1becae534385256b4100770781/7b32b476a8cc245285256b6c006c8db7/$FILE/si412c_lesson7.pdf
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Spray Dryer Absorber
Source Group:	ICI Boilers (All Other Solid Fuels)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$20,161,524
Ref Yr CPT:	$21,722,302
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$20,161,524
Ref Yr CPT:	$21,722,302
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 19

Description: Spray Dryer Absorber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	6.07

Affected SCCs:

Code	Description
39999999	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Industrial Processes; Other Not Classified
31100199	Industrial Processes; Building Construction; Construction: Building Contractors; Other Not Classified
30699999	Industrial Processes; Petroleum Industry; Petroleum Products - Not Classified; Not Classified **
30501021	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Removal
30500199	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; See Comment **
30500105	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; General **
10301202	External Combustion Boilers; Commercial/Institutional; Solid Waste; Refuse Derived Fuel
10301201	External Combustion Boilers; Commercial/Institutional; Solid Waste; Specify Waste Material in Comments
10201201	External Combustion Boilers; Industrial; Solid Waste; Specify Waste Material in Comments

10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal
10101204	External Combustion Boilers; Electric Generation; Solid Waste; Tire Derived Fuel : Shredded
10101202	External Combustion Boilers; Electric Generation; Solid Waste; Refuse Derived Fuel
10101201	External Combustion Boilers; Electric Generation; Solid Waste; Specify Waste Material in Comments
10100801	External Combustion Boilers; Electric Generation; Petroleum Coke; All Boiler Sizes

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Spray Dryer Absorber; ICI Boilers (Bituminous Coal)
Abbreviation:	SSDAIBBC
Description:	Spray Dryer Absorbers - In spray dryer absorbers, the flue gases are introduced into an absorbing tower (dryer) where the gases are contacted with a finely atomized alkaline slurry [usually a calcium-based sorbent such as Ca(OH)2 or CaO]. Acid gases are absorbed by the slurry mixture, and react to form solid salts. The heat of the flue gas is used to evaporate all the water droplets leaving a non-saturated (i.e. dry) flue gas exiting the absorber tower. The effect of cooling and humidifying the hot gas stream increases collection efficiency over simple dry injection. Since spray dryer absorbers only remove gases, a separate device is always required to remove particles. The particulate control devices are generally fabric filters or electrostatic precipitators (ESPs). Reference: EPA Online Training re Installation of Wet Scrubbers, 1998. http://yosemite.epa.gov/oaqps/eogtrain.nsf/ae20ef1becae534385256b4100770781/7b32b476a8cc245285256b6c006c8db7/$FILE/si412c_lesson7.pdf
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Spray Dryer Absorber
Source Group:	ICI Boilers (Bituminous Coal)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$17,276
Ref Yr CPT:	$18,614
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$17,276
Ref Yr CPT:	$18,614
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremenental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 19

Description: Spray Dryer Absorber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	4.68

Affected SCCs:

Code	Description
10300218	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10300217	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Bubbling Bed
10300214	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Hand-fired
10300209	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Spreader Stoker
10300208	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Underfeed Stoker
10300206	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom
10200218	External Combustion Boilers; Industrial; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10200205	External Combustion Boilers; Industrial; Bituminous Coal; Overfeed Stoker
10200204	External Combustion Boilers; Industrial; Bituminous Coal; Spreader Stoker

10200202	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Spray Dryer Absorber; ICI Boilers (Distillate Oil)

Abbreviation: SSDAIBDO

Description: Spray Dryer Absorbers - In spray dryer absorbers, the flue gases are introduced into an absorbing tower (dryer) where the gases are contacted with a finely atomized alkaline slurry [usually a calcium-based sorbent such as Ca(OH)2 or CaO]. Acid gases are absorbed by the slurry mixture, and react to form solid salts. The heat of the flue gas is used to evaporate all the water droplets leaving a non-saturated (i.e. dry) flue gas exiting the absorber tower. The effect of cooling and humidifying the hot gas stream increases collection efficiency over simple dry injection. Since spray dryer absorbers only remove gases, a separate device is always required to remove particles. The particulate control devices are generally fabric filters or electrostatic precipitators (ESPs).

Reference: EPA Online Training re Installation of Wet Scrubbers, 1998. http://yosemite.epa.gov/oaqps/eogtrain.nsf/ae20ef1becae534385256b4100770781/7b32b476a8cc245285256b6c006c8db7/$FILE/si412c_lesson7.pdf

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Spray Dryer Absorber

Source Group: ICI Boilers (Distillate Oil)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$4,203,564
Ref Yr CPT:	$4,528,978
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$4,203,564
Ref Yr CPT:	$4,528,978
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 19

Description: Spray Dryer Absorber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	10.84

Affected SCCs:

Code	Description
30290001	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
10500205	External Combustion; Space Heaters; Commercial/Institutional; Distillate Oil
10500105	External Combustion; Space Heaters; Industrial; Distillate Oil
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil

10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Spray Dryer Absorber; ICI Boilers (Dry Biomass)
Abbreviation:	SSDAIBDB
Description:	Spray Dryer Absorbers - In spray dryer absorbers, the flue gases are introduced into an absorbing tower (dryer) where the gases are contacted with a finely atomized alkaline slurry [usually a calcium-based sorbent such as Ca(OH)2 or CaO]. Acid gases are absorbed by the slurry mixture, and react to form solid salts. The heat of the flue gas is used to evaporate all the water droplets leaving a non-saturated (i.e. dry) flue gas exiting the absorber tower. The effect of cooling and humidifying the hot gas stream increases collection efficiency over simple dry injection. Since spray dryer absorbers only remove gases, a separate device is always required to remove particles. The particulate control devices are generally fabric filters or electrostatic precipitators (ESPs). Reference: EPA Online Training re Installation of Wet Scrubbers, 1998. http://yosemite.epa.gov/oaqps/eogtrain.nsf/ae20ef1becae534385256b4100770781/7b32b476a8cc245285256b6c006c8db7/$FILE/si412c_lesson7.pdf
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Spray Dryer Absorber
Source Group:	ICI Boilers (Dry Biomass)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$320,445
Ref Yr CPT:	$345,252
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$320,445
Ref Yr CPT:	$345,252
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 19

Description: Spray Dryer Absorber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	8.48

Affected SCCs:

Code	Description
10300912	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Fluidized bed combustion boilers
10300911	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Stoker boilers **
10300902	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood/Bark-fired Boiler
10200911	External Combustion Boilers; Industrial; Wood/Bark Waste; Stoker boilers **
10200910	External Combustion Boilers; Industrial; Wood/Bark Waste; Fuel cell/Dutch oven boilers **
10200908	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Dry Wood (<20% moisture)
10200907	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood Cogeneration
10200906	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler (< 50,000 Lb Steam) **
10200905	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler (< 50,000 Lb Steam) **

10200902	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler
10200901	External Combustion Boilers; Industrial; Wood/Bark Waste; Bark-fired Boiler
10100911	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Stoker boilers **
10100902	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood/Bark Fired Boiler

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Spray Dryer Absorber; ICI Boilers (Gaseous Fuels)
Abbreviation: SSDAIBGF
Description: Spray Dryer Absorbers - In spray dryer absorbers, the flue gases are introduced into an absorbing tower (dryer) where the gases are contacted with a finely atomized alkaline slurry [usually a calcium-based sorbent such as Ca(OH)2 or CaO]. Acid gases are absorbed by the slurry mixture, and react to form solid salts. The heat of the flue gas is used to evaporate all the water droplets leaving a non-saturated (i.e. dry) flue gas exiting the absorber tower. The effect of cooling and humidifying the hot gas stream increases collection efficiency over simple dry injection. Since spray dryer absorbers only remove gases, a separate device is always required to remove particles. The particulate control devices are generally fabric filters or electrostatic precipitators (ESPs).

Reference: EPA Online Training re Installation of Wet Scrubbers, 1998. http://yosemite.epa.gov/oaqps/eogtrain.nsf/ae20ef1becae534385256b4100770781/7b32b476a8cc245285256b6c006c8db7/$FILE/si412c_lesson7.pdf
Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Spray Dryer Absorber
Source Group: ICI Boilers (Gaseous Fuels)
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$8,645,314
Ref Yr CPT:	$9,314,580
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$8,645,314
Ref Yr CPT:	$9,314,580
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 19

Description: Spray Dryer Absorber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	16.42

Affected SCCs:

Code	Description
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100701	External Combustion Boilers; Electric Generation; Process Gas; Boiler, >= 100 Million BTU/hr
10100702	External Combustion Boilers; Electric Generation; Process Gas; Boiler < 100 Million Btu/hr
10100703	External Combustion Boilers; Electric Generation; Petroleum Refinery Gas; Boiler
10101002	External Combustion Boilers; Electric Generation; Liquified Petroleum Gas (LPG); Propane
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr

10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200711	External Combustion Boilers; Industrial; Process Gas; Landfill Gas
10200799	External Combustion Boilers; Industrial; Process Gas; Other: Specify in Comments
10201001	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Butane
10201002	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Propane
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300811	External Combustion Boilers; Commercial/Institutional; Landfill Gas; Landfill Gas
10301001	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane
10301002	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Propane
10301003	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane/Propane Mixture: Specify Percent Butane in Comments
10500106	External Combustion; Space Heaters; Industrial; Natural Gas
10500206	External Combustion; Space Heaters; Commercial/Institutional; Natural Gas
30290003	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Natural Gas: Process Heaters
31000203	Industrial Processes; Oil and Gas Production; Natural Gas Production; Compressors (See also 310003-12 and -13)
31000414	Industrial Processes; Oil and Gas Production; Process Heaters; Natural Gas: Steam Generators

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Spray Dryer Absorber; ICI Boilers (Residual Oil)
Abbreviation:	SSDAIBRO
Description:	Spray Dryer Absorbers - In spray dryer absorbers, the flue gases are introduced into an absorbing tower (dryer) where the gases are contacted with a finely atomized alkaline slurry [usually a calcium-based sorbent such as Ca(OH)2 or CaO]. Acid gases are absorbed by the slurry mixture, and react to form solid salts. The heat of the flue gas is used to evaporate all the water droplets leaving a non-saturated (i.e. dry) flue gas exiting the absorber tower. The effect of cooling and humidifying the hot gas stream increases collection efficiency over simple dry injection. Since spray dryer absorbers only remove gases, a separate device is always required to remove particles. The particulate control devices are generally fabric filters or electrostatic precipitators (ESPs). Reference: EPA Online Training re Installation of Wet Scrubbers, 1998. http://yosemite.epa.gov/oaqps/eogtrain.nsf/ae20ef1becae534385256b4100770781/7b32b476a8cc245285256b6c006c8db7/$FILE/si412c_lesson7.pdf
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Spray Dryer Absorber
Source Group:	ICI Boilers (Residual Oil)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$146,786
Ref Yr CPT:	$158,149
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$146,786
Ref Yr CPT:	$158,149
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 19

Description: Spray Dryer Absorber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	9.08

Affected SCCs:

Code	Description
10300404	External Combustion Boilers; Commercial/Institutional; Residual Oil; Grade 5 Oil
10300402	External Combustion Boilers; Commercial/Institutional; Residual Oil; 10-100 Million BTU/hr **
10300401	External Combustion Boilers; Commercial/Institutional; Residual Oil - Grade 6; Boiler
10200404	External Combustion Boilers; Industrial; Residual Oil; Grade 5 Oil
10200402	External Combustion Boilers; Industrial; Residual Oil; 10-100 Million BTU/hr
10200401	External Combustion Boilers; Industrial; Residual Oil; Grade 6 oil
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Spray Dryer Absorber; ICI Boilers (Sub-bituminous Coal)
Abbreviation: SSDAIBSC
Description: Spray Dryer Absorbers - In spray dryer absorbers, the flue gases are introduced into an absorbing tower (dryer) where the gases are contacted with a finely atomized alkaline slurry [usually a calcium-based sorbent such as Ca(OH)2 or CaO]. Acid gases are absorbed by the slurry mixture, and react to form solid salts. The heat of the flue gas is used to evaporate all the water droplets leaving a non-saturated (i.e. dry) flue gas exiting the absorber tower. The effect of cooling and humidifying the hot gas stream increases collection efficiency over simple dry injection. Since spray dryer absorbers only remove gases, a separate device is always required to remove particles. The particulate control devices are generally fabric filters or electrostatic precipitators (ESPs).

Reference: EPA Online Training re Installation of Wet Scrubbers, 1998. http://yosemite.epa.gov/oaqps/eogtrain.nsf/ae20ef1becae534385256b4100770781/7b32b476a8cc245285256b6c006c8db7/$FILE/si412c_lesson7.pdf

Class: Known
Pollutant: SO2
Equipment Life: 15.0 years
Control Technology: Spray Dryer Absorber
Source Group: ICI Boilers (Sub-bituminous Coal)
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$16,899
Ref Yr CPT:	$18,208
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$16,899
Ref Yr CPT:	$18,208
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 19

Description: Spray Dryer Absorber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	5.06

Affected SCCs:

Code	Description
10200225	External Combustion Boilers; Industrial; Subbituminous Coal; Traveling Grate (Overfeed) Stoker
10200224	External Combustion Boilers; Industrial; Subbituminous Coal; Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research

Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Spray Dryer Absorber; ICI Boilers (Wet Biomass)
Abbreviation:	SSDAIBWB
Description:	Spray Dryer Absorbers - In spray dryer absorbers, the flue gases are introduced into an absorbing tower (dryer) where the gases are contacted with a finely atomized alkaline slurry [usually a calcium-based sorbent such as Ca(OH)2 or CaO]. Acid gases are absorbed by the slurry mixture, and react to form solid salts. The heat of the flue gas is used to evaporate all the water droplets leaving a non-saturated (i.e. dry) flue gas exiting the absorber tower. The effect of cooling and humidifying the hot gas stream increases collection efficiency over simple dry injection. Since spray dryer absorbers only remove gases, a separate device is always required to remove particles. The particulate control devices are generally fabric filters or electrostatic precipitators (ESPs). Reference: EPA Online Training re Installation of Wet Scrubbers, 1998. http://yosemite.epa.gov/oaqps/eogtrain.nsf/ae20ef1becae534385256b4100770781/7b32b476a8cc245285256b6c006c8db7/$FILE/si412c_lesson7.pdf
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Spray Dryer Absorber
Source Group:	ICI Boilers (Wet Biomass)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008
CPT:	$392,044
Ref Yr CPT:	$422,394
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2008

CPT:	$392,044
Ref Yr CPT:	$422,394
Control Efficiency:	80.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

Name: Type 19

Description: Spray Dryer Absorber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008
Stack Gas Moisture Content, %	8.42

Affected SCCs:

Code	Description
10300903	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10200903	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10101101	External Combustion Boilers; Electric Generation; Bagasse; All Boiler Sizes
10100903	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research

Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Sulfuric Acid Plant; Primary Metals Industry

Abbreviation: SSADPPRMTL

Description: Application: This control is the use of flue gas desulfurization technologies to reduce NOx emissions.

This control applies to SO2 sources in the primary metals industry.

Discussion: FGD scrubbers can be either wet or dry systems. In wet systems, a liquid sorbent is sprayed into the flue gas in an absorber vessel. Limestone and lime-based reagents are most frequently used in scrubbers in the United States (EPA, 2002). Dry and semi-dry FGD systems include spray dryers, and dry injection into a duct or a combustion zone.

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Sulfuric Acid Plant

Source Group: Primary Metals Industry

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2	SO2
Locale:		
Effective Date:	2020-01-01 00:00:00.0	N/A
Cost Year:	1999	1990
CPT:		
Ref Yr CPT:		
Control Efficiency:	90.0	70.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	11	3
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	SO2	SO2
Locale:		
Effective Date:	2020-01-01 00:00:00.0	N/A
Cost Year:	1999	1990
CPT:		
Ref Yr CPT:		

Control Efficiency:	90.0	70.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	11	3
Capital Rec Fac:	0.10000000149011612	0.10000000149011612
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 3

Description: Non-EGU SO2

Inventory Fields: stkflow

Formula: Capital Cost = Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack flow rate Capital Cost = ((1028000/Min. stack flow rate)^0.6)x Capital Cost factor x Gas Flow Rate factor x Retrofit fator x Min. Stack Flow rate
O&M Cost = (3.35 + (0.00729 x 8736)) x Min. stack flow rate x 0.9383
Total Cost = (Capital cost x CRF) + O&M Cost

Notes:
Min Stack Flow Rate >= 1028000 acfm
Min Stack Flow Rate < 1028000 acfm
Capital Cost factor = $192 / kw
Gas flow rate factor = 0.486 KW/acfm

Variable Name	Value
Pollutant	SO2
Cost Year	1990

Affected SCCs:

Code	Description
30399999	Industrial Processes; Primary Metal Production; Other Not Classified; Other Not Classified
30303003	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Strand
30301201	Industrial Processes; Primary Metal Production; Titanium; Chlorination
30301199	Industrial Processes; Primary Metal Production; Molybdenum; Other Not Classified
30301101	Industrial Processes; Primary Metal Production; Molybdenum; Mining: General
30301002	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Operation
30301001	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Single Stream
30300999	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified

30300933	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Reheat Furnaces
30300931	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Rolling
30300911	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Soaking Pits
30300908	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Arc Furnace: Carbon Steel (Stack)
30300901	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Open Hearth Furnace: Stack
30300825	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cast House
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300817	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cooler
30300813	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Windbox
30300201	Industrial Processes; Primary Metal Production; Aluminum Hydroxide Calcining; Overall Process
30300199	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Not otherwise classified
30300105	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Anode Baking Furnace Primary Emissions
30300103	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Vertical Stud Soderberg Potline Primary Emissions
30300102	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Horizontal Stud Soderberg Potline Primary Emissions
30300101	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Prebaked Potline Primary Emissions [See also 303001-13 thru-16]

References:

- EPA, 2002: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual," 6th ed., EPA/452/B-02-001, Research Triangle Park, NC, January 2002.

Other information:

ADMIN_PCT:	0%
CE_TEXT:	90% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The costs are based on stack flowrate in cubic feet per minute. The equations below are simplified from the EPA Control Cost Manual (EPA, 2002). Cost equations for flue gas desulfurization: Capital cost: DEF = de-escalation factor (to convert to 1990 dollars) = 0.9383 RF = retrofit factor = 1.1 For stack flowrate less than 1,0280,000 cu. ft./min = (1,0280,000/Flowrate)^0.6)*93.3*RF*Flowrate* DEF For stack flowrate greater than or equal to 1,0280,000 cu. ft./min = 93.3*RF*Flowrate*DEF Operating and Maintenance (O&M) cost = 3.35+0.000729*8736*DEF * Flowrate Equipment Life in Years = Equiplife = 15 years Interest Rate = I = 7% Capital Recovery Factor: CRF = [i (1 + i) ^ Equiplife] / [((1 + i)^ Equiplife) - 1 Annual cost = (Capital cost * CRF) + O&M cost The cost effectiveness is determined by dividing the annual cost by the annual tons SO2 reduced.
CPTON_TEXT:	The cost effectiveness is variable depending on stack flow rate in cubic feet per minute.
CTRL_EFF_T:	90%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	90%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SO2:	Co*
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%

UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name:	Sulfur Recovery and/or Tail Gas Treatment; Sulfur Recovery Plants - Elemental Sulfur (Claus: 2 Stage w/o control (92-95% removal))
Abbreviation:	SSRTGSRP95
Description:	Application: This control is the application of Sulfur recover and/or tail gas treatment controls to Sulfur Recovery Plant sources to reduce SO2 emissions. This control applies to uncontrolled elemental Sulfur Recovery plants (Claus: 3 Stage (92-95% removal)).
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Sulfur Recovery and/or Tail Gas Treatment
Source Group:	Sulfur Recovery Plants - Elemental Sulfur (Claus: 2 Stage w/o control (92-95% removal))
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$643
Ref Yr CPT:	$1,030
Control Efficiency:	99.80000305175781
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$643
Ref Yr CPT:	$1,030
Control Efficiency:	99.80000305175781
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30103201	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Mod. Claus: 2 Stage w/o Control (92-95% Removal)

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name:	Sulfur Recovery and/or Tail Gas Treatment; Sulfur Recovery Plants - Elemental Sulfur (Claus: 3 Stage w/o control (95-96% removal))
Abbreviation:	SSRTGSRP96
Description:	Application: This control is the application of Sulfur recover and/or tail gas treatment controls to Sulfur Recovery Plant sources to reduce SO2 emissions. This control applies to uncontrolled elemental Sulfur Recovery plants (Claus: 3 Stage (95-96% removal)).
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Sulfur Recovery and/or Tail Gas Treatment
Source Group:	Sulfur Recovery Plants - Elemental Sulfur (Claus: 3 Stage w/o control (95-96% removal))
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$643
Ref Yr CPT:	$1,030
Control Efficiency:	99.80000305175781
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$643
Ref Yr CPT:	$1,030
Control Efficiency:	99.80000305175781
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30103202	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Mod. Claus: 3 Stage w/o Control (95-96% Removal)

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name:	Sulfur Recovery and/or Tail Gas Treatment; Sulfur Recovery Plants - Elemental Sulfur (Claus: 3 Stage w/o control (96-97% removal))
Abbreviation:	SSRTGSRP97
Description:	Application: This control is the application of Sulfur recover and/or tail gas treatment controls to Sulfur Recovery Plant sources to reduce SO2 emissions. This control applies to uncontrolled elemental Sulfur Recovery plants (Claus: 3 Stage (96-97% removal)).
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Sulfur Recovery and/or Tail Gas Treatment
Source Group:	Sulfur Recovery Plants - Elemental Sulfur (Claus: 3 Stage w/o control (96-97% removal))
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$643
Ref Yr CPT:	$1,030
Control Efficiency:	99.5
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	1990
CPT:	$643
Ref Yr CPT:	$1,030
Control Efficiency:	99.5
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	0.10000000149011612
Discount Rate:	7.0
Cap Ann Ratio:	N/A
Incremenental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30103203	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Mod. Claus: 4 Stage w/o Control (96-97% Removal)

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name: Wet Flue Gas Desulfurization;Cement Kilns (dry process)
Abbreviation: SWFGDDRKL
Description: Application: This control is the injection of two types of dry sorbents into the ductwork downstream of the boiler to reduce SO2 emissions. Either calcium-based sorbent was injected upstream of the economizer, or sodium-based sorbent downstream of the air heater. Humidification downstream of the dry sorbent injection was incorporated to aid SO2 capture and lower flue gas temperature and gas flow before entering the fabric filter dust collector (FFDC).
Class: Known
Pollutant: SO2
Equipment Life: N/A years
Control Technology: Wet Flue Gas Desulfurization
Source Group: Cement Kilns
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2	SO2
Locale:		
Effective Date:	N/A	2020-01-01 00:00:00.0
Cost Year:	2002	2002
CPT:	$4,000	$4,000
Ref Yr CPT:	$5,030	$5,030
Control Efficiency:	90.0	95.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	SO2	SO2
Locale:		
Effective Date:	N/A	2020-01-01 00:00:00.0
Cost Year:	2002	2002
CPT:	$4,000	$4,000
Ref Yr CPT:	$5,030	$5,030
Control Efficiency:	90.0	95.0
Min Emis:	N/A	N/A

Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln

References:

N/A

Other information:

Summary:

Control Measure Name: Wet Flue Gas Desulfurization;Cement Kilns (preheater)

Abbreviation: SWFGDPRKL

Description: Application: This control is the injection of two types of dry sorbents into the ductwork downstream of the boiler to reduce SO2 emissions. Either calcium-based sorbent was injected upstream of the economizer, or sodium-based sorbent downstream of the air heater. Humidification downstream of the dry sorbent injection was incorporated to aid SO2 capture and lower flue gas temperature and gas flow before entering the fabric filter dust collector (FFDC).

Class: Known

Pollutant: SO2

Equipment Life: N/A years

Control Technology: Wet Flue Gas Desulfurization

Source Group: Cement Kilns

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$35,000
Ref Yr CPT:	$44,009
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$35,000
Ref Yr CPT:	$44,009
Control Efficiency:	90.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremenental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln

References:

N/A

Other information:

Summary:

Control Measure Name: Wet Flue Gas Desulfurization;Cement Kilns (preheater/precalciner)
Abbreviation: SWFGDPRPR
Description: Application: This control is the injection of two types of dry sorbents into the ductwork downstream of the boiler to reduce SO2 emissions. Either calcium-based sorbent was injected upstream of the economizer, or sodium-based sorbent downstream of the air heater. Humidification downstream of the dry sorbent injection was incorporated to aid SO2 capture and lower flue gas temperature and gas flow before entering the fabric filter dust collector (FFDC).
Class: Known
Pollutant: SO2
Equipment Life: N/A years
Control Technology: Wet Flue Gas Desulfurization
Source Group: Cement Kilns
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$25,000
Ref Yr CPT:	$31,435
Control Efficiency:	90.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2002
CPT:	$25,000
Ref Yr CPT:	$31,435
Control Efficiency:	90.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln

References:

N/A

Other information:

Summary:

Control Measure Name: Wet Flue Gas Desulfurization;Cement Kilns (wet process)
Abbreviation: SWFGDCEMKL
Description: Application: This control is the injection of two types of dry sorbents into the ductwork downstream of the boiler to reduce SO2 emissions. Either calcium-based sorbent was injected upstream of the economizer, or sodium-based sorbent downstream of the air heater. Humidification downstream of the dry sorbent injection was incorporated to aid SO2 capture and lower flue gas temperature and gas flow before entering the fabric filter dust collector (FFDC).
Class: Known
Pollutant: SO2
Equipment Life: N/A years
Control Technology: Wet Flue Gas Desulfurization
Source Group: Cement Kilns
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2	SO2
Locale:		
Effective Date:	2020-01-01 00:00:00.0	N/A
Cost Year:	2002	2002
CPT:	$7,000	$7,000
Ref Yr CPT:	$8,802	$8,802
Control Efficiency:	95.0	90.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	SO2	SO2
Locale:		
Effective Date:	2020-01-01 00:00:00.0	N/A
Cost Year:	2002	2002
CPT:	$7,000	$7,000
Ref Yr CPT:	$8,802	$8,802
Control Efficiency:	95.0	90.0
Min Emis:	N/A	N/A

Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30500706	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Kilns

References:

N/A

Other information:

Summary:

Control Measure Name: Wet Flue Gas Desulfurization;Petroleum Refinery Catalytic and Thermal Cracking Units
Abbreviation: SWFGDPETCK
Description: Application: This control is the injection of two types of dry sorbents into the ductwork downstream of the boiler to reduce SO2 emissions. Either calcium-based sorbent was injected upstream of the economizer, or sodium-based sorbent downstream of the air heater. Humidification downstream of the dry sorbent injection was incorporated to aid SO2 capture and lower flue gas temperature and gas flow before entering the fabric filter dust collector (FFDC).
Class: Known
Pollutant: SO2
Equipment Life: N/A years
Control Technology: Wet Flue Gas Desulfurization
Source Group: Petroleum Refinery Catalytic and Thermal Cracking Units
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	$665
Ref Yr CPT:	$798
Control Efficiency:	97.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	$665
Ref Yr CPT:	$798
Control Efficiency:	97.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30600301	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Thermal Catalytic Cracking Unit
30600202	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Catalyst Handling System
30600201	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Fluid Catalytic Cracking Unit

References:

- Assessment of Control Technology Options for Petroleum Refineries in the Mid-Atlantic Region. Draft Final Technical Support Document. Prepared by MACTEC Federal Programs, Inc. for MARAMA. October 13, 2006.
- Eagleson, Scott T., Hutter, Edward, Dharia, Dilip J., John, Ramash B. and Singhania, Sudhanshu, "Economic Advantages in Controlling Refinery FCCU Atmospheric Emissions", presented at the XII Refinery Technology Meet, September 23-25

Other information:

Summary:

Control Measure Name: Wet Flue Gas Desulfurization;Petroleum Refinery Process Heaters
Abbreviation: SWFGDPETPH
Description: Application: This control is the injection of two types of dry sorbents into the ductwork downstream of the boiler to reduce SO2 emissions. Either calcium-based sorbent was injected upstream of the economizer, or sodium-based sorbent downstream of the air heater. Humidification downstream of the dry sorbent injection was incorporated to aid SO2 capture and lower flue gas temperature and gas flow before entering the fabric filter dust collector (FFDC).
Class: Known
Pollutant: SO2
Equipment Life: N/A years
Control Technology: Wet Flue Gas Desulfurization
Source Group: Petroleum Refinery Process Heaters
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	$26,529
Ref Yr CPT:	$31,830
Control Efficiency:	96.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	SO2
Locale:	
Effective Date:	N/A
Cost Year:	2004
CPT:	$26,529
Ref Yr CPT:	$31,830
Control Efficiency:	96.0
Min Emis:	N/A

Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30600199	Industrial Processes; Petroleum Industry; Process Heaters; Other Not Classified
30600111	Industrial Processes; Petroleum Industry; Process Heaters; Oil-fired (No. 6 Oil) : 100 Million Btu Capacity
30600108	Industrial Processes; Petroleum Industry; Process Heaters; Landfill Gas-fired
30600107	Industrial Processes; Petroleum Industry; Process Heaters; LPG-fired
30600106	Industrial Processes; Petroleum Industry; Process Heaters; Process Gas-fired
30600105	Industrial Processes; Petroleum Industry; Process Heaters; Natural Gas-fired
30600104	Industrial Processes; Petroleum Industry; Process Heaters; Gas-fired
30600103	Industrial Processes; Petroleum Industry; Process Heaters; Oil-fired
30600102	Industrial Processes; Petroleum Industry; Process Heaters; Gas-fired **
30600101	Industrial Processes; Petroleum Industry; Process Heaters; Oil-fired **
30600100	Industrial Processes;Petroleum Industry;Process Heaters;undefined

References:

- Assessment of Control Technology Options for Petroleum Refineries in the Mid-Atlantic Region. Draft Final Technical Support Document. Prepared by MACTEC Federal Programs, Inc. for MARAMA. October 13, 2006.

Other information:

Summary:

Control Measure Name:	Wet Scrubber; ICI Boilers (Coal)
Abbreviation:	SWSICIBC
Description:	Wet Scrubber - This describes a variety of devices that remove pollutants from a furnace flue gas or from other gas streams. In a wet scrubber, the polluted gas stream is brought into contact with the scrubbing liquid, by spraying it with the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the pollutants. The design of wet scrubbers or any air pollution control device depends on the industrial process conditions and the nature of the air pollutants involved. Inlet gas characteristics and dust properties (if particles are present) are of primary importance. Scrubbers can be designed to collect particulate matter and/or gaseous pollutants. The versatility of wet scrubbers allows them to be built in numerous configurations, all designed to provide good contact between the liquid and polluted gas stream. Wet scrubbers remove dust particles by capturing them in liquid droplets. The droplets are then collected, the liquid dissolving or absorbing the pollutant gases. Any droplets that are in the scrubber inlet gas must be separated from the outlet gas stream by means of another device referred to as a mist eliminator or entrainment separator (these terms are interchangeable). Also, the resultant scrubbing liquid must be treated prior to any ultimate discharge or being reused in the plant. A wet scrubber's ability to collect small particles is often directly proportional to the power input into the scrubber. Low energy devices such as spray towers are used to collect particles larger than 5 micrometers. To obtain high efficiency removal of 1 micrometer (or less) particles generally requires high energy devices such as venturi scrubbers or augmented devices such as condensation scrubbers. Additionally, a properly designed and operated entrainment separator or mist eliminator is important to achieve high removal efficiencies. The greater the number of liquid droplets that are not captured by the mist eliminator the higher the potential emission levels. Wet scrubbers that remove gaseous pollutants are referred to as absorbers. Good gas-to-liquid contact is essential to obtain high removal efficiencies in absorbers. A number of wet scrubber designs are used to remove gaseous pollutants, with the packed tower and the plate tower being the most common. If the gas stream contains both particle matter and gases, wet scrubbers are generally the only single air pollution control device that can remove both pollutants. Wet scrubbers can achieve high removal efficiencies for either particles or gases and, in some instances, can achieve a high removal efficiency for both pollutants in the same system. However, in many cases, the best operating conditions for particles collection are the poorest for gas removal. Reference: Wikipedia, "Wet Scrubber", April 2014. http://en.wikipedia.org/wiki/Wet_scrubber
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Wet Scrubber
Source Group:	ICI Boilers (Coal)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	N/A	2008
CPT:			$14,531
Ref Yr CPT:			$15,656
Control Efficiency:	95.0	95.0	95.0

Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	N/A	2008
CPT:			$14,531
Ref Yr CPT:			$15,656
Control Efficiency:	95.0	95.0	95.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 16

Description: Wet Scrubber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008

Affected SCCs:

Code	Description
10301202	External Combustion Boilers; Commercial/Institutional; Solid Waste; Refuse Derived Fuel
10301201	External Combustion Boilers; Commercial/Institutional; Solid Waste; Specify Waste Material in Comments
10300218	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10300217	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Bubbling Bed
10300214	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Hand-fired
10300209	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Spreader Stoker
10300208	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Underfeed Stoker
10300206	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom
10201201	External Combustion Boilers; Industrial; Solid Waste; Specify Waste Material in Comments
10200225	External Combustion Boilers; Industrial; Subbituminous Coal; Traveling Grate (Overfeed) Stoker
10200224	External Combustion Boilers; Industrial; Subbituminous Coal; Spreader Stoker
10200218	External Combustion Boilers; Industrial; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10200205	External Combustion Boilers; Industrial; Bituminous Coal; Overfeed Stoker
10200204	External Combustion Boilers; Industrial; Bituminous Coal; Spreader Stoker
10200202	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom
10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal
10101204	External Combustion Boilers; Electric Generation; Solid Waste; Tire Derived Fuel : Shredded
10101202	External Combustion Boilers; Electric Generation; Solid Waste; Refuse Derived Fuel
10101201	External Combustion Boilers; Electric Generation; Solid Waste; Specify Waste Material in Comments
10100801	External Combustion Boilers; Electric Generation; Petroleum Coke; All Boiler Sizes
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom

10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Wet Scrubber; ICI Boilers (Dry Wood <20% moisture)

Abbreviation: SWSICIBDW

Description: Wet Scrubber - This describes a variety of devices that remove pollutants from a furnace flue gas or from other gas streams. In a wet scrubber, the polluted gas stream is brought into contact with the scrubbing liquid, by spraying it with the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the pollutants.

The design of wet scrubbers or any air pollution control device depends on the industrial process conditions and the nature of the air pollutants involved. Inlet gas characteristics and dust properties (if particles are present) are of primary importance. Scrubbers can be designed to collect particulate matter and/or gaseous pollutants. The versatility of wet scrubbers allows them to be built in numerous configurations, all designed to provide good contact between the liquid and polluted gas stream.

Wet scrubbers remove dust particles by capturing them in liquid droplets. The droplets are then collected, the liquid dissolving or absorbing the pollutant gases. Any droplets that are in the scrubber inlet gas must be separated from the outlet gas stream by means of another device referred to as a mist eliminator or entrainment separator (these terms are interchangeable). Also, the resultant scrubbing liquid must be treated prior to any ultimate discharge or being reused in the plant.

A wet scrubber's ability to collect small particles is often directly proportional to the power input into the scrubber. Low energy devices such as spray towers are used to collect particles larger than 5 micrometers. To obtain high efficiency removal of 1 micrometer (or less) particles generally requires high energy devices such as venturi scrubbers or augmented devices such as condensation scrubbers. Additionally, a properly designed and operated entrainment separator or mist eliminator is important to achieve high removal efficiencies. The greater the number of liquid droplets that are not captured by the mist eliminator the higher the potential emission levels.

Wet scrubbers that remove gaseous pollutants are referred to as absorbers. Good gas-to-liquid contact is essential to obtain high removal efficiencies in absorbers. A number of wet scrubber designs are used to remove gaseous pollutants, with the packed tower and the plate tower being the most common.

If the gas stream contains both particle matter and gases, wet scrubbers are generally the only single air pollution control device that can remove both pollutants. Wet scrubbers can achieve high removal efficiencies for either particles or gases and, in some instances, can achieve a high removal efficiency for both pollutants in the same system. However, in many cases, the best operating conditions for particles collection are the poorest for gas removal.

Reference: Wikipedia, "Wet Scrubber", April 2014.
http://en.wikipedia.org/wiki/Wet_scrubber

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Wet Scrubber

Source Group: ICI Boilers (Dry Wood <20% moisture)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	N/A	2008
CPT:			$346,823
Ref Yr CPT:			$373,672
Control Efficiency:	85.0	85.0	95.0

Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	N/A	2008
CPT:			$346,823
Ref Yr CPT:			$373,672
Control Efficiency:	85.0	85.0	95.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 16

Description: Wet Scrubber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008

Affected SCCs:

Code	Description
10200908	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Dry Wood (<20% moisture)

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Wet Scrubber; ICI Boilers (Natural Gas and Other Gas Fuels)
Abbreviation:	SWSICIBG
Description:	Wet Scrubber - This describes a variety of devices that remove pollutants from a furnace flue gas or from other gas streams. In a wet scrubber, the polluted gas stream is brought into contact with the scrubbing liquid, by spraying it with the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the pollutants. The design of wet scrubbers or any air pollution control device depends on the industrial process conditions and the nature of the air pollutants involved. Inlet gas characteristics and dust properties (if particles are present) are of primary importance. Scrubbers can be designed to collect particulate matter and/or gaseous pollutants. The versatility of wet scrubbers allows them to be built in numerous configurations, all designed to provide good contact between the liquid and polluted gas stream. Wet scrubbers remove dust particles by capturing them in liquid droplets. The droplets are then collected, the liquid dissolving or absorbing the pollutant gases. Any droplets that are in the scrubber inlet gas must be separated from the outlet gas stream by means of another device referred to as a mist eliminator or entrainment separator (these terms are interchangeable). Also, the resultant scrubbing liquid must be treated prior to any ultimate discharge or being reused in the plant. A wet scrubber's ability to collect small particles is often directly proportional to the power input into the scrubber. Low energy devices such as spray towers are used to collect particles larger than 5 micrometers. To obtain high efficiency removal of 1 micrometer (or less) particles generally requires high energy devices such as venturi scrubbers or augmented devices such as condensation scrubbers. Additionally, a properly designed and operated entrainment separator or mist eliminator is important to achieve high removal efficiencies. The greater the number of liquid droplets that are not captured by the mist eliminator the higher the potential emission levels. Wet scrubbers that remove gaseous pollutants are referred to as absorbers. Good gas-to-liquid contact is essential to obtain high removal efficiencies in absorbers. A number of wet scrubber designs are used to remove gaseous pollutants, with the packed tower and the plate tower being the most common. If the gas stream contains both particle matter and gases, wet scrubbers are generally the only single air pollution control device that can remove both pollutants. Wet scrubbers can achieve high removal efficiencies for either particles or gases and, in some instances, can achieve a high removal efficiency for both pollutants in the same system. However, in many cases, the best operating conditions for particles collection are the poorest for gas removal. Reference: Wikipedia, "Wet Scrubber", April 2014. http://en.wikipedia.org/wiki/Wet_scrubber
Class:	Known
Pollutant:	SO2
Equipment Life:	15.0 years
Control Technology:	Wet Scrubber
Source Group:	ICI Boilers (Natural Gas and Other Gas Fuels)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	N/A	2008
CPT:			$306,114
Ref Yr CPT:			$329,812
Control Efficiency:	50.0	50.0	95.0

Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	N/A	2008
CPT:			$306,114
Ref Yr CPT:			$329,812
Control Efficiency:	50.0	50.0	95.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 16

Description: Wet Scrubber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008

Affected SCCs:

Code	Description
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100701	External Combustion Boilers; Electric Generation; Process Gas; Boiler, >= 100 Million BTU/hr
10100702	External Combustion Boilers; Electric Generation; Process Gas; Boiler < 100 Million Btu/hr
10100703	External Combustion Boilers; Electric Generation; Petroleum Refinery Gas; Boiler
10101002	External Combustion Boilers; Electric Generation; Liquified Petroleum Gas (LPG); Propane
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200711	External Combustion Boilers; Industrial; Process Gas; Landfill Gas
10200799	External Combustion Boilers; Industrial; Process Gas; Other: Specify in Comments
10201001	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Butane
10201002	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Propane
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300811	External Combustion Boilers; Commercial/Institutional; Landfill Gas; Landfill Gas
10301001	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane
10301002	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Propane
10301003	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane/Propane Mixture: Specify Percent Butane in Comments
10500106	External Combustion; Space Heaters; Industrial; Natural Gas
10500206	External Combustion; Space Heaters; Commercial/Institutional; Natural Gas
30130201	Industrial Processes; Chemical Manufacturing; Carbon Tetrachloride; General
30290003	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Natural Gas: Process Heaters
30500105	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; General **

30500199	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; See Comment **
30501021	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Removal
30699999	Industrial Processes; Petroleum Industry; Petroleum Products - Not Classified; Not Classified **
31000203	Industrial Processes; Oil and Gas Production; Natural Gas Production; Compressors (See also 310003-12 and -13)
31000414	Industrial Processes; Oil and Gas Production; Process Heaters; Natural Gas: Steam Generators
31100199	Industrial Processes; Building Construction; Construction: Building Contractors; Other Not Classified
39999999	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Industrial Processes; Other Not Classified

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Wet Scrubber; ICI Boilers (Oil and Other Liquid Fuels)

Abbreviation: SWSICIBO

Description: Wet Scrubber - This describes a variety of devices that remove pollutants from a furnace flue gas or from other gas streams. In a wet scrubber, the polluted gas stream is brought into contact with the scrubbing liquid, by spraying it with the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the pollutants.

The design of wet scrubbers or any air pollution control device depends on the industrial process conditions and the nature of the air pollutants involved. Inlet gas characteristics and dust properties (if particles are present) are of primary importance. Scrubbers can be designed to collect particulate matter and/or gaseous pollutants. The versatility of wet scrubbers allows them to be built in numerous configurations, all designed to provide good contact between the liquid and polluted gas stream.

Wet scrubbers remove dust particles by capturing them in liquid droplets. The droplets are then collected, the liquid dissolving or absorbing the pollutant gases. Any droplets that are in the scrubber inlet gas must be separated from the outlet gas stream by means of another device referred to as a mist eliminator or entrainment separator (these terms are interchangeable). Also, the resultant scrubbing liquid must be treated prior to any ultimate discharge or being reused in the plant.

A wet scrubber's ability to collect small particles is often directly proportional to the power input into the scrubber. Low energy devices such as spray towers are used to collect particles larger than 5 micrometers. To obtain high efficiency removal of 1 micrometer (or less) particles generally requires high energy devices such as venturi scrubbers or augmented devices such as condensation scrubbers. Additionally, a properly designed and operated entrainment separator or mist eliminator is important to achieve high removal efficiencies. The greater the number of liquid droplets that are not captured by the mist eliminator the higher the potential emission levels.

Wet scrubbers that remove gaseous pollutants are referred to as absorbers. Good gas-to-liquid contact is essential to obtain high removal efficiencies in absorbers. A number of wet scrubber designs are used to remove gaseous pollutants, with the packed tower and the plate tower being the most common.

If the gas stream contains both particle matter and gases, wet scrubbers are generally the only single air pollution control device that can remove both pollutants. Wet scrubbers can achieve high removal efficiencies for either particles or gases and, in some instances, can achieve a high removal efficiency for both pollutants in the same system. However, in many cases, the best operating conditions for particles collection are the poorest for gas removal.

Reference: Wikipedia, "Wet Scrubber", April 2014.
http://en.wikipedia.org/wiki/Wet_scrubber

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Wet Scrubber

Source Group: ICI Boilers (Oil and Other Liquid Fuels)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	N/A	2008
CPT:			$90,895
Ref Yr CPT:			$97,931
Control Efficiency:	94.0	94.0	95.0

Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	N/A	2008
CPT:			$90,895
Ref Yr CPT:			$97,931
Control Efficiency:	94.0	94.0	95.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 16

Description: Wet Scrubber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008

Affected SCCs:

Code	Description
30290001	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
10500205	External Combustion; Space Heaters; Commercial/Institutional; Distillate Oil
10500105	External Combustion; Space Heaters; Industrial; Distillate Oil
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler
10300404	External Combustion Boilers; Commercial/Institutional; Residual Oil; Grade 5 Oil
10300402	External Combustion Boilers; Commercial/Institutional; Residual Oil; 10-100 Million BTU/hr **
10300401	External Combustion Boilers; Commercial/Institutional; Residual Oil - Grade 6; Boiler
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10201303	External Combustion Boilers; Industrial; Liquid Waste; Salable Animal Fat
10201302	External Combustion Boilers; Industrial; Liquid Waste; Waste Oil
10201301	External Combustion Boilers; Industrial; Liquid Waste; Specify Waste Material in Comments
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler
10200404	External Combustion Boilers; Industrial; Residual Oil; Grade 5 Oil
10200402	External Combustion Boilers; Industrial; Residual Oil; 10-100 Million BTU/hr
10200401	External Combustion Boilers; Industrial; Residual Oil; Grade 6 oil
10101302	External Combustion Boilers; Electric Generation; Liquid Waste; Waste Oil
10101301	External Combustion Boilers; Electric Generation; Liquid Waste; Specify Waste Material in Comments
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Wet Scrubber; ICI Boilers (Wood/Bark Waste)

Abbreviation: SWSICIBW

Description: Wet Scrubber - This describes a variety of devices that remove pollutants from a furnace flue gas or from other gas streams. In a wet scrubber, the polluted gas stream is brought into contact with the scrubbing liquid, by spraying it with the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the pollutants.

The design of wet scrubbers or any air pollution control device depends on the industrial process conditions and the nature of the air pollutants involved. Inlet gas characteristics and dust properties (if particles are present) are of primary importance. Scrubbers can be designed to collect particulate matter and/or gaseous pollutants. The versatility of wet scrubbers allows them to be built in numerous configurations, all designed to provide good contact between the liquid and polluted gas stream.

Wet scrubbers remove dust particles by capturing them in liquid droplets. The droplets are then collected, the liquid dissolving or absorbing the pollutant gases. Any droplets that are in the scrubber inlet gas must be separated from the outlet gas stream by means of another device referred to as a mist eliminator or entrainment separator (these terms are interchangeable). Also, the resultant scrubbing liquid must be treated prior to any ultimate discharge or being reused in the plant.

A wet scrubber's ability to collect small particles is often directly proportional to the power input into the scrubber. Low energy devices such as spray towers are used to collect particles larger than 5 micrometers. To obtain high efficiency removal of 1 micrometer (or less) particles generally requires high energy devices such as venturi scrubbers or augmented devices such as condensation scrubbers. Additionally, a properly designed and operated entrainment separator or mist eliminator is important to achieve high removal efficiencies. The greater the number of liquid droplets that are not captured by the mist eliminator the higher the potential emission levels.

Wet scrubbers that remove gaseous pollutants are referred to as absorbers. Good gas-to-liquid contact is essential to obtain high removal efficiencies in absorbers. A number of wet scrubber designs are used to remove gaseous pollutants, with the packed tower and the plate tower being the most common.

If the gas stream contains both particle matter and gases, wet scrubbers are generally the only single air pollution control device that can remove both pollutants. Wet scrubbers can achieve high removal efficiencies for either particles or gases and, in some instances, can achieve a high removal efficiency for both pollutants in the same system. However, in many cases, the best operating conditions for particles collection are the poorest for gas removal.

Reference: Wikipedia, "Wet Scrubber", April 2014.
http://en.wikipedia.org/wiki/Wet_scrubber

Class: Known

Pollutant: SO2

Equipment Life: 15.0 years

Control Technology: Wet Scrubber

Source Group: ICI Boilers (Wood/Bark Waste)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	N/A	2008
CPT:			$70,168
Ref Yr CPT:			$75,600
Control Efficiency:	90.0	90.0	95.0

Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	N/A	2008
CPT:			$70,168
Ref Yr CPT:			$75,600
Control Efficiency:	90.0	90.0	95.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 16

Description: Wet Scrubber Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	SO2
Cost Year	2008

Affected SCCs:

Code	Description
10300912	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Fluidized bed combustion boilers
10300911	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Stoker boilers **
10300903	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10300902	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood/Bark-fired Boiler
10200911	External Combustion Boilers; Industrial; Wood/Bark Waste; Stoker boilers **
10200910	External Combustion Boilers; Industrial; Wood/Bark Waste; Fuel cell/Dutch oven boilers **
10200907	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood Cogeneration
10200906	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler (< 50,000 Lb Steam) **
10200905	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler (< 50,000 Lb Steam) **
10200903	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10200902	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler
10200901	External Combustion Boilers; Industrial; Wood/Bark Waste; Bark-fired Boiler
10101101	External Combustion Boilers; Electric Generation; Bagasse; All Boiler Sizes
10100911	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Stoker boilers **
10100903	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10100902	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood/Bark Fired Boiler

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

PM2.5 Control Measures

There are 112 PM2.5 control measures included in this report

Summary:

Control Measure Name:	Electrostatic Precipitator;Commercial Cooking (Under-Fired Charbroiling)
Abbreviation:	1216130118
Description:	Application: Installation of an ESP for large commercial cooking conveyorized charbroilers. Discussion: This control is to be applied to all commercial cooking category SCCs, but with a rule penetration of only 18.75% (equal to 75% of all commercial cooking emissions with application to 25% of this amount of emissions).
Class:	Known
Pollutant:	PM2_5
Equipment Life:	10.0 years
Control Technology:	Electrostatic Precipitator for Commercial Cooking
Source Group:	Conveyorized Charbroilers
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM2_5	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1990	1990
CPT:			$7,366	$7,366
Ref Yr CPT:			$11,796	$11,796
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	14.0	14.0	14.0	14.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM2_5	PM25-PRI
Locale:				

Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1990	1990
CPT:			$7,366	$7,366
Ref Yr CPT:			$11,796	$11,796
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	14.0	14.0	14.0	14.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2302002200	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Charbroiling; Under-fired Charbroiling

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.
- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Stella, G. M., 2006: Excel Spreadsheet CostDefaultSpecificsACN.xls. Email dated 05-Jul-2006. Alpine Geophysics, LLC.

Other information:

CTRL_EFF_H: 99%

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_L:	99%
CTRL_EFF_T:	99%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co*
ADMIN_PCT:	0%
CE_TEXT:	99% PM10 and PM2.5 from uncontrolled
CHEM_PCT:	0%
ELEC_PCT:	0%
COST_BASIS:	Cost Information per Larry Sorrels (EPA)
CPTON_TEXT:	The capital cost of this control: $38,500 (range of capital costs from $2,000 - 75,000). Annualized capital costs: $5,482. Equipment life of the control is 10 years, and costs are annualized at 7%. O&M costs: $500. Total annualized costs: $5,982.
OTHR_PCT:	0%
EC:	Co
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name: Curtailment Program, aka Burn Ban; Fireplaces, Hydronic Heaters, Wood Stoves
Abbreviation: PBBFPHHWDS
Description: State and local air quality agencies forecast next day air quality levels. When it is expected to be near or above the 24-hr PM2.5 NAAQS, limited (e.g., wood pellet only) or full curtailment of wood burning is required. A public awareness campaign and enforcement are critical.
Class: Known
Pollutant: PM25-PRI
Equipment Life: N/A years
Control Technology: Curtailment Program, aka Burn Ban
Source Group: Fireplaces, Hydronic Heaters, Wood Stoves
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2010
CPT:				$8,700
Ref Yr CPT:				$9,191
Control Efficiency:	75.0	75.0	75.0	75.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2010
CPT:				$8,700
Ref Yr CPT:				$9,191
Control Efficiency:	75.0	75.0	75.0	75.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0

Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104009000	Stationary Source Fuel Combustion; Residential; Firelog; Total: All Combustor Types
2104008700	Stationary Source Fuel Combustion; Residential; Wood; Outdoor wood burning device, NEC (fire-pits, chimeas, etc)
2104008610	Stationary Source Fuel Combustion; Residential; Wood; Hydronic heater: outdoor
2104008510	Stationary Source Fuel Combustion; Residential; Wood; Furnace: Indoor, cordwood-fired, non-EPA certified
2104008400	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: pellet-fired, general (freestanding or FP insert)
2104008330	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, EPA certified, catalytic
2104008320	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, EPA certified, non-catalytic
2104008310	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, non-EPA certified
2104008300	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, general
2104008230	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; EPA certified; catalytic
2104008220	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; EPA certified; non-catalytic
2104008210	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; non-EPA certified
2104008100	Stationary Source Fuel Combustion; Residential; Wood; Fireplace: general

References:

- http://www.epa.gov/burnwise/resources.html

Other information:

Summary:

Control Measure Name: Substitute chipping for burning; Household burning

Abbreviation: PCHIPHB

Description: Application: This control is the adoption of chipping rather than burning for household burning to reduce PM2.5 emissions. This control uses state-level emission reduction and control cost data.

Class: Emerging

Pollutant: PM2_5

Equipment Life: N/A years

Control Technology: Substitute chipping for burning

Source Group: Household burning

Sectors: ptfire

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM2_5	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$3,500	$3,500
Ref Yr CPT:	$4,674	$4,674
Control Efficiency:	50.0	50.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM2_5	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$3,500	$3,500
Ref Yr CPT:	$4,674	$4,674
Control Efficiency:	50.0	50.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0

Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2610000500	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)
2610000400	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Yard Waste - Brush Species Unspecified
2610000320	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Weed Species is Tales (wild reeds)
2610000310	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Weed Species is Russian thistle (tumbleweed)
2610000300	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Yard Waste - Weed Species Unspecified (incl Grass)
2610000270	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Sugar Maple
2610000260	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Red Oak
2610000250	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Tulip
2610000240	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is California Sycamore
2610000230	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is American Sycamore
2610000220	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Silver Maple
2610000210	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Magnolia
2610000200	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Black Locust
2610000190	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Sweet Gum
2610000180	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Eucalyptus
2610000170	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is American Elm

2610000160	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Cottonwood
2610000150	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Horse Chestnut
2610000140	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Catalpa
2610000130	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is White Ash
2610000120	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Modesto Ash
2610000110	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Leaf Species is Black Ash
2610000100	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Yard Waste - Leaf Species Unspecified
2610030000	Waste Disposal, Treatment, and Recovery; Open Burning; Residential; Household Waste (use 26-10-000-xxx for Yard Wastes)

References:

- "PMDevelopmentMeasuresList.xls" spreadsheet provided by David Misenheimer (Misenheimer.David@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 27-Aug-2007.

Other information:

Summary:

Control Measure Name: Substitute chipping for burning; Open burning

Abbreviation: PCHIPOB

Description: Application: This control is the adoption of chipping rather than burning for open burning to reduce PM2.5 emissions. This control uses state-level emission reduction and control cost data.

Class: Emerging

Pollutant: PM2_5

Equipment Life: N/A years

Control Technology: Substitute chipping for burning

Source Group: Open burning

Sectors: ptfire

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM2_5	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$3,500	$3,500
Ref Yr CPT:	$4,674	$4,674
Control Efficiency:	100.0	100.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM2_5	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$3,500	$3,500
Ref Yr CPT:	$4,674	$4,674
Control Efficiency:	100.0	100.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0

Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
28100150F1	Miscellaneous Area Sources; Other Combustion; Prescribed Forest Burning; Flaming Natural
28100150F0	Miscellaneous Area Sources; Other Combustion; Prescribed Forest Burning; Flaming
2810015000	Miscellaneous Area Sources; Other Combustion; Prescribed Forest Burning; Unspecified
28100050F0	Miscellaneous Area Sources; Other Combustion; Managed Burning, Slash (Logging Debris); Flaming
2810005000	Miscellaneous Area Sources; Other Combustion; Managed Burning, Slash (Logging Debris); Unspecified Burn Method (use 2610000500 for non-logging debris)
2801500620	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Forest Residues: Species is Ponderosa Pine (see also 28-10-015-000)
2801500610	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Forest Residues: Species are Hemlock, Douglas fir, Cedar
2801500600	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Forest Residues Unspecified (see also 28-10-015-000)
2801500500	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Vine Crop Unspecified
2801500450	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Filbert (Hazelnut)
2801500440	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Walnut
2801500430	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Prune
2801500420	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Pear
2801500410	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Peach
2801500400	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Olive
2801500390	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Nectarine

2801500380	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Fig
2801500370	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Date palm
2801500360	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Citrus (orange, lemon)
2801500350	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Cherry
2801500340	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Avocado
2801500330	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Apricot
2801500320	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Apple
2801500310	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Almond
2801500300	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop Unspecified
2610040400	Waste Disposal, Treatment, and Recovery; Open Burning; Municipal (collected from residences, parks,other for central burn); Yard Waste - Total (includes Leaves, Weeds, and Brush)
2610020000	Waste Disposal, Treatment, and Recovery; Open Burning; Commercial/Institutional; Total
2610010000	Waste Disposal, Treatment, and Recovery; Open Burning; Industrial; Total
2610000000	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Total
2610000500	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)

References:

- "PMDevelopmentMeasuresList.xls" spreadsheet provided by David Misenheimer (Misenheimer.David@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 27-Aug-2007.

Other information:

Summary:

Control Measure Name: Catalytic Oxidizer;Commercial Cooking (Charbroiling)
Abbreviation: PCHRBCAOX
Description: Application: Catalytic Oxidizer control device burns or oxidizes smoke and gases from the cooking process to carbon dioxide and water, using an infrastructure coated with a noble metal alloy.
Class: Known
Pollutant: PM2_5
Equipment Life: 10.0 years
Control Technology: Catalytic Oxidizer
Source Group: Conveyorized Charbroilers
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM2_5	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1990	1990
CPT:			$2,150	$2,150
Ref Yr CPT:			$3,443	$3,443
Control Efficiency:	83.0	83.0	83.0	83.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	10.0	10.0	10.0	10.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.140000001	0.140000001
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM2_5	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1990	1990
CPT:			$2,150	$2,150
Ref Yr CPT:			$3,443	$3,443
Control Efficiency:	83.0	83.0	83.0	83.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0

Rule Penetration:	10.0	10.0	10.0	10.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.140000001	0.140000001
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrementenal CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2302002100	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Charbroiling; Conveyorized Charbroiling

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Ventura County, 2004: Ventura County, "Final Staff Report: Proposed New Rule 74.25, Restaurant Cooking Operations Proposed Revisions to Rule 23, Exemptions From Permit", August 31, 2004
- CE-ERT, 2002: CE-CERT, UC-Riverside: "Assessment of Emissions from a Chain-Driven Charbroilers using a Catalytic Control device." Final Report for Engelhard Corp., September 13, 2002

Other information:

COST_BASIS:

Control costs were estimated by assuming that replacement catalyst is bought when the original system is purchased.

The Cost per ton calculation:

Baseline PM Emissions per restaurant = 0.61 tons / yr
Capital Recovery Factor (CRF) (10 years @ 8%) = 0.149

$ / ton = [0.149($5,657.5 + $3,700)] + $107.5 / [(0.83 reduction) (0.61 PM)]

= $2,966 / year

SPVLBR_PCT: 0%

RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_L:	80%
CTRL_EFF_T:	83%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co*
ADMIN_PCT:	0%
CE_TEXT:	83% from uncontrolled for PM & VOC
CHEM_PCT:	0%
ELEC_PCT:	0%
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $2966 per ton PM reduced (2001$).
CTRL_EFF_H:	90%
OTHR_PCT:	0%
EC:	Co
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
VOC:	Co

Summary:

Control Measure Name: Electrostatic Precipitator;Commercial Cooking (Charbroiling Total)
Abbreviation: PCHRBESP
Description: Application: Installation of an ESP for large commercial cooking conveyorized charbroilers.

Discussion: This control is to be applied to all commercial cooking category SCCs, but with a rule penetration of only 18.75% (equal to 75% of all commercial cooking emissions with application to 25% of this amount of emissions).

Class: Known
Pollutant: PM2_5
Equipment Life: 10.0 years
Control Technology: Electrostatic Precipitator for Commercial Cooking
Source Group: Conveyorized Charbroilers
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM2_5	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1990	1990
CPT:			$7,366	$7,366
Ref Yr CPT:			$11,796	$11,796
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	10.0	10.0	10.0	10.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremememtal CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM2_5	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1990	1990
CPT:			$7,366	$7,366
Ref Yr CPT:			$11,796	$11,796
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A

Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	10.0	10.0	10.0	10.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2302002000	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Charbroiling; Charbroiling Total

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.
- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Stella, G. M., 2006: Excel Spreadsheet CostDefaultSpecificsACN.xls. Email dated 05-Jul-2006. Alpine Geophysics, LLC.

Other information:

CTRL_EFF_H:	99%
SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%

CTRL_EFF_L:	99%
CTRL_EFF_T:	99%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co*
ADMIN_PCT:	0%
CE_TEXT:	99% PM10 and PM2.5 from uncontrolled
CHEM_PCT:	0%
ELEC_PCT:	0%
COST_BASIS:	Cost Information per Larry Sorrels (EPA)
CPTON_TEXT:	The capital cost of this control: $38,500 (range of capital costs from $2,000 - 75,000). Annualized capital costs: $5,482. Equipment life of the control is 10 years, and costs are annualized at 7%. O&M costs: $500. Total annualized costs: $5,982.
OTHR_PCT:	0%
EC:	Co
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name: Convert to Gas Logs; Fireplaces
Abbreviation: PCTGLGFPL
Description: Incentives by various air districts in CA have helped retrofit thousands of open fireplaces to gas log sets. In addition to vented gas log sets, the option exists to install vented gas stove inserts into a wood-burning fireplace. Unlike gas logs, which provide little heat, a gas stove insert can be an efficient and clean way to a heat a room. The cost per ton of PM2.5 reductions will likely be greater as gas stove inserts cost more than gas log sets.
Class: Known
Pollutant: PM25-PRI
Equipment Life: N/A years
Control Technology: Convert to Gas Logs
Source Group: Fireplaces
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2006
CPT:				$11,000
Ref Yr CPT:				$12,406
Control Efficiency:	100.0	100.0	100.0	100.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2006
CPT:				$11,000
Ref Yr CPT:				$12,406
Control Efficiency:	100.0	100.0	100.0	100.0
Min Emis:	N/A	N/A	N/A	N/A

Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104008100	Stationary Source Fuel Combustion; Residential; Wood; Fireplace: general

References:

- http://www.epa.gov/burnwise/resources.html

Other information:

Summary:

Control Measure Name: Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Mineral Products - Cement Manufacture

Abbreviation: PDESPMICM

Description: Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper.

This control applies to cement manufacturing operations.

Discussion: The largest source of particulate emissions at a cement plant is the kiln used to produce clinker. Cement kilns are rotary kilns, which are slowly rotating refractory-lined steel cylinders inclined slightly from the horizontal. Raw materials are fed into the top end of the kiln and spend several hours traversing the kiln. In wet process kilns (SCC 30500706), the raw materials are fed as a wet slurry. During this time, the raw materials are heated by a flame at the discharge end of the kiln. This heating dries the raw materials, converts limestone to lime, and promotes reaction between and fusion of the separate ingredients to form clinker. Clinker exiting the kiln is fed to a clinker cooler (SCC 30500714) for cooling before storage and further processing (STAPPA/ALAPCO, 1996).

In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Dry Electrostatic Precipitator-Wire Plate Type

Source Group: Mineral Products - Cement Manufacture

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$189	$189
Ref Yr CPT:			$268	$268
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton

Capital Rec Fac:	N/A	N/A	0.090000003576278 69	0.090000003576278 69
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$189	$189
Ref Yr CPT:			$268	$268
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.090000003576278 69	0.090000003576278 69
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	27.0

Typical O&M Control Cost Factor	16.0
Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
30500607	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Unloading
30500608	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Piles
30500609	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Primary Crushing
30500610	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Secondary Crushing
30500611	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Screening
30500612	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Transfer
30500613	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Grinding and Drying
30500615	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Piles
30500616	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Transfer
30500617	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Grinding
30500618	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Silos
30500619	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Load Out
30500620	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Predryer
30500624	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Feed Belt
30500625	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Weigh Hopper
30500626	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Air Separator
30500627	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Feed Belt
30500628	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Weigh Hopper
30500629	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Air Separator
30500699	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Other Not Classified
30500707	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Raw Material Unloading
30500708	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Raw Material Piles
30500709	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Primary Crushing
30500710	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Secondary Crushing
30500711	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Screening

30500712	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Raw Material Transfer
30500714	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Cooler
30500715	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Piles
30500716	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Transfer
30500717	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Grinding
30500718	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Cement Silos
30500719	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Cement Load Out
30500727	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Feed Belt
30500728	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Weigh Hopper
30500729	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Air Separator
30500799	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Other Not Classified

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.
CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%
INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%
NG_RT:	$0/cf

OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name: Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Mineral Products - Other

Abbreviation: PDESPMIOR

Description: Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper.

This control applies to mineral production operations not classified as cement operations, coat cleaning, or stone quarrying.

Discussion: Material handling operations including crushing, grinding, and screening, can produce significant PM emissions. Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply.

In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Dry Electrostatic Precipitator-Wire Plate Type

Source Group: Mineral Products - Other

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$197	$197
Ref Yr CPT:			$280	$280
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A

Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$197	$197
Ref Yr CPT:			$280	$280
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	27.0
Typical O&M Control Cost Factor	16.0
Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
30500300	Industrial Processes;Mineral Products;Brick Manufacture;undefined
30500301	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Drying
30500302	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Grinding & Screening
30500303	Industrial Processes; Mineral Products; Brick Manufacture; Storage of Raw Materials
30500304	Industrial Processes; Mineral Products; Brick Manufacture; Curing **
30500305	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Handling and Transferring
30500306	Industrial Processes; Mineral Products; Brick Manufacture; Pulverizing
30500307	Industrial Processes; Mineral Products; Brick Manufacture; Calcining
30500308	Industrial Processes; Mineral Products; Brick Manufacture; Screening
30500309	Industrial Processes; Mineral Products; Brick Manufacture; Blending and Mixing
30500310	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Sawdust Fired Tunnel Kilns
30500311	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Tunnel Kilns
30500312	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Tunnel Kilns
30500313	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Tunnel Kilns
30500314	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Periodic Kilns
30500315	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Periodic Kilns
30500316	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Periodic Kilns
30500317	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Unloading
30500318	Industrial Processes; Mineral Products; Brick Manufacture; Tunnel Kiln: Wood-fired
30500319	Industrial Processes; Mineral Products; Brick Manufacture; Transfer and Conveying
30500321	Industrial Processes; Mineral Products; Brick Manufacture; General
30500322	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing High-Sulfur Material
30500330	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Periodic Kiln
30500331	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel Fired Tunnel Kiln
30500332	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Kiln, Other Type
30500333	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Kiln, Other Type
30500334	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Kiln, Other Type
30500335	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Kiln, Other Type

30500340	Industrial Processes; Mineral Products; Brick Manufacture; Primary Crusher
30500342	Industrial Processes; Mineral Products; Brick Manufacture; Extrusion Line
30500350	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat From Kiln Cooling Zone
30500351	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat And Supplemental Gas Burners
30500355	Industrial Processes; Mineral Products; Brick Manufacture; Coal Crushing And Storage System
30500360	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer
30500361	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer: Heated With Exhaust From Sawdust-fired Kiln
30500370	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing Structural Clay Tile
30500397	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500398	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500399	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500401	Industrial Processes; Mineral Products; Calcium Carbide; Electric Furnace: Hoods and Main Stack
30500402	Industrial Processes; Mineral Products; Calcium Carbide; Coke Dryer
30500403	Industrial Processes; Mineral Products; Calcium Carbide; Furnace Room Vents
30500404	Industrial Processes; Mineral Products; Calcium Carbide; Tap Fume Vents
30500405	Industrial Processes; Mineral Products; Calcium Carbide; Primary/Secondary Crushing
30500406	Industrial Processes; Mineral Products; Calcium Carbide; Circular Charging: Conveyor
30500499	Industrial Processes; Mineral Products; Calcium Carbide; Other Not Classified
30500501	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Dryer
30500502	Industrial Processes; Mineral Products; Castable Refractory; Raw Material Crushing/Processing
30500503	Industrial Processes; Mineral Products; Castable Refractory; Electric Arc Melt Furnace
30500504	Industrial Processes; Mineral Products; Castable Refractory; Curing Oven
30500505	Industrial Processes; Mineral Products; Castable Refractory; Molding and Shakeout
30500506	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Calciner
30500507	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Tunnel Kiln
30500508	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Rotary Dryer
30500509	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Tunnel Kiln
30500598	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500599	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln
30500607	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Unloading
30500608	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Piles
30500609	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Primary Crushing
30500610	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Secondary Crushing
30500611	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Screening

30500612	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Transfer
30500613	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Grinding and Drying
30500614	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Cooler
30500615	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Piles
30500616	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Transfer
30500617	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Grinding
30500618	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Silos
30500619	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Load Out
30500620	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Predryer
30500621	Industrial Processes; Mineral Products; Cement Manufacturing (Wet or Dry Process); Pulverized Coal Kiln Feed Units
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln
30500624	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Feed Belt
30500625	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Weigh Hopper
30500626	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Air Separator
30500627	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Feed Belt
30500628	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Weigh Hopper
30500629	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Air Separator
30500699	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Other Not Classified
30500800	Industrial Processes;Mineral Products;Ceramic Clay/Tile Manufacture;undefined
30500801	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying ** (use SCC 3-05-008-13)
30500802	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Comminution - Crushing, Grinding, & Milling
30500803	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Storage
30500804	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Screening and floating ** (use SCC 3-05-008-16)
30500805	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Direct Mixing of Ceramic Powder and Binder Solution
30500806	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Handling and Transfer
30500807	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Grinding, dry ** (use SCC 3-05-008-02)
30500810	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Natural Gas-fired Spray Dryer
30500811	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Infrared (IR) Drying Prior to Firing

30500812	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glazing and firing kiln ** (use SCCs 3-05-008-45 & -50)
30500813	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Convection Drying Prior to Firing
30500816	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Sizing - Vibrating Screens
30500818	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Air Classifier
30500821	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Rotary Calciner
30500822	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Rotary Calciner
30500823	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Fluidized Bed Calciner
30500824	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Fluidized Bed Calciner
30500828	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Mixing - Raw Matls, Binders, Plasticizers, Surfactants, & Other Agent
30500830	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - General
30500831	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - Tape Casters
30500835	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Green Machining-Grindg, Cutg, or Laminatg Formed Ceramics Prior to Fir
30500840	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Natural Gas-fired Kiln
30500841	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Fuel Oil-fired Kiln
30500843	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glaze Preparation - Ballmill or Attrition Mill
30500845	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Ceramic Glaze Spray Booth
30500850	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Natural Gas-fired Kiln
30500854	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Fuel Oil-fired Kiln
30500856	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Refiring Kiln - Refiring after Decal, Paint, or Ink Applied; Natural-g
30500858	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Cooler - Cooling Ceramics Following Firing
30500860	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Grinding and Polishing
30500870	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Annealing
30500880	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Surface Coating
30500899	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Other Not Classified
30500901	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Fly Ash Sintering
30500902	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay/Coke Sintering
30500903	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Natural Clay/Shale Sintering
30500904	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Crushing/Screening

30500905	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Transfer/Conveying
30500906	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Storage Piles
30500907	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Coke Product Crushing/Screening
30500908	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Shale Product Crushing/Screening
30500909	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Clinker Cooling
30500910	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Storage
30500915	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Rotary Kiln
30500916	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Dryer
30500917	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay Reciprocating Grate Clinker Cooler
30500999	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Other Not Classified
30501101	Industrial Processes; Mineral Products; Concrete Batching; Total Facility Emissions except road dust & wind-blown dust
30501104	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Elevated Storage
30501105	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Elevated Storage
30501106	Industrial Processes; Mineral Products; Concrete Batching; Transfer: Sand/Aggregate to Elevated Bins (See Also -04 & -05)
30501107	Industrial Processes; Mineral Products; Concrete Batching; Cement Unloading to Elevated Storage Silo
30501108	Industrial Processes; Mineral Products; Concrete Batching; Weight Hopper Loading of Sand and Aggregate
30501109	Industrial Processes; Mineral Products; Concrete Batching; Mixer Loading of Cement/Sand/Aggregate
30501110	Industrial Processes; Mineral Products; Concrete Batching; Loading of Transit Mix Truck
30501111	Industrial Processes; Mineral Products; Concrete Batching; Loading of Dry-batch Truck
30501112	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Wet
30501113	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Dry
30501114	Industrial Processes; Mineral Products; Concrete Batching; Transferring: Conveyors/Elevators
30501115	Industrial Processes; Mineral Products; Concrete Batching; Storage: Bins/Hoppers
30501117	Industrial Processes; Mineral Products; Concrete Batching; Cement Supplement Unloading to Elevated Storage Silo
30501120	Industrial Processes; Mineral Products; Concrete Batching; Asbestos/Cement Products
30501121	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Delivery to Ground Storage
30501122	Industrial Processes; Mineral Products; Concrete Batching; Sand Delivery to Ground Storage
30501123	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Conveyor
30501124	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Conveyor
30501199	Industrial Processes; Mineral Products; Concrete Batching; Other Not Classified
30501201	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Wool-type Fiber)

30501202	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Wool-type Fiber)
30501203	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Electric Furnace (Wool-type Fiber)
30501204	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Rotary Spun (Wool-type Fiber)
30501205	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven: Rotary Spun (Wool-type Fiber)
30501206	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Cooling (Wool-type Fiber)
30501207	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Wool-type Fiber)
30501208	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Flame Attenuation (Wool-type Fiber)
30501209	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing: Flame Attenuation (Wool-type Fiber)
30501211	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Textile-type Fiber)
30501212	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Textile-type Fiber)
30501213	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Textile-type Fiber)
30501214	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming Process (Textile-type Fiber)
30501215	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven (Textile-type Fiber)
30501221	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Unloading/Conveying
30501222	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Storage Bins
30501223	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Mixing/Weighing
30501224	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Crushing/Charging
30501299	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Other Not Classified
30501301	Industrial Processes; Mineral Products; Frit Manufacture; General ** (use 3-05-013-05 or 3-05-013-06)
30501302	Industrial Processes; Mineral Products; Frit Manufacture; Weighing of raw materials
30501303	Industrial Processes; Mineral Products; Frit Manufacture; Dry Mixing of raw materials
30501304	Industrial Processes; Mineral Products; Frit Manufacture; Smelting Furnace Charging
30501305	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Smelting Furnace
30501306	Industrial Processes; Mineral Products; Frit Manufacture; Continuous Smelting Furnace
30501310	Industrial Processes; Mineral Products; Frit Manufacture; Water Spray Quenching to shatter material into small particles
30501311	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Dryer (usually not used with a continuous furnace)
30501315	Industrial Processes; Mineral Products; Frit Manufacture; Dry Milling of quenched frit with a ball mill
30501316	Industrial Processes; Mineral Products; Frit Manufacture; Product Screening
30501399	Industrial Processes; Mineral Products; Frit Manufacture; Other Not Classified
30501400	Industrial Processes;Mineral Products;Glass Manufacture;undefined

30501401	Industrial Processes; Mineral Products; Glass Manufacture; Furnace/General**
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace
30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace
30501405	Industrial Processes; Mineral Products; Glass Manufacture; Presintering
30501406	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Forming/Finishing
30501407	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Forming/Finishing
30501408	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Forming/Finishing
30501410	Industrial Processes; Mineral Products; Glass Manufacture; Raw Material Handling (All Types of Glass)
30501411	Industrial Processes; Mineral Products; Glass Manufacture; General **
30501412	Industrial Processes; Mineral Products; Glass Manufacture; Hold Tanks **
30501413	Industrial Processes; Mineral Products; Glass Manufacture; Cullet: Crushing/Grinding
30501414	Industrial Processes; Mineral Products; Glass Manufacture; Ground Cullet Beading Furnace
30501415	Industrial Processes; Mineral Products; Glass Manufacture; Glass Etching with Hydrofluoric Acid Solution
30501416	Industrial Processes; Mineral Products; Glass Manufacture; Glass Manufacturing
30501417	Industrial Processes; Mineral Products; Glass Manufacture; Briquetting
30501418	Industrial Processes; Mineral Products; Glass Manufacture; Pelletizing
30501420	Industrial Processes; Mineral Products; Glass Manufacture; Mirror Plating: General
30501421	Industrial Processes; Mineral Products; Glass Manufacture; Demineralizer: General
30501499	Industrial Processes; Mineral Products; Glass Manufacture; See Comment **
30501500	Industrial Processes;Mineral Products;Gypsum Manufacture;undefined
30501501	Industrial Processes; Mineral Products; Gypsum Manufacture; Rotary Ore Dryer
30501502	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Grinder/Roller Mills
30501503	Industrial Processes; Mineral Products; Gypsum Manufacture; Not Classified **
30501504	Industrial Processes; Mineral Products; Gypsum Manufacture; Conveying
30501505	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Crushing: Gypsum Ore
30501506	Industrial Processes; Mineral Products; Gypsum Manufacture; Secondary Crushing: Gypsum Ore
30501507	Industrial Processes; Mineral Products; Gypsum Manufacture; Screening: Gypsum Ore
30501508	Industrial Processes; Mineral Products; Gypsum Manufacture; Stockpile: Gypsum Ore
30501509	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Gypsum Ore
30501510	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Landplaster
30501511	Industrial Processes; Mineral Products; Gypsum Manufacture; Continuous Kettle: Calciner
30501512	Industrial Processes; Mineral Products; Gypsum Manufacture; Flash Calciner
30501513	Industrial Processes; Mineral Products; Gypsum Manufacture; Impact Mill
30501514	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Stucco
30501515	Industrial Processes; Mineral Products; Gypsum Manufacture; Tube/Ball Mills

30501516	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers
30501517	Industrial Processes; Mineral Products; Gypsum Manufacture; Bagging
30501518	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers/Conveyors
30501519	Industrial Processes; Mineral Products; Gypsum Manufacture; Forming Line
30501520	Industrial Processes; Mineral Products; Gypsum Manufacture; Drying Kiln
30501521	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (8 Ft.)
30501522	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (12 Ft.)
30501599	Industrial Processes; Mineral Products; Gypsum Manufacture; See Comment **
30501601	Industrial Processes; Mineral Products; Lime Manufacture; Primary Crushing
30501602	Industrial Processes; Mineral Products; Lime Manufacture; Secondary Crushing/Screening
30501603	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Vertical Kiln
30501604	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Rotary Kiln ** (See SCC Codes 3-05-016-18,-19,-20,-21)
30501605	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Calcimatic Kiln
30501606	Industrial Processes; Mineral Products; Lime Manufacture; Fluidized Bed Kiln
30501607	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Transfer and Conveying
30501608	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Unloading
30501609	Industrial Processes; Mineral Products; Lime Manufacture; Hydrator: Atmospheric
30501610	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Storage Piles
30501611	Industrial Processes; Mineral Products; Lime Manufacture; Product Cooler
30501612	Industrial Processes; Mineral Products; Lime Manufacture; Pressure Hydrator
30501613	Industrial Processes; Mineral Products; Lime Manufacture; Lime Silos
30501614	Industrial Processes; Mineral Products; Lime Manufacture; Packing/Shipping
30501615	Industrial Processes; Mineral Products; Lime Manufacture; Product Transfer and Conveying
30501616	Industrial Processes; Mineral Products; Lime Manufacture; Primary Screening
30501617	Industrial Processes; Mineral Products; Lime Manufacture; Multiple Hearth Calciner
30501618	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Kiln
30501619	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Rotary Kiln
30501620	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Gas-fired Rotary Kiln
30501621	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Coke-fired Rotary Kiln
30501622	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Preheater Kiln
30501623	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Parallel Flow Regenerative Kiln
30501624	Industrial Processes; Mineral Products; Lime Manufacture; Conveyor Transfer - Primary Crushed Material
30501625	Industrial Processes; Mineral Products; Lime Manufacture; Secondary/Tertiary Screening
30501626	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Enclosed Truck
30501627	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Open Truck

30501628	Industrial Processes; Mineral Products; Lime Manufacture; Pulverizing
30501629	Industrial Processes; Mineral Products; Lime Manufacture; Tertiary Screening After Pulverizing
30501630	Industrial Processes; Mineral Products; Lime Manufacture; Screening After Calcination
30501631	Industrial Processes; Mineral Products; Lime Manufacture; Crushing and Pulverizing After Calcinating
30501632	Industrial Processes; Mineral Products; Lime Manufacture; Milling
30501633	Industrial Processes; Mineral Products; Lime Manufacture; Separator After Hydrator
30501640	Industrial Processes; Mineral Products; Lime Manufacture; Vehicle Traffic
30501650	Industrial Processes; Mineral Products; Lime Manufacture; Quarrying Raw Limestone
30501660	Industrial Processes; Mineral Products; Lime Manufacture; Waste Treatment
30501699	Industrial Processes; Mineral Products; Lime Manufacture; See Comment **
30501701	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cupola
30501702	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Reverberatory Furnace
30501703	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Blow Chamber
30501704	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Curing Oven
30501705	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cooler
30501706	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Granulated Products Processing
30501707	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Handling
30501708	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Packaging
30501709	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Batt Application
30501710	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Storage of Oils and Binders
30501711	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Mixing of Oils and Binders
30501799	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Other Not Classified
30501801	Industrial Processes; Mineral Products; Perlite Manufacturing; Vertical Furnace
30501899	Industrial Processes; Mineral Products; Perlite Manufacturing; Other Not Classified
30501901	Industrial Processes; Mineral Products; Phosphate Rock; Drying
30501902	Industrial Processes; Mineral Products; Phosphate Rock; Grinding
30501903	Industrial Processes; Mineral Products; Phosphate Rock; Transfer/Storage
30501904	Industrial Processes; Mineral Products; Phosphate Rock; Open Storage
30501905	Industrial Processes; Mineral Products; Phosphate Rock; Calcining
30501906	Industrial Processes; Mineral Products; Phosphate Rock; Rotary Dryer
30501907	Industrial Processes; Mineral Products; Phosphate Rock; Ball Mill
30501908	Industrial Processes; Mineral Products; Phosphate Rock; Mineral Products Benification
30501999	Industrial Processes; Mineral Products; Phosphate Rock; Other Not Classified
30502101	Industrial Processes; Mineral Products; Salt Mining; General
30502102	Industrial Processes; Mineral Products; Salt Mining; Granulation: Stack Dryer
30502103	Industrial Processes; Mineral Products; Salt Mining; Filtration: Vacuum Filter
30502104	Industrial Processes; Mineral Products; Salt Mining; Crushing

30502105	Industrial Processes; Mineral Products; Salt Mining; Screening
30502106	Industrial Processes; Mineral Products; Salt Mining; Conveying
30502201	Industrial Processes; Mineral Products; Potash Production; Mine: Grinding/Drying
30502299	Industrial Processes; Mineral Products; Potash Production; Other Not Classified
30502401	Industrial Processes; Mineral Products; Magnesium Carbonate; Mine/Process
30502499	Industrial Processes; Mineral Products; Magnesium Carbonate; Other Not Classified
30502500	Industrial Processes;Mineral Products;Construction Sand and Gravel;undefined
30502501	Industrial Processes; Mineral Products; Construction Sand and Gravel; Total Plant: General **
30502502	Industrial Processes; Mineral Products; Construction Sand and Gravel; Aggregate Storage
30502503	Industrial Processes; Mineral Products; Construction Sand and Gravel; Material Transfer and Conveying
30502504	Industrial Processes; Mineral Products; Construction Sand and Gravel; Hauling
30502505	Industrial Processes; Mineral Products; Construction Sand and Gravel; Pile Forming: Stacker
30502506	Industrial Processes; Mineral Products; Construction Sand and Gravel; Bulk Loading
30502507	Industrial Processes; Mineral Products; Construction Sand and Gravel; Storage Piles
30502508	Industrial Processes; Mineral Products; Construction Sand and Gravel; Dryer ** (See 3-05-027-20 thru -24 for Industrial Sand Dryers)
30502509	Industrial Processes; Mineral Products; Construction Sand and Gravel; Cooler ** (See 3-05-027-30 for Industrial Sand Coolers)
30502510	Industrial Processes; Mineral Products; Construction Sand and Gravel; Crushing
30502511	Industrial Processes; Mineral Products; Construction Sand and Gravel; Screening
30502512	Industrial Processes; Mineral Products; Construction Sand and Gravel; Overburden Removal
30502513	Industrial Processes; Mineral Products; Construction Sand and Gravel; Excavating
30502514	Industrial Processes; Mineral Products; Construction Sand and Gravel; Drilling and Blasting
30502522	Industrial Processes; Mineral Products; Construction Sand and Gravel; Rodmilling: Fine Crushing of Construction Sand
30502523	Industrial Processes; Mineral Products; Construction Sand and Gravel; Fine Screening of Construction Sand Following Dewatering or Rodmilling
30502599	Industrial Processes; Mineral Products; Construction Sand and Gravel; Not Classified **
30502601	Industrial Processes; Mineral Products; Diatomaceous Earth; Handling
30502699	Industrial Processes; Mineral Products; Diatomaceous Earth; Other Not Classified
30502701	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Primary Crushing of Raw Material
30502705	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Secondary Crushing
30502709	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Grinding: Size Reduction to 50 Microns or Smaller
30502713	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Screening: Size Classification
30502717	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Draining: Removal of Moisture to About 6% After Froth Flotation
30502720	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas- or Oil-fired Rotary or Fluidized Bed Dryer
30502721	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Rotary Dryer

30502722	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Rotary Dryer
30502723	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Fluidized Bed Dryer
30502724	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Fluidized Bed Dryer
30502730	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Cooling of Dried Sand
30502740	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Final Classifying: Screening to Classify Sand by Size
30502760	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Handling, Transfer, and Storage
30502910	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Rotary Kiln
30502920	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Clinker Cooler
30503099	Industrial Processes; Mineral Products; Ceramic Electric Parts; Other Not Classified
30503101	Industrial Processes; Mineral Products; Asbestos Mining; Surface Blasting
30503102	Industrial Processes; Mineral Products; Asbestos Mining; Surface Drilling
30503103	Industrial Processes; Mineral Products; Asbestos Mining; Cobbing
30503104	Industrial Processes; Mineral Products; Asbestos Mining; Loading
30503105	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Asbestos
30503106	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Waste
30503107	Industrial Processes; Mineral Products; Asbestos Mining; Unloading
30503108	Industrial Processes; Mineral Products; Asbestos Mining; Overburden Stripping
30503109	Industrial Processes; Mineral Products; Asbestos Mining; Ventilation of Process Operations
30503110	Industrial Processes; Mineral Products; Asbestos Mining; Stockpiling
30503111	Industrial Processes; Mineral Products; Asbestos Mining; Tailing Piles
30503199	Industrial Processes; Mineral Products; Asbestos Mining; Other Not Classified
30503201	Industrial Processes; Mineral Products; Asbestos Milling; Crushing
30503202	Industrial Processes; Mineral Products; Asbestos Milling; Drying
30503203	Industrial Processes; Mineral Products; Asbestos Milling; Recrushing
30503204	Industrial Processes; Mineral Products; Asbestos Milling; Screening
30503205	Industrial Processes; Mineral Products; Asbestos Milling; Fiberizing
30503206	Industrial Processes; Mineral Products; Asbestos Milling; Bagging
30503299	Industrial Processes; Mineral Products; Asbestos Milling; Other Not Classified
30503301	Industrial Processes; Mineral Products; Vermiculite; General
30503312	Industrial Processes; Mineral Products; Vermiculite; Screening of Crude Vermiculite Ore
30503319	Industrial Processes; Mineral Products; Vermiculite; Blending of Vermiculite Ore
30503321	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Gas-fired
30503322	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Oil-fired
30503326	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Gas-fired

30503327	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Oil-fired
30503331	Industrial Processes; Mineral Products; Vermiculite; Crushing of Dried Vermiculite Concentrate
30503336	Industrial Processes; Mineral Products; Vermiculite; Screening: Size Classification of Crushed Vermiculite Concentrate
30503341	Industrial Processes; Mineral Products; Vermiculite; Conveying of Vermiculite Concentrate to Storage
30503351	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Gas-fired Vertical Furnace
30503352	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Oil-fired Vertical Furnace
30503361	Industrial Processes; Mineral Products; Vermiculite; Product Grinding: Grinding of Exfoliated Vermiculite
30503366	Industrial Processes; Mineral Products; Vermiculite; Product Classifying: Air Classification of Exfoliated Vermiculite
30503401	Industrial Processes; Mineral Products; Feldspar; Ball Mill
30503402	Industrial Processes; Mineral Products; Feldspar; Dryer
30503501	Industrial Processes; Mineral Products; Abrasive Grain Processing; Primary Crushing
30503502	Industrial Processes; Mineral Products; Abrasive Grain Processing; Secondary Crushing
30503503	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Crushing
30503504	Industrial Processes; Mineral Products; Abrasive Grain Processing; Crushed Grain Screening
30503505	Industrial Processes; Mineral Products; Abrasive Grain Processing; Washing/Drying
30503506	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Screening
30503507	Industrial Processes; Mineral Products; Abrasive Grain Processing; Air Classification
30503601	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Mixing
30503602	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Molding
30503603	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Steam Autoclaving
30503604	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Drying
30503605	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Firing or Curing
30503606	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Cooling
30503607	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Final Machining
30503701	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Printing of Backing
30503702	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Make Coat Application
30503703	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Grain Application
30503704	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Drying
30503705	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Size Coat Application
30503706	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Drying and Curing
30503707	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Roll Winding
30503708	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Production
30503901	Industrial Processes; Mineral Products; Pyrrhotite; Fluid Bed Roaster
30503902	Industrial Processes; Mineral Products; Pyrrhotite; Reduction Kiln

30504001	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Blasting
30504002	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Drilling
30504003	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Cobbing
30504010	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Underground Ventilation
30504020	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Loading
30504021	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Material
30504022	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Waste
30504023	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Unloading
30504024	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Overburden Stripping
30504025	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Stockpiling
30504030	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Primary Crusher
30504031	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Secondary Crusher
30504032	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Concentrator
30504033	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Dryer
30504034	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Screening
30504036	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Tailing Piles
30504099	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Other Not Classified
30504101	Industrial Processes; Mineral Products; Clay processing: Kaolin; Mining
30504102	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material storage
30504103	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material transfer
30504115	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material crushing, NEC
30504119	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material grinding, NEC
30504129	Industrial Processes; Mineral Products; Clay processing: Kaolin; Screening, NEC
30504130	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, rotary dryer
30504131	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, spray dryer
30504132	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, apron dryer
30504133	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, vibrating grate dryer
30504139	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, dryer NEC
30504140	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, rotary calciner
30504141	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, multiple hearth furnace
30504142	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, flash calciner
30504149	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, calciner NEC
30504150	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product grinding

30504151	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product screening/classification
30504160	Industrial Processes; Mineral Products; Clay processing: Kaolin; Bleaching
30504170	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product transfer
30504171	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product storage
30504172	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product packaging
30504201	Industrial Processes; Mineral Products; Clay processing: Ball clay; Mining
30504202	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material storage
30504203	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material transfer
30504215	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material crushing, NEC
30504219	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material grinding, NEC
30504230	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, rotary dryer
30504231	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, spray dryer
30504232	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, apron dryer
30504233	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, vibrating grate dryer
30504239	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, dryer NEC
30504250	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product grinding
30504270	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product transfer
30504271	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product storage
30504272	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product packaging
30504301	Industrial Processes; Mineral Products; Clay processing: Fire clay; Mining
30504302	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material storage
30504303	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material transfer
30504315	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material crushing, NEC
30504319	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material grinding, NEC
30504329	Industrial Processes; Mineral Products; Clay processing: Fire clay; Screening, NEC
30504330	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, rotary dryer
30504331	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, spray dryer
30504332	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, apron dryer
30504333	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, vibrating grate dryer
30504339	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, dryer NEC
30504340	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, rotary calciner
30504341	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, multiple hearth furnace
30504342	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, flash calciner
30504349	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, calciner NEC
30504350	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product grinding
30504351	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product screening/classification
30504370	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product transfer
30504371	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product storage

30504372	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product packaging
30504401	Industrial Processes; Mineral Products; Clay processing: Bentonite; Mining
30504402	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material storage
30504403	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material transfer
30504415	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material crushing, NEC
30504419	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material grinding, NEC
30504430	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, rotary dryer
30504431	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, spray dryer
30504432	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, apron dryer
30504433	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, vibrating grate dryer
30504439	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, dryer NEC
30504450	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product grinding
30504451	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product screening/classification
30504470	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product transfer
30504471	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product storage
30504472	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product packaging
30504501	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Mining
30504502	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material storage
30504503	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material transfer
30504515	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material crushing, NEC
30504519	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material grinding, NEC
30504530	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, rotary dryer
30504531	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, spray dryer
30504532	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, apron dryer
30504533	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, vibrating grate dryer
30504539	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, dryer NEC
30504550	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product grinding
30504551	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product screening/classification
30504570	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product transfer
30504571	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product storage
30504572	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product packaging
30504601	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Mining
30504602	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material storage
30504603	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material transfer
30504615	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material crushing, NEC

30504619	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material grinding, NEC
30504629	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Screening, NEC
30504630	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, rotary dryer
30504631	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, spray dryer
30504632	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, apron dryer
30504633	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, vibrating grate dryer
30504639	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, dryer NEC
30504670	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product transfer
30504671	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product storage
30504672	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product packaging
30505001	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Processing (Blowing)
30505005	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Storage (Prior to Blowing)
30505010	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Blowing Still
30505020	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Natural Gas
30505021	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Residual Oil
30505022	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Distillate Oil
30505023	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: LP Gas
30508906	Industrial Processes; Mineral Products; Talc Processing; Storage of Raw Mined Talc Before Processing
30508908	Industrial Processes; Mineral Products; Talc Processing; Conveyor Transfer of Raw Talc to Primary Crusher
30508909	Industrial Processes; Mineral Products; Talc Processing; Natural Gas Fired Crude Ore Dryer
30508910	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil Fired Crude Ore Dryer
30508911	Industrial Processes; Mineral Products; Talc Processing; Primary crusher
30508912	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Railcar Loading
30508914	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Storage Bin Loading
30508917	Industrial Processes; Mineral Products; Talc Processing; Screening Oversize Ore to Return to Primary Crusher
30508921	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Dryer
30508923	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Dryer
30508931	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Calciner
30508933	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Calciner
30508941	Industrial Processes; Mineral Products; Talc Processing; Rotary Cooler Following Calciner
30508945	Industrial Processes; Mineral Products; Talc Processing; Grinding of Dried Talc

30508947	Industrial Processes; Mineral Products; Talc Processing; Grinding/Drying of Talc with Heated Makeup Air
30508949	Industrial Processes; Mineral Products; Talc Processing; Ground Talc Storage Bin Loading
30508950	Industrial Processes; Mineral Products; Talc Processing; Air Classifier - Size Classification of Ground Talc
30508953	Industrial Processes; Mineral Products; Talc Processing; Pelletizer
30508955	Industrial Processes; Mineral Products; Talc Processing; Pellet Dryer
30508958	Industrial Processes; Mineral Products; Talc Processing; Pneumatic Conveyor Vents
30508961	Industrial Processes; Mineral Products; Talc Processing; Concentration of Talc Fines Using Shaking Table
30508971	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Flash Drying of Slurry after Flotation
30508973	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Flash Drying of Slurry after Flotation
30508982	Industrial Processes; Mineral Products; Talc Processing; Custom Grinding - Additional Size Reduction
30508985	Industrial Processes; Mineral Products; Talc Processing; Final Product Storage Bin Loading
30508988	Industrial Processes; Mineral Products; Talc Processing; Packaging
30509001	Industrial Processes; Mineral Products; Mica; Rotary Dryer
30509002	Industrial Processes; Mineral Products; Mica; Fluid Energy Mill - Grinding
30509101	Industrial Processes; Mineral Products; Sandspar; Rotary Dryer
30509201	Industrial Processes; Mineral Products; Catalyst Manufacturing; Transferring and Handling
30509202	Industrial Processes; Mineral Products; Catalyst Manufacturing; Mixing and Blending
30509203	Industrial Processes; Mineral Products; Catalyst Manufacturing; Reacting
30509204	Industrial Processes; Mineral Products; Catalyst Manufacturing; Drying
30509205	Industrial Processes; Mineral Products; Catalyst Manufacturing; Storage
30510000	Industrial Processes;Mineral Products;Bulk Materials Elevators;undefined
30510001	Industrial Processes; Mineral Products; Bulk Materials Elevators; Unloading
30510002	Industrial Processes; Mineral Products; Bulk Materials Elevators; Loading
30510003	Industrial Processes; Mineral Products; Bulk Materials Elevators; Removal from Bins
30510004	Industrial Processes; Mineral Products; Bulk Materials Elevators; Drying
30510005	Industrial Processes; Mineral Products; Bulk Materials Elevators; Cleaning
30510006	Industrial Processes; Mineral Products; Bulk Materials Elevators; Elevator Legs (Headhouse)
30510007	Industrial Processes; Mineral Products; Bulk Materials Elevators; Tripper (Gallery Belt)
30510100	Industrial Processes;Mineral Products;Bulk Materials Conveyors;undefined
30510101	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Ammonium Sulfate
30510102	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Cement
30510103	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coal
30510104	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coke
30510105	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Limestone
30510106	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Phosphate Rock

30510107	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Scrap Metal
30510108	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Sulfur
30510196	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Chemical: Specify in Comments
30510197	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Fertilizer: Specify in Comments
30510198	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Mineral: Specify in Comments
30510199	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Other Not Classified
30510200	Industrial Processes;Mineral Products;Bulk Materials Storage Bins;undefined
30510201	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Ammonium Sulfate
30510202	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Cement
30510203	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coal
30510204	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coke
30510205	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Limestone
30510206	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Phosphate Rock
30510207	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Scrap Metal
30510208	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sulfur
30510209	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sand
30510296	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Chemical: Specify in Comments
30510297	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Fertilizer: Specify in Comments
30510298	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Mineral: Specify in Comments
30510299	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Other Not Classified
30510301	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Ammonium Sulfate
30510302	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Cement
30510303	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coal
30510304	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coke
30510305	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Limestone
30510306	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Phosphate Rock
30510307	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Scrap Metal
30510308	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sulfur
30510309	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sand
30510310	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fluxes
30510396	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Chemical: Specify in Comments
30510397	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fertilizer: Specify in Comments
30510398	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Mineral: Specify in Comments
30510399	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Other Not Classified
30510401	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Ammonium Sulfate
30510402	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Cement

30510403	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coal
30510404	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coke
30510405	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Limestone
30510406	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Phosphate Rock
30510407	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Scrap Metal
30510408	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Sulfur
30510496	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Chemical: Specify in Comments
30510497	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Fertilizer: Specify in Comments
30510498	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Mineral: Specify in Comments
30510499	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Other Not Classified
30510501	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Ammonium Sulfate
30510502	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Cement
30510503	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coal
30510504	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coke
30510505	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Limestone
30510506	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Phosphate Rock
30510507	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Scrap Metal
30510508	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Sulfur
30510596	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Chemical: Specify in Comments
30510597	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Fertilizer: Specify in Comments
30510598	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Mineral: Specify in Comments
30510599	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Other Not Classified
30510600	Industrial Processes;Mineral Products;Bulk Materials Screening/Size Classification;undefined
30510604	Industrial Processes; Mineral Products; Bulk Materials Screening/Size Classification; Coke
30510708	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Sulfur
30510709	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Bauxite
30510800	Industrial Processes;Mineral Products;Bulk Materials: Grinding/Crushing;undefined
30510808	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Sulfur
30510809	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Bauxite
30515001	Industrial Processes; Mineral Products; Calcining; Raw Material Handling
30515002	Industrial Processes; Mineral Products; Calcining; General
30515003	Industrial Processes; Mineral Products; Calcining; Grinding/Milling
30515004	Industrial Processes; Mineral Products; Calcining; Finished Product Handling
30515005	Industrial Processes; Mineral Products; Calcining; Mixing
30531001	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Fluidized Bed

30531002	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Flash or Suspension
30531003	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Multilouvered
30531004	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Rotary
30531005	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cascade
30531006	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Continuous Carrier
30531007	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screen
30531008	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Unloading
30531009	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Raw Coal Storage
30531010	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Crushing
30531011	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Coal Transfer
30531012	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screening
30531013	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Air Tables
30531014	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cleaned Coal Storage
30531015	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading
30531016	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading: Clean Coal
30531017	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Secondary Crushing
30531090	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Haul Roads: General
30531099	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Other Not Classified
30532001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Primary Crushing
30532002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Secondary Crushing/Screening
30532003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Tertiary Crushing/Screening
30532004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Recrushing/Screening
30532005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Fines Mill
30532006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Miscellaneous Operations: Screen/Convey/Handling
30532007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Open Storage

30532008	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Cut Stone: General
30532009	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Blasting: General
30532010	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532011	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Hauling
30532012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drying
30532013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Bar Grizzlies
30532014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Shaker Screens
30532015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Vibrating Screens
30532016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Revolving Screens
30532017	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Pugmill
30532018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling with Liquid Injection
30532020	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Unloading
30532032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Conveyor
30532033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Front End Loader
30532090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30580001	Industrial Processes; Mineral Products; Equipment Leaks; Equipment Leaks
30582001	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Area Drains
30582002	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Equipment Drains
30582599	Industrial Processes; Mineral Products; Wastewater, Points of Generation; Specify Point of Generation
30588801	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588802	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588803	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588804	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588805	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30590001	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30590002	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Process Heaters
30590003	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Process Heaters
30590005	Industrial Processes; Mineral Products; Fuel Fired Equipment; Liquified Petroleum Gas (LPG): Process Heaters

30590011	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Incinerators
30590012	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Incinerators
30590013	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Incinerators
30590021	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Flares
30590023	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Flares
30599900	Industrial Processes;Mineral Products;Other Not Defined;undefined
30599999	Industrial Processes; Mineral Products; Other Not Defined; Specify in Comments Field

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.
CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%
INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%
NG_RT:	$0/cf

OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name: Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Non-Ferrous Metals Processing - Aluminum

Abbreviation: PDESPMPAM

Description: Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper.

This control applies to aluminum processing operations.

Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Dry Electrostatic Precipitator-Wire Plate Type

Source Group: Non-Ferrous Metals Processing - Aluminum

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$190	$190
Ref Yr CPT:			$270	$270
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$190	$190
Ref Yr CPT:			$270	$270
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremememtal CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	27.0
Typical O&M Control Cost Factor	16.0
Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
30300201	Industrial Processes; Primary Metal Production; Aluminum Hydroxide Calcining; Overall Process
30300199	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Not otherwise classified
30300111	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Anode Bake Furnace Seocndary Emissions
30300110	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Vertical Stud Soderberg Potline Secondary Emission [See also 30300118]
30300109	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Horizontal Stud Soderberg Potline Secondary Emissions
30300108	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Prebake Potline Secondary Emissions [See also 303001 -19 thru -22]
30300107	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Roof Vents
30300106	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Degassing
30300105	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Anode Baking Furnace Primary Emissions
30300104	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Materials Handling [See also 30300123 and 30300125]
30300103	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Vertical Stud Soderberg Potline Primary Emissions
30300102	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Horizontal Stud Soderberg Potline Primary Emissions
30300101	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Prebaked Potline Primary Emissions [See also 303001-13 thru-16]
30300004	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Loading and Unloading
30300003	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Fine Ore Storage
30300002	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Drying Oven
30300001	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Crushing/Handling

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled

CHEM_PCT:	0%
COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.
CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%
INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name: Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Non-Ferrous Metals Processing - Copper

Abbreviation: PDESPMPCR

Description: Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESOPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper.

This control applies to copper and copper-allow metal processing operations.

Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Dry Electrostatic Precipitator-Wire Plate Type

Source Group: Non-Ferrous Metals Processing - Copper

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$157	$157
Ref Yr CPT:			$223	$223
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$157	$157
Ref Yr CPT:			$223	$223
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	27.0
Typical O&M Control Cost Factor	16.0
Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
30300502	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Multiple Hearth Roaster
30300503	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Smelting Furnace after Roaster
30300504	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Converter (All Configurations)
30300505	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fire (Furnace) Refining
30300506	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Ore Concentrate Dryer
30300507	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Smelting Furnace w/ Ore Charge w/o Roasting
30300508	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Refined Metal Finishing Operations
30300509	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluidized Bed Roaster
30300510	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Smelting Furnace
30300511	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electrolytic Refining
30300512	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Flash Smelting
30300513	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Roasting: Fugitive Emissions
30300514	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace: Fugitive Emissions
30300515	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Converter: Fugitive Emissions
30300516	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Anode Refining Furnace: Fugitive Emissions
30300517	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Slag Cleaning Furnace: Fugitive Emissions
30300518	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Converter Slag Return: Fugitive Emissions
30300519	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Unpaved Road Traffic: Fugitive Emissions
30300521	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Noranda Reactor
30300522	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Slag Cleaning Furnace
30300523	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace with Converter
30300524	Industrial Processes; Primary Metal Production; Primary Copper Smelting; AFT MHR+RF/FBR+EF
30300525	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluid Bed Roaster with Reverberatory Furnace and Converter
30300526	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Dryer with Electric Furnace and Cleaning Furnace and Convertor
30300527	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Dryer with Flash Furnace and Converter
30300528	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Norander Reactor and Converter
30300529	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Multiple Hearth Roaster with Reverberatory Furnace and Converter
30300530	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluid Bed Roaster with Electric Furnace and Converter

30300531	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace After Multiple Hearth Roaster
30300532	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace After Fluid Bed Roaster
30300533	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Furnace After Concentrate Dryer
30300534	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Flash Furnace After Concentrate Dryer
30300535	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Furnace After Fluid Bed Roaster
30300541	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Concentrate Dryer Followed by Noranda Reactors and Converter
30300599	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Other Not Classified
30400200	Industrial Processes;Secondary Metal Production;Copper;undefined
30400204	Industrial Processes; Secondary Metal Production; Copper; Electric Induction Furnace
30400207	Industrial Processes; Secondary Metal Production; Copper; Scrap Dryer (Rotary)
30400208	Industrial Processes; Secondary Metal Production; Copper; Wire Burning: Incinerator
30400209	Industrial Processes; Secondary Metal Production; Copper; Sweating Furnace
30400210	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Copper: Cupolas
30400211	Industrial Processes; Secondary Metal Production; Copper; Charge with Insulated Copper Wire: Cupolas
30400212	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Copper And Brass: Cupolas
30400213	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Iron: Cupolas
30400214	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Reverberatory Furnace
30400215	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Reverberatory Furnace
30400216	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Rotary Furnace
30400217	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Rotary Furnace
30400218	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Crucible and Pot Furnace
30400219	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Crucible and Pot Furnace
30400220	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Electric Arc Furnace
30400221	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Electric Arc Furnace
30400223	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Electric Induction
30400224	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Electric Induction
30400230	Industrial Processes; Secondary Metal Production; Copper; Scrap Metal Pretreatment
30400231	Industrial Processes; Secondary Metal Production; Copper; Scrap Dryer
30400232	Industrial Processes; Secondary Metal Production; Copper; Wire Incinerator
30400233	Industrial Processes; Secondary Metal Production; Copper; Sweating Furnace

30400234	Industrial Processes; Secondary Metal Production; Copper; Cupola Furnace
30400235	Industrial Processes; Secondary Metal Production; Copper; Reverberatory Furnace
30400236	Industrial Processes; Secondary Metal Production; Copper; Rotary Furnace
30400237	Industrial Processes; Secondary Metal Production; Copper; Crucible Furnace
30400238	Industrial Processes; Secondary Metal Production; Copper; Electric Induction Furnace
30400239	Industrial Processes; Secondary Metal Production; Copper; Casting Operations
30400240	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Holding Furnace
30400241	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Holding Furnace
30400242	Industrial Processes; Secondary Metal Production; Copper; Charge with Other Alloy (7%): Reverberatory Furnace
30400243	Industrial Processes; Secondary Metal Production; Copper; Charge with High Lead Alloy (58%): Reverberatory Furnace
30400244	Industrial Processes; Secondary Metal Production; Copper; Charge with Red/Yellow Brass: Reverberatory Furnace
30400250	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Converter
30400251	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Converter
30400299	Industrial Processes; Secondary Metal Production; Copper; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.
CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%
INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%
NG_RT:	$0/cf

OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name: Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Ferrous Metals Processing - Ferroalloy Production

Abbreviation: PDESPMPFP

Description: Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper.

This control applies to ferroalloy production operations, including (but not limited to) several processes within this industry were selected for control, basic oxygen process furnace (SCC 30300914) and EAF argon O2 decarb vessels (SCC 30300928).

Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Dry Electrostatic Precipitator-Wire Plate Type

Source Group: Ferrous Metals Processing - Ferroalloy Production

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$174	$174
Ref Yr CPT:			$247	$247
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				

Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$174	$174
Ref Yr CPT:			$247	$247
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	27.0
Typical O&M Control Cost Factor	16.0
Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
30300601	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 50% FeSi
30300602	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 75% FeSi
30300603	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 90% FeSi
30300604	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: Silicon Metal
30300605	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: Silicomanaganese
30300606	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 80% Ferromanganese
30300607	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 80% Ferrochromium
30300608	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Unloading
30300609	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Crushing
30300610	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ore Screening
30300611	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ore Dryer
30300613	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Storage
30300614	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Transfer
30300615	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ferromanganese: Blast Furnace
30300616	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ferrosilicon: Blast Furnace
30300617	Industrial Processes; Primary Metal Production; Ferroalloy Production; Cast House
30300618	Industrial Processes; Primary Metal Production; Ferroalloy Production; Mix House/Weighing
30300619	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Charging
30300620	Industrial Processes; Primary Metal Production; Ferroalloy Production; Tapping
30300621	Industrial Processes; Primary Metal Production; Ferroalloy Production; Casting
30300622	Industrial Processes; Primary Metal Production; Ferroalloy Production; Cooling
30300623	Industrial Processes; Primary Metal Production; Ferroalloy Production; Product Crushing
30300624	Industrial Processes; Primary Metal Production; Ferroalloy Production; Product Storage
30300625	Industrial Processes; Primary Metal Production; Ferroalloy Production; Product Loading
30300651	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Ferromanganese: Electric Arc Furnace
30300652	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Ferrochromium: Electric Arc Furnace
30300653	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Ferrochromium Silicon: Electric Arc Furnace
30300654	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Other Alloys
30300699	Industrial Processes; Primary Metal Production; Ferroalloy Production; Other Not Classified

30300701	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Ferromanganese
30300702	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Other Alloys
30300703	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Ferrochromium
30300704	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Ferrochromium Silicon

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.
CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%
INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%
NG_RT:	$0/cf

OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name: Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Ferrous Metals Processing - Iron & Steel Production

Abbreviation: PDESPMPIS

Description: Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper.

This control applies to iron and steel production operations.

Discussion: Steel normally is produced in either basic oxygen process furnaces or electric arc furnaces. In the basic oxygen process furnace, a mixture of 70 percent molten iron from the blast furnace and 30 percent iron scrap are melted together. Pure oxygen is blown across the top or through the molten steel to oxidize carbon and oxygen impurities, thus removing these from the steel. Basic oxygen process furnaces are large open-mouthed furnaces that can be tilted to accept a charge or to tap the molten steel to a charging ladle for transfer to an ingot mold or continuous caster.

Because basic oxygen furnaces are open, they produce significant uncontrolled particulate emissions, notably during the refining stage when oxygen is being blown. Electric arc furnaces use the current passing between carbon electrodes to heat molten steel, but also use oxy-fuel burners to accelerate the initial melting process. These furnaces are charged largely with scrap iron. Significant emissions occur during charging, when the furnace roof is open, during melting, as the electrodes are lowered into the scrap and the arc is struck, and during tapping, when alloying elements are added to the melt.

In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Dry Electrostatic Precipitator-Wire Plate Type

Source Group: Ferrous Metals Processing - Iron & Steel Production

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$153	$153
Ref Yr CPT:			$217	$217
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0

Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.090000003576278 69	0.090000003576278 69
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$153	$153
Ref Yr CPT:			$217	$217
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.090000003576278 69	0.090000003576278 69
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995

Typical Capital Control Cost Factor	27.0
Typical O&M Control Cost Factor	16.0
Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
30300831	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unpaved Roads: Light Duty Vehicles
30300829	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Taphole and Trough
30300828	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Local Evacuation
30300827	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Lump Ore Unloading
30300825	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cast House
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300823	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Charge Materials: Transfer/Handling
30300822	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Stockpile: Ore, Pellets, Limestone, Coke, Sinter
30300821	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unload Ore, Pellets, Limestone, into Blast Furnace
30300820	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Conveyor: Transfer Station
30300819	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Process (Combined Code includes 15,16,17,18)
30300818	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cold Screening
30300817	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cooler
30300816	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Hot Screening
30300815	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Breaker
30300812	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Transfer/Handling
30300809	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Removal and Dumping
30300808	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Crushing and Sizing
30300805	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Low-Silt
30300804	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Hi-Silt

30300802	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Agglomerate Charging
30300801	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Ore Charging
30300999	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified
30300998	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified
30300936	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Coating: Tin, Zinc, etc.
30300935	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Cold Rolling
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing
30300933	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Reheat Furnaces
30300932	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Scarfing
30300931	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Rolling
30300930	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Q-BOP Melting and Refining
30300929	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Plate Burner/Torch Cutter
30300928	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Argon-oxygen Decarburization
30300927	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Scrap Preheater
30300926	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Induction Furnace
30300925	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Leaded Steel)
30300924	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Processing
30300923	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Tapping and Dumping
30300922	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Continuous Casting
30300921	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Unleaded Steel)
30300920	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal Desulfurization
30300919	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: Open Hearth
30300918	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: Open Hearth
30300917	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: BOF
30300916	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: BOF

30300915	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal (Iron) Transfer to Steelmaking Furnace
30300912	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Grinding
30300911	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Soaking Pits
30300901	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Open Hearth Furnace: Stack
30300899	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); See Comment **
30300842	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blended Ore Unloading
30300841	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Flue Dust Unloading
30300834	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Paved Roads: All Vehicle Types

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.
CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%
INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%
NG_RT:	$0/cf

OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name: Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Non-Ferrous Metals Processing - Lead

Abbreviation: PDESPMPLD

Description: Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper.

This control applies to lead processing operations.

Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Dry Electrostatic Precipitator-Wire Plate Type

Source Group: Non-Ferrous Metals Processing - Lead

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$328	$328
Ref Yr CPT:			$466	$466
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$328	$328
Ref Yr CPT:			$466	$466
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremememtal CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	27.0
Typical O&M Control Cost Factor	16.0
Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
30301001	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Single Stream
30301002	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Operation
30301003	Industrial Processes; Primary Metal Production; Lead Production; Dross Reverberatory Furnace
30301004	Industrial Processes; Primary Metal Production; Lead Production; Ore Crushing
30301005	Industrial Processes; Primary Metal Production; Lead Production; Materials Handling (Includes 11, 12, 13, 04, 14)
30301006	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Dual Stream Feed End
30301007	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Dual Stream Discharge End
30301008	Industrial Processes; Primary Metal Production; Lead Production; Slag Fume Furnace
30301009	Industrial Processes; Primary Metal Production; Lead Production; Lead Drossing
30301010	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Crushing and Grinding
30301011	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Unloading
30301012	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Storage Piles
30301013	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Transfer
30301014	Industrial Processes; Primary Metal Production; Lead Production; Sintering Charge Mixing
30301015	Industrial Processes; Primary Metal Production; Lead Production; Sinter Crushing/Screening
30301016	Industrial Processes; Primary Metal Production; Lead Production; Sinter Transfer
30301017	Industrial Processes; Primary Metal Production; Lead Production; Sinter Fines Return Handling
30301018	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Charging
30301019	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Tapping (Metal and Slag)
30301020	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Lead Pouring
30301021	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Slag Pouring
30301022	Industrial Processes; Primary Metal Production; Lead Production; Lead Refining/Silver Retort
30301023	Industrial Processes; Primary Metal Production; Lead Production; Lead Casting
30301024	Industrial Processes; Primary Metal Production; Lead Production; Reverberatory or Kettle Softening
30301025	Industrial Processes; Primary Metal Production; Lead Production; Sinter Machine Leakage
30301026	Industrial Processes; Primary Metal Production; Lead Production; Sinter Dump Area
30301027	Industrial Processes; Primary Metal Production; Lead Production; Vacuum Distillation
30301028	Industrial Processes; Primary Metal Production; Lead Production; Tetrahedrite Dryer
30301029	Industrial Processes; Primary Metal Production; Lead Production; Sinter Machine (Weak Gas)
30301030	Industrial Processes; Primary Metal Production; Lead Production; Sinter Storage
30301031	Industrial Processes; Primary Metal Production; Lead Production; Speiss Pit
30301032	Industrial Processes; Primary Metal Production; Lead Production; Ore Screening
30301099	Industrial Processes; Primary Metal Production; Lead Production; Other Not Classified
30400401	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace

30400402	Industrial Processes; Secondary Metal Production; Lead; Reverberatory Furnace
30400403	Industrial Processes; Secondary Metal Production; Lead; Blast Furnace (Cupola)
30400404	Industrial Processes; Secondary Metal Production; Lead; Rotary Sweating Furnace
30400405	Industrial Processes; Secondary Metal Production; Lead; Reverberatory Sweating Furnace
30400406	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace Heater: Distillate Oil
30400407	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace Heater: Natural Gas
30400408	Industrial Processes; Secondary Metal Production; Lead; Barton Process Reactor (Oxidation Kettle)
30400409	Industrial Processes; Secondary Metal Production; Lead; Casting
30400410	Industrial Processes; Secondary Metal Production; Lead; Battery Breaking
30400411	Industrial Processes; Secondary Metal Production; Lead; Scrap Crushing
30400412	Industrial Processes; Secondary Metal Production; Lead; Sweating Furnace: Fugitive Emissions
30400413	Industrial Processes; Secondary Metal Production; Lead; Smelting Furnace: Fugitive Emissions
30400414	Industrial Processes; Secondary Metal Production; Lead; Kettle Refining: Fugitive Emissions
30400415	Industrial Processes; Secondary Metal Production; Lead; Agglomeration Furnace
30400416	Industrial Processes; Secondary Metal Production; Lead; Furnace Charging
30400417	Industrial Processes; Secondary Metal Production; Lead; Furnace Lead/Slagtapping
30400418	Industrial Processes; Secondary Metal Production; Lead; Electric Furnace
30400419	Industrial Processes; Secondary Metal Production; Lead; Raw Material Dryer
30400420	Industrial Processes; Secondary Metal Production; Lead; Raw Material Unloading
30400421	Industrial Processes; Secondary Metal Production; Lead; Raw Material Transfer/Conveying
30400422	Industrial Processes; Secondary Metal Production; Lead; Raw Material Storage Pile
30400423	Industrial Processes; Secondary Metal Production; Lead; Slag Breaking
30400424	Industrial Processes; Secondary Metal Production; Lead; Size Separation
30400425	Industrial Processes; Secondary Metal Production; Lead; Casting: Fugitive Emissions
30400426	Industrial Processes; Secondary Metal Production; Lead; Kettle Refining
30400499	Industrial Processes; Secondary Metal Production; Lead; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.
CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%

INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name: Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Non-Ferrous Metals Processing - Other

Abbreviation: PDESPMPOR

Description: Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper.

This control applies to miscellaneous non-ferrous metals processing operations, including molybdenum, titanium, gold, barium ore, lead battery, magnesium, nickel, electrode manufacture and metal heat treating operations.

Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Dry Electrostatic Precipitator-Wire Plate Type

Source Group: Non-Ferrous Metals Processing - Other

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$159	$159
Ref Yr CPT:			$226	$226
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				

Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$159	$159
Ref Yr CPT:			$226	$226
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	27.0
Typical O&M Control Cost Factor	16.0
Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
30301101	Industrial Processes; Primary Metal Production; Molybdenum; Mining: General
30301102	Industrial Processes; Primary Metal Production; Molybdenum; Milling: General
30301199	Industrial Processes; Primary Metal Production; Molybdenum; Other Not Classified
30301201	Industrial Processes; Primary Metal Production; Titanium; Chlorination
30301202	Industrial Processes; Primary Metal Production; Titanium; Drying Titanium Sand Ore (Cyclone Exit)
30301299	Industrial Processes; Primary Metal Production; Titanium; Other Not Classified
30301301	Industrial Processes; Primary Metal Production; Gold Processing; General Processes
30301302	Industrial Processes; Primary Metal Production; Gold Processing; Fines Crushing
30301401	Industrial Processes; Primary Metal Production; Barium Ore Processing; Ore Grinding
30301402	Industrial Processes; Primary Metal Production; Barium Ore Processing; Reduction Kiln
30301403	Industrial Processes; Primary Metal Production; Barium Ore Processing; Dryers/Calciners
30301499	Industrial Processes; Primary Metal Production; Barium Ore Processing; Other Not Classified
30400501	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process **
30400502	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Casting Furnace **
30400503	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixer **
30400504	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation **
30400505	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process
30400506	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Casting
30400507	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixing
30400508	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Oxide Mill (Baghouse Outlet)
30400509	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation
30400510	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Reclaiming Furnace
30400511	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Small Parts Casting
30400512	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Formation
30400513	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Barton Process: Oxidation Kettle
30400521	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process
30400522	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Casting
30400523	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixing
30400524	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Oxide Mill (Baghouse Outlet)
30400525	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation
30400526	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Reclaiming Furnace

30400527	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Small Parts Casting
30400528	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Formation
30400529	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Cast/Paste Mix: Combined Operation
30400530	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mix/Lead Charge: Combined Operation
30400531	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Wash and Paint
30400599	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Other Not Classified
30400601	Industrial Processes; Secondary Metal Production; Magnesium; Pot Furnace
30400602	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process
30400605	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Neutralization Tank
30400606	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: HCl Absorbers
30400607	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Evaporator
30400608	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Filtering/Concentration
30400609	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Shelf Dryer
30400610	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Rotary Dryer
30400611	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Prilling
30400612	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Granule Storage Tanks
30400613	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Electrolysis
30400614	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Regenerative Furnaces
30400630	Industrial Processes; Secondary Metal Production; Magnesium; Natural Lead Industrial (NLI) Brine Process
30400635	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: MgCl2 Melt/Purification
30400636	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: 2nd Vessel, Further Purification
30400637	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: Electrolysis
30400650	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process
30400655	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Purification II
30400656	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Electrolysis
30400660	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Chlorine Recovery
30400699	Industrial Processes; Secondary Metal Production; Magnesium; Other Not Classified
30401001	Industrial Processes; Secondary Metal Production; Nickel; Flux Furnace
30401002	Industrial Processes; Secondary Metal Production; Nickel; Mixing/Blending/Grinding/Screening
30401004	Industrial Processes; Secondary Metal Production; Nickel; Heat Treat Furnace

30401005	Industrial Processes; Secondary Metal Production; Nickel; Induction Furnace (Inlet Air)
30401006	Industrial Processes; Secondary Metal Production; Nickel; Induction Furnace (Under Vacuum)
30401007	Industrial Processes; Secondary Metal Production; Nickel; Electric Arc Furnace with Carbon Electrode
30401008	Industrial Processes; Secondary Metal Production; Nickel; Electric Arc Furnace
30401010	Industrial Processes; Secondary Metal Production; Nickel; Finishing: Pickling/Neutralizing
30401011	Industrial Processes; Secondary Metal Production; Nickel; Finishing: Grinding
30401015	Industrial Processes; Secondary Metal Production; Nickel; Multiple Hearth Roaster
30401016	Industrial Processes; Secondary Metal Production; Nickel; Converters
30401017	Industrial Processes; Secondary Metal Production; Nickel; Reverberatory Furnace
30401018	Industrial Processes; Secondary Metal Production; Nickel; Electric Furnace
30401019	Industrial Processes; Secondary Metal Production; Nickel; Sinter Machine
30401061	Industrial Processes; Secondary Metal Production; Nickel; Roasting: Fugitive Emissions
30401062	Industrial Processes; Secondary Metal Production; Nickel; Reverberatory Furnace: Fugitive Emissions
30401063	Industrial Processes; Secondary Metal Production; Nickel; Converter: Fugitive Emissions
30401099	Industrial Processes; Secondary Metal Production; Nickel; Other Not Classified
30402001	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Calcination
30402002	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Mixing
30402003	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Pitch Treating
30402004	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Bake Furnaces
30402005	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Grafitization of Coal by Heating Process
30402099	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Other Not Classified
30402201	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Furnace: General
30402210	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Quench Bath
30402211	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Quenching

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.
CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%

INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name: Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Non-Ferrous Metals Processing - Zinc

Abbreviation: PDESPMPZC

Description: Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper.

This control applies to zinc processing operations.

Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Dry Electrostatic Precipitator-Wire Plate Type

Source Group: Non-Ferrous Metals Processing - Zinc

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$126	$126
Ref Yr CPT:			$179	$179
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$126	$126
Ref Yr CPT:			$179	$179
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	27.0
Typical O&M Control Cost Factor	16.0
Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
30303002	Industrial Processes; Primary Metal Production; Zinc Production; Multiple Hearth Roaster
30303003	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Strand
30303005	Industrial Processes; Primary Metal Production; Zinc Production; Vertical Retort/Electrothermal Furnace
30303006	Industrial Processes; Primary Metal Production; Zinc Production; Electrolytic Processor
30303007	Industrial Processes; Primary Metal Production; Zinc Production; Flash Roaster
30303008	Industrial Processes; Primary Metal Production; Zinc Production; Fluid Bed Roaster
30303009	Industrial Processes; Primary Metal Production; Zinc Production; Raw Material Handling and Transfer
30303010	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Breaking and Cooling
30303011	Industrial Processes; Primary Metal Production; Zinc Production; Zinc Casting
30303012	Industrial Processes; Primary Metal Production; Zinc Production; Raw Material Unloading
30303013	Industrial Processes; Primary Metal Production; Zinc Production; Suspension Roaster
30303014	Industrial Processes; Primary Metal Production; Zinc Production; Crushing/Screening
30303015	Industrial Processes; Primary Metal Production; Zinc Production; Zinc Melting
30303016	Industrial Processes; Primary Metal Production; Zinc Production; Alloying
30303017	Industrial Processes; Primary Metal Production; Zinc Production; Leaching
30303018	Industrial Processes; Primary Metal Production; Zinc Production; Purification
30303019	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant Wind Box
30303020	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant Discharge and Screens
30303021	Industrial Processes; Primary Metal Production; Zinc Production; Retort Furnace
30303022	Industrial Processes; Primary Metal Production; Zinc Production; Flue Dust Handling
30303023	Industrial Processes; Primary Metal Production; Zinc Production; Dross Handling
30303024	Industrial Processes; Primary Metal Production; Zinc Production; Roasting: Fugitive Emissions
30303025	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant, Wind Box: Fugitive Emissions
30303026	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant, Discharge Screens: Fugitive Emissions
30303027	Industrial Processes; Primary Metal Production; Zinc Production; Retort Building: Fugitive Emissions
30303028	Industrial Processes; Primary Metal Production; Zinc Production; Casting: Fugitive Emissions
30303029	Industrial Processes; Primary Metal Production; Zinc Production; Electric Retort
30303099	Industrial Processes; Primary Metal Production; Zinc Production; Other Not Classified
30400801	Industrial Processes; Secondary Metal Production; Zinc; Retort Furnace
30400802	Industrial Processes; Secondary Metal Production; Zinc; Horizontal Muffle Furnace
30400803	Industrial Processes; Secondary Metal Production; Zinc; Pot Furnace
30400805	Industrial Processes; Secondary Metal Production; Zinc; Galvanizing Kettle
30400806	Industrial Processes; Secondary Metal Production; Zinc; Calcining Kiln
30400807	Industrial Processes; Secondary Metal Production; Zinc; Concentrate Dryer

30400809	Industrial Processes; Secondary Metal Production; Zinc; Rotary Sweat Furnace
30400810	Industrial Processes; Secondary Metal Production; Zinc; Muffle Sweat Furnace
30400811	Industrial Processes; Secondary Metal Production; Zinc; Electric Resistance Sweat Furnace
30400812	Industrial Processes; Secondary Metal Production; Zinc; Crushing/Screening of Zinc Residues
30400814	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: Clean Metallic Scrap
30400818	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: Clean Metallic Scrap
30400824	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: General Metallic Scrap
30400828	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: General Metallic Scrap
30400834	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: Residual Metallic Scrap
30400838	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: Residual Metallic Scrap
30400840	Industrial Processes; Secondary Metal Production; Zinc; Alloying
30400841	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Crucible
30400842	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Reverberatory Furnace
30400843	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Electric Induction Furnace
30400851	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation: Pouring
30400852	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation: Casting
30400853	Industrial Processes; Secondary Metal Production; Zinc; Graphite Rod Distillation
30400854	Industrial Processes; Secondary Metal Production; Zinc; Retort Distillation/Oxidation
30400855	Industrial Processes; Secondary Metal Production; Zinc; Muffle Distillation/Oxidation
30400861	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweating
30400862	Industrial Processes; Secondary Metal Production; Zinc; Rotary Sweating
30400863	Industrial Processes; Secondary Metal Production; Zinc; Muffle Sweating
30400864	Industrial Processes; Secondary Metal Production; Zinc; Kettle (Pot) Sweating
30400865	Industrial Processes; Secondary Metal Production; Zinc; Electric Resistance Sweating
30400866	Industrial Processes; Secondary Metal Production; Zinc; Sodium Carbonate Leaching
30400867	Industrial Processes; Secondary Metal Production; Zinc; Kettle (Pot) Melting Furnace
30400868	Industrial Processes; Secondary Metal Production; Zinc; Crucible Melting Furnace
30400869	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Melting Furnace
30400870	Industrial Processes; Secondary Metal Production; Zinc; Electric Induction Melting Furnace
30400871	Industrial Processes; Secondary Metal Production; Zinc; Alloying Retort Distillation
30400872	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation
30400873	Industrial Processes; Secondary Metal Production; Zinc; Casting
30400874	Industrial Processes; Secondary Metal Production; Zinc; Graphite Rod Distillation
30400875	Industrial Processes; Secondary Metal Production; Zinc; Retort Distillation/Oxidation
30400876	Industrial Processes; Secondary Metal Production; Zinc; Muffle Distillation/Oxidation

30400877	Industrial Processes; Secondary Metal Production; Zinc; Retort Reduction
30400899	Industrial Processes; Secondary Metal Production; Zinc; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.
CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%
INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%
NG_RT:	$0/cf

OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name: Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Municipal Waste Incineration

Abbreviation: PDESPMUWI

Description: Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper.

This control applies to municipal waste incineration operations classified under SCCs: 50100101,
50100102, 50100103, 50100105, and 50100107.

Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Dry Electrostatic Precipitator-Wire Plate Type

Source Group: Municipal Waste Incineration

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$137	$137
Ref Yr CPT:			$194	$194
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				

Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$137	$137
Ref Yr CPT:			$194	$194
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	27.0
Typical O&M Control Cost Factor	16.0
Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
50100108	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Fluidized Bed: Refuse Derived Fuel
50100107	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Modular Excess Air Combustor
50100106	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Mass Burn Rotary Waterwall Combustor
50100105	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Mass Burn Waterwall Combustor
50100104	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Mass Burn Refractory Wall Combustor
50100103	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Refuse Derived Fuel
50100102	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Mass Burn: Single Chamber
50100101	Waste Disposal; Solid Waste Disposal - Government; Municipal Incineration; Starved Air: Multiple Chamber

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.
CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%
INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%
NG_RT:	$0/cf

OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name:	Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Wood Pulp & Paper
Abbreviation:	PDESPWDPP
Description:	Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper. This control applies to wood pulp and paper product operations. Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona. Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Dry Electrostatic Precipitator-Wire Plate Type
Source Group:	Wood Pulp & Paper
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$132	$132
Ref Yr CPT:			$187	$187
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$132	$132
Ref Yr CPT:			$187	$187
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremememtal CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	27.0
Typical O&M Control Cost Factor	16.0
Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
30700120	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Stock Washing/Screening
30700119	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Salt Cake Mix Tank (Boiler Ash Handling)
30700117	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Venting of condensate stripper off-gases
30700116	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Turpentine Storage and Loading (incl decanting, storage and loading)
30700115	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Chlorine Dioxide Generator
30700114	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Bleach Plant
30700113	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Lime Mud Filter System
30700112	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Lime Mud Washers
30700111	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Filtrate Tanks
30700110	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Recovery Furnace/Indirect Contact Evaporator
30700109	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Black Liquor Oxidation System
30700108	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Fluid Bed Calciner
30700107	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Turpentine Condenser
30700106	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Lime Kiln
30700104	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Recovery Furnace/Direct Contact Evaporator
30700103	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Multiple Effect Evaporators and Concentrators

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled

CHEM_PCT:	0%
COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.
CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%
INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name: Diesel Oxidation Catalyst (DPF infeasible);IC Diesel Engine

Abbreviation: PDIEOXCAT

Description: Application: This control is the application of a diesel oxidation catalyst retrofit to reduce PM emissions from stationary IC diesel engines. This control is intended to be used in cases where the installation of a diesel particulate filter is infeasible. Diesel oxidation catalysts require the use of low sulfur fuel.

Class: Known

Pollutant: PM2_5

Equipment Life: N/A years

Control Technology: Diesel Oxidation Catalyst (Diesel Particulate Filter infeasible)

Source Group: IC Diesel Engine

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	2003	2003
CPT:			$1,500	$1,500
Ref Yr CPT:			$1,849	$1,849
Control Efficiency:	20.0	20.0	20.0	20.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:	Cost effectiveness is based on the combined CO/HC/NOx and PM reduction	Cost effectiveness is based on the combined CO/HC/NOx and PM reduction	Cost effectiveness is based on the combined CO/HC/NOx and PM reduction	Cost effectiveness is based on the combined CO/HC/NOx and PM reduction
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	2003	2003
CPT:			$1,500	$1,500
Ref Yr CPT:			$1,849	$1,849
Control Efficiency:	20.0	20.0	20.0	20.0

Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:	Cost effectiveness is based on the combined CO/HC/NOx and PM reduction	Cost effectiveness is based on the combined CO/HC/NOx and PM reduction	Cost effectiveness is based on the combined CO/HC/NOx and PM reduction	Cost effectiveness is based on the combined CO/HC/NOx and PM reduction
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
20400407	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Dual Fuel (Gas/Oil)
20400402	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Diesel/Kerosene
20400302	Internal Combustion Engines; Engine Testing; Turbine; Diesel/Kerosene
20300109	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Turbine: Exhaust
20300107	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating: Exhaust
20300105	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating: Crankcase Blowby
20300102	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Turbine
20300101	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating
20300100	Internal Combustion Engines;Commercial/Institutional;Distillate Oil (Diesel);undefined
20200407	Internal Combustion Engines; Industrial; Large Bore Engine; Exhaust
20200403	Internal Combustion Engines; Industrial; Large Bore Engine; Cogeneration: Dual Fuel
20200402	Internal Combustion Engines; Industrial; Large Bore Engine; Dual Fuel (Oil/Gas)
20200401	Internal Combustion Engines; Industrial; Large Bore Engine; Diesel
20200107	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Exhaust
20200105	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Crankcase Blowby
20200104	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Cogeneration
20200103	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Turbine: Cogeneration
20200102	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating

20200101	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Turbine
20200100	Internal Combustion Engines;Industrial;Distillate Oil (Diesel);undefined
20100109	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Turbine: Exhaust
20100107	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating: Exhaust
20100105	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating: Crankcase Blowby
20100102	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating
20100101	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Turbine
20100100	Internal Combustion Engines;Electric Generation;Distillate Oil (Diesel);undefined

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.

Other information:

Summary:

Control Measure Name: Diesel Particulate Filter;IC Diesel Engine
Abbreviation: PDIEPRTFIL
Description: Application: This control is the application of a diesel particulate filter to stationary IC diesel engines to reduce PM emissions. Diesel particulate filters require the use of low sulfur fuel.
Class: Known
Pollutant: PM2_5
Equipment Life: N/A years
Control Technology: Diesel Particulate Filter
Source Group: IC Diesel Engine
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	2003	2003
CPT:			$10,500	$10,500
Ref Yr CPT:			$12,945	$12,945
Control Efficiency:	85.0	85.0	85.0	85.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:			Cost effectiveness is based on the combined CO/HC and PM reduction; Development measure from PM NAAQS RIA	Cost effectiveness is based on the combined CO/HC and PM reduction; Development measure from PM NAAQS RIA
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	2003	2003
CPT:			$10,500	$10,500
Ref Yr CPT:			$12,945	$12,945
Control Efficiency:	85.0	85.0	85.0	85.0

Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:			Cost effectiveness is based on the combined CO/HC and PM reduction; Development measure from PM NAAQS RIA	Cost effectiveness is based on the combined CO/HC and PM reduction; Development measure from PM NAAQS RIA
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
20400407	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Dual Fuel (Gas/Oil)
20400402	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Diesel/Kerosene
20400302	Internal Combustion Engines; Engine Testing; Turbine; Diesel/Kerosene
20300109	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Turbine: Exhaust
20300107	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating: Exhaust
20300105	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating: Crankcase Blowby
20300102	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Turbine
20300101	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating
20300100	Internal Combustion Engines;Commercial/Institutional;Distillate Oil (Diesel);undefined
20200407	Internal Combustion Engines; Industrial; Large Bore Engine; Exhaust
20200403	Internal Combustion Engines; Industrial; Large Bore Engine; Cogeneration: Dual Fuel
20200402	Internal Combustion Engines; Industrial; Large Bore Engine; Dual Fuel (Oil/Gas)
20200401	Internal Combustion Engines; Industrial; Large Bore Engine; Diesel
20200107	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Exhaust
20200105	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Crankcase Blowby
20200104	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating: Cogeneration
20200103	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Turbine: Cogeneration

20200102	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating
20200101	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Turbine
20200100	Internal Combustion Engines;Industrial;Distillate Oil (Diesel);undefined
20100109	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Turbine: Exhaust
20100107	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating: Exhaust
20100105	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating: Crankcase Blowby
20100102	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating
20100101	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Turbine
20100100	Internal Combustion Engines;Electric Generation;Distillate Oil (Diesel);undefined

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.

Other information:

Summary:

Control Measure Name: Dry Injection / Fabric Filter System (DIFF); ICI Boilers (Bituminous Coal)

Abbreviation: PDIFFIBBC

Description: Dry Injection and Fabric Filter System (DIFF) - Dry sorbent injection (DSI) systems remove SO2, hydrogen chloride (HCl), and other acid gases through two basic steps: Step one. A powdered sorbent is injected into the flue gas,àö,â•combustion exhaust gas exiting a combustion source such as a boiler, where it reacts with the acid gas. The sorbents most commonly associated with DSI are trona (sodium sesquicarbonate, a naturally occurring mineral mined in Wyoming), sodium bicarbonate, and hydrated lime. Step two. The compound is removed by a downstream particulate matter control device such as an electrostatic precipitator (ESP) or a fabric filter (FF), also referred to as a baghouse. Fabric filters are generally more effective (when combined with DSI) than ESPs, with respect to overall acid gas reduction.

Reference: U.S. Energy Information Administration, March 2012. http://www.eia.gov/todayinenergy/detail.cfm?id=5430

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Dry Injection / Fabric Filter System (DIFF)

Source Group: ICI Boilers (Bituminous Coal)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$80,389	
Ref Yr CPT:		$86,612	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$80,389	

Ref Yr CPT:		$86,612	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 17

Description: Dry Injection/Fabric Filter System (Diff) Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	4.68

Affected SCCs:

Code	Description
10300218	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10300217	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Bubbling Bed
10300214	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Hand-fired
10300209	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Spreader Stoker
10300208	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Underfeed Stoker
10300206	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom
10200218	External Combustion Boilers; Industrial; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10200205	External Combustion Boilers; Industrial; Bituminous Coal; Overfeed Stoker
10200204	External Combustion Boilers; Industrial; Bituminous Coal; Spreader Stoker
10200202	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom

10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Dry Injection / Fabric Filter System (DIFF); ICI Boilers (Dry Biomass)

Abbreviation: PDIFFIBDB

Description: Dry Injection and Fabric Filter System (DIFF) - Dry sorbent injection (DSI) systems remove SO2, hydrogen chloride (HCl), and other acid gases through two basic steps: Step one. A powdered sorbent is injected into the flue gas,àö,â•combustion exhaust gas exiting a combustion source such as a boiler, where it reacts with the acid gas. The sorbents most commonly associated with DSI are trona (sodium sesquicarbonate, a naturally occurring mineral mined in Wyoming), sodium bicarbonate, and hydrated lime. Step two. The compound is removed by a downstream particulate matter control device such as an electrostatic precipitator (ESP) or a fabric filter (FF), also referred to as a baghouse. Fabric filters are generally more effective (when combined with DSI) than ESPs, with respect to overall acid gas reduction.

Reference: U.S. Energy Information Administration, March 2012.
http://www.eia.gov/todayinenergy/detail.cfm?id=5430

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Dry Injection / Fabric Filter System (DIFF)

Source Group: ICI Boilers (Dry Biomass)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$56,215	
Ref Yr CPT:		$60,566	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$56,215	

Ref Yr CPT:		$60,566	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 17

Description: Dry Injection/Fabric Filter System (Diff) Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	8.48

Affected SCCs:

Code	Description
10300912	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Fluidized bed combustion boilers
10300911	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Stoker boilers **
10300902	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood/Bark-fired Boiler
10200911	External Combustion Boilers; Industrial; Wood/Bark Waste; Stoker boilers **
10200910	External Combustion Boilers; Industrial; Wood/Bark Waste; Fuel cell/Dutch oven boilers **
10200908	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Dry Wood (<20% moisture)
10200907	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood Cogeneration
10200906	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler (< 50,000 Lb Steam) **
10200905	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler (< 50,000 Lb Steam) **
10200902	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler

10200901	External Combustion Boilers; Industrial; Wood/Bark Waste; Bark-fired Boiler
10100911	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Stoker boilers **
10100902	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood/Bark Fired Boiler

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Dry Injection / Fabric Filter System (DIFF); ICI Boilers (Distillate Oil)

Abbreviation: PDIFFIBDO

Description: Dry Injection and Fabric Filter System (DIFF) - Dry sorbent injection (DSI) systems remove SO2, hydrogen chloride (HCl), and other acid gases through two basic steps: Step one. A powdered sorbent is injected into the flue gas,àö‚â•combustion exhaust gas exiting a combustion source such as a boiler, where it reacts with the acid gas. The sorbents most commonly associated with DSI are trona (sodium sesquicarbonate, a naturally occurring mineral mined in Wyoming), sodium bicarbonate, and hydrated lime. Step two. The compound is removed by a downstream particulate matter control device such as an electrostatic precipitator (ESP) or a fabric filter (FF), also referred to as a baghouse. Fabric filters are generally more effective (when combined with DSI) than ESPs, with respect to overall acid gas reduction.

Reference: U.S. Energy Information Administration, March 2012. http://www.eia.gov/todayinenergy/detail.cfm?id=5430

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Dry Injection / Fabric Filter System (DIFF)

Source Group: ICI Boilers (Distillate Oil)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$1,727,223	
Ref Yr CPT:		$1,860,933	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$1,727,223	

Ref Yr CPT:		$1,860,933	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 17

Description: Dry Injection/Fabric Filter System (Diff) Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	10.84

Affected SCCs:

Code	Description
30290001	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
10500205	External Combustion; Space Heaters; Commercial/Institutional; Distillate Oil
10500105	External Combustion; Space Heaters; Industrial; Distillate Oil
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **

10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Dry Injection / Fabric Filter System (DIFF); ICI Boilers (Gaseous Fuels)

Abbreviation: PDIFFIBGF

Description: Dry Injection and Fabric Filter System (DIFF) - Dry sorbent injection (DSI) systems remove SO2, hydrogen chloride (HCl), and other acid gases through two basic steps: Step one. A powdered sorbent is injected into the flue gas,àö,â•combustion exhaust gas exiting a combustion source such as a boiler, where it reacts with the acid gas. The sorbents most commonly associated with DSI are trona (sodium sesquicarbonate, a naturally occurring mineral mined in Wyoming), sodium bicarbonate, and hydrated lime. Step two. The compound is removed by a downstream particulate matter control device such as an electrostatic precipitator (ESP) or a fabric filter (FF), also referred to as a baghouse. Fabric filters are generally more effective (when combined with DSI) than ESPs, with respect to overall acid gas reduction.

Reference: U.S. Energy Information Administration, March 2012. http://www.eia.gov/todayinenergy/detail.cfm?id=5430

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Dry Injection / Fabric Filter System (DIFF)

Source Group: ICI Boilers (Gaseous Fuels)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$1,606,727	
Ref Yr CPT:		$1,731,110	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$1,606,727	

Ref Yr CPT:		$1,731,110	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 17

Description: Dry Injection/Fabric Filter System (Diff) Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	16.42

Affected SCCs:

Code	Description
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100701	External Combustion Boilers; Electric Generation; Process Gas; Boiler, >= 100 Million BTU/hr
10100702	External Combustion Boilers; Electric Generation; Process Gas; Boiler < 100 Million Btu/hr
10100703	External Combustion Boilers; Electric Generation; Petroleum Refinery Gas; Boiler
10101002	External Combustion Boilers; Electric Generation; Liquified Petroleum Gas (LPG); Propane
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration

10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200711	External Combustion Boilers; Industrial; Process Gas; Landfill Gas
10200799	External Combustion Boilers; Industrial; Process Gas; Other: Specify in Comments
10201001	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Butane
10201002	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Propane
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300811	External Combustion Boilers; Commercial/Institutional; Landfill Gas; Landfill Gas
10301001	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane
10301002	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Propane
10301003	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane/Propane Mixture: Specify Percent Butane in Comments
10500106	External Combustion; Space Heaters; Industrial; Natural Gas
10500206	External Combustion; Space Heaters; Commercial/Institutional; Natural Gas
30290003	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Natural Gas: Process Heaters
31000203	Industrial Processes; Oil and Gas Production; Natural Gas Production; Compressors (See also 310003-12 and -13)
31000414	Industrial Processes; Oil and Gas Production; Process Heaters; Natural Gas: Steam Generators

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Dry Injection / Fabric Filter System (DIFF); ICI Boilers (All Other Liquid Fuels)

Abbreviation: PDIFFIBOLF

Description: Dry Injection and Fabric Filter System (DIFF) - Dry sorbent injection (DSI) systems remove SO2, hydrogen chloride (HCl), and other acid gases through two basic steps: Step one. A powdered sorbent is injected into the flue gas,àö,â•combustion exhaust gas exiting a combustion source such as a boiler, where it reacts with the acid gas. The sorbents most commonly associated with DSI are trona (sodium sesquicarbonate, a naturally occurring mineral mined in Wyoming), sodium bicarbonate, and hydrated lime. Step two. The compound is removed by a downstream particulate matter control device such as an electrostatic precipitator (ESP) or a fabric filter (FF), also referred to as a baghouse. Fabric filters are generally more effective (when combined with DSI) than ESPs, with respect to overall acid gas reduction.

Reference: U.S. Energy Information Administration, March 2012. http://www.eia.gov/todayinenergy/detail.cfm?id=5430

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Dry Injection / Fabric Filter System (DIFF)

Source Group: ICI Boilers (All Other Liquid Fuels)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$318,341	
Ref Yr CPT:		$342,985	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$318,341	

Ref Yr CPT:		$342,985	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 17

Description: Dry Injection/Fabric Filter System (Diff) Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	10.52

Affected SCCs:

Code	Description
30130201	Industrial Processes; Chemical Manufacturing; Carbon Tetrachloride; General
10201303	External Combustion Boilers; Industrial; Liquid Waste; Salable Animal Fat
10201302	External Combustion Boilers; Industrial; Liquid Waste; Waste Oil
10201301	External Combustion Boilers; Industrial; Liquid Waste; Specify Waste Material in Comments
10101302	External Combustion Boilers; Electric Generation; Liquid Waste; Waste Oil
10101301	External Combustion Boilers; Electric Generation; Liquid Waste; Specify Waste Material in Comments

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research

Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Dry Injection / Fabric Filter System (DIFF); ICI Boilers (All Other Solid Fuels)
Abbreviation: PDIFFIBOSF
Description: Dry Injection and Fabric Filter System (DIFF) - Dry sorbent injection (DSI) systems remove SO2, hydrogen chloride (HCl), and other acid gases through two basic steps: Step one. A powdered sorbent is injected into the flue gas,àö,â•combustion exhaust gas exiting a combustion source such as a boiler, where it reacts with the acid gas. The sorbents most commonly associated with DSI are trona (sodium sesquicarbonate, a naturally occurring mineral mined in Wyoming), sodium bicarbonate, and hydrated lime. Step two. The compound is removed by a downstream particulate matter control device such as an electrostatic precipitator (ESP) or a fabric filter (FF), also referred to as a baghouse. Fabric filters are generally more effective (when combined with DSI) than ESPs, with respect to overall acid gas reduction.

Reference: U.S. Energy Information Administration, March 2012. http://www.eia.gov/todayinenergy/detail.cfm?id=5430
Class: Known
Pollutant: PM25-PRI
Equipment Life: 15.0 years
Control Technology: Dry Injection / Fabric Filter System (DIFF)
Source Group: ICI Boilers (All Other Solid Fuels)
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$7,648,153	
Ref Yr CPT:		$8,240,224	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$7,648,153	

Ref Yr CPT:		$8,240,224	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 17

Description: Dry Injection/Fabric Filter System (Diff) Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	6.07

Affected SCCs:

Code	Description
39999999	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Industrial Processes; Other Not Classified
31100199	Industrial Processes; Building Construction; Construction: Building Contractors; Other Not Classified
30699999	Industrial Processes; Petroleum Industry; Petroleum Products - Not Classified; Not Classified **
30501021	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Removal
30500199	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; See Comment **
30500105	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; General **
10301202	External Combustion Boilers; Commercial/Institutional; Solid Waste; Refuse Derived Fuel
10301201	External Combustion Boilers; Commercial/Institutional; Solid Waste; Specify Waste Material in Comments
10201201	External Combustion Boilers; Industrial; Solid Waste; Specify Waste Material in Comments
10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal

10101204	External Combustion Boilers; Electric Generation; Solid Waste; Tire Derived Fuel : Shredded
10101202	External Combustion Boilers; Electric Generation; Solid Waste; Refuse Derived Fuel
10101201	External Combustion Boilers; Electric Generation; Solid Waste; Specify Waste Material in Comments
10100801	External Combustion Boilers; Electric Generation; Petroleum Coke; All Boiler Sizes

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Dry Injection / Fabric Filter System (DIFF); ICI Boilers (Residual Oil)

Abbreviation: PDIFFIBRO

Description: Dry Injection and Fabric Filter System (DIFF) - Dry sorbent injection (DSI) systems remove SO2, hydrogen chloride (HCl), and other acid gases through two basic steps: Step one. A powdered sorbent is injected into the flue gas,àö,â•combustion exhaust gas exiting a combustion source such as a boiler, where it reacts with the acid gas. The sorbents most commonly associated with DSI are trona (sodium sesquicarbonate, a naturally occurring mineral mined in Wyoming), sodium bicarbonate, and hydrated lime. Step two. The compound is removed by a downstream particulate matter control device such as an electrostatic precipitator (ESP) or a fabric filter (FF), also referred to as a baghouse. Fabric filters are generally more effective (when combined with DSI) than ESPs, with respect to overall acid gas reduction.

Reference: U.S. Energy Information Administration, March 2012. http://www.eia.gov/todayinenergy/detail.cfm?id=5430

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Dry Injection / Fabric Filter System (DIFF)

Source Group: ICI Boilers (Residual Oil)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$240,357	
Ref Yr CPT:		$258,964	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$240,357	

Ref Yr CPT:		$258,964	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 17

Description: Dry Injection/Fabric Filter System (Diff) Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	9.08

Affected SCCs:

Code	Description
10300404	External Combustion Boilers; Commercial/Institutional; Residual Oil; Grade 5 Oil
10300402	External Combustion Boilers; Commercial/Institutional; Residual Oil; 10-100 Million BTU/hr **
10300401	External Combustion Boilers; Commercial/Institutional; Residual Oil - Grade 6; Boiler
10200404	External Combustion Boilers; Industrial; Residual Oil; Grade 5 Oil
10200402	External Combustion Boilers; Industrial; Residual Oil; 10-100 Million BTU/hr
10200401	External Combustion Boilers; Industrial; Residual Oil; Grade 6 oil
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S.

Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Dry Injection / Fabric Filter System (DIFF); ICI Boilers (Sub-bituminous Coal)
Abbreviation:	PDIFFIBSC
Description:	Dry Injection and Fabric Filter System (DIFF) - Dry sorbent injection (DSI) systems remove SO2, hydrogen chloride (HCl), and other acid gases through two basic steps: Step one. A powdered sorbent is injected into the flue gas,àö,â•combustion exhaust gas exiting a combustion source such as a boiler, where it reacts with the acid gas. The sorbents most commonly associated with DSI are trona (sodium sesquicarbonate, a naturally occurring mineral mined in Wyoming), sodium bicarbonate, and hydrated lime. Step two. The compound is removed by a downstream particulate matter control device such as an electrostatic precipitator (ESP) or a fabric filter (FF), also referred to as a baghouse. Fabric filters are generally more effective (when combined with DSI) than ESPs, with respect to overall acid gas reduction. Reference: U.S. Energy Information Administration, March 2012. http://www.eia.gov/todayinenergy/detail.cfm?id=5430
Class:	Known
Pollutant:	PM25-PRI
Equipment Life:	15.0 years
Control Technology:	Dry Injection / Fabric Filter System (DIFF)
Source Group:	ICI Boilers (Sub-bituminous Coal)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$43,613	
Ref Yr CPT:		$46,990	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$43,613	

Ref Yr CPT:		$46,990	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 17

Description: Dry Injection/Fabric Filter System (Diff) Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	5.06

Affected SCCs:

Code	Description
10200225	External Combustion Boilers; Industrial; Subbituminous Coal; Traveling Grate (Overfeed) Stoker
10200224	External Combustion Boilers; Industrial; Subbituminous Coal; Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Dry Injection / Fabric Filter System (DIFF); ICI Boilers (Wet Biomass)

Abbreviation: PDIFFIBWB

Description: Dry Injection and Fabric Filter System (DIFF) - Dry sorbent injection (DSI) systems remove SO2, hydrogen chloride (HCl), and other acid gases through two basic steps: Step one. A powdered sorbent is injected into the flue gas,àö‚â•combustion exhaust gas exiting a combustion source such as a boiler, where it reacts with the acid gas. The sorbents most commonly associated with DSI are trona (sodium sesquicarbonate, a naturally occurring mineral mined in Wyoming), sodium bicarbonate, and hydrated lime. Step two. The compound is removed by a downstream particulate matter control device such as an electrostatic precipitator (ESP) or a fabric filter (FF), also referred to as a baghouse. Fabric filters are generally more effective (when combined with DSI) than ESPs, with respect to overall acid gas reduction.

Reference: U.S. Energy Information Administration, March 2012. http://www.eia.gov/todayinenergy/detail.cfm?id=5430

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Dry Injection / Fabric Filter System (DIFF)

Source Group: ICI Boilers (Wet Biomass)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$114,714	
Ref Yr CPT:		$123,594	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0
Pollutant:	PM10-PRI	PM25-PRI	SO2
Locale:			
Effective Date:	N/A	N/A	N/A
Cost Year:	N/A	2008	N/A
CPT:		$114,714	

Ref Yr CPT:		$123,594	
Control Efficiency:	99.0	99.0	70.0
Min Emis:	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A
Details:			
Existing Measure:			
Existing NEI Dev:	0	0	0

Cost Equations:

Name: Type 17

Description: Dry Injection/Fabric Filter System (Diff) Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	8.42

Affected SCCs:

Code	Description
10300903	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10200903	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10101101	External Combustion Boilers; Electric Generation; Bagasse; All Boiler Sizes
10100903	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Diesel Particulate Filter; Internal Combustion Engines
Abbreviation: PDPFICE
Description: Application: This control is the use of diesel particulate filter retrofits to reduce PM emissions.

This control applies to stationary internal combustion engines.
Class: Emerging
Pollutant: PM2_5
Equipment Life: N/A years
Control Technology: Diesel Particulate Filter
Source Group: Internal Combustion Engines
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM25-PRI	PM2_5
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$9,100	$9,100
Ref Yr CPT:	$12,153	$12,153
Control Efficiency:	90.0	90.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM25-PRI	PM2_5
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$9,100	$9,100
Ref Yr CPT:	$12,153	$12,153
Control Efficiency:	90.0	90.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0

Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
20400402	Internal Combustion Engines; Engine Testing; Reciprocating Engine; Diesel/Kerosene
20300101	Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating
20200102	Internal Combustion Engines; Industrial; Distillate Oil (Diesel); Reciprocating
20100102	Internal Combustion Engines; Electric Generation; Distillate Oil (Diesel); Reciprocating

References:

- "PMDevelopmentMeasuresList.xls" spreadsheet provided by David Misenheimer (Misenheimer.David@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 27-Aug-2007.

Other information:

Summary:

Control Measure Name: EPA-certified wood stove; Wood Stoves
Abbreviation: PECWSWDSTV
Description: Implement a program and provide incentives to replace old uncertified wood stoves with new EPA-certified wood stoves. Education on proper wood stove use (e.g., burn only dry wood) and maintenance is critical. See for more info: http://www.epa.gov/burnwise.
Class: Known
Pollutant: PM25-PRI
Equipment Life: N/A years
Control Technology: EPA-certified wood stove
Source Group: Wood Stoves
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2010
CPT:				$9,900
Ref Yr CPT:				$10,458
Control Efficiency:	60.0	60.0	60.0	60.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2010
CPT:				$9,900
Ref Yr CPT:				$10,458
Control Efficiency:	60.0	60.0	60.0	60.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0

Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104008310	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, non-EPA certified

References:

- http://www.epa.gov/burnwise/resources.html

Other information:

Summary:

Control Measure Name: EPA Phase 2 Qualified Units; Fireplaces

Abbreviation: PEP2QUFPL

Description: If new fireplace construction is allowed, approve only EPA Phase 2 qualified models. Under the EPA Wood-burning Fireplace Program, cleaner wood-burning fireplaces are qualified when their PM2.5 emissions are at or below the Phase 2 PM2.5 emissions level. For a list of Phase 2 qualified cleaner burning fireplaces, go to: http://www.epa.gov/burnwise/fireplacelist.html. Cost per ton value ($9,500/ton) indicates value incremental cost of installing a Phase 2 qualified RWC appliance instead of a non-Phase 2 RWC appliance.

Class: Known

Pollutant: PM25-PRI

Equipment Life: N/A years

Control Technology: EPA Phase 2 Qualified Units

Source Group: Fireplaces

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2006
CPT:				$9,500
Ref Yr CPT:				$10,714
Control Efficiency:	70.0	70.0	70.0	70.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremememtal CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2006
CPT:				$9,500
Ref Yr CPT:				$10,714
Control Efficiency:	70.0	70.0	70.0	70.0
Min Emis:	N/A	N/A	N/A	N/A

Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104008100	Stationary Source Fuel Combustion; Residential; Wood; Fireplace: general

References:

- http://www.epa.gov/burnwise/resources.html

Other information:

Summary:

Control Measure Name: Electrostatic Precipitator; ICI Boilers

Abbreviation: PESPICIB

Description: Electrostatic Precipitator - An electrostatic precipitator (ESP) is a particulate collection device that removes particles from a flowing gas (such as air) using the force of an induced electrostatic charge. Electrostatic precipitators are highly efficient filtration devices that minimally impede the flow of gases through the device, and can easily remove fine particulate matter such as dust and smoke from the air stream. In contrast to wet scrubbers which apply energy directly to the flowing fluid medium, an ESP applies energy only to the particulate matter being collected and therefore is very efficient in its consumption of energy (in the form of electricity).

Reference: Wikipedia, "Electrostatic Precipitator", April 2014. http://en.wikipedia.org/wiki/Electrostatic_precipitator

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Electrostatic Precipitator

Source Group: ICI Boilers

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$237,260
Ref Yr CPT:		$255,627
Control Efficiency:	98.0	98.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$237,260
Ref Yr CPT:		$255,627

Control Efficiency:	98.0	98.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 15

Description: Electrostatic Precipitator Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008

Affected SCCs:

Code	Description
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing

10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100701	External Combustion Boilers; Electric Generation; Process Gas; Boiler, >= 100 Million BTU/hr
10100702	External Combustion Boilers; Electric Generation; Process Gas; Boiler < 100 Million Btu/hr
10100703	External Combustion Boilers; Electric Generation; Petroleum Refinery Gas; Boiler
10100801	External Combustion Boilers; Electric Generation; Petroleum Coke; All Boiler Sizes
10100902	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood/Bark Fired Boiler
10100903	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10100911	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Stoker boilers **
10101002	External Combustion Boilers; Electric Generation; Liquified Petroleum Gas (LPG); Propane
10101101	External Combustion Boilers; Electric Generation; Bagasse; All Boiler Sizes
10101201	External Combustion Boilers; Electric Generation; Solid Waste; Specify Waste Material in Comments
10101202	External Combustion Boilers; Electric Generation; Solid Waste; Refuse Derived Fuel
10101204	External Combustion Boilers; Electric Generation; Solid Waste; Tire Derived Fuel : Shredded
10101301	External Combustion Boilers; Electric Generation; Liquid Waste; Specify Waste Material in Comments
10101302	External Combustion Boilers; Electric Generation; Liquid Waste; Waste Oil
10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal
10200202	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom
10200204	External Combustion Boilers; Industrial; Bituminous Coal; Spreader Stoker
10200205	External Combustion Boilers; Industrial; Bituminous Coal; Overfeed Stoker
10200218	External Combustion Boilers; Industrial; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10200224	External Combustion Boilers; Industrial; Subbituminous Coal; Spreader Stoker
10200225	External Combustion Boilers; Industrial; Subbituminous Coal; Traveling Grate (Overfeed) Stoker
10200401	External Combustion Boilers; Industrial; Residual Oil; Grade 6 oil
10200402	External Combustion Boilers; Industrial; Residual Oil; 10-100 Million BTU/hr
10200404	External Combustion Boilers; Industrial; Residual Oil; Grade 5 Oil
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr

10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200711	External Combustion Boilers; Industrial; Process Gas; Landfill Gas
10200799	External Combustion Boilers; Industrial; Process Gas; Other: Specify in Comments
10200901	External Combustion Boilers; Industrial; Wood/Bark Waste; Bark-fired Boiler
10200902	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler
10200903	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10200905	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler (< 50,000 Lb Steam) **
10200906	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler (< 50,000 Lb Steam) **
10200907	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood Cogeneration
10200908	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Dry Wood (<20% moisture)
10200910	External Combustion Boilers; Industrial; Wood/Bark Waste; Fuel cell/Dutch oven boilers **
10200911	External Combustion Boilers; Industrial; Wood/Bark Waste; Stoker boilers **
10201001	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Butane
10201002	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Propane
10201201	External Combustion Boilers; Industrial; Solid Waste; Specify Waste Material in Comments
10201301	External Combustion Boilers; Industrial; Liquid Waste; Specify Waste Material in Comments
10201302	External Combustion Boilers; Industrial; Liquid Waste; Waste Oil
10201303	External Combustion Boilers; Industrial; Liquid Waste; Salable Animal Fat
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10300206	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom
10300208	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Underfeed Stoker
10300209	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Spreader Stoker
10300214	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Hand-fired
10300217	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Bubbling Bed
10300218	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10300401	External Combustion Boilers; Commercial/Institutional; Residual Oil - Grade 6; Boiler
10300402	External Combustion Boilers; Commercial/Institutional; Residual Oil; 10-100 Million BTU/hr **
10300404	External Combustion Boilers; Commercial/Institutional; Residual Oil; Grade 5 Oil
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler

10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300811	External Combustion Boilers; Commercial/Institutional; Landfill Gas; Landfill Gas
10300902	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood/Bark-fired Boiler
10300903	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10300911	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Stoker boilers **
10300912	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Fluidized bed combustion boilers
10301001	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane
10301002	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Propane
10301003	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane/Propane Mixture: Specify Percent Butane in Comments
10301201	External Combustion Boilers; Commercial/Institutional; Solid Waste; Specify Waste Material in Comments
10301202	External Combustion Boilers; Commercial/Institutional; Solid Waste; Refuse Derived Fuel
10500105	External Combustion; Space Heaters; Industrial; Distillate Oil
10500106	External Combustion; Space Heaters; Industrial; Natural Gas
10500205	External Combustion; Space Heaters; Commercial/Institutional; Distillate Oil
10500206	External Combustion; Space Heaters; Commercial/Institutional; Natural Gas
30130201	Industrial Processes; Chemical Manufacturing; Carbon Tetrachloride; General
30290001	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30290003	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Natural Gas: Process Heaters
30500105	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; General **
30500199	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; See Comment **
30501021	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Removal
30699999	Industrial Processes; Petroleum Industry; Petroleum Products - Not Classified; Not Classified **
31000203	Industrial Processes; Oil and Gas Production; Natural Gas Production; Compressors (See also 310003-12 and -13)
31000414	Industrial Processes; Oil and Gas Production; Process Heaters; Natural Gas: Steam Generators
31100199	Industrial Processes; Building Construction; Construction: Building Contractors; Other Not Classified
39999999	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Industrial Processes; Other Not Classified

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Electrostatic Precipitator;Petroleum Refinery Catalytic and Thermal Cracking Units
Abbreviation: PESPPETCRK
Description: Application: This control is the use of electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls.

This control applies to catalytic cracking and thermal cracking units at petroleum refineries.
Class: Known
Pollutant: PM2_5
Equipment Life: N/A years
Control Technology: Electrostatic Precipitator
Source Group: Petroleum Refinery Catalytic and Thermal Cracking Units
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1999	1999
CPT:			$5,050	$5,050
Ref Yr CPT:			$6,744	$6,744
Control Efficiency:	95.0	95.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1999	1999
CPT:			$5,050	$5,050
Ref Yr CPT:			$6,744	$6,744
Control Efficiency:	95.0	95.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A

Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30600301	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Thermal Catalytic Cracking Unit
30600202	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Catalyst Handling System
30600201	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Fluid Catalytic Cracking Unit

References:

- Assessment of Control Technology Options for Petroleum Refineries in the Mid-Atlantic Region. Draft Final Technical Support Document. Prepared by MACTEC Federal Programs, Inc. for MARAMA. October 13, 2006.

Other information:

Summary:

Control Measure Name:	Fabric Filter; ICI Boilers (Bituminous Coal)
Abbreviation:	PFFICIBBC
Description:	Fabric Filter - A fabric filter (or baghouse) is an air pollution control device that removes particulates out of air or gas released from commercial processes or combustion for electricity generation. Power plants, steel mills, pharmaceutical producers, food manufacturers, chemical producers and other industrial companies often use baghouses to control emission of air pollutants. Baghouses came into widespread use in the late 1970s after the invention of high-temperature fabrics (for use in the filter media) capable of withstanding temperatures over 350,Äö†ªF. Unlike electrostatic precipitators, where performance may vary significantly depending on process and electrical conditions, functioning baghouses typically have a particulate collection efficiency of 99% or better, even when particle size is very small. Most baghouses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. (For applications where there is relatively low dust loading and gas temperatures are 250,Äö†ªF or less, pleated, nonwoven cartridges are sometimes used as filtering media instead of bags.) Dust-laden gas or air enters the baghouse through hoppers (large funnel-shaped containers used for storing and dispensing particulate) and is directed into the baghouse compartment. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and a layer of dust accumulates on the filter media surface until air can no longer move through it. When sufficient pressure drop (delta P) occurs, the cleaning process begins. Cleaning can take place while the baghouse is online (filtering) or is offline (in isolation). When the compartment is clean, normal filtering resumes. Baghouses are very efficient particulate collectors because of the dust cake formed on the surface of the bags. The fabric provides a surface on which dust collects through the following four mechanisms: Inertial collection - Dust particles strike the fibers placed perpendicular to the gas-flow direction instead of changing direction with the gas stream. Interception - Particles that do not cross the fluid streamlines come in contact with fibers because of the fiber size. Brownian movement - Submicrometre particles are diffused, increasing the probability of contact between the particles and collecting surfaces. Electrostatic forces - The presence of an electrostatic charge on the particles and the filter can increase dust capture. A combination of these mechanisms results in formation of the dust cake on the filter, which eventually increases the resistance to gas flow. The filter must be cleaned periodically. Reference: Wikipedia, "Baghouse", April 2014. http://en.wikipedia.org/wiki/Baghouse
Class:	Known
Pollutant:	PM25-PRI
Equipment Life:	15.0 years
Control Technology:	Fabric Filter
Source Group:	ICI Boilers (Bituminous Coal)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$219,599
Ref Yr CPT:		$236,599
Control Efficiency:	99.0	99.0

Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$219,599
Ref Yr CPT:		$236,599
Control Efficiency:	99.0	99.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 14

Description: Fabric Filter Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	4.68

Affected SCCs:

Code	Description
10300218	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10300217	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Bubbling Bed
10300214	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Hand-fired
10300209	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Spreader Stoker
10300208	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Underfeed Stoker
10300206	External Combustion Boilers; Commercial/Institutional; Bituminous Coal; Pulverized Coal: Dry Bottom
10200218	External Combustion Boilers; Industrial; Bituminous Coal; Atmospheric Fluidized Bed Combustion: Circulating Bed
10200205	External Combustion Boilers; Industrial; Bituminous Coal; Overfeed Stoker
10200204	External Combustion Boilers; Industrial; Bituminous Coal; Spreader Stoker
10200202	External Combustion Boilers; Industrial; Bituminous Coal; Pulverized Coal: Dry Bottom
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Fabric Filter; ICI Boilers (Dry Biomass)

Abbreviation: PFFICIBDB

Description: Fabric Filter - A fabric filter (or baghouse) is an air pollution control device that removes particulates out of air or gas released from commercial processes or combustion for electricity generation. Power plants, steel mills, pharmaceutical producers, food manufacturers, chemical producers and other industrial companies often use baghouses to control emission of air pollutants. Baghouses came into widespread use in the late 1970s after the invention of high-temperature fabrics (for use in the filter media) capable of withstanding temperatures over 350,Äö†ªF.

Unlike electrostatic precipitators, where performance may vary significantly depending on process and electrical conditions, functioning baghouses typically have a particulate collection efficiency of 99% or better, even when particle size is very small.

Most baghouses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. (For applications where there is relatively low dust loading and gas temperatures are 250,Äö†ªF or less, pleated, nonwoven cartridges are sometimes used as filtering media instead of bags.) Dust-laden gas or air enters the baghouse through hoppers (large funnel-shaped containers used for storing and dispensing particulate) and is directed into the baghouse compartment. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and a layer of dust accumulates on the filter media surface until air can no longer move through it. When sufficient pressure drop (delta P) occurs, the cleaning process begins. Cleaning can take place while the baghouse is online (filtering) or is offline (in isolation). When the compartment is clean, normal filtering resumes.

Baghouses are very efficient particulate collectors because of the dust cake formed on the surface of the bags. The fabric provides a surface on which dust collects through the following four mechanisms:

Inertial collection - Dust particles strike the fibers placed perpendicular to the gas-flow direction instead of changing direction with the gas stream.
Interception - Particles that do not cross the fluid streamlines come in contact with fibers because of the fiber size.
Brownian movement - Submicrometre particles are diffused, increasing the probability of contact between the particles and collecting surfaces.
Electrostatic forces - The presence of an electrostatic charge on the particles and the filter can increase dust capture.

A combination of these mechanisms results in formation of the dust cake on the filter, which eventually increases the resistance to gas flow. The filter must be cleaned periodically.

Reference: Wikipedia, "Baghouse", April 2014. http://en.wikipedia.org/wiki/Baghouse

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Fabric Filter

Source Group: ICI Boilers (Dry Biomass)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$151,053
Ref Yr CPT:		$162,747
Control Efficiency:	99.0	99.0

Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$151,053
Ref Yr CPT:		$162,747
Control Efficiency:	99.0	99.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 14

Description: Fabric Filter Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	8.48

Affected SCCs:

Code	Description
10300912	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Fluidized bed combustion boilers
10300911	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Stoker boilers **
10300902	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood/Bark-fired Boiler
10200911	External Combustion Boilers; Industrial; Wood/Bark Waste; Stoker boilers **
10200910	External Combustion Boilers; Industrial; Wood/Bark Waste; Fuel cell/Dutch oven boilers **
10200908	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Dry Wood (<20% moisture)
10200907	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood Cogeneration
10200906	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler (< 50,000 Lb Steam) **
10200905	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler (< 50,000 Lb Steam) **
10200902	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood/Bark-fired Boiler
10200901	External Combustion Boilers; Industrial; Wood/Bark Waste; Bark-fired Boiler
10100911	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Stoker boilers **
10100902	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood/Bark Fired Boiler

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Fabric Filter; ICI Boilers (Distillate Oil)

Abbreviation: PFFICIBDO

Description: Fabric Filter - A fabric filter (or baghouse) is an air pollution control device that removes particulates out of air or gas released from commercial processes or combustion for electricity generation. Power plants, steel mills, pharmaceutical producers, food manufacturers, chemical producers and other industrial companies often use baghouses to control emission of air pollutants. Baghouses came into widespread use in the late 1970s after the invention of high-temperature fabrics (for use in the filter media) capable of withstanding temperatures over 350,Äö†ªF.

Unlike electrostatic precipitators, where performance may vary significantly depending on process and electrical conditions, functioning baghouses typically have a particulate collection efficiency of 99% or better, even when particle size is very small.

Most baghouses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. (For applications where there is relatively low dust loading and gas temperatures are 250,Äö†ªF or less, pleated, nonwoven cartridges are sometimes used as filtering media instead of bags.) Dust-laden gas or air enters the baghouse through hoppers (large funnel-shaped containers used for storing and dispensing particulate) and is directed into the baghouse compartment. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and a layer of dust accumulates on the filter media surface until air can no longer move through it. When sufficient pressure drop (delta P) occurs, the cleaning process begins. Cleaning can take place while the baghouse is online (filtering) or is offline (in isolation). When the compartment is clean, normal filtering resumes.

Baghouses are very efficient particulate collectors because of the dust cake formed on the surface of the bags. The fabric provides a surface on which dust collects through the following four mechanisms:

Inertial collection - Dust particles strike the fibers placed perpendicular to the gas-flow direction instead of changing direction with the gas stream.
Interception - Particles that do not cross the fluid streamlines come in contact with fibers because of the fiber size.
Brownian movement - Submicrometre particles are diffused, increasing the probability of contact between the particles and collecting surfaces.
Electrostatic forces - The presence of an electrostatic charge on the particles and the filter can increase dust capture.

A combination of these mechanisms results in formation of the dust cake on the filter, which eventually increases the resistance to gas flow. The filter must be cleaned periodically.

Reference: Wikipedia, "Baghouse", April 2014. http://en.wikipedia.org/wiki/Baghouse

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Fabric Filter

Source Group: ICI Boilers (Distillate Oil)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$7,104,667
Ref Yr CPT:		$7,654,666
Control Efficiency:	99.0	99.0

Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$7,104,667
Ref Yr CPT:		$7,654,666
Control Efficiency:	99.0	99.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 14

Description: Fabric Filter Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	10.84

Affected SCCs:

Code	Description
30290001	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
10500205	External Combustion; Space Heaters; Commercial/Institutional; Distillate Oil
10500105	External Combustion; Space Heaters; Industrial; Distillate Oil
10300504	External Combustion Boilers; Commercial/Institutional; Distillate Oil; Grade 4 Oil
10300503	External Combustion Boilers; Commercial/Institutional; Distillate Oil; < 10 Million BTU/hr **
10300502	External Combustion Boilers; Commercial/Institutional; Distillate Oil; 10-100 Million BTU/hr **
10300501	External Combustion Boilers; Commercial/Institutional; Distillate Oil - Grades 1 and 2; Boiler
10201403	External Combustion Boilers; Industrial; CO Boiler; Distillate Oil
10200505	External Combustion Boilers; Industrial; Distillate Oil; Cogeneration
10200504	External Combustion Boilers; Industrial; Distillate Oil; Grade 4 Oil
10200503	External Combustion Boilers; Industrial; Distillate Oil; < 10 Million BTU/hr **
10200502	External Combustion Boilers; Industrial; Distillate Oil; 10-100 Million BTU/hr **
10200501	External Combustion Boilers; Industrial; Distillate Oil - Grades 1 and 2; Boiler
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Fabric Filter; ICI Boilers (Gaseous Fuels)
Abbreviation:	PFFICIBGF
Description:	Fabric Filter - A fabric filter (or baghouse) is an air pollution control device that removes particulates out of air or gas released from commercial processes or combustion for electricity generation. Power plants, steel mills, pharmaceutical producers, food manufacturers, chemical producers and other industrial companies often use baghouses to control emission of air pollutants. Baghouses came into widespread use in the late 1970s after the invention of high-temperature fabrics (for use in the filter media) capable of withstanding temperatures over 350,Äö†ªF. Unlike electrostatic precipitators, where performance may vary significantly depending on process and electrical conditions, functioning baghouses typically have a particulate collection efficiency of 99% or better, even when particle size is very small. Most baghouses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. (For applications where there is relatively low dust loading and gas temperatures are 250,Äö†ªF or less, pleated, nonwoven cartridges are sometimes used as filtering media instead of bags.) Dust-laden gas or air enters the baghouse through hoppers (large funnel-shaped containers used for storing and dispensing particulate) and is directed into the baghouse compartment. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and a layer of dust accumulates on the filter media surface until air can no longer move through it. When sufficient pressure drop (delta P) occurs, the cleaning process begins. Cleaning can take place while the baghouse is online (filtering) or is offline (in isolation). When the compartment is clean, normal filtering resumes. Baghouses are very efficient particulate collectors because of the dust cake formed on the surface of the bags. The fabric provides a surface on which dust collects through the following four mechanisms: Inertial collection - Dust particles strike the fibers placed perpendicular to the gas-flow direction instead of changing direction with the gas stream. Interception - Particles that do not cross the fluid streamlines come in contact with fibers because of the fiber size. Brownian movement - Submicrometre particles are diffused, increasing the probability of contact between the particles and collecting surfaces. Electrostatic forces - The presence of an electrostatic charge on the particles and the filter can increase dust capture. A combination of these mechanisms results in formation of the dust cake on the filter, which eventually increases the resistance to gas flow. The filter must be cleaned periodically. Reference: Wikipedia, "Baghouse", April 2014. http://en.wikipedia.org/wiki/Baghouse
Class:	Known
Pollutant:	PM25-PRI
Equipment Life:	15.0 years
Control Technology:	Fabric Filter
Source Group:	ICI Boilers (Gaseous Fuels)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$1,229,703
Ref Yr CPT:		$1,324,899
Control Efficiency:	99.0	99.0

Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$1,229,703
Ref Yr CPT:		$1,324,899
Control Efficiency:	99.0	99.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 14

Description: Fabric Filter Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	16.42

Affected SCCs:

Code	Description
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100701	External Combustion Boilers; Electric Generation; Process Gas; Boiler, >= 100 Million BTU/hr
10100702	External Combustion Boilers; Electric Generation; Process Gas; Boiler < 100 Million Btu/hr
10100703	External Combustion Boilers; Electric Generation; Petroleum Refinery Gas; Boiler
10101002	External Combustion Boilers; Electric Generation; Liquified Petroleum Gas (LPG); Propane
10200601	External Combustion Boilers; Industrial; Natural Gas; > 100 Million BTU/hr
10200602	External Combustion Boilers; Industrial; Natural Gas; 10-100 Million BTU/hr
10200603	External Combustion Boilers; Industrial; Natural Gas; < 10 Million BTU/hr
10200604	External Combustion Boilers; Industrial; Natural Gas; Cogeneration
10200701	External Combustion Boilers; Industrial; Process Gas; Petroleum Refinery Gas
10200704	External Combustion Boilers; Industrial; Process Gas; Blast Furnace Gas
10200707	External Combustion Boilers; Industrial; Process Gas; Coke Oven Gas
10200710	External Combustion Boilers; Industrial; Process Gas; Cogeneration
10200711	External Combustion Boilers; Industrial; Process Gas; Landfill Gas
10200799	External Combustion Boilers; Industrial; Process Gas; Other: Specify in Comments
10201001	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Butane
10201002	External Combustion Boilers; Industrial; Liquified Petroleum Gas (LPG); Propane
10201401	External Combustion Boilers; Industrial; CO Boiler; Natural Gas
10300601	External Combustion Boilers; Commercial/Institutional; Natural Gas; > 100 Million BTU/hr
10300602	External Combustion Boilers; Commercial/Institutional; Natural Gas; 10-100 Million BTU/hr
10300603	External Combustion Boilers; Commercial/Institutional; Natural Gas; < 10 Million BTU/hr
10300701	External Combustion Boilers; Commercial/Institutional; Process Gas; POTW Digester Gas-fired Boiler
10300799	External Combustion Boilers; Commercial/Institutional; Process Gas; Other Not Classified
10300811	External Combustion Boilers; Commercial/Institutional; Landfill Gas; Landfill Gas
10301001	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane
10301002	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Propane
10301003	External Combustion Boilers; Commercial/Institutional; Liquified Petroleum Gas (LPG); Butane/Propane Mixture: Specify Percent Butane in Comments
10500106	External Combustion; Space Heaters; Industrial; Natural Gas
10500206	External Combustion; Space Heaters; Commercial/Institutional; Natural Gas
30290003	Industrial Processes; Food and Agriculture; Fuel Fired Equipment; Natural Gas: Process Heaters
31000203	Industrial Processes; Oil and Gas Production; Natural Gas Production; Compressors (See also 310003-12 and -13)

31000414	Industrial Processes; Oil and Gas Production; Process Heaters; Natural Gas: Steam Generators

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Fabric Filter; ICI Boilers (All Other Liquid Fuels)

Abbreviation: PFFICIBOLF

Description: Fabric Filter - A fabric filter (or baghouse) is an air pollution control device that removes particulates out of air or gas released from commercial processes or combustion for electricity generation. Power plants, steel mills, pharmaceutical producers, food manufacturers, chemical producers and other industrial companies often use baghouses to control emission of air pollutants. Baghouses came into widespread use in the late 1970s after the invention of high-temperature fabrics (for use in the filter media) capable of withstanding temperatures over 350,Äö†ªF.

Unlike electrostatic precipitators, where performance may vary significantly depending on process and electrical conditions, functioning baghouses typically have a particulate collection efficiency of 99% or better, even when particle size is very small.

Most baghouses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. (For applications where there is relatively low dust loading and gas temperatures are 250,Äö†ªF or less, pleated, nonwoven cartridges are sometimes used as filtering media instead of bags.) Dust-laden gas or air enters the baghouse through hoppers (large funnel-shaped containers used for storing and dispensing particulate) and is directed into the baghouse compartment. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and a layer of dust accumulates on the filter media surface until air can no longer move through it. When sufficient pressure drop (delta P) occurs, the cleaning process begins. Cleaning can take place while the baghouse is online (filtering) or is offline (in isolation). When the compartment is clean, normal filtering resumes.

Baghouses are very efficient particulate collectors because of the dust cake formed on the surface of the bags. The fabric provides a surface on which dust collects through the following four mechanisms:

Inertial collection - Dust particles strike the fibers placed perpendicular to the gas-flow direction instead of changing direction with the gas stream.
Interception - Particles that do not cross the fluid streamlines come in contact with fibers because of the fiber size.
Brownian movement - Submicrometre particles are diffused, increasing the probability of contact between the particles and collecting surfaces.
Electrostatic forces - The presence of an electrostatic charge on the particles and the filter can increase dust capture.

A combination of these mechanisms results in formation of the dust cake on the filter, which eventually increases the resistance to gas flow. The filter must be cleaned periodically.

Reference: Wikipedia, "Baghouse", April 2014. http://en.wikipedia.org/wiki/Baghouse

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Fabric Filter

Source Group: ICI Boilers (All Other Liquid Fuels)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$438,160
Ref Yr CPT:		$472,079
Control Efficiency:	99.0	99.0

Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$438,160
Ref Yr CPT:		$472,079
Control Efficiency:	99.0	99.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 14

Description: Fabric Filter Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	10.52

Affected SCCs:

Code	Description
30130201	Industrial Processes; Chemical Manufacturing; Carbon Tetrachloride; General
10201303	External Combustion Boilers; Industrial; Liquid Waste; Salable Animal Fat
10201302	External Combustion Boilers; Industrial; Liquid Waste; Waste Oil
10201301	External Combustion Boilers; Industrial; Liquid Waste; Specify Waste Material in Comments
10101302	External Combustion Boilers; Electric Generation; Liquid Waste; Waste Oil
10101301	External Combustion Boilers; Electric Generation; Liquid Waste; Specify Waste Material in Comments

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Fabric Filter; ICI Boilers (All Other Solid Fuels)

Abbreviation: PFFICIBOSF

Description: Fabric Filter - A fabric filter (or baghouse) is an air pollution control device that removes particulates out of air or gas released from commercial processes or combustion for electricity generation. Power plants, steel mills, pharmaceutical producers, food manufacturers, chemical producers and other industrial companies often use baghouses to control emission of air pollutants. Baghouses came into widespread use in the late 1970s after the invention of high-temperature fabrics (for use in the filter media) capable of withstanding temperatures over 350‚Äö√ᆪF.

Unlike electrostatic precipitators, where performance may vary significantly depending on process and electrical conditions, functioning baghouses typically have a particulate collection efficiency of 99% or better, even when particle size is very small.

Most baghouses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. (For applications where there is relatively low dust loading and gas temperatures are 250‚Äö√ᆪF or less, pleated, nonwoven cartridges are sometimes used as filtering media instead of bags.) Dust-laden gas or air enters the baghouse through hoppers (large funnel-shaped containers used for storing and dispensing particulate) and is directed into the baghouse compartment. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and a layer of dust accumulates on the filter media surface until air can no longer move through it. When sufficient pressure drop (delta P) occurs, the cleaning process begins. Cleaning can take place while the baghouse is online (filtering) or is offline (in isolation). When the compartment is clean, normal filtering resumes.

Baghouses are very efficient particulate collectors because of the dust cake formed on the surface of the bags. The fabric provides a surface on which dust collects through the following four mechanisms:

Inertial collection - Dust particles strike the fibers placed perpendicular to the gas-flow direction instead of changing direction with the gas stream.
Interception - Particles that do not cross the fluid streamlines come in contact with fibers because of the fiber size.
Brownian movement - Submicrometre particles are diffused, increasing the probability of contact between the particles and collecting surfaces.
Electrostatic forces - The presence of an electrostatic charge on the particles and the filter can increase dust capture.

A combination of these mechanisms results in formation of the dust cake on the filter, which eventually increases the resistance to gas flow. The filter must be cleaned periodically.

Reference: Wikipedia, "Baghouse", April 2014. http://en.wikipedia.org/wiki/Baghouse

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Fabric Filter

Source Group: ICI Boilers (All Other Solid Fuels)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$1,183,781
Ref Yr CPT:		$1,275,422
Control Efficiency:	99.0	99.0

Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$1,183,781
Ref Yr CPT:		$1,275,422
Control Efficiency:	99.0	99.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 14

Description: Fabric Filter Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	6.07

Affected SCCs:

Code	Description
39999999	Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Industrial Processes; Other Not Classified
31100199	Industrial Processes; Building Construction; Construction: Building Contractors; Other Not Classified
30699999	Industrial Processes; Petroleum Industry; Petroleum Products - Not Classified; Not Classified **
30501021	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Removal
30500199	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; See Comment **
30500105	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; General **
10301202	External Combustion Boilers; Commercial/Institutional; Solid Waste; Refuse Derived Fuel
10301201	External Combustion Boilers; Commercial/Institutional; Solid Waste; Specify Waste Material in Comments
10201201	External Combustion Boilers; Industrial; Solid Waste; Specify Waste Material in Comments
10200101	External Combustion Boilers; Industrial; Anthracite Coal; Pulverized Coal
10101204	External Combustion Boilers; Electric Generation; Solid Waste; Tire Derived Fuel : Shredded
10101202	External Combustion Boilers; Electric Generation; Solid Waste; Refuse Derived Fuel
10101201	External Combustion Boilers; Electric Generation; Solid Waste; Specify Waste Material in Comments
10100801	External Combustion Boilers; Electric Generation; Petroleum Coke; All Boiler Sizes

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name:	Fabric Filter; ICI Boilers (Residual Oil)
Abbreviation:	PFFICIBRO
Description:	Fabric Filter - A fabric filter (or baghouse) is an air pollution control device that removes particulates out of air or gas released from commercial processes or combustion for electricity generation. Power plants, steel mills, pharmaceutical producers, food manufacturers, chemical producers and other industrial companies often use baghouses to control emission of air pollutants. Baghouses came into widespread use in the late 1970s after the invention of high-temperature fabrics (for use in the filter media) capable of withstanding temperatures over 350‚Äö√∂‚Ć‚™F. Unlike electrostatic precipitators, where performance may vary significantly depending on process and electrical conditions, functioning baghouses typically have a particulate collection efficiency of 99% or better, even when particle size is very small. Most baghouses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. (For applications where there is relatively low dust loading and gas temperatures are 250‚Äö√∂‚Ć‚™F or less, pleated, nonwoven cartridges are sometimes used as filtering media instead of bags.) Dust-laden gas or air enters the baghouse through hoppers (large funnel-shaped containers used for storing and dispensing particulate) and is directed into the baghouse compartment. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and a layer of dust accumulates on the filter media surface until air can no longer move through it. When sufficient pressure drop (delta P) occurs, the cleaning process begins. Cleaning can take place while the baghouse is online (filtering) or is offline (in isolation). When the compartment is clean, normal filtering resumes. Baghouses are very efficient particulate collectors because of the dust cake formed on the surface of the bags. The fabric provides a surface on which dust collects through the following four mechanisms: Inertial collection - Dust particles strike the fibers placed perpendicular to the gas-flow direction instead of changing direction with the gas stream. Interception - Particles that do not cross the fluid streamlines come in contact with fibers because of the fiber size. Brownian movement - Submicrometre particles are diffused, increasing the probability of contact between the particles and collecting surfaces. Electrostatic forces - The presence of an electrostatic charge on the particles and the filter can increase dust capture. A combination of these mechanisms results in formation of the dust cake on the filter, which eventually increases the resistance to gas flow. The filter must be cleaned periodically. Reference: Wikipedia, "Baghouse", April 2014. http://en.wikipedia.org/wiki/Baghouse
Class:	Known
Pollutant:	PM25-PRI
Equipment Life:	15.0 years
Control Technology:	Fabric Filter
Source Group:	ICI Boilers (Residual Oil)
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$542,115
Ref Yr CPT:		$584,082
Control Efficiency:	99.0	99.0

Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$542,115
Ref Yr CPT:		$584,082
Control Efficiency:	99.0	99.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 14

Description: Fabric Filter Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	9.08

Affected SCCs:

Code	Description
10300404	External Combustion Boilers; Commercial/Institutional; Residual Oil; Grade 5 Oil
10300402	External Combustion Boilers; Commercial/Institutional; Residual Oil; 10-100 Million BTU/hr **
10300401	External Combustion Boilers; Commercial/Institutional; Residual Oil - Grade 6; Boiler
10200404	External Combustion Boilers; Industrial; Residual Oil; Grade 5 Oil
10200402	External Combustion Boilers; Industrial; Residual Oil; 10-100 Million BTU/hr
10200401	External Combustion Boilers; Industrial; Residual Oil; Grade 6 oil
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Fabric Filter; ICI Boilers (Sub-bituminous Coal)

Abbreviation: PFFICIBSC

Description: Fabric Filter - A fabric filter (or baghouse) is an air pollution control device that removes particulates out of air or gas released from commercial processes or combustion for electricity generation. Power plants, steel mills, pharmaceutical producers, food manufacturers, chemical producers and other industrial companies often use baghouses to control emission of air pollutants. Baghouses came into widespread use in the late 1970s after the invention of high-temperature fabrics (for use in the filter media) capable of withstanding temperatures over 350,Äö†ªF.

Unlike electrostatic precipitators, where performance may vary significantly depending on process and electrical conditions, functioning baghouses typically have a particulate collection efficiency of 99% or better, even when particle size is very small.

Most baghouses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. (For applications where there is relatively low dust loading and gas temperatures are 250,Äö†ªF or less, pleated, nonwoven cartridges are sometimes used as filtering media instead of bags.) Dust-laden gas or air enters the baghouse through hoppers (large funnel-shaped containers used for storing and dispensing particulate) and is directed into the baghouse compartment. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and a layer of dust accumulates on the filter media surface until air can no longer move through it. When sufficient pressure drop (delta P) occurs, the cleaning process begins. Cleaning can take place while the baghouse is online (filtering) or is offline (in isolation). When the compartment is clean, normal filtering resumes.

Baghouses are very efficient particulate collectors because of the dust cake formed on the surface of the bags. The fabric provides a surface on which dust collects through the following four mechanisms:

Inertial collection - Dust particles strike the fibers placed perpendicular to the gas-flow direction instead of changing direction with the gas stream.
Interception - Particles that do not cross the fluid streamlines come in contact with fibers because of the fiber size.
Brownian movement - Submicrometre particles are diffused, increasing the probability of contact between the particles and collecting surfaces.
Electrostatic forces - The presence of an electrostatic charge on the particles and the filter can increase dust capture.

A combination of these mechanisms results in formation of the dust cake on the filter, which eventually increases the resistance to gas flow. The filter must be cleaned periodically.

Reference: Wikipedia, "Baghouse", April 2014. http://en.wikipedia.org/wiki/Baghouse

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Fabric Filter

Source Group: ICI Boilers (Sub-bituminous Coal)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$731,895
Ref Yr CPT:		$788,553
Control Efficiency:	99.0	99.0

Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$731,895
Ref Yr CPT:		$788,553
Control Efficiency:	99.0	99.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 14

Description: Fabric Filter Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	5.06

Affected SCCs:

Code	Description
10200225	External Combustion Boilers; Industrial; Subbituminous Coal; Traveling Grate (Overfeed) Stoker
10200224	External Combustion Boilers; Industrial; Subbituminous Coal; Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Fabric Filter; ICI Boilers (Wet Biomass)

Abbreviation: PFFICIBWB

Description: Fabric Filter - A fabric filter (or baghouse) is an air pollution control device that removes particulates out of air or gas released from commercial processes or combustion for electricity generation. Power plants, steel mills, pharmaceutical producers, food manufacturers, chemical producers and other industrial companies often use baghouses to control emission of air pollutants. Baghouses came into widespread use in the late 1970s after the invention of high-temperature fabrics (for use in the filter media) capable of withstanding temperatures over 350‚Äö√Ñ√∂‚àö√ë‚àö‚Ä†‚Äö√Ñ√∂‚àö√ë‚àöŒ©F.

Unlike electrostatic precipitators, where performance may vary significantly depending on process and electrical conditions, functioning baghouses typically have a particulate collection efficiency of 99% or better, even when particle size is very small.

Most baghouses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. (For applications where there is relatively low dust loading and gas temperatures are 250,Äö†ªF or less, pleated, nonwoven cartridges are sometimes used as filtering media instead of bags.) Dust-laden gas or air enters the baghouse through hoppers (large funnel-shaped containers used for storing and dispensing particulate) and is directed into the baghouse compartment. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and a layer of dust accumulates on the filter media surface until air can no longer move through it. When sufficient pressure drop (delta P) occurs, the cleaning process begins. Cleaning can take place while the baghouse is online (filtering) or is offline (in isolation). When the compartment is clean, normal filtering resumes.

Baghouses are very efficient particulate collectors because of the dust cake formed on the surface of the bags. The fabric provides a surface on which dust collects through the following four mechanisms:

Inertial collection - Dust particles strike the fibers placed perpendicular to the gas-flow direction instead of changing direction with the gas stream.
Interception - Particles that do not cross the fluid streamlines come in contact with fibers because of the fiber size.
Brownian movement - Submicrometre particles are diffused, increasing the probability of contact between the particles and collecting surfaces.
Electrostatic forces - The presence of an electrostatic charge on the particles and the filter can increase dust capture.

A combination of these mechanisms results in formation of the dust cake on the filter, which eventually increases the resistance to gas flow. The filter must be cleaned periodically.

Reference: Wikipedia, "Baghouse", April 2014. http://en.wikipedia.org/wiki/Baghouse

Class: Known

Pollutant: PM25-PRI

Equipment Life: 15.0 years

Control Technology: Fabric Filter

Source Group: ICI Boilers (Wet Biomass)

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$534,723
Ref Yr CPT:		$576,118
Control Efficiency:	99.0	99.0

Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM10-PRI	PM25-PRI
Locale:		
Effective Date:	N/A	N/A
Cost Year:	N/A	2008
CPT:		$534,723
Ref Yr CPT:		$576,118
Control Efficiency:	99.0	99.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

Name: Type 14

Description: Fabric Filter Cost Equations

Inventory Fields: design_capacity, design_capacity_units, stkflow, stktemp, annual_avg_hours_per_year

Formula:

Variable Name	Value
Pollutant	PM25-PRI
Cost Year	2008
Stack Gas Moisture Content, %	8.42

Affected SCCs:

Code	Description
10300903	External Combustion Boilers; Commercial/Institutional; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10200903	External Combustion Boilers; Industrial; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)
10100903	External Combustion Boilers; Electric Generation; Wood/Bark Waste; Wood-fired Boiler - Wet Wood (>=20% moisture)

References:

- ERG, 2013: Eastern Research Group, Inc., "SO2 and PM Cost Equations for Industrial, Commercial, and Institutional (ICI) Boilers and Process Heaters," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2013.

Other information:

Summary:

Control Measure Name: Fabric Filter (Mech. Shaker Type);(PM10) Asphalt Manufacture

Abbreviation: PFFMSASMN

Description: Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags.

This control applies to asphalt manufacturing processes.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Mech. Shaker Type)

Source Group: Asphalt Manufacture

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				

Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	1998	N/A	N/A	1998
CPT:	$311			$311
Ref Yr CPT:	$422			$422
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	0.09000000357627869	N/A	N/A	0.09000000357627869
Discount Rate:	7.0	N/A	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0
N/A
Cost Year:
1998

N/A
N/A
1998
CPT:
$311
$311
Ref Yr CPT:
$422
$422
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.0900000357627869
N/A

N/A
0.09000000357627869
Discount Rate:
7.0
N/A
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	29.0

Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30500100	Industrial Processes;Mineral Products;Asphalt Roofing Manufacture;undefined
30500104	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Felt Saturation: Dipping/Spraying
30500107	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingles and Rolls: Mineral Dryer
30500112	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Spraying Only
30500113	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Dipping/Spraying
30500114	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Asphaltic Felt: Coating
30500115	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Steam Drying Drums
30500116	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Saturation: Dip Saturator, Drying-in Drum, Hot Looper & Coater
30500118	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Saturation: Dip Saturator, Drying-in Drum and Hot Looper
30500119	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Sation:Spray/Dip Satur,Drying-in Drm,Hot Loopr,Coatr & Str Tk
30500120	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Ferric Chloride
30500121	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Mineral Stabilizer
30500130	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Fixed Roof Tank: Asphalt/Breathing Loss
30500131	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Fixed Roof Tank: Working Loss
30500132	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Floating Roof Tank: Standing Loss
30500133	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Floating Roof Tank: Working Loss
30500134	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Blown Saturant Storage
30500135	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Blown Coating Storage
30500140	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Unloading
30500141	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Storage
30500142	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Unloading
30500143	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Storage
30500144	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Transport Screw Conveyor and Bucket Elevator
30500145	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Transport Screw Conveyor and Bucket Elevator

30500146	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Sand Surge Bin
30500147	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Surge Bin
30500150	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust (Filler) and Asphalt Coating Mixer
30500151	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules
30500152	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Sand Applicator
30500153	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Cooling Rolls
30500154	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Finish Floating Looper
30500198	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Other Not Classified
30500199	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; See Comment **
30500200	Industrial Processes;Mineral Products;Asphalt Concrete;undefined
30500201	Industrial Processes; Mineral Products; Asphalt Concrete; Rotary Dryer: Conventional Plant (see 3-05-002-50 to -53 for subtypes)
30500202	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevs, Screens, Bins&Mixer (also see -45 thru -47
30500203	Industrial Processes; Mineral Products; Asphalt Concrete; Storage Piles
30500204	Industrial Processes; Mineral Products; Asphalt Concrete; Cold Aggregate Handling
30500205	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Dryer: Drum Mix Plant (see 3-05-002-55 thru -63 for subtypes)
30500206	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Natural Gas
30500207	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Residual Oil
30500208	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Distillate Oil
30500209	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: LPG
30500210	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Waste Oil
30500211	Industrial Processes; Mineral Products; Asphalt Concrete; Rotary Dryer Conventional Plant with Cyclone ** use 3-05-002-01 w/CTL
30500212	Industrial Processes; Mineral Products; Asphalt Concrete; Heated Asphalt Storage Tanks
30500214	Industrial Processes; Mineral Products; Asphalt Concrete; Truck Load-out
30500215	Industrial Processes; Mineral Products; Asphalt Concrete; In Place Recycling: Propane
30500217	Industrial Processes; Mineral Products; Asphalt Concrete; Cold Aggregate Conveyors and Elevators
30500220	Industrial Processes; Mineral Products; Asphalt Concrete; Elevators: Batch Process (also see -45 thru -47 for combos w/scr,bins
30500230	Industrial Processes; Mineral Products; Asphalt Concrete; Hot Bins and Screens: Batch Process (also see -45 thru -47 for combos)
30500231	Industrial Processes; Mineral Products; Asphalt Concrete; Hot Bins and Screens: Continuous Process
30500240	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Batch Process (also see -45 thru -47 for combos w/scr,bins
30500241	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Continuous Mix (outside the drum) Process
30500242	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Drum Mix Process ** (use 3-05-002-005 and subtypes)
30500245	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer & NG Rot Dryer

30500246	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer& #2 Oil Rot Dryer
30500247	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevs, Scrns, Bins, Mixer& Waste/Drain/#6 Oil Rot
30500250	Industrial Processes; Mineral Products; Asphalt Concrete; Conventional Continuous Mix (outside of drum) Plant: Rotary Dryer
30500251	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Natural Gas-Fired (also see -45)
30500252	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Oil-Fired (also see -46)
30500253	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Waste/Drain/# 6 Oil-Fired (also see -47
30500255	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas-Fired
30500256	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas, Parallel Flow
30500257	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas, Counterflow
30500258	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired
30500259	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Parallel Flow
30500260	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Counterflow
30500261	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil-Fired
30500262	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Pl: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil, Parallel Flo
30500263	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Pl: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil, Counterflow
30500270	Industrial Processes; Mineral Products; Asphalt Concrete; Yard Emissions: Emissions from asphalt in truck beds
30500298	Industrial Processes; Mineral Products; Asphalt Concrete; Other Not Classified
30500299	Industrial Processes; Mineral Products; Asphalt Concrete; See Comment **

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%

MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.05%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name: Fabric Filter (Mech. Shaker Type);(PM10) Mineral Products - Coal Cleaning

Abbreviation: PFFMSMICC

Description: Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags.

This control applies to coal cleaning at coal mining operations. Coal mining, cleaning and material handling (305010) consists of the preparation and handling of coal to upgrade its value.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Mech. Shaker Type)

Source Group: Mineral Products - Coal Cleaning

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0

Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	N/A	1998	N/A
CPT:	$238		$238	
Ref Yr CPT:	$323		$323	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:

1998
N/A
1998
N/A
CPT:
$238
$238
Ref Yr CPT:
$323
$323
Control Efficiency:
99.0
99.5
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869

N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998

Typical Capital Control Cost Factor	29.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30501000	Industrial Processes;Mineral Products;Coal Mining, Cleaning, and Material Handling (See 305310);undefined
30501003	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Multilouvered Dryer
30501005	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Cascade Dryer
30501006	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Continuous Carrier/Conveyor
30501008	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Unloading
30501009	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Raw Coal Storage
30501011	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Transfer
30501013	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Cleaning: Air Table
30501015	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Loading (For Clean Coal Loading USE 30501016)
30501016	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Clean Coal Loading
30501021	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Removal
30501022	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Drilling/Blasting
30501023	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Loading
30501024	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Hauling
30501030	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Topsoil Removal (See also 305010 -33, -35, -36, -37, -42, -45, -48)
30501031	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Scrapers: Travel Mode
30501032	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Topsoil Unloading
30501033	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden (See also 305010 -30, -35, -36, -37, -42, -45, -48)
30501034	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Seam: Drilling
30501035	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Blasting: Coal Overburden
30501036	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Dragline: Overburden Removal

30501037	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Loading: Overburden
30501038	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Loading: Coal
30501039	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Hauling: Haul Trucks
30501040	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: End Dump - Coal
30501041	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: Bottom Dump - Coal
30501042	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: Bottom Dump - Overburden
30501043	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Open Storage Pile: Coal
30501044	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Train Loading: Coal
30501045	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Bulldozing: Overburden
30501046	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Bulldozing: Coal
30501047	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Grading
30501048	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Replacement
30501049	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Wind Erosion: Exposed Areas
30501050	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Vehicle Traffic: Light/Medium Vehicles
30501051	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Open Storage Pile: Spoils
30501060	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Primary Crusher
30501061	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Secondary Crusher
30501062	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Screens
30501090	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Haul Roads: General
30501099	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.

• EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000).. Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co

ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name: Fabric Filter (Mech. Shaker Type);(PM10) Mineral Products - Cement Manufacture

Abbreviation: PFFMSMICM

Description: Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags.

This control applies to cement manufacturing operations.

Discussion: The largest source of particulate emissions at a cement plant is the kiln used to produce clinker. Cement kilns are rotary kilns, which are slowly rotating refractory-lined steel cylinders inclined slightly from the horizontal. Raw materials are fed into the top end of the kiln and spend several hours traversing the kiln. In wet process kilns (SCC 30500706), the raw materials are fed as a wet slurry. During this time, the raw materials are heated by a flame at the discharge end of the kiln. This heating dries the raw materials, converts limestone to lime, and promotes reaction between and fusion of the separate ingredients to form clinker. Clinker exiting the kiln is fed to a clinker cooler (SCC 30500714) for cooling before storage and further processing (STAPPA/ALAPCO, 1996).

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Mech. Shaker Type)

Source Group: Mineral Products - Cement Manufacture

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				

Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	1998	N/A	N/A	1998
CPT:	$216			$216
Ref Yr CPT:	$293			$293
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	0.09000000357627869	N/A	N/A	0.09000000357627869
Discount Rate:	7.0	N/A	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:

N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0
N/A
Cost Year:
1998
N/A
N/A
1998
CPT:
$216
$216
Ref Yr CPT:
$293
$293
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:

cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A
N/A
0.09000000357627869
Discount Rate:
7.0
N/A
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	29.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln
30500609	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Primary Crushing
30500610	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Secondary Crushing
30500611	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Screening
30500612	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Transfer
30500613	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Grinding and Drying
30500614	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Cooler
30500616	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Transfer
30500617	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Grinding
30500618	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Silos
30500620	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Predryer
30500621	Industrial Processes; Mineral Products; Cement Manufacturing (Wet or Dry Process); Pulverized Coal Kiln Feed Units
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln
30500624	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Feed Belt
30500625	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Weigh Hopper
30500626	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Air Separator
30500627	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Feed Belt
30500628	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Weigh Hopper

30500629	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Air Separator
30500706	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Kilns
30500709	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Primary Crushing
30500710	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Secondary Crushing
30500711	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Screening
30500712	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Raw Material Transfer
30500714	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Cooler
30500715	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Piles
30500716	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Transfer
30500717	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Grinding
30500718	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Cement Silos
30500727	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Feed Belt
30500728	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Weigh Hopper
30500729	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Air Separator

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name: Fabric Filter (Mech. Shaker Type);(PM10) Mineral Products - Other

Abbreviation: PFFMSMIOR

Description: Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags.

This control applies to miscellaneous mineral production operations including (but not limited to) brick manufacture, calcium carbide operations, clay and fly ash sintering, concrete batching, gypsum manufacturing, lime production, phosphate rock operations, sand production, fiberglass manufacturing and glass manufacturing operations.

Discussion: Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions. Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Mech. Shaker Type)

Source Group: Mineral Products - Other

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				

Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	1998	1998	N/A
CPT:		$217	$217	
Ref Yr CPT:		$294	$294	
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton	cpton	
Capital Rec Fac:	N/A	0.09000000357627869	0.09000000357627869	N/A
Discount Rate:	N/A	7.0	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:

Effective Date:
2020-01-01 00:00:00.0
N/A
N/A
2020-01-01 00:00:00.0
Cost Year:
N/A
1998
1998
N/A
CPT:
$217
$217
Ref Yr CPT:
$294
$294
Control Efficiency:
99.5
99.0
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0

Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
0.09000000357627869
N/A
Discount Rate:
N/A
7.0
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:

Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	29.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30500300	Industrial Processes;Mineral Products;Brick Manufacture;undefined
30500301	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Drying
30500302	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Grinding & Screening
30500303	Industrial Processes; Mineral Products; Brick Manufacture; Storage of Raw Materials
30500304	Industrial Processes; Mineral Products; Brick Manufacture; Curing **
30500305	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Handling and Transferring
30500306	Industrial Processes; Mineral Products; Brick Manufacture; Pulverizing
30500307	Industrial Processes; Mineral Products; Brick Manufacture; Calcining
30500308	Industrial Processes; Mineral Products; Brick Manufacture; Screening
30500309	Industrial Processes; Mineral Products; Brick Manufacture; Blending and Mixing
30500310	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Sawdust Fired Tunnel Kilns
30500311	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Tunnel Kilns
30500312	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Tunnel Kilns
30500313	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Tunnel Kilns
30500314	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Periodic Kilns
30500315	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Periodic Kilns
30500316	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Periodic Kilns
30500317	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Unloading
30500318	Industrial Processes; Mineral Products; Brick Manufacture; Tunnel Kiln: Wood-fired

30500319	Industrial Processes; Mineral Products; Brick Manufacture; Transfer and Conveying
30500321	Industrial Processes; Mineral Products; Brick Manufacture; General
30500322	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing High-Sulfur Material
30500330	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Periodic Kiln
30500331	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel Fired Tunnel Kiln
30500332	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Kiln, Other Type
30500333	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Kiln, Other Type
30500334	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Kiln, Other Type
30500335	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Kiln, Other Type
30500340	Industrial Processes; Mineral Products; Brick Manufacture; Primary Crusher
30500342	Industrial Processes; Mineral Products; Brick Manufacture; Extrusion Line
30500350	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat From Kiln Cooling Zone
30500351	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat And Supplemental Gas Burners
30500355	Industrial Processes; Mineral Products; Brick Manufacture; Coal Crushing And Storage System
30500360	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer
30500361	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer: Heated With Exhaust From Sawdust-fired Kiln
30500370	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing Structural Clay Tile
30500397	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500398	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500399	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500401	Industrial Processes; Mineral Products; Calcium Carbide; Electric Furnace: Hoods and Main Stack
30500402	Industrial Processes; Mineral Products; Calcium Carbide; Coke Dryer
30500403	Industrial Processes; Mineral Products; Calcium Carbide; Furnace Room Vents
30500404	Industrial Processes; Mineral Products; Calcium Carbide; Tap Fume Vents
30500405	Industrial Processes; Mineral Products; Calcium Carbide; Primary/Secondary Crushing
30500406	Industrial Processes; Mineral Products; Calcium Carbide; Circular Charging: Conveyor
30500499	Industrial Processes; Mineral Products; Calcium Carbide; Other Not Classified
30500501	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Dryer
30500502	Industrial Processes; Mineral Products; Castable Refractory; Raw Material Crushing/Processing
30500503	Industrial Processes; Mineral Products; Castable Refractory; Electric Arc Melt Furnace
30500504	Industrial Processes; Mineral Products; Castable Refractory; Curing Oven
30500505	Industrial Processes; Mineral Products; Castable Refractory; Molding and Shakeout
30500506	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Calciner

30500507	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Tunnel Kiln
30500508	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Rotary Dryer
30500509	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Tunnel Kiln
30500598	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500599	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln
30500607	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Unloading
30500608	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Piles
30500609	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Primary Crushing
30500610	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Secondary Crushing
30500611	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Screening
30500612	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Transfer
30500613	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Grinding and Drying
30500614	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Cooler
30500615	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Piles
30500616	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Transfer
30500617	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Grinding
30500618	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Silos
30500619	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Load Out
30500620	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Predryer
30500621	Industrial Processes; Mineral Products; Cement Manufacturing (Wet or Dry Process); Pulverized Coal Kiln Feed Units
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln
30500624	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Feed Belt
30500625	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Weigh Hopper
30500626	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Air Separator
30500627	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Feed Belt
30500628	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Weigh Hopper
30500629	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Air Separator
30500699	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Other Not Classified
30500800	Industrial Processes;Mineral Products;Ceramic Clay/Tile Manufacture;undefined
30500801	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying ** (use SCC 3-05-008-13)

30500802	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Comminution - Crushing, Grinding, & Milling
30500803	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Storage
30500804	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Screening and floating ** (use SCC 3-05-008-16)
30500805	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Direct Mixing of Ceramic Powder and Binder Solution
30500806	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Handling and Transfer
30500807	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Grinding, dry ** (use SCC 3-05-008-02)
30500810	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Natural Gas-fired Spray Dryer
30500811	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Infrared (IR) Drying Prior to Firing
30500812	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glazing and firing kiln ** (use SCCs 3-05-008-45 & -50)
30500813	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Convection Drying Prior to Firing
30500816	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Sizing - Vibrating Screens
30500818	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Air Classifier
30500821	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Rotary Calciner
30500822	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Rotary Calciner
30500823	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Fluidized Bed Calciner
30500824	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Fluidized Bed Calciner
30500828	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Mixing - Raw Matls, Binders, Plasticizers, Surfactants, & Other Agent
30500830	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - General
30500831	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - Tape Casters
30500835	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Green Machining-Grindg, Cutg, or Laminatg Formed Ceramics Prior to Fir
30500840	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Natural Gas-fired Kiln
30500841	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Fuel Oil-fired Kiln
30500843	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glaze Preparation - Ballmill or Attrition Mill
30500845	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Ceramic Glaze Spray Booth
30500850	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Natural Gas-fired Kiln
30500854	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Fuel Oil-fired Kiln
30500856	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Refiring Kiln - Refiring after Decal, Paint, or Ink Applied; Natural-g

30500858	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Cooler - Cooling Ceramics Following Firing
30500860	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Grinding and Polishing
30500870	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Annealing
30500880	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Surface Coating
30500899	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Other Not Classified
30500901	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Fly Ash Sintering
30500902	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay/Coke Sintering
30500903	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Natural Clay/Shale Sintering
30500904	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Crushing/Screening
30500905	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Transfer/Conveying
30500906	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Storage Piles
30500907	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Coke Product Crushing/Screening
30500908	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Shale Product Crushing/Screening
30500909	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Clinker Cooling
30500910	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Storage
30500915	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Rotary Kiln
30500916	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Dryer
30500917	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay Reciprocating Grate Clinker Cooler
30500999	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Other Not Classified
30501101	Industrial Processes; Mineral Products; Concrete Batching; Total Facility Emissions except road dust & wind-blown dust
30501104	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Elevated Storage
30501105	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Elevated Storage
30501106	Industrial Processes; Mineral Products; Concrete Batching; Transfer: Sand/Aggregate to Elevated Bins (See Also -04 & -05)
30501107	Industrial Processes; Mineral Products; Concrete Batching; Cement Unloading to Elevated Storage Silo
30501108	Industrial Processes; Mineral Products; Concrete Batching; Weight Hopper Loading of Sand and Aggregate
30501109	Industrial Processes; Mineral Products; Concrete Batching; Mixer Loading of Cement/Sand/Aggregate
30501110	Industrial Processes; Mineral Products; Concrete Batching; Loading of Transit Mix Truck
30501111	Industrial Processes; Mineral Products; Concrete Batching; Loading of Dry-batch Truck
30501112	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Wet
30501113	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Dry

30501114	Industrial Processes; Mineral Products; Concrete Batching; Transferring: Conveyors/Elevators
30501115	Industrial Processes; Mineral Products; Concrete Batching; Storage: Bins/Hoppers
30501117	Industrial Processes; Mineral Products; Concrete Batching; Cement Supplement Unloading to Elevated Storage Silo
30501120	Industrial Processes; Mineral Products; Concrete Batching; Asbestos/Cement Products
30501121	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Delivery to Ground Storage
30501122	Industrial Processes; Mineral Products; Concrete Batching; Sand Delivery to Ground Storage
30501123	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Conveyor
30501124	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Conveyor
30501199	Industrial Processes; Mineral Products; Concrete Batching; Other Not Classified
30501201	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Wool-type Fiber)
30501202	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Wool-type Fiber)
30501203	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Electric Furnace (Wool-type Fiber)
30501204	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Rotary Spun (Wool-type Fiber)
30501205	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven: Rotary Spun (Wool-type Fiber)
30501206	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Cooling (Wool-type Fiber)
30501207	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Wool-type Fiber)
30501208	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Flame Attenuation (Wool-type Fiber)
30501209	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing: Flame Attenuation (Wool-type Fiber)
30501211	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Textile-type Fiber)
30501212	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Textile-type Fiber)
30501213	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Textile-type Fiber)
30501214	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming Process (Textile-type Fiber)
30501215	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven (Textile-type Fiber)
30501221	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Unloading/Conveying
30501222	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Storage Bins
30501223	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Mixing/Weighing
30501224	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Crushing/Charging
30501299	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Other Not Classified
30501301	Industrial Processes; Mineral Products; Frit Manufacture; General ** (use 3-05-013-05 or 3-05-013-06)
30501302	Industrial Processes; Mineral Products; Frit Manufacture; Weighing of raw materials

30501303	Industrial Processes; Mineral Products; Frit Manufacture; Dry Mixing of raw materials
30501304	Industrial Processes; Mineral Products; Frit Manufacture; Smelting Furnace Charging
30501305	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Smelting Furnace
30501306	Industrial Processes; Mineral Products; Frit Manufacture; Continuous Smelting Furnace
30501310	Industrial Processes; Mineral Products; Frit Manufacture; Water Spray Quenching to shatter material into small particles
30501311	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Dryer (usually not used with a continuous furnace)
30501315	Industrial Processes; Mineral Products; Frit Manufacture; Dry Milling of quenched frit with a ball mill
30501316	Industrial Processes; Mineral Products; Frit Manufacture; Product Screening
30501399	Industrial Processes; Mineral Products; Frit Manufacture; Other Not Classified
30501400	Industrial Processes;Mineral Products;Glass Manufacture;undefined
30501401	Industrial Processes; Mineral Products; Glass Manufacture; Furnace/General**
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace
30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace
30501405	Industrial Processes; Mineral Products; Glass Manufacture; Presintering
30501406	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Forming/Finishing
30501407	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Forming/Finishing
30501408	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Forming/Finishing
30501410	Industrial Processes; Mineral Products; Glass Manufacture; Raw Material Handling (All Types of Glass)
30501411	Industrial Processes; Mineral Products; Glass Manufacture; General **
30501412	Industrial Processes; Mineral Products; Glass Manufacture; Hold Tanks **
30501413	Industrial Processes; Mineral Products; Glass Manufacture; Cullet: Crushing/Grinding
30501414	Industrial Processes; Mineral Products; Glass Manufacture; Ground Cullet Beading Furnace
30501415	Industrial Processes; Mineral Products; Glass Manufacture; Glass Etching with Hydrofluoric Acid Solution
30501416	Industrial Processes; Mineral Products; Glass Manufacture; Glass Manufacturing
30501417	Industrial Processes; Mineral Products; Glass Manufacture; Briquetting
30501418	Industrial Processes; Mineral Products; Glass Manufacture; Pelletizing
30501420	Industrial Processes; Mineral Products; Glass Manufacture; Mirror Plating: General
30501421	Industrial Processes; Mineral Products; Glass Manufacture; Demineralizer: General
30501499	Industrial Processes; Mineral Products; Glass Manufacture; See Comment **
30501500	Industrial Processes;Mineral Products;Gypsum Manufacture;undefined
30501501	Industrial Processes; Mineral Products; Gypsum Manufacture; Rotary Ore Dryer
30501502	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Grinder/Roller Mills
30501503	Industrial Processes; Mineral Products; Gypsum Manufacture; Not Classified **
30501504	Industrial Processes; Mineral Products; Gypsum Manufacture; Conveying

30501505	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Crushing: Gypsum Ore
30501506	Industrial Processes; Mineral Products; Gypsum Manufacture; Secondary Crushing: Gypsum Ore
30501507	Industrial Processes; Mineral Products; Gypsum Manufacture; Screening: Gypsum Ore
30501508	Industrial Processes; Mineral Products; Gypsum Manufacture; Stockpile: Gypsum Ore
30501509	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Gypsum Ore
30501510	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Landplaster
30501511	Industrial Processes; Mineral Products; Gypsum Manufacture; Continuous Kettle: Calciner
30501512	Industrial Processes; Mineral Products; Gypsum Manufacture; Flash Calciner
30501513	Industrial Processes; Mineral Products; Gypsum Manufacture; Impact Mill
30501514	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Stucco
30501515	Industrial Processes; Mineral Products; Gypsum Manufacture; Tube/Ball Mills
30501516	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers
30501517	Industrial Processes; Mineral Products; Gypsum Manufacture; Bagging
30501518	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers/Conveyors
30501519	Industrial Processes; Mineral Products; Gypsum Manufacture; Forming Line
30501520	Industrial Processes; Mineral Products; Gypsum Manufacture; Drying Kiln
30501521	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (8 Ft.)
30501522	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (12 Ft.)
30501599	Industrial Processes; Mineral Products; Gypsum Manufacture; See Comment **
30501601	Industrial Processes; Mineral Products; Lime Manufacture; Primary Crushing
30501602	Industrial Processes; Mineral Products; Lime Manufacture; Secondary Crushing/Screening
30501603	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Vertical Kiln
30501604	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Rotary Kiln ** (See SCC Codes 3-05-016-18,-19,-20,-21)
30501605	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Calcimatic Kiln
30501606	Industrial Processes; Mineral Products; Lime Manufacture; Fluidized Bed Kiln
30501607	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Transfer and Conveying
30501608	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Unloading
30501609	Industrial Processes; Mineral Products; Lime Manufacture; Hydrator: Atmospheric
30501610	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Storage Piles
30501611	Industrial Processes; Mineral Products; Lime Manufacture; Product Cooler
30501612	Industrial Processes; Mineral Products; Lime Manufacture; Pressure Hydrator
30501613	Industrial Processes; Mineral Products; Lime Manufacture; Lime Silos
30501614	Industrial Processes; Mineral Products; Lime Manufacture; Packing/Shipping
30501615	Industrial Processes; Mineral Products; Lime Manufacture; Product Transfer and Conveying
30501616	Industrial Processes; Mineral Products; Lime Manufacture; Primary Screening
30501617	Industrial Processes; Mineral Products; Lime Manufacture; Multiple Hearth Calciner
30501618	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Kiln
30501619	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Rotary Kiln

30501620	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Gas-fired Rotary Kiln
30501621	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Coke-fired Rotary Kiln
30501622	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Preheater Kiln
30501623	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Parallel Flow Regenerative Kiln
30501624	Industrial Processes; Mineral Products; Lime Manufacture; Conveyor Transfer - Primary Crushed Material
30501625	Industrial Processes; Mineral Products; Lime Manufacture; Secondary/Tertiary Screening
30501626	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Enclosed Truck
30501627	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Open Truck
30501628	Industrial Processes; Mineral Products; Lime Manufacture; Pulverizing
30501629	Industrial Processes; Mineral Products; Lime Manufacture; Tertiary Screening After Pulverizing
30501630	Industrial Processes; Mineral Products; Lime Manufacture; Screening After Calcination
30501631	Industrial Processes; Mineral Products; Lime Manufacture; Crushing and Pulverizing After Calcinating
30501632	Industrial Processes; Mineral Products; Lime Manufacture; Milling
30501633	Industrial Processes; Mineral Products; Lime Manufacture; Separator After Hydrator
30501640	Industrial Processes; Mineral Products; Lime Manufacture; Vehicle Traffic
30501650	Industrial Processes; Mineral Products; Lime Manufacture; Quarrying Raw Limestone
30501660	Industrial Processes; Mineral Products; Lime Manufacture; Waste Treatment
30501699	Industrial Processes; Mineral Products; Lime Manufacture; See Comment **
30501701	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cupola
30501702	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Reverberatory Furnace
30501703	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Blow Chamber
30501704	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Curing Oven
30501705	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cooler
30501706	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Granulated Products Processing
30501707	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Handling
30501708	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Packaging
30501709	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Batt Application
30501710	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Storage of Oils and Binders
30501711	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Mixing of Oils and Binders
30501799	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Other Not Classified
30501801	Industrial Processes; Mineral Products; Perlite Manufacturing; Vertical Furnace
30501899	Industrial Processes; Mineral Products; Perlite Manufacturing; Other Not Classified
30501901	Industrial Processes; Mineral Products; Phosphate Rock; Drying
30501902	Industrial Processes; Mineral Products; Phosphate Rock; Grinding
30501903	Industrial Processes; Mineral Products; Phosphate Rock; Transfer/Storage

30501904	Industrial Processes; Mineral Products; Phosphate Rock; Open Storage
30501905	Industrial Processes; Mineral Products; Phosphate Rock; Calcining
30501906	Industrial Processes; Mineral Products; Phosphate Rock; Rotary Dryer
30501907	Industrial Processes; Mineral Products; Phosphate Rock; Ball Mill
30501908	Industrial Processes; Mineral Products; Phosphate Rock; Mineral Products Benification
30501999	Industrial Processes; Mineral Products; Phosphate Rock; Other Not Classified
30502101	Industrial Processes; Mineral Products; Salt Mining; General
30502102	Industrial Processes; Mineral Products; Salt Mining; Granulation: Stack Dryer
30502103	Industrial Processes; Mineral Products; Salt Mining; Filtration: Vacuum Filter
30502104	Industrial Processes; Mineral Products; Salt Mining; Crushing
30502105	Industrial Processes; Mineral Products; Salt Mining; Screening
30502106	Industrial Processes; Mineral Products; Salt Mining; Conveying
30502201	Industrial Processes; Mineral Products; Potash Production; Mine: Grinding/Drying
30502299	Industrial Processes; Mineral Products; Potash Production; Other Not Classified
30502401	Industrial Processes; Mineral Products; Magnesium Carbonate; Mine/Process
30502499	Industrial Processes; Mineral Products; Magnesium Carbonate; Other Not Classified
30502500	Industrial Processes;Mineral Products;Construction Sand and Gravel;undefined
30502501	Industrial Processes; Mineral Products; Construction Sand and Gravel; Total Plant: General **
30502502	Industrial Processes; Mineral Products; Construction Sand and Gravel; Aggregate Storage
30502503	Industrial Processes; Mineral Products; Construction Sand and Gravel; Material Transfer and Conveying
30502504	Industrial Processes; Mineral Products; Construction Sand and Gravel; Hauling
30502505	Industrial Processes; Mineral Products; Construction Sand and Gravel; Pile Forming: Stacker
30502506	Industrial Processes; Mineral Products; Construction Sand and Gravel; Bulk Loading
30502507	Industrial Processes; Mineral Products; Construction Sand and Gravel; Storage Piles
30502508	Industrial Processes; Mineral Products; Construction Sand and Gravel; Dryer ** (See 3-05-027-20 thru -24 for Industrial Sand Dryers)
30502509	Industrial Processes; Mineral Products; Construction Sand and Gravel; Cooler ** (See 3-05-027-30 for Industrial Sand Coolers)
30502510	Industrial Processes; Mineral Products; Construction Sand and Gravel; Crushing
30502511	Industrial Processes; Mineral Products; Construction Sand and Gravel; Screening
30502512	Industrial Processes; Mineral Products; Construction Sand and Gravel; Overburden Removal
30502513	Industrial Processes; Mineral Products; Construction Sand and Gravel; Excavating
30502514	Industrial Processes; Mineral Products; Construction Sand and Gravel; Drilling and Blasting
30502522	Industrial Processes; Mineral Products; Construction Sand and Gravel; Rodmilling: Fine Crushing of Construction Sand
30502523	Industrial Processes; Mineral Products; Construction Sand and Gravel; Fine Screening of Construction Sand Following Dewatering or Rodmilling
30502599	Industrial Processes; Mineral Products; Construction Sand and Gravel; Not Classified **
30502601	Industrial Processes; Mineral Products; Diatomaceous Earth; Handling
30502699	Industrial Processes; Mineral Products; Diatomaceous Earth; Other Not Classified

30502701	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Primary Crushing of Raw Material
30502705	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Secondary Crushing
30502709	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Grinding: Size Reduction to 50 Microns or Smaller
30502713	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Screening: Size Classification
30502717	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Draining: Removal of Moisture to About 6% After Froth Flotation
30502720	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas- or Oil-fired Rotary or Fluidized Bed Dryer
30502721	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Rotary Dryer
30502722	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Rotary Dryer
30502723	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Fluidized Bed Dryer
30502724	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Fluidized Bed Dryer
30502730	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Cooling of Dried Sand
30502740	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Final Classifying: Screening to Classify Sand by Size
30502760	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Handling, Transfer, and Storage
30502910	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Rotary Kiln
30502920	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Clinker Cooler
30503099	Industrial Processes; Mineral Products; Ceramic Electric Parts; Other Not Classified
30503101	Industrial Processes; Mineral Products; Asbestos Mining; Surface Blasting
30503102	Industrial Processes; Mineral Products; Asbestos Mining; Surface Drilling
30503103	Industrial Processes; Mineral Products; Asbestos Mining; Cobbing
30503104	Industrial Processes; Mineral Products; Asbestos Mining; Loading
30503105	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Asbestos
30503106	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Waste
30503107	Industrial Processes; Mineral Products; Asbestos Mining; Unloading
30503108	Industrial Processes; Mineral Products; Asbestos Mining; Overburden Stripping
30503109	Industrial Processes; Mineral Products; Asbestos Mining; Ventilation of Process Operations
30503110	Industrial Processes; Mineral Products; Asbestos Mining; Stockpiling
30503111	Industrial Processes; Mineral Products; Asbestos Mining; Tailing Piles
30503199	Industrial Processes; Mineral Products; Asbestos Mining; Other Not Classified
30503201	Industrial Processes; Mineral Products; Asbestos Milling; Crushing
30503202	Industrial Processes; Mineral Products; Asbestos Milling; Drying
30503203	Industrial Processes; Mineral Products; Asbestos Milling; Recrushing
30503204	Industrial Processes; Mineral Products; Asbestos Milling; Screening
30503205	Industrial Processes; Mineral Products; Asbestos Milling; Fiberizing

30503206	Industrial Processes; Mineral Products; Asbestos Milling; Bagging
30503299	Industrial Processes; Mineral Products; Asbestos Milling; Other Not Classified
30503301	Industrial Processes; Mineral Products; Vermiculite; General
30503312	Industrial Processes; Mineral Products; Vermiculite; Screening of Crude Vermiculite Ore
30503319	Industrial Processes; Mineral Products; Vermiculite; Blending of Vermiculite Ore
30503321	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Gas-fired
30503322	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Oil-fired
30503326	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Gas-fired
30503327	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Oil-fired
30503331	Industrial Processes; Mineral Products; Vermiculite; Crushing of Dried Vermiculite Concentrate
30503336	Industrial Processes; Mineral Products; Vermiculite; Screening: Size Classification of Crushed Vermiculite Concentrate
30503341	Industrial Processes; Mineral Products; Vermiculite; Conveying of Vermiculite Concentrate to Storage
30503351	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Gas-fired Vertical Furnace
30503352	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Oil-fired Vertical Furnace
30503361	Industrial Processes; Mineral Products; Vermiculite; Product Grinding: Grinding of Exfoliated Vermiculite
30503366	Industrial Processes; Mineral Products; Vermiculite; Product Classifying: Air Classification of Exfoliated Vermiculite
30503401	Industrial Processes; Mineral Products; Feldspar; Ball Mill
30503402	Industrial Processes; Mineral Products; Feldspar; Dryer
30503501	Industrial Processes; Mineral Products; Abrasive Grain Processing; Primary Crushing
30503502	Industrial Processes; Mineral Products; Abrasive Grain Processing; Secondary Crushing
30503503	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Crushing
30503504	Industrial Processes; Mineral Products; Abrasive Grain Processing; Crushed Grain Screening
30503505	Industrial Processes; Mineral Products; Abrasive Grain Processing; Washing/Drying
30503506	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Screening
30503507	Industrial Processes; Mineral Products; Abrasive Grain Processing; Air Classification
30503601	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Mixing
30503602	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Molding
30503603	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Steam Autoclaving
30503604	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Drying
30503605	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Firing or Curing
30503606	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Cooling
30503607	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Final Machining
30503701	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Printing of Backing

30503702	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Make Coat Application
30503703	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Grain Application
30503704	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Drying
30503705	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Size Coat Application
30503706	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Drying and Curing
30503707	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Roll Winding
30503708	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Production
30503901	Industrial Processes; Mineral Products; Pyrrhotite; Fluid Bed Roaster
30503902	Industrial Processes; Mineral Products; Pyrrhotite; Reduction Kiln
30504001	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Blasting
30504002	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Drilling
30504003	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Cobbing
30504010	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Underground Ventilation
30504020	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Loading
30504021	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Material
30504022	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Waste
30504023	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Unloading
30504024	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Overburden Stripping
30504025	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Stockpiling
30504030	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Primary Crusher
30504031	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Secondary Crusher
30504032	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Concentrator
30504033	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Dryer
30504034	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Screening
30504036	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Tailing Piles
30504099	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Other Not Classified
30504101	Industrial Processes; Mineral Products; Clay processing: Kaolin; Mining
30504102	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material storage
30504103	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material transfer
30504115	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material crushing, NEC
30504119	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material grinding, NEC
30504129	Industrial Processes; Mineral Products; Clay processing: Kaolin; Screening, NEC
30504130	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, rotary dryer

30504131	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, spray dryer
30504132	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, apron dryer
30504133	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, vibrating grate dryer
30504139	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, dryer NEC
30504140	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, rotary calciner
30504141	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, multiple hearth furnace
30504142	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, flash calciner
30504149	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, calciner NEC
30504150	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product grinding
30504151	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product screening/classification
30504160	Industrial Processes; Mineral Products; Clay processing: Kaolin; Bleaching
30504170	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product transfer
30504171	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product storage
30504172	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product packaging
30504201	Industrial Processes; Mineral Products; Clay processing: Ball clay; Mining
30504202	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material storage
30504203	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material transfer
30504215	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material crushing, NEC
30504219	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material grinding, NEC
30504230	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, rotary dryer
30504231	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, spray dryer
30504232	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, apron dryer
30504233	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, vibrating grate dryer
30504239	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, dryer NEC
30504250	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product grinding
30504270	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product transfer
30504271	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product storage
30504272	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product packaging
30504301	Industrial Processes; Mineral Products; Clay processing: Fire clay; Mining
30504302	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material storage
30504303	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material transfer
30504315	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material crushing, NEC
30504319	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material grinding, NEC
30504329	Industrial Processes; Mineral Products; Clay processing: Fire clay; Screening, NEC
30504330	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, rotary dryer
30504331	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, spray dryer
30504332	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, apron dryer
30504333	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, vibrating grate dryer

30504339	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, dryer NEC
30504340	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, rotary calciner
30504341	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, multiple hearth furnace
30504342	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, flash calciner
30504349	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, calciner NEC
30504350	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product grinding
30504351	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product screening/classification
30504370	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product transfer
30504371	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product storage
30504372	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product packaging
30504401	Industrial Processes; Mineral Products; Clay processing: Bentonite; Mining
30504402	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material storage
30504403	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material transfer
30504415	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material crushing, NEC
30504419	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material grinding, NEC
30504430	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, rotary dryer
30504431	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, spray dryer
30504432	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, apron dryer
30504433	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, vibrating grate dryer
30504439	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, dryer NEC
30504450	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product grinding
30504451	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product screening/classification
30504470	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product transfer
30504471	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product storage
30504472	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product packaging
30504501	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Mining
30504502	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material storage
30504503	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material transfer
30504515	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material crushing, NEC
30504519	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material grinding, NEC
30504530	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, rotary dryer
30504531	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, spray dryer
30504532	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, apron dryer
30504533	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, vibrating grate dryer
30504539	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, dryer NEC
30504550	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product grinding

30504551	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product screening/classification
30504570	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product transfer
30504571	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product storage
30504572	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product packaging
30504601	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Mining
30504602	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material storage
30504603	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material transfer
30504615	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material crushing, NEC
30504619	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material grinding, NEC
30504629	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Screening, NEC
30504630	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, rotary dryer
30504631	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, spray dryer
30504632	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, apron dryer
30504633	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, vibrating grate dryer
30504639	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, dryer NEC
30504670	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product transfer
30504671	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product storage
30504672	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product packaging
30505001	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Processing (Blowing)
30505005	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Storage (Prior to Blowing)
30505010	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Blowing Still
30505020	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Natural Gas
30505021	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Residual Oil
30505022	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Distillate Oil
30505023	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: LP Gas
30508906	Industrial Processes; Mineral Products; Talc Processing; Storage of Raw Mined Talc Before Processing
30508908	Industrial Processes; Mineral Products; Talc Processing; Conveyor Transfer of Raw Talc to Primary Crusher
30508909	Industrial Processes; Mineral Products; Talc Processing; Natural Gas Fired Crude Ore Dryer
30508910	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil Fired Crude Ore Dryer

30508911	Industrial Processes; Mineral Products; Talc Processing; Primary crusher
30508912	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Railcar Loading
30508914	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Storage Bin Loading
30508917	Industrial Processes; Mineral Products; Talc Processing; Screening Oversize Ore to Return to Primary Crusher
30508921	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Dryer
30508923	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Dryer
30508931	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Calciner
30508933	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Calciner
30508941	Industrial Processes; Mineral Products; Talc Processing; Rotary Cooler Following Calciner
30508945	Industrial Processes; Mineral Products; Talc Processing; Grinding of Dried Talc
30508947	Industrial Processes; Mineral Products; Talc Processing; Grinding/Drying of Talc with Heated Makeup Air
30508949	Industrial Processes; Mineral Products; Talc Processing; Ground Talc Storage Bin Loading
30508950	Industrial Processes; Mineral Products; Talc Processing; Air Classifier - Size Classification of Ground Talc
30508953	Industrial Processes; Mineral Products; Talc Processing; Pelletizer
30508955	Industrial Processes; Mineral Products; Talc Processing; Pellet Dryer
30508958	Industrial Processes; Mineral Products; Talc Processing; Pneumatic Conveyor Vents
30508961	Industrial Processes; Mineral Products; Talc Processing; Concentration of Talc Fines Using Shaking Table
30508971	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Flash Drying of Slurry after Flotation
30508973	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Flash Drying of Slurry after Flotation
30508982	Industrial Processes; Mineral Products; Talc Processing; Custom Grinding - Additional Size Reduction
30508985	Industrial Processes; Mineral Products; Talc Processing; Final Product Storage Bin Loading
30508988	Industrial Processes; Mineral Products; Talc Processing; Packaging
30509001	Industrial Processes; Mineral Products; Mica; Rotary Dryer
30509002	Industrial Processes; Mineral Products; Mica; Fluid Energy Mill - Grinding
30509101	Industrial Processes; Mineral Products; Sandspar; Rotary Dryer
30509201	Industrial Processes; Mineral Products; Catalyst Manufacturing; Transferring and Handling
30509202	Industrial Processes; Mineral Products; Catalyst Manufacturing; Mixing and Blending
30509203	Industrial Processes; Mineral Products; Catalyst Manufacturing; Reacting
30509204	Industrial Processes; Mineral Products; Catalyst Manufacturing; Drying
30509205	Industrial Processes; Mineral Products; Catalyst Manufacturing; Storage
30510000	Industrial Processes;Mineral Products;Bulk Materials Elevators;undefined
30510001	Industrial Processes; Mineral Products; Bulk Materials Elevators; Unloading
30510002	Industrial Processes; Mineral Products; Bulk Materials Elevators; Loading
30510003	Industrial Processes; Mineral Products; Bulk Materials Elevators; Removal from Bins
30510004	Industrial Processes; Mineral Products; Bulk Materials Elevators; Drying

30510005	Industrial Processes; Mineral Products; Bulk Materials Elevators; Cleaning
30510006	Industrial Processes; Mineral Products; Bulk Materials Elevators; Elevator Legs (Headhouse)
30510007	Industrial Processes; Mineral Products; Bulk Materials Elevators; Tripper (Gallery Belt)
30510100	Industrial Processes;Mineral Products;Bulk Materials Conveyors;undefined
30510101	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Ammonium Sulfate
30510102	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Cement
30510103	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coal
30510104	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coke
30510105	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Limestone
30510106	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Phosphate Rock
30510107	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Scrap Metal
30510108	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Sulfur
30510196	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Chemical: Specify in Comments
30510197	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Fertilizer: Specify in Comments
30510198	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Mineral: Specify in Comments
30510199	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Other Not Classified
30510200	Industrial Processes;Mineral Products;Bulk Materials Storage Bins;undefined
30510201	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Ammonium Sulfate
30510202	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Cement
30510203	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coal
30510204	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coke
30510205	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Limestone
30510206	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Phosphate Rock
30510207	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Scrap Metal
30510208	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sulfur
30510209	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sand
30510296	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Chemical: Specify in Comments
30510297	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Fertilizer: Specify in Comments
30510298	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Mineral: Specify in Comments
30510299	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Other Not Classified
30510301	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Ammonium Sulfate
30510302	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Cement
30510303	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coal
30510304	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coke
30510305	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Limestone
30510306	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Phosphate Rock
30510307	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Scrap Metal

30510308	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sulfur
30510309	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sand
30510310	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fluxes
30510396	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Chemical: Specify in Comments
30510397	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fertilizer: Specify in Comments
30510398	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Mineral: Specify in Comments
30510399	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Other Not Classified
30510401	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Ammonium Sulfate
30510402	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Cement
30510403	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coal
30510404	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coke
30510405	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Limestone
30510406	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Phosphate Rock
30510407	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Scrap Metal
30510408	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Sulfur
30510496	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Chemical: Specify in Comments
30510497	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Fertilizer: Specify in Comments
30510498	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Mineral: Specify in Comments
30510499	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Other Not Classified
30510501	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Ammonium Sulfate
30510502	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Cement
30510503	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coal
30510504	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coke
30510505	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Limestone
30510506	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Phosphate Rock
30510507	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Scrap Metal
30510508	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Sulfur
30510596	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Chemical: Specify in Comments
30510597	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Fertilizer: Specify in Comments
30510598	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Mineral: Specify in Comments
30510599	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Other Not Classified
30510600	Industrial Processes;Mineral Products;Bulk Materials Screening/Size Classification;undefined
30510604	Industrial Processes; Mineral Products; Bulk Materials Screening/Size Classification; Coke
30510708	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Sulfur

30510709	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Bauxite
30510800	Industrial Processes;Mineral Products;Bulk Materials: Grinding/Crushing;undefined
30510808	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Sulfur
30510809	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Bauxite
30515001	Industrial Processes; Mineral Products; Calcining; Raw Material Handling
30515002	Industrial Processes; Mineral Products; Calcining; General
30515003	Industrial Processes; Mineral Products; Calcining; Grinding/Milling
30515004	Industrial Processes; Mineral Products; Calcining; Finished Product Handling
30515005	Industrial Processes; Mineral Products; Calcining; Mixing
30531001	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Fluidized Bed
30531002	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Flash or Suspension
30531003	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Multilouvered
30531004	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Rotary
30531005	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cascade
30531006	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Continuous Carrier
30531007	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screen
30531008	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Unloading
30531009	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Raw Coal Storage
30531010	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Crushing
30531011	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Coal Transfer
30531012	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screening
30531013	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Air Tables
30531014	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cleaned Coal Storage
30531015	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading
30531016	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading: Clean Coal
30531017	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Secondary Crushing
30531090	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Haul Roads: General
30531099	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Other Not Classified

30532001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Primary Crushing
30532002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Secondary Crushing/Screening
30532003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Tertiary Crushing/Screening
30532004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Recrushing/Screening
30532005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Fines Mill
30532006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Miscellaneous Operations: Screen/Convey/Handling
30532007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Open Storage
30532008	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Cut Stone: General
30532009	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Blasting: General
30532010	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532011	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Hauling
30532012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drying
30532013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Bar Grizzlies
30532014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Shaker Screens
30532015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Vibrating Screens
30532016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Revolving Screens
30532017	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Pugmill
30532018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling with Liquid Injection
30532020	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Unloading
30532032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Conveyor
30532033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Front End Loader
30532090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30580001	Industrial Processes; Mineral Products; Equipment Leaks; Equipment Leaks
30582001	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Area Drains
30582002	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Equipment Drains

30582599	Industrial Processes; Mineral Products; Wastewater, Points of Generation; Specify Point of Generation
30588801	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588802	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588803	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588804	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588805	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30590001	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30590002	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Process Heaters
30590003	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Process Heaters
30590005	Industrial Processes; Mineral Products; Fuel Fired Equipment; Liquified Petroleum Gas (LPG): Process Heaters
30590011	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Incinerators
30590012	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Incinerators
30590013	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Incinerators
30590021	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Flares
30590023	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Flares
30599900	Industrial Processes;Mineral Products;Other Not Defined;undefined
30599999	Industrial Processes; Mineral Products; Other Not Defined; Specify in Comments Field

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name: Fabric Filter (Mech. Shaker Type);(PM10) Non-Ferrous Metals Processing - Aluminum

Abbreviation: PFFMSMPAM

Description: Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags.

This control applies to aluminum processing and production operations.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Mech. Shaker Type)

Source Group: Non-Ferrous Metals Processing - Aluminum

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				

Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1998	N/A	1998
CPT:		$211		$211
Ref Yr CPT:		$286		$286
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A

1998
N/A
1998
CPT:
$211
$211
Ref Yr CPT:
$286
$286
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869

N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	29.0

Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30300201	Industrial Processes; Primary Metal Production; Aluminum Hydroxide Calcining; Overall Process
30300199	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Not otherwise classified
30300111	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Anode Bake Furnace Seocndary Emissions
30300110	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Vertical Stud Soderberg Potline Secondary Emission [See also 30300118]
30300109	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Horizontal Stud Soderberg Potline Secondary Emissions
30300108	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Prebake Potline Secondary Emissions [See also 303001 -19 thru -22]
30300107	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Roof Vents
30300106	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Degassing
30300105	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Anode Baking Furnace Primary Emissions
30300104	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Materials Handling [See also 30300123 and 30300125]
30300103	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Vertical Stud Soderberg Potline Primary Emissions
30300102	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Horizontal Stud Soderberg Potline Primary Emissions
30300101	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Prebaked Potline Primary Emissions [See also 303001-13 thru-16]
30300004	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Loading and Unloading
30300003	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Fine Ore Storage
30300002	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Drying Oven
30300001	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Crushing/Handling

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.

• EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000).. Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co

ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name: Fabric Filter (Mech. Shaker Type);(PM10) Ferrous Metals Processing - Coke

Abbreviation: PFFMSMPCE

Description: Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags.

This control applies to by-product coke metal processing operations.

Discussion: By product coke production is used to manufacture metallurgical coke by heating high-grade bituminous coal (low sulfur and low ash) in an enclosed oven chamber without oxygen. The resulting solid material consists of elemental carbon and any minerals (ash) that were present in the coal blend that did not volatilize during the process. Sources of air emissions consist of coke oven doors, coke oven lids and off-takes, coke oven charging, coke oven pushing, coke oven underfire stack, coke quenching, battery venting, and coke by-product-recovery plants.

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Mech. Shaker Type)

Source Group: Ferrous Metals Processing - Coke

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.5	99.0

Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1998	N/A	1998
CPT:		$164		$164
Ref Yr CPT:		$222		$222
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0

N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
1998
N/A
1998
CPT:
$164
$164
Ref Yr CPT:
$222
$222
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:

cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	29.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30300399	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Not Classified **
30300361	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Equipment Leaks
30300353	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Naphthalene Processing/Handling
30300352	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Tar Bottom Final Cooler
30300351	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; By-product Coke Manufacturing
30300344	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Wash-oil Circulation Tank
30300343	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Wash Oil Decanter
30300342	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Light Oil Decanter/Condenser Vent
30300341	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Light Oil Sump
30300336	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Tar Storage
30300335	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Tar Interceding Sump
30300333	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Excess-ammonia Liquor Tank
30300332	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Flushing-liquor Circulation Tank
30300331	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; By-product Coke Manufacturing
30300318	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Combustion Stack: Blast Furnace Gas (BFG)
30300317	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Combustion Stack: Coke Oven Gas (COG)
30300316	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Storage Pile

30300315	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Gas By-product Plant
30300314	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Topside Leaks
30300313	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Preheater
30300312	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coke: Crushing/Screening/Handling
30300311	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Screening
30300310	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Crushing
30300309	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Conveying
30300307	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Crushing/Handling
30300306	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Oven Underfiring
30300305	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Unloading
30300303	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Oven Pushing
30300302	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Oven Charging
30300300	Industrial Processes;Primary Metal Production;By-product Coke Manufacturing;undefined

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS: The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1990). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $8 to $71 per scfm
Typical value is $29 per scfm

O&M Costs:

Range from $4 to $24 per scfm
Typical value is $11 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.0671	$/kW-hr
Compressed air	0.25	$/1000 scf
Dust disposal	25	$/ton disposed

Note: All costs are in 1998 dollars.

CPTON_H: $303/ton

CPTON_L: $37/ton

CPTON_TEXT: When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)

CTRL_EFF_T: 99%

EC: Co

ELEC_PCT: 3.56%

ELEC_RT: $0.07/kWh

FUEL_PCT: 0%

HG_CE_T: 99%

INSRNC_PCT: 4.15%

MNTLBR_PCT: 5.25%

MNTLBR_RT: $17.74/hr

MNTMTL_PCT: 0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name:	Fabric Filter (Mech. Shaker Type);(PM10) Non-Ferrous Metals Processing - Copper
Abbreviation:	PFFMSMPCR
Description:	Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags. This control applies to copper and copper alloy production operations. Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Fabric Filter (Mech. Shaker Type)
Source Group:	Non-Ferrous Metals Processing - Copper
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				

Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1998	N/A	1998
CPT:		$174		$174
Ref Yr CPT:		$236		$236
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A

1998
N/A
1998
CPT:
$174
$174
Ref Yr CPT:
$236
$236
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869

N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	29.0

Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30300502	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Multiple Hearth Roaster
30300503	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Smelting Furnace after Roaster
30300504	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Converter (All Configurations)
30300505	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fire (Furnace) Refining
30300506	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Ore Concentrate Dryer
30300507	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Smelting Furnace w/ Ore Charge w/o Roasting
30300508	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Refined Metal Finishing Operations
30300509	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluidized Bed Roaster
30300510	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Smelting Furnace
30300511	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electrolytic Refining
30300512	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Flash Smelting
30300513	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Roasting: Fugitive Emissions
30300514	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace: Fugitive Emissions
30300517	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Slag Cleaning Furnace: Fugitive Emissions
30300518	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Converter Slag Return: Fugitive Emissions
30300521	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Noranda Reactor
30300522	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Slag Cleaning Furnace
30300523	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace with Converter
30300524	Industrial Processes; Primary Metal Production; Primary Copper Smelting; AFT MHR+RF/FBR+EF
30300525	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluid Bed Roaster with Reverberatory Furnace and Converter
30300526	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Dryer with Electric Furnace and Cleaning Furnace and Convertor
30300527	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Dryer with Flash Furnace and Converter
30300528	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Norander Reactor and Converter

30300529	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Multiple Hearth Roaster with Reverberatory Furnace and Converter
30300530	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluid Bed Roaster with Electric Furnace and Converter
30300531	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace After Multiple Hearth Roaster
30300532	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace After Fluid Bed Roaster
30300533	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Furnace After Concentrate Dryer
30300534	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Flash Furnace After Concentrate Dryer
30300535	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Furnace After Fluid Bed Roaster
30300541	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Concentrate Dryer Followed by Noranda Reactors and Converter
30300599	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Other Not Classified
30400200	Industrial Processes;Secondary Metal Production;Copper;undefined
30400204	Industrial Processes; Secondary Metal Production; Copper; Electric Induction Furnace
30400207	Industrial Processes; Secondary Metal Production; Copper; Scrap Dryer (Rotary)
30400208	Industrial Processes; Secondary Metal Production; Copper; Wire Burning: Incinerator
30400209	Industrial Processes; Secondary Metal Production; Copper; Sweating Furnace
30400210	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Copper: Cupolas
30400211	Industrial Processes; Secondary Metal Production; Copper; Charge with Insulated Copper Wire: Cupolas
30400212	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Copper And Brass: Cupolas
30400213	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Iron: Cupolas
30400214	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Reverberatory Furnace
30400215	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Reverberatory Furnace
30400216	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Rotary Furnace
30400217	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Rotary Furnace
30400218	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Crucible and Pot Furnace
30400219	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Crucible and Pot Furnace
30400220	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Electric Arc Furnace
30400221	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Electric Arc Furnace
30400223	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Electric Induction
30400224	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Electric Induction
30400230	Industrial Processes; Secondary Metal Production; Copper; Scrap Metal Pretreatment

30400231	Industrial Processes; Secondary Metal Production; Copper; Scrap Dryer
30400232	Industrial Processes; Secondary Metal Production; Copper; Wire Incinerator
30400233	Industrial Processes; Secondary Metal Production; Copper; Sweating Furnace
30400234	Industrial Processes; Secondary Metal Production; Copper; Cupola Furnace
30400235	Industrial Processes; Secondary Metal Production; Copper; Reverberatory Furnace
30400236	Industrial Processes; Secondary Metal Production; Copper; Rotary Furnace
30400237	Industrial Processes; Secondary Metal Production; Copper; Crucible Furnace
30400238	Industrial Processes; Secondary Metal Production; Copper; Electric Induction Furnace
30400239	Industrial Processes; Secondary Metal Production; Copper; Casting Operations
30400240	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Holding Furnace
30400241	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Holding Furnace
30400242	Industrial Processes; Secondary Metal Production; Copper; Charge with Other Alloy (7%): Reverberatory Furnace
30400243	Industrial Processes; Secondary Metal Production; Copper; Charge with High Lead Alloy (58%): Reverberatory Furnace
30400244	Industrial Processes; Secondary Metal Production; Copper; Charge with Red/Yellow Brass: Reverberatory Furnace
30400250	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Converter
30400251	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Converter
30400299	Industrial Processes; Secondary Metal Production; Copper; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name: Fabric Filter (Mech. Shaker Type);(PM10) Ferrous Metals Processing - Ferroalloy Production

Abbreviation: PFFMSMPFP

Description: Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags.

This control applies to ferroalloy production operations, including (but not limited to) several processes within this industry were selected for control, basic oxygen process furnace (SCC 30300914) and EAF argon O2 decarb vessels (SCC 30300928).

Discussion: Steel normally is produced in either basic oxygen process furnaces or electric arc furnaces. In the basic oxygen process furnace, a mixture of 70 percent molten iron from the blast furnace and 30 percent iron scrap are melted together. Pure oxygen is blown across the top or through the molten steel to oxidize carbon and oxygen impurities, thus removing these from the steel. Basic oxygen process furnaces are large open-mouthed furnaces that can be tilted to accept a charge or to tap the molten steel to a charging ladle for transfer to an ingot mold or continuous caster.

Because basic oxygen furnaces are open, they produce significant uncontrolled particulate emissions, notably during the refining stage when oxygen is being blown. Electric arc furnaces use the current passing between carbon electrodes to heat molten steel, but also use oxy-fuel burners to accelerate the initial melting process. These furnaces are charged largely with scrap iron. Significant emissions occur during charging, when the furnace roof is open, during melting, as the electrodes are lowered into the scrap and the arc is struck, and during tapping, when alloying elements are added to the melt.

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Mech. Shaker Type)

Source Group: Ferrous Metals Processing - Ferroalloy Production

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI

Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	1998	1998	N/A
CPT:		$194	$194	
Ref Yr CPT:		$263	$263	
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton	cpton	
Capital Rec Fac:	N/A	0.09000000357627869	0.09000000357627869	N/A
Discount Rate:	N/A	7.0	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI

PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
N/A
2020-01-01 00:00:00.0
Cost Year:
N/A
1998
1998
N/A
CPT:
$194
$194
Ref Yr CPT:
$263
$263
Control Efficiency:
99.5
99.0
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0

Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
0.09000000357627869
N/A
Discount Rate:
N/A
7.0
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	29.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30300601	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 50% FeSi
30300602	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 75% FeSi
30300603	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 90% FeSi
30300604	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: Silicon Metal
30300605	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: Silicomanaganese
30300606	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 80% Ferromanganese
30300607	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 80% Ferrochromium
30300608	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Unloading
30300609	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Crushing
30300610	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ore Screening
30300611	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ore Dryer
30300613	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Storage
30300614	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Transfer
30300615	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ferromanganese: Blast Furnace
30300616	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ferrosilicon: Blast Furnace
30300617	Industrial Processes; Primary Metal Production; Ferroalloy Production; Cast House

30300618	Industrial Processes; Primary Metal Production; Ferroalloy Production; Mix House/Weighing
30300619	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Charging
30300620	Industrial Processes; Primary Metal Production; Ferroalloy Production; Tapping
30300621	Industrial Processes; Primary Metal Production; Ferroalloy Production; Casting
30300622	Industrial Processes; Primary Metal Production; Ferroalloy Production; Cooling
30300623	Industrial Processes; Primary Metal Production; Ferroalloy Production; Product Crushing
30300624	Industrial Processes; Primary Metal Production; Ferroalloy Production; Product Storage
30300625	Industrial Processes; Primary Metal Production; Ferroalloy Production; Product Loading
30300651	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Ferromanganese: Electric Arc Furnace
30300652	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Ferrochromium: Electric Arc Furnace
30300653	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Ferrochromium Silicon: Electric Arc Furnace
30300654	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Other Alloys
30300699	Industrial Processes; Primary Metal Production; Ferroalloy Production; Other Not Classified
30300701	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Ferromanganese
30300702	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Other Alloys
30300703	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Ferrochromium
30300704	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Ferrochromium Silicon

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name: Fabric Filter (Mech. Shaker Type);(PM10) Ferrous Metals Processing - Gray Iron Foundaries

Abbreviation: PFFMSMPGI

Description: Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags.

This control applies to gray iron foundry operations.

Discussion: Grey iron is an alloy of iron, carbon, and silicon, containing a higher percentage of the last two elements than found in malleable iron. The high strengths are obtained by the proper adjustment of the carbon and silicon contents or by alloying.

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Mech. Shaker Type)

Source Group: Ferrous Metals Processing - Gray Iron Foundaries

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A

Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	1998	N/A	N/A	1998
CPT:	$172			$172
Ref Yr CPT:	$233			$233
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	0.09000000357627869	N/A	N/A	0.09000000357627869
Discount Rate:	7.0	N/A	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0

N/A
Cost Year:
1998
N/A
N/A
1998
CPT:
$172
$172
Ref Yr CPT:
$233
$233
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton

Capital Rec Fac:
0.09000000357627869
N/A
N/A
0.09000000357627869
Discount Rate:
7.0
N/A
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	29.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30400300	Industrial Processes;Secondary Metal Production;Grey Iron Foundries;undefined
30400301	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Cupola
30400302	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Reverberatory Furnace
30400303	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Electric Induction Furnace
30400304	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Electric Arc Furnace
30400305	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Annealing Operation
30400310	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Inoculation
30400314	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Scrap Metal Preheating
30400315	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Charge Handling
30400316	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Tapping
30400317	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring Ladle
30400318	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring, Cooling
30400319	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Making, Baking
30400320	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring/Casting
30400321	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Magnesium Treatment
30400322	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Refining
30400325	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Castings Cooling
30400330	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Miscellaneous Casting-Fabricating **
30400331	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Shakeout
30400332	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Knock Out
30400333	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Shakeout Machine
30400340	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Grinding/Cleaning
30400341	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Cleaning/Tumblers
30400342	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Cleaning/Chippers
30400350	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Grinding/Handling

30400351	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400352	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Grinding/Handling
30400353	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400354	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400355	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Dryer
30400356	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Silo
30400357	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Conveyors/Elevators
30400358	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Screens
30400360	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Castings Finishing
30400370	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Shell Core Machine
30400371	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Machines/Other
30400398	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Other Not Classified
30400399	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name:	Fabric Filter (Mech. Shaker Type);(PM10) Ferrous Metals Processing - Iron & Steel Production
Abbreviation:	PFFMSMPIS
Description:	Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags. This control applies to iron and steel production operations. Discussion: Steel normally is produced in either basic oxygen process furnaces or electric arc furnaces. In the basic oxygen process furnace, a mixture of 70 percent molten iron from the blast furnace and 30 percent iron scrap are melted together. Pure oxygen is blown across the top or through the molten steel to oxidize carbon and oxygen impurities, thus removing these from the steel. Basic oxygen process furnaces are large open-mouthed furnaces that can be tilted to accept a charge or to tap the molten steel to a charging ladle for transfer to an ingot mold or continuous caster. Because basic oxygen furnaces are open, they produce significant uncontrolled particulate emissions, notably during the refining stage when oxygen is being blown. Electric arc furnaces use the current passing between carbon electrodes to heat molten steel, but also use oxy-fuel burners to accelerate the initial melting process. These furnaces are charged largely with scrap iron. Significant emissions occur during charging, when the furnace roof is open, during melting, as the electrodes are lowered into the scrap and the arc is struck, and during tapping, when alloying elements are added to the melt. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Fabric Filter (Mech. Shaker Type)
Source Group:	Ferrous Metals Processing - Iron & Steel Production
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				

Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	1998	N/A	N/A	1998
CPT:	$170			$170
Ref Yr CPT:	$231			$231
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	0.09000000357627869	N/A	N/A	0.09000000357627869
Discount Rate:	7.0	N/A	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5

PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0
N/A
Cost Year:
1998
N/A
N/A
1998
CPT:
$170
$170
Ref Yr CPT:
$231
$231
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:

100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A
N/A
0.09000000357627869
Discount Rate:
7.0
N/A
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	29.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30300801	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Ore Charging
30300802	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Agglomerate Charging
30300804	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Hi-Silt
30300805	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Low-Silt
30300808	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Crushing and Sizing
30300809	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Removal and Dumping
30300811	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Stockpiles, Coke Breeze, Limestone, Ore Fines
30300812	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Transfer/Handling
30300813	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Windbox
30300814	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Discharge End
30300815	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Breaker
30300816	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Hot Screening
30300817	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cooler
30300818	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cold Screening

30300819	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Process (Combined Code includes 15,16,17,18)
30300820	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Conveyor: Transfer Station
30300821	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unload Ore, Pellets, Limestone, into Blast Furnace
30300822	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Stockpile: Ore, Pellets, Limestone, Coke, Sinter
30300823	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Charge Materials: Transfer/Handling
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300825	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cast House
30300827	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Lump Ore Unloading
30300828	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Local Evacuation
30300829	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Taphole and Trough
30300831	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unpaved Roads: Light Duty Vehicles
30300834	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Paved Roads: All Vehicle Types
30300841	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Flue Dust Unloading
30300842	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blended Ore Unloading
30300899	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); See Comment **
30300901	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Open Hearth Furnace: Stack
30300904	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Arc Furnace: Alloy Steel (Stack)
30300906	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: Electric Arc Furnace
30300907	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: Electric Arc Furnace
30300908	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Arc Furnace: Carbon Steel (Stack)
30300911	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Soaking Pits
30300912	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Grinding
30300915	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal (Iron) Transfer to Steelmaking Furnace
30300916	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: BOF
30300917	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: BOF

30300918	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: Open Hearth
30300919	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: Open Hearth
30300920	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal Desulfurization
30300921	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Unleaded Steel)
30300922	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Continuous Casting
30300923	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Tapping and Dumping
30300924	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Processing
30300925	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Leaded Steel)
30300926	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Induction Furnace
30300927	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Scrap Preheater
30300928	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Argon-oxygen Decarburization
30300929	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Plate Burner/Torch Cutter
30300930	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Q-BOP Melting and Refining
30300931	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Rolling
30300932	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Scarfing
30300933	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Reheat Furnaces
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing
30300935	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Cold Rolling
30300936	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Coating: Tin, Zinc, etc.
30300998	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified
30300999	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle

Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%

EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name: Fabric Filter (Mech. Shaker Type);(PM10) Non-Ferrous Metals Processing - Lead

Abbreviation: PFFMSMPLD

Description: Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags.

This control applies lead production operations.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Mech. Shaker Type)

Source Group: Non-Ferrous Metals Processing - Lead

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				

Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	N/A	1998	N/A
CPT:	$364		$364	
Ref Yr CPT:	$494		$494	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:
1998

N/A
1998
N/A
CPT:
$364
$364
Ref Yr CPT:
$494
$494
Control Efficiency:
99.0
99.5
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A

0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	29.0

Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30301001	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Single Stream
30301002	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Operation
30301003	Industrial Processes; Primary Metal Production; Lead Production; Dross Reverberatory Furnace
30301004	Industrial Processes; Primary Metal Production; Lead Production; Ore Crushing
30301005	Industrial Processes; Primary Metal Production; Lead Production; Materials Handling (Includes 11, 12, 13, 04, 14)
30301006	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Dual Stream Feed End
30301007	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Dual Stream Discharge End
30301008	Industrial Processes; Primary Metal Production; Lead Production; Slag Fume Furnace
30301009	Industrial Processes; Primary Metal Production; Lead Production; Lead Drossing
30301010	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Crushing and Grinding
30301011	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Unloading
30301012	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Storage Piles
30301013	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Transfer
30301014	Industrial Processes; Primary Metal Production; Lead Production; Sintering Charge Mixing
30301015	Industrial Processes; Primary Metal Production; Lead Production; Sinter Crushing/Screening
30301016	Industrial Processes; Primary Metal Production; Lead Production; Sinter Transfer
30301017	Industrial Processes; Primary Metal Production; Lead Production; Sinter Fines Return Handling
30301018	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Charging
30301019	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Tapping (Metal and Slag)
30301020	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Lead Pouring
30301021	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Slag Pouring
30301022	Industrial Processes; Primary Metal Production; Lead Production; Lead Refining/Silver Retort
30301023	Industrial Processes; Primary Metal Production; Lead Production; Lead Casting
30301024	Industrial Processes; Primary Metal Production; Lead Production; Reverberatory or Kettle Softening
30301025	Industrial Processes; Primary Metal Production; Lead Production; Sinter Machine Leakage
30301026	Industrial Processes; Primary Metal Production; Lead Production; Sinter Dump Area
30301027	Industrial Processes; Primary Metal Production; Lead Production; Vacuum Distillation
30301028	Industrial Processes; Primary Metal Production; Lead Production; Tetrahedrite Dryer

30301029	Industrial Processes; Primary Metal Production; Lead Production; Sinter Machine (Weak Gas)
30301030	Industrial Processes; Primary Metal Production; Lead Production; Sinter Storage
30301031	Industrial Processes; Primary Metal Production; Lead Production; Speiss Pit
30301032	Industrial Processes; Primary Metal Production; Lead Production; Ore Screening
30301099	Industrial Processes; Primary Metal Production; Lead Production; Other Not Classified
30400401	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace
30400402	Industrial Processes; Secondary Metal Production; Lead; Reverberatory Furnace
30400403	Industrial Processes; Secondary Metal Production; Lead; Blast Furnace (Cupola)
30400404	Industrial Processes; Secondary Metal Production; Lead; Rotary Sweating Furnace
30400405	Industrial Processes; Secondary Metal Production; Lead; Reverberatory Sweating Furnace
30400406	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace Heater: Distillate Oil
30400407	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace Heater: Natural Gas
30400408	Industrial Processes; Secondary Metal Production; Lead; Barton Process Reactor (Oxidation Kettle)
30400409	Industrial Processes; Secondary Metal Production; Lead; Casting
30400410	Industrial Processes; Secondary Metal Production; Lead; Battery Breaking
30400411	Industrial Processes; Secondary Metal Production; Lead; Scrap Crushing
30400412	Industrial Processes; Secondary Metal Production; Lead; Sweating Furnace: Fugitive Emissions
30400413	Industrial Processes; Secondary Metal Production; Lead; Smelting Furnace: Fugitive Emissions
30400414	Industrial Processes; Secondary Metal Production; Lead; Kettle Refining: Fugitive Emissions
30400415	Industrial Processes; Secondary Metal Production; Lead; Agglomeration Furnace
30400416	Industrial Processes; Secondary Metal Production; Lead; Furnace Charging
30400417	Industrial Processes; Secondary Metal Production; Lead; Furnace Lead/Slagtapping
30400418	Industrial Processes; Secondary Metal Production; Lead; Electric Furnace
30400419	Industrial Processes; Secondary Metal Production; Lead; Raw Material Dryer
30400420	Industrial Processes; Secondary Metal Production; Lead; Raw Material Unloading
30400421	Industrial Processes; Secondary Metal Production; Lead; Raw Material Transfer/Conveying
30400422	Industrial Processes; Secondary Metal Production; Lead; Raw Material Storage Pile
30400423	Industrial Processes; Secondary Metal Production; Lead; Slag Breaking
30400424	Industrial Processes; Secondary Metal Production; Lead; Size Separation
30400425	Industrial Processes; Secondary Metal Production; Lead; Casting: Fugitive Emissions
30400426	Industrial Processes; Secondary Metal Production; Lead; Kettle Refining
30400499	Industrial Processes; Secondary Metal Production; Lead; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT: 2.07%

CE_TEXT: 99% from uncontrolled for both PM10 and PM2.5

CHEM_PCT: 0%

COST_BASIS: The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $8 to $71 per scfm
Typical value is $29 per scfm

O&M Costs:

Range from $4 to $24 per scfm
Typical value is $11 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.0671	$/kW-hr
Compressed air	0.25	$/1000 scf
Dust disposal	25	$/ton disposed

Note: All costs are in 1998 dollars.

CPTON_H: $303/ton

CPTON_L: $37/ton

CPTON_TEXT: When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)

CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name: Fabric Filter (Mech. Shaker Type);(PM10) Non-Ferrous Metals Processing - Other

Abbreviation: PFFMSMPOR

Description: Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags.

This control applies to miscellaneous non-ferrous metals processing operations, including molybdenum, titanium, gold, barium ore, lead battery, magnesium, nickel, electrode manufacture and metal heat treating operations.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Mech. Shaker Type)

Source Group: Non-Ferrous Metals Processing - Other

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0

Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	1998	N/A	N/A	1998
CPT:	$177			$177
Ref Yr CPT:	$240			$240
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	0.09000000357627869	N/A	N/A	0.09000000357627869
Discount Rate:	7.0	N/A	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0
N/A
Cost Year:

1998
N/A
N/A
1998
CPT:
$177
$177
Ref Yr CPT:
$240
$240
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869

N/A
N/A
0.09000000357627869
Discount Rate:
7.0
N/A
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998

Typical Capital Control Cost Factor	29.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30301101	Industrial Processes; Primary Metal Production; Molybdenum; Mining: General
30301102	Industrial Processes; Primary Metal Production; Molybdenum; Milling: General
30301199	Industrial Processes; Primary Metal Production; Molybdenum; Other Not Classified
30301201	Industrial Processes; Primary Metal Production; Titanium; Chlorination
30301202	Industrial Processes; Primary Metal Production; Titanium; Drying Titanium Sand Ore (Cyclone Exit)
30301299	Industrial Processes; Primary Metal Production; Titanium; Other Not Classified
30301301	Industrial Processes; Primary Metal Production; Gold Processing; General Processes
30301302	Industrial Processes; Primary Metal Production; Gold Processing; Fines Crushing
30301401	Industrial Processes; Primary Metal Production; Barium Ore Processing; Ore Grinding
30301402	Industrial Processes; Primary Metal Production; Barium Ore Processing; Reduction Kiln
30301403	Industrial Processes; Primary Metal Production; Barium Ore Processing; Dryers/Calciners
30301499	Industrial Processes; Primary Metal Production; Barium Ore Processing; Other Not Classified
30400501	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process **
30400502	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Casting Furnace **
30400503	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixer **
30400504	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation **
30400505	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process
30400506	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Casting
30400507	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixing
30400508	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Oxide Mill (Baghouse Outlet)
30400509	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation
30400510	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Reclaiming Furnace
30400511	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Small Parts Casting
30400512	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Formation
30400513	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Barton Process: Oxidation Kettle
30400521	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process
30400522	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Casting

30400523	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixing
30400524	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Oxide Mill (Baghouse Outlet)
30400525	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation
30400526	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Reclaiming Furnace
30400527	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Small Parts Casting
30400528	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Formation
30400529	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Cast/Paste Mix: Combined Operation
30400530	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mix/Lead Charge: Combined Operation
30400531	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Wash and Paint
30400599	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Other Not Classified
30400601	Industrial Processes; Secondary Metal Production; Magnesium; Pot Furnace
30400602	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process
30400605	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Neutralization Tank
30400606	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: HCl Absorbers
30400607	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Evaporator
30400608	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Filtering/Concentration
30400609	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Shelf Dryer
30400610	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Rotary Dryer
30400611	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Prilling
30400612	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Granule Storage Tanks
30400613	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Electrolysis
30400614	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Regenerative Furnaces
30400630	Industrial Processes; Secondary Metal Production; Magnesium; Natural Lead Industrial (NLI) Brine Process
30400635	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: MgCl2 Melt/Purification
30400636	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: 2nd Vessel, Further Purification
30400637	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: Electrolysis
30400650	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process
30400655	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Purification II
30400656	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Electrolysis

30400660	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Chlorine Recovery
30400699	Industrial Processes; Secondary Metal Production; Magnesium; Other Not Classified
30401001	Industrial Processes; Secondary Metal Production; Nickel; Flux Furnace
30401002	Industrial Processes; Secondary Metal Production; Nickel; Mixing/Blending/Grinding/Screening
30401004	Industrial Processes; Secondary Metal Production; Nickel; Heat Treat Furnace
30401005	Industrial Processes; Secondary Metal Production; Nickel; Induction Furnace (Inlet Air)
30401006	Industrial Processes; Secondary Metal Production; Nickel; Induction Furnace (Under Vacuum)
30401007	Industrial Processes; Secondary Metal Production; Nickel; Electric Arc Furnace with Carbon Electrode
30401008	Industrial Processes; Secondary Metal Production; Nickel; Electric Arc Furnace
30401010	Industrial Processes; Secondary Metal Production; Nickel; Finishing: Pickling/Neutralizing
30401011	Industrial Processes; Secondary Metal Production; Nickel; Finishing: Grinding
30401015	Industrial Processes; Secondary Metal Production; Nickel; Multiple Hearth Roaster
30401016	Industrial Processes; Secondary Metal Production; Nickel; Converters
30401017	Industrial Processes; Secondary Metal Production; Nickel; Reverberatory Furnace
30401018	Industrial Processes; Secondary Metal Production; Nickel; Electric Furnace
30401019	Industrial Processes; Secondary Metal Production; Nickel; Sinter Machine
30401061	Industrial Processes; Secondary Metal Production; Nickel; Roasting: Fugitive Emissions
30401062	Industrial Processes; Secondary Metal Production; Nickel; Reverberatory Furnace: Fugitive Emissions
30401063	Industrial Processes; Secondary Metal Production; Nickel; Converter: Fugitive Emissions
30401099	Industrial Processes; Secondary Metal Production; Nickel; Other Not Classified
30402001	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Calcination
30402002	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Mixing
30402003	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Pitch Treating
30402004	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Bake Furnaces
30402005	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Grafitization of Coal by Heating Process
30402099	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Other Not Classified
30402201	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Furnace: General
30402210	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Quench Bath
30402211	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Quenching

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)

CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name:	Fabric Filter (Mech. Shaker Type);(PM10) Ferrous Metals Processing - Steel Foundaries
Abbreviation:	PFFMSMPSF
Description:	Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags. This control applies to ferrous metals processing operations, specifically steel foundries. Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Fabric Filter (Mech. Shaker Type)
Source Group:	Ferrous Metals Processing - Steel Foundaries
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0

Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	1998	1998	N/A
CPT:		$156	$156	
Ref Yr CPT:		$212	$212	
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton	cpton	
Capital Rec Fac:	N/A	0.09000000357627869	0.09000000357627869	N/A
Discount Rate:	N/A	7.0	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
N/A
2020-01-01 00:00:00.0
Cost Year:

N/A
1998
1998
N/A
CPT:
$156
$156
Ref Yr CPT:
$212
$212
Control Efficiency:
99.5
99.0
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A

0.09000000357627869
0.09000000357627869
N/A
Discount Rate:
N/A
7.0
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998

Typical Capital Control Cost Factor	29.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30400701	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace
30400702	Industrial Processes; Secondary Metal Production; Steel Foundries; Open Hearth Furnace
30400703	Industrial Processes; Secondary Metal Production; Steel Foundries; Open Hearth Furnace with Oxygen Lance
30400704	Industrial Processes; Secondary Metal Production; Steel Foundries; Heat Treating Furnace
30400705	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Induction Furnace
30400706	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Grinding/Handling
30400707	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400708	Industrial Processes; Secondary Metal Production; Steel Foundries; Pouring/Casting
30400709	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Shakeout
30400710	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Knock Out
30400711	Industrial Processes; Secondary Metal Production; Steel Foundries; Cleaning
30400712	Industrial Processes; Secondary Metal Production; Steel Foundries; Charge Handling
30400713	Industrial Processes; Secondary Metal Production; Steel Foundries; Castings Cooling
30400714	Industrial Processes; Secondary Metal Production; Steel Foundries; Shakeout Machine
30400715	Industrial Processes; Secondary Metal Production; Steel Foundries; Finishing
30400716	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Grinding/Handling
30400717	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400718	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400720	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Dryer
30400721	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Silo
30400722	Industrial Processes; Secondary Metal Production; Steel Foundries; Muller
30400723	Industrial Processes; Secondary Metal Production; Steel Foundries; Conveyors/Elevators
30400724	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Screens
30400725	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Cleaning/Tumblers
30400726	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Cleaning/Chippers
30400730	Industrial Processes; Secondary Metal Production; Steel Foundries; Shell Core Machine
30400731	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Machines/Other
30400732	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace: Baghouse

30400733	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace: Baghouse Dust Handling
30400735	Industrial Processes; Secondary Metal Production; Steel Foundries; Raw Material Unloading
30400736	Industrial Processes; Secondary Metal Production; Steel Foundries; Conveyors/Elevators: Raw Material
30400737	Industrial Processes; Secondary Metal Production; Steel Foundries; Raw Material Silo
30400739	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Centrifugation
30400740	Industrial Processes; Secondary Metal Production; Steel Foundries; Reheating Furnace: Natural Gas
30400741	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Heating
30400742	Industrial Processes; Secondary Metal Production; Steel Foundries; Crucible
30400743	Industrial Processes; Secondary Metal Production; Steel Foundries; Pneumatic Converter Furnace
30400744	Industrial Processes; Secondary Metal Production; Steel Foundries; Ladle
30400745	Industrial Processes; Secondary Metal Production; Steel Foundries; Fugitive Emissions: Furnace
30400760	Industrial Processes; Secondary Metal Production; Steel Foundries; Alloy Feeding
30400765	Industrial Processes; Secondary Metal Production; Steel Foundries; Billet Cutting
30400768	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Handling
30400770	Industrial Processes; Secondary Metal Production; Steel Foundries; Slag Storage Pile
30400775	Industrial Processes; Secondary Metal Production; Steel Foundries; Slag Crushing
30400780	Industrial Processes; Secondary Metal Production; Steel Foundries; Limerock Handling
30400785	Industrial Processes; Secondary Metal Production; Steel Foundries; Roof Monitors - Hot Metal Transfer
30400799	Industrial Processes; Secondary Metal Production; Steel Foundries; Other Not Classified
30400901	Industrial Processes; Secondary Metal Production; Malleable Iron; Annealing
30400999	Industrial Processes; Secondary Metal Production; Malleable Iron; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5

CHEM_PCT:	0%
COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	0.05%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name:	Fabric Filter (Mech. Shaker Type);(PM10) Non-Ferrous Metals Processing - Zinc
Abbreviation:	PFFMSMPZC
Description:	Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags. This control applies to zinc production and processing operations. Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Fabric Filter (Mech. Shaker Type)
Source Group:	Non-Ferrous Metals Processing - Zinc
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				

Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	N/A	1998	N/A
CPT:	$140		$140	
Ref Yr CPT:	$190		$190	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:
1998

N/A
1998
N/A
CPT:
$140
$140
Ref Yr CPT:
$190
$190
Control Efficiency:
99.0
99.5
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A

0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	29.0

Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30303002	Industrial Processes; Primary Metal Production; Zinc Production; Multiple Hearth Roaster
30303003	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Strand
30303005	Industrial Processes; Primary Metal Production; Zinc Production; Vertical Retort/Electrothermal Furnace
30303006	Industrial Processes; Primary Metal Production; Zinc Production; Electrolytic Processor
30303007	Industrial Processes; Primary Metal Production; Zinc Production; Flash Roaster
30303008	Industrial Processes; Primary Metal Production; Zinc Production; Fluid Bed Roaster
30303009	Industrial Processes; Primary Metal Production; Zinc Production; Raw Material Handling and Transfer
30303010	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Breaking and Cooling
30303011	Industrial Processes; Primary Metal Production; Zinc Production; Zinc Casting
30303012	Industrial Processes; Primary Metal Production; Zinc Production; Raw Material Unloading
30303013	Industrial Processes; Primary Metal Production; Zinc Production; Suspension Roaster
30303014	Industrial Processes; Primary Metal Production; Zinc Production; Crushing/Screening
30303015	Industrial Processes; Primary Metal Production; Zinc Production; Zinc Melting
30303016	Industrial Processes; Primary Metal Production; Zinc Production; Alloying
30303017	Industrial Processes; Primary Metal Production; Zinc Production; Leaching
30303018	Industrial Processes; Primary Metal Production; Zinc Production; Purification
30303019	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant Wind Box
30303020	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant Discharge and Screens
30303021	Industrial Processes; Primary Metal Production; Zinc Production; Retort Furnace
30303022	Industrial Processes; Primary Metal Production; Zinc Production; Flue Dust Handling
30303023	Industrial Processes; Primary Metal Production; Zinc Production; Dross Handling
30303024	Industrial Processes; Primary Metal Production; Zinc Production; Roasting: Fugitive Emissions
30303025	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant, Wind Box: Fugitive Emissions
30303026	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant, Discharge Screens: Fugitive Emissions
30303027	Industrial Processes; Primary Metal Production; Zinc Production; Retort Building: Fugitive Emissions
30303028	Industrial Processes; Primary Metal Production; Zinc Production; Casting: Fugitive Emissions
30303029	Industrial Processes; Primary Metal Production; Zinc Production; Electric Retort
30303099	Industrial Processes; Primary Metal Production; Zinc Production; Other Not Classified

30400801	Industrial Processes; Secondary Metal Production; Zinc; Retort Furnace
30400802	Industrial Processes; Secondary Metal Production; Zinc; Horizontal Muffle Furnace
30400803	Industrial Processes; Secondary Metal Production; Zinc; Pot Furnace
30400805	Industrial Processes; Secondary Metal Production; Zinc; Galvanizing Kettle
30400806	Industrial Processes; Secondary Metal Production; Zinc; Calcining Kiln
30400807	Industrial Processes; Secondary Metal Production; Zinc; Concentrate Dryer
30400809	Industrial Processes; Secondary Metal Production; Zinc; Rotary Sweat Furnace
30400810	Industrial Processes; Secondary Metal Production; Zinc; Muffle Sweat Furnace
30400811	Industrial Processes; Secondary Metal Production; Zinc; Electric Resistance Sweat Furnace
30400812	Industrial Processes; Secondary Metal Production; Zinc; Crushing/Screening of Zinc Residues
30400814	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: Clean Metallic Scrap
30400818	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: Clean Metallic Scrap
30400824	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: General Metallic Scrap
30400828	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: General Metallic Scrap
30400834	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: Residual Metallic Scrap
30400838	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: Residual Metallic Scrap
30400840	Industrial Processes; Secondary Metal Production; Zinc; Alloying
30400841	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Crucible
30400842	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Reverberatory Furnace
30400843	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Electric Induction Furnace
30400851	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation: Pouring
30400852	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation: Casting
30400853	Industrial Processes; Secondary Metal Production; Zinc; Graphite Rod Distillation
30400854	Industrial Processes; Secondary Metal Production; Zinc; Retort Distillation/Oxidation
30400855	Industrial Processes; Secondary Metal Production; Zinc; Muffle Distillation/Oxidation
30400861	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweating
30400862	Industrial Processes; Secondary Metal Production; Zinc; Rotary Sweating
30400863	Industrial Processes; Secondary Metal Production; Zinc; Muffle Sweating
30400864	Industrial Processes; Secondary Metal Production; Zinc; Kettle (Pot) Sweating
30400865	Industrial Processes; Secondary Metal Production; Zinc; Electric Resistance Sweating
30400866	Industrial Processes; Secondary Metal Production; Zinc; Sodium Carbonate Leaching
30400867	Industrial Processes; Secondary Metal Production; Zinc; Kettle (Pot) Melting Furnace
30400868	Industrial Processes; Secondary Metal Production; Zinc; Crucible Melting Furnace
30400869	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Melting Furnace
30400870	Industrial Processes; Secondary Metal Production; Zinc; Electric Induction Melting Furnace

30400871	Industrial Processes; Secondary Metal Production; Zinc; Alloying Retort Distillation
30400872	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation
30400873	Industrial Processes; Secondary Metal Production; Zinc; Casting
30400874	Industrial Processes; Secondary Metal Production; Zinc; Graphite Rod Distillation
30400875	Industrial Processes; Secondary Metal Production; Zinc; Retort Distillation/Oxidation
30400876	Industrial Processes; Secondary Metal Production; Zinc; Muffle Distillation/Oxidation
30400877	Industrial Processes; Secondary Metal Production; Zinc; Retort Reduction
30400899	Industrial Processes; Secondary Metal Production; Zinc; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $8 to $71 per scfm Typical value is $29 per scfm O&M Costs: Range from $4 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name: Fabric Filter (Pulse Jet Type);(PM10) Asphalt Manufacture

Abbreviation: PFFPJASMN

Description: Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake.

This control applies to asphalt manufacturing operations.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998).

During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake.

There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake.

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Pulse Jet Type)

Source Group: Asphalt Manufacture

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				

Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1998	N/A	1998
CPT:		$289		$289
Ref Yr CPT:		$392		$392
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5

PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
1998
N/A
1998
CPT:
$289
$289
Ref Yr CPT:
$392
$392
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:

100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	13.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	380.0
Typical Default CPT Factor - O&M	28.0
Typical Default CPT Factor - Annualized	117.0

Affected SCCs:

Code	Description
30500100	Industrial Processes;Mineral Products;Asphalt Roofing Manufacture;undefined
30500104	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Felt Saturation: Dipping/Spraying
30500107	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingles and Rolls: Mineral Dryer
30500112	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Spraying Only
30500113	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Dipping/Spraying
30500114	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Asphaltic Felt: Coating
30500115	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Steam Drying Drums
30500116	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Saturation: Dip Saturator, Drying-in Drum, Hot Looper & Coater
30500118	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Saturation: Dip Saturator, Drying-in Drum and Hot Looper
30500119	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Sation:Spray/Dip Satur,Drying-in Drm,Hot Loopr,Coatr & Str Tk
30500120	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Ferric Chloride
30500121	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Mineral Stabilizer
30500130	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Fixed Roof Tank: Asphalt/Breathing Loss
30500131	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Fixed Roof Tank: Working Loss
30500132	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Floating Roof Tank: Standing Loss

30500133	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Floating Roof Tank: Working Loss
30500134	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Blown Saturant Storage
30500135	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Blown Coating Storage
30500140	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Unloading
30500141	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Storage
30500142	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Unloading
30500143	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Storage
30500144	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Transport Screw Conveyor and Bucket Elevator
30500145	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Transport Screw Conveyor and Bucket Elevator
30500146	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Sand Surge Bin
30500147	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Surge Bin
30500150	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust (Filler) and Asphalt Coating Mixer
30500151	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules
30500152	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Sand Applicator
30500153	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Cooling Rolls
30500154	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Finish Floating Looper
30500198	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Other Not Classified
30500199	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; See Comment **
30500200	Industrial Processes;Mineral Products;Asphalt Concrete;undefined
30500201	Industrial Processes; Mineral Products; Asphalt Concrete; Rotary Dryer: Conventional Plant (see 3-05-002-50 to -53 for subtypes)
30500202	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevs, Screens, Bins&Mixer (also see -45 thru -47
30500203	Industrial Processes; Mineral Products; Asphalt Concrete; Storage Piles
30500204	Industrial Processes; Mineral Products; Asphalt Concrete; Cold Aggregate Handling
30500205	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Dryer: Drum Mix Plant (see 3-05-002-55 thru -63 for subtypes)
30500206	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Natural Gas
30500207	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Residual Oil
30500208	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Distillate Oil
30500209	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: LPG
30500210	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Waste Oil
30500211	Industrial Processes; Mineral Products; Asphalt Concrete; Rotary Dryer Conventional Plant with Cyclone ** use 3-05-002-01 w/CTL
30500212	Industrial Processes; Mineral Products; Asphalt Concrete; Heated Asphalt Storage Tanks
30500213	Industrial Processes; Mineral Products; Asphalt Concrete; Storage Silo
30500214	Industrial Processes; Mineral Products; Asphalt Concrete; Truck Load-out
30500215	Industrial Processes; Mineral Products; Asphalt Concrete; In Place Recycling: Propane

30500216	Industrial Processes; Mineral Products; Asphalt Concrete; Cold Aggregate Feed Bins
30500217	Industrial Processes; Mineral Products; Asphalt Concrete; Cold Aggregate Conveyors and Elevators
30500220	Industrial Processes; Mineral Products; Asphalt Concrete; Elevators: Batch Process (also see -45 thru -47 for combos w/scr,bins
30500221	Industrial Processes; Mineral Products; Asphalt Concrete; Elevators: Continuous Process
30500230	Industrial Processes; Mineral Products; Asphalt Concrete; Hot Bins and Screens: Batch Process (also see -45 thru -47 for combos)
30500231	Industrial Processes; Mineral Products; Asphalt Concrete; Hot Bins and Screens: Continuous Process
30500240	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Batch Process (also see -45 thru -47 for combos w/scr,bins
30500241	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Continuous Mix (outside the drum) Process
30500242	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Drum Mix Process ** (use 3-05-002-005 and subtypes)
30500245	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer & NG Rot Dryer
30500246	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer& #2 Oil Rot Dryer
30500247	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevs, Scrns, Bins, Mixer& Waste/Drain/#6 Oil Rot
30500250	Industrial Processes; Mineral Products; Asphalt Concrete; Conventional Continuous Mix (outside of drum) Plant: Rotary Dryer
30500251	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Natural Gas-Fired (also see -45)
30500252	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Oil-Fired (also see -46)
30500253	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Waste/Drain/# 6 Oil-Fired (also see -47
30500255	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas-Fired
30500256	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas, Parallel Flow
30500257	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas, Counterflow
30500258	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired
30500259	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Parallel Flow
30500260	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Counterflow
30500261	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil-Fired
30500262	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Pl: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil, Parallel Flo
30500263	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Pl: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil, Counterflow
30500270	Industrial Processes; Mineral Products; Asphalt Concrete; Yard Emissions: Emissions from asphalt in truck beds

30500298	Industrial Processes; Mineral Products; Asphalt Concrete; Other Not Classified
30500299	Industrial Processes; Mineral Products; Asphalt Concrete; See Comment **

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	0.91%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for pulse-jet cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $6 to $26 per scfm Typical value is $13 per scfm O&M Costs: Range from $5 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$266/ton
CPTON_L:	$42/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $42 to $266 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $117 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	15%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.83%
MNTLBR_PCT:	5%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.45%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.91%
RPLMTL_PCT:	3.9%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	87.9%
TINDIR_PCT:	12.1%
UTIL_PCT:	3.59%
WSTDSP_PCT:	51.33%

Summary:

Control Measure Name: Fabric Filter (Pulse Jet Type);(PM10) Mineral Products - Coal Cleaning

Abbreviation: PFFPJMICC

Description: Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake.

This control applies to coal cleaning PM10 and PM2.5 sources at mining operations.

Discussion: Coal mining, cleaning and material handling (305010) consists of the preparation and handling of coal to upgrade its value. For the purpose of this study, thermal dryers, pneumatic coal cleaning and truck/vehicle travel are the sources considered. Thermal dryers are used at the end of the series of cleaning operations to remove moisture from coal, thereby reducing freezing problems and weight, and increasing the heating value. The major portion of water is removed by the use of screens, thickeners, and cyclones. The coal is then dried in a thermal dryer. Particulate emissions result from the entrainment of fine coal particles during the thermal drying process (EPA, 1995). Pneumatic coal-cleaning equipment classifies bituminous coal by size or separates bituminous coal from refuse by application of air streams. Fugitive PM emissions result when haul trucks or other vehicles travel on unpaved roads or surfaces.

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998).

During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake.

There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake.

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Pulse Jet Type)

Source Group: Mineral Products - Coal Cleaning
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	1998	1998	N/A
CPT:		$221	$221	
Ref Yr CPT:		$300	$300	
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton	cpton	
Capital Rec Fac:	N/A	0.09000000357627869	0.09000000357627869	N/A
Discount Rate:	N/A	7.0	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A

Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
N/A
2020-01-01 00:00:00.0
Cost Year:
N/A
1998
1998
N/A
CPT:
$221
$221
Ref Yr CPT:
$300
$300
Control Efficiency:
99.5
99.0
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A

N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
0.09000000357627869
N/A
Discount Rate:
N/A
7.0
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0

0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	13.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	380.0
Typical Default CPT Factor - O&M	28.0
Typical Default CPT Factor - Annualized	117.0

Affected SCCs:

Code	Description
30501000	Industrial Processes;Mineral Products;Coal Mining, Cleaning, and Material Handling (See 305310);undefined
30501003	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Multilouvered Dryer
30501005	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Cascade Dryer
30501006	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Continuous Carrier/Conveyor
30501008	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Unloading
30501009	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Raw Coal Storage
30501011	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Transfer
30501013	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Cleaning: Air Table
30501015	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Loading (For Clean Coal Loading USE 30501016)
30501016	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Clean Coal Loading

30501021	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Removal
30501022	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Drilling/Blasting
30501023	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Loading
30501024	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Hauling
30501030	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Topsoil Removal (See also 305010 -33, -35, -36, -37, -42, -45, -48)
30501031	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Scrapers: Travel Mode
30501032	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Topsoil Unloading
30501033	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden (See also 305010 -30, -35, -36, -37, -42, -45, -48)
30501034	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Seam: Drilling
30501035	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Blasting: Coal Overburden
30501036	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Dragline: Overburden Removal
30501037	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Loading: Overburden
30501038	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Loading: Coal
30501039	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Hauling: Haul Trucks
30501040	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: End Dump - Coal
30501041	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: Bottom Dump - Coal
30501042	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: Bottom Dump - Overburden
30501043	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Open Storage Pile: Coal
30501044	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Train Loading: Coal
30501045	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Bulldozing: Overburden
30501046	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Bulldozing: Coal
30501047	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Grading
30501048	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Replacement
30501049	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Wind Erosion: Exposed Areas
30501050	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Vehicle Traffic: Light/Medium Vehicles
30501051	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Open Storage Pile: Spoils

30501060	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Primary Crusher
30501061	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Secondary Crusher
30501062	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Screens
30501090	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Haul Roads: General
30501099	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.
- EPA, 1995: U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors," AP-42, Volume I, Fifth Edition, Research Triangle Park, NC, January 1995.

Other information:

ADMIN_PCT:	0.91%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for pulse-jet cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $6 to $26 per scfm Typical value is $13 per scfm O&M Costs: Range from $5 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$266/ton
CPTON_L:	$42/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $42 to $266 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $117 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	15%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.83%
MNTLBR_PCT:	5%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.45%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.91%
RPLMTL_PCT:	3.9%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	87.9%
TINDIR_PCT:	12.1%
UTIL_PCT:	3.59%
WSTDSP_PCT:	51.33%

Summary:

Control Measure Name: Fabric Filter (Pulse Jet Type);(PM10) Mineral Products - Cement Manufacture

Abbreviation: PFFPJMICM

Description: Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake.

This control applies to electricity generation sources powered by pulverized dry-bottom and bituminous/subbituminous coal.

Discussion: The largest source of particulate emissions at a cement plant is the kiln used to produce clinker. Cement kilns are rotary kilns, which are slowly rotating refractory-lined steel cylinders inclined slightly from the horizontal. Raw materials are fed into the top end of the kiln and spend several hours traversing the kiln. In wet process kilns (SCC 30500706), the raw materials are fed as a wet slurry. During this time, the raw materials are heated by a flame at the discharge end of the kiln. This heating dries the raw materials, converts limestone to lime, and promotes reaction between and fusion of the separate ingredients to form clinker. Clinker exiting the kiln is fed to a clinker cooler (SCC 30500714) for cooling before storage and further processing (STAPPA/ALAPCO, 1996).

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998).

During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake.

There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake.

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Pulse Jet Type)

Source Group: Mineral Products - Cement Manufacture
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	N/A	1998	N/A
CPT:	$295		$295	
Ref Yr CPT:	$400		$400	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A

Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:				
PM25-PRI				
PM25-PRI				
PM2_5				
PM2_5				
Locale:				
Effective Date:				
N/A				
2020-01-01 00:00:00.0				
N/A				
2020-01-01 00:00:00.0				
Cost Year:				
1998				
N/A				
1998				
N/A				
CPT:				
$295				
$295				
Ref Yr CPT:				
$400				
$400				
Control Efficiency:				
99.0				
99.5				
99.0				
99.5				
Min Emis:				
N/A				
N/A				
N/A				
N/A				
Max Emis:				
N/A				
N/A				
N/A				

N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremenental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0

0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	13.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	380.0
Typical Default CPT Factor - O&M	28.0
Typical Default CPT Factor - Annualized	117.0

Affected SCCs:

Code	Description
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln
30500609	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Primary Crushing
30500610	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Secondary Crushing
30500611	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Screening
30500612	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Transfer
30500613	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Grinding and Drying
30500614	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Cooler
30500616	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Transfer
30500617	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Grinding
30500618	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Silos
30500620	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Predryer
30500621	Industrial Processes; Mineral Products; Cement Manufacturing (Wet or Dry Process); Pulverized Coal Kiln Feed Units
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln

30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln
30500624	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Feed Belt
30500625	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Weigh Hopper
30500626	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Air Separator
30500627	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Feed Belt
30500628	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Weigh Hopper
30500629	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Air Separator
30500706	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Kilns
30500709	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Primary Crushing
30500710	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Secondary Crushing
30500711	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Screening
30500712	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Raw Material Transfer
30500714	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Cooler
30500715	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Piles
30500716	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Transfer
30500717	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Grinding
30500718	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Cement Silos
30500727	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Feed Belt
30500728	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Weigh Hopper
30500729	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Air Separator

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	0.91%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for pulse-jet cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $6 to $26 per scfm Typical value is $13 per scfm O&M Costs: Range from $5 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$266/ton
CPTON_L:	$42/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $42 to $266 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $117 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	15%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%

HG_CE_T:	99%
INSRNC_PCT:	1.83%
MNTLBR_PCT:	5%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.45%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.91%
RPLMTL_PCT:	3.9%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	87.9%
TINDIR_PCT:	12.1%
UTIL_PCT:	3.59%
WSTDSP_PCT:	51.33%

Summary:

Control Measure Name: Fabric Filter (Pulse Jet Type);(PM10) Mineral Products - Other

Abbreviation: PFFPJMIOR

Description: Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake.

This control applies to miscellaneous mineral production operations including (but not limited to) brick manufacture, calcium carbide operations, clay and fly ash sintering, concrete batching, gypsum manufacturing, lime production, phosphate rock operations, sand production, fiberglass manufacturing and glass manufacturing operations. Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions.

Discussion: Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998).

During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake.

There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake.

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Pulse Jet Type)

Source Group: Mineral Products - Other
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	N/A	1998	N/A
CPT:	$201		$201	
Ref Yr CPT:	$273		$273	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A

Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:				
PM25-PRI				
PM25-PRI				
PM2_5				
PM2_5				
Locale:				
Effective Date:				
N/A				
2020-01-01 00:00:00.0				
N/A				
2020-01-01 00:00:00.0				
Cost Year:				
1998				
N/A				
1998				
N/A				
CPT:				
$201				
$201				
Ref Yr CPT:				
$273				
$273				
Control Efficiency:				
99.0				
99.5				
99.0				
99.5				
Min Emis:				
N/A				
N/A				
N/A				
N/A				
Max Emis:				
N/A				
N/A				
N/A				

N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0

0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	13.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	380.0
Typical Default CPT Factor - O&M	28.0
Typical Default CPT Factor - Annualized	117.0

Affected SCCs:

Code	Description
30500300	Industrial Processes;Mineral Products;Brick Manufacture;undefined
30500301	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Drying
30500302	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Grinding & Screening
30500303	Industrial Processes; Mineral Products; Brick Manufacture; Storage of Raw Materials
30500304	Industrial Processes; Mineral Products; Brick Manufacture; Curing **
30500305	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Handling and Transferring
30500306	Industrial Processes; Mineral Products; Brick Manufacture; Pulverizing
30500307	Industrial Processes; Mineral Products; Brick Manufacture; Calcining
30500308	Industrial Processes; Mineral Products; Brick Manufacture; Screening
30500309	Industrial Processes; Mineral Products; Brick Manufacture; Blending and Mixing
30500310	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Sawdust Fired Tunnel Kilns
30500311	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Tunnel Kilns
30500312	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Tunnel Kilns

30500313	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Tunnel Kilns
30500314	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Periodic Kilns
30500315	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Periodic Kilns
30500316	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Periodic Kilns
30500317	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Unloading
30500318	Industrial Processes; Mineral Products; Brick Manufacture; Tunnel Kiln: Wood-fired
30500319	Industrial Processes; Mineral Products; Brick Manufacture; Transfer and Conveying
30500321	Industrial Processes; Mineral Products; Brick Manufacture; General
30500322	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing High-Sulfur Material
30500330	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Periodic Kiln
30500331	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel Fired Tunnel Kiln
30500332	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Kiln, Other Type
30500333	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Kiln, Other Type
30500334	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Kiln, Other Type
30500335	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Kiln, Other Type
30500340	Industrial Processes; Mineral Products; Brick Manufacture; Primary Crusher
30500342	Industrial Processes; Mineral Products; Brick Manufacture; Extrusion Line
30500350	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat From Kiln Cooling Zone
30500351	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat And Supplemental Gas Burners
30500355	Industrial Processes; Mineral Products; Brick Manufacture; Coal Crushing And Storage System
30500360	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer
30500361	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer: Heated With Exhaust From Sawdust-fired Kiln
30500370	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing Structural Clay Tile
30500397	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500398	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500399	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500401	Industrial Processes; Mineral Products; Calcium Carbide; Electric Furnace: Hoods and Main Stack
30500402	Industrial Processes; Mineral Products; Calcium Carbide; Coke Dryer
30500403	Industrial Processes; Mineral Products; Calcium Carbide; Furnace Room Vents
30500404	Industrial Processes; Mineral Products; Calcium Carbide; Tap Fume Vents
30500405	Industrial Processes; Mineral Products; Calcium Carbide; Primary/Secondary Crushing

30500406	Industrial Processes; Mineral Products; Calcium Carbide; Circular Charging: Conveyor
30500499	Industrial Processes; Mineral Products; Calcium Carbide; Other Not Classified
30500501	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Dryer
30500502	Industrial Processes; Mineral Products; Castable Refractory; Raw Material Crushing/Processing
30500503	Industrial Processes; Mineral Products; Castable Refractory; Electric Arc Melt Furnace
30500504	Industrial Processes; Mineral Products; Castable Refractory; Curing Oven
30500505	Industrial Processes; Mineral Products; Castable Refractory; Molding and Shakeout
30500506	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Calciner
30500507	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Tunnel Kiln
30500508	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Rotary Dryer
30500509	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Tunnel Kiln
30500598	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500599	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln
30500607	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Unloading
30500608	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Piles
30500609	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Primary Crushing
30500610	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Secondary Crushing
30500611	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Screening
30500612	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Transfer
30500613	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Grinding and Drying
30500614	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Cooler
30500615	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Piles
30500616	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Transfer
30500617	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Grinding
30500618	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Silos
30500619	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Load Out
30500620	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Predryer
30500621	Industrial Processes; Mineral Products; Cement Manufacturing (Wet or Dry Process); Pulverized Coal Kiln Feed Units
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln
30500624	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Feed Belt
30500625	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Weigh Hopper
30500626	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Air Separator

30500627	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Feed Belt
30500628	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Weigh Hopper
30500629	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Air Separator
30500699	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Other Not Classified
30500800	Industrial Processes;Mineral Products;Ceramic Clay/Tile Manufacture;undefined
30500801	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying ** (use SCC 3-05-008-13)
30500802	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Comminution - Crushing, Grinding, & Milling
30500803	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Storage
30500804	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Screening and floating ** (use SCC 3-05-008-16)
30500805	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Direct Mixing of Ceramic Powder and Binder Solution
30500806	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Handling and Transfer
30500807	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Grinding, dry ** (use SCC 3-05-008-02)
30500810	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Natural Gas-fired Spray Dryer
30500811	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Infrared (IR) Drying Prior to Firing
30500812	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glazing and firing kiln ** (use SCCs 3-05-008-45 & -50)
30500813	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Convection Drying Prior to Firing
30500816	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Sizing - Vibrating Screens
30500818	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Air Classifier
30500821	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Rotary Calciner
30500822	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Rotary Calciner
30500823	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Fluidized Bed Calciner
30500824	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Fluidized Bed Calciner
30500828	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Mixing - Raw Matls, Binders, Plasticizers, Surfactants, & Other Agent
30500830	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - General
30500831	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - Tape Casters
30500835	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Green Machining-Grindg, Cutg, or Laminatg Formed Ceramics Prior to Fir
30500840	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Natural Gas-fired Kiln
30500841	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Fuel Oil-fired Kiln

30500843	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glaze Preparation - Ballmill or Attrition Mill
30500845	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Ceramic Glaze Spray Booth
30500850	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Natural Gas-fired Kiln
30500854	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Fuel Oil-fired Kiln
30500856	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Refiring Kiln - Refiring after Decal, Paint, or Ink Applied; Natural-g
30500858	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Cooler - Cooling Ceramics Following Firing
30500860	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Grinding and Polishing
30500870	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Annealing
30500880	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Surface Coating
30500899	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Other Not Classified
30500901	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Fly Ash Sintering
30500902	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay/Coke Sintering
30500903	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Natural Clay/Shale Sintering
30500904	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Crushing/Screening
30500905	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Transfer/Conveying
30500906	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Storage Piles
30500907	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Coke Product Crushing/Screening
30500908	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Shale Product Crushing/Screening
30500909	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Clinker Cooling
30500910	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Storage
30500915	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Rotary Kiln
30500916	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Dryer
30500917	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay Reciprocating Grate Clinker Cooler
30500999	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Other Not Classified
30501101	Industrial Processes; Mineral Products; Concrete Batching; Total Facility Emissions except road dust & wind-blown dust
30501104	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Elevated Storage
30501105	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Elevated Storage
30501106	Industrial Processes; Mineral Products; Concrete Batching; Transfer: Sand/Aggregate to Elevated Bins (See Also -04 & -05)
30501107	Industrial Processes; Mineral Products; Concrete Batching; Cement Unloading to Elevated Storage Silo

30501108	Industrial Processes; Mineral Products; Concrete Batching; Weight Hopper Loading of Sand and Aggregate
30501109	Industrial Processes; Mineral Products; Concrete Batching; Mixer Loading of Cement/Sand/Aggregate
30501110	Industrial Processes; Mineral Products; Concrete Batching; Loading of Transit Mix Truck
30501111	Industrial Processes; Mineral Products; Concrete Batching; Loading of Dry-batch Truck
30501112	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Wet
30501113	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Dry
30501114	Industrial Processes; Mineral Products; Concrete Batching; Transferring: Conveyors/Elevators
30501115	Industrial Processes; Mineral Products; Concrete Batching; Storage: Bins/Hoppers
30501117	Industrial Processes; Mineral Products; Concrete Batching; Cement Supplement Unloading to Elevated Storage Silo
30501120	Industrial Processes; Mineral Products; Concrete Batching; Asbestos/Cement Products
30501121	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Delivery to Ground Storage
30501122	Industrial Processes; Mineral Products; Concrete Batching; Sand Delivery to Ground Storage
30501123	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Conveyor
30501124	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Conveyor
30501199	Industrial Processes; Mineral Products; Concrete Batching; Other Not Classified
30501201	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Wool-type Fiber)
30501202	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Wool-type Fiber)
30501203	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Electric Furnace (Wool-type Fiber)
30501204	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Rotary Spun (Wool-type Fiber)
30501205	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven: Rotary Spun (Wool-type Fiber)
30501206	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Cooling (Wool-type Fiber)
30501207	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Wool-type Fiber)
30501208	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Flame Attenuation (Wool-type Fiber)
30501209	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing: Flame Attenuation (Wool-type Fiber)
30501211	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Textile-type Fiber)
30501212	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Textile-type Fiber)
30501213	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Textile-type Fiber)
30501214	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming Process (Textile-type Fiber)
30501215	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven (Textile-type Fiber)
30501221	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Unloading/Conveying

30501222	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Storage Bins
30501223	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Mixing/Weighing
30501224	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Crushing/Charging
30501299	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Other Not Classified
30501301	Industrial Processes; Mineral Products; Frit Manufacture; General ** (use 3-05-013-05 or 3-05-013-06)
30501302	Industrial Processes; Mineral Products; Frit Manufacture; Weighing of raw materials
30501303	Industrial Processes; Mineral Products; Frit Manufacture; Dry Mixing of raw materials
30501304	Industrial Processes; Mineral Products; Frit Manufacture; Smelting Furnace Charging
30501305	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Smelting Furnace
30501306	Industrial Processes; Mineral Products; Frit Manufacture; Continuous Smelting Furnace
30501310	Industrial Processes; Mineral Products; Frit Manufacture; Water Spray Quenching to shatter material into small particles
30501311	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Dryer (usually not used with a continuous furnace)
30501315	Industrial Processes; Mineral Products; Frit Manufacture; Dry Milling of quenched frit with a ball mill
30501316	Industrial Processes; Mineral Products; Frit Manufacture; Product Screening
30501399	Industrial Processes; Mineral Products; Frit Manufacture; Other Not Classified
30501400	Industrial Processes;Mineral Products;Glass Manufacture;undefined
30501401	Industrial Processes; Mineral Products; Glass Manufacture; Furnace/General**
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace
30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace
30501405	Industrial Processes; Mineral Products; Glass Manufacture; Presintering
30501406	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Forming/Finishing
30501407	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Forming/Finishing
30501408	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Forming/Finishing
30501410	Industrial Processes; Mineral Products; Glass Manufacture; Raw Material Handling (All Types of Glass)
30501411	Industrial Processes; Mineral Products; Glass Manufacture; General **
30501412	Industrial Processes; Mineral Products; Glass Manufacture; Hold Tanks **
30501413	Industrial Processes; Mineral Products; Glass Manufacture; Cullet: Crushing/Grinding
30501414	Industrial Processes; Mineral Products; Glass Manufacture; Ground Cullet Beading Furnace
30501415	Industrial Processes; Mineral Products; Glass Manufacture; Glass Etching with Hydrofluoric Acid Solution
30501416	Industrial Processes; Mineral Products; Glass Manufacture; Glass Manufacturing
30501417	Industrial Processes; Mineral Products; Glass Manufacture; Briquetting
30501418	Industrial Processes; Mineral Products; Glass Manufacture; Pelletizing
30501420	Industrial Processes; Mineral Products; Glass Manufacture; Mirror Plating: General

30501421	Industrial Processes; Mineral Products; Glass Manufacture; Demineralizer: General
30501499	Industrial Processes; Mineral Products; Glass Manufacture; See Comment **
30501500	Industrial Processes;Mineral Products;Gypsum Manufacture;undefined
30501501	Industrial Processes; Mineral Products; Gypsum Manufacture; Rotary Ore Dryer
30501502	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Grinder/Roller Mills
30501503	Industrial Processes; Mineral Products; Gypsum Manufacture; Not Classified **
30501504	Industrial Processes; Mineral Products; Gypsum Manufacture; Conveying
30501505	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Crushing: Gypsum Ore
30501506	Industrial Processes; Mineral Products; Gypsum Manufacture; Secondary Crushing: Gypsum Ore
30501507	Industrial Processes; Mineral Products; Gypsum Manufacture; Screening: Gypsum Ore
30501508	Industrial Processes; Mineral Products; Gypsum Manufacture; Stockpile: Gypsum Ore
30501509	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Gypsum Ore
30501510	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Landplaster
30501511	Industrial Processes; Mineral Products; Gypsum Manufacture; Continuous Kettle: Calciner
30501512	Industrial Processes; Mineral Products; Gypsum Manufacture; Flash Calciner
30501513	Industrial Processes; Mineral Products; Gypsum Manufacture; Impact Mill
30501514	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Stucco
30501515	Industrial Processes; Mineral Products; Gypsum Manufacture; Tube/Ball Mills
30501516	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers
30501517	Industrial Processes; Mineral Products; Gypsum Manufacture; Bagging
30501518	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers/Conveyors
30501519	Industrial Processes; Mineral Products; Gypsum Manufacture; Forming Line
30501520	Industrial Processes; Mineral Products; Gypsum Manufacture; Drying Kiln
30501521	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (8 Ft.)
30501522	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (12 Ft.)
30501599	Industrial Processes; Mineral Products; Gypsum Manufacture; See Comment **
30501601	Industrial Processes; Mineral Products; Lime Manufacture; Primary Crushing
30501602	Industrial Processes; Mineral Products; Lime Manufacture; Secondary Crushing/Screening
30501603	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Vertical Kiln
30501604	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Rotary Kiln ** (See SCC Codes 3-05-016-18,-19,-20,-21)
30501605	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Calcimatic Kiln
30501606	Industrial Processes; Mineral Products; Lime Manufacture; Fluidized Bed Kiln
30501607	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Transfer and Conveying
30501608	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Unloading
30501609	Industrial Processes; Mineral Products; Lime Manufacture; Hydrator: Atmospheric
30501610	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Storage Piles
30501611	Industrial Processes; Mineral Products; Lime Manufacture; Product Cooler
30501612	Industrial Processes; Mineral Products; Lime Manufacture; Pressure Hydrator

30501613	Industrial Processes; Mineral Products; Lime Manufacture; Lime Silos
30501614	Industrial Processes; Mineral Products; Lime Manufacture; Packing/Shipping
30501615	Industrial Processes; Mineral Products; Lime Manufacture; Product Transfer and Conveying
30501616	Industrial Processes; Mineral Products; Lime Manufacture; Primary Screening
30501617	Industrial Processes; Mineral Products; Lime Manufacture; Multiple Hearth Calciner
30501618	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Kiln
30501619	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Rotary Kiln
30501620	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Gas-fired Rotary Kiln
30501621	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Coke-fired Rotary Kiln
30501622	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Preheater Kiln
30501623	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Parallel Flow Regenerative Kiln
30501624	Industrial Processes; Mineral Products; Lime Manufacture; Conveyor Transfer - Primary Crushed Material
30501625	Industrial Processes; Mineral Products; Lime Manufacture; Secondary/Tertiary Screening
30501626	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Enclosed Truck
30501627	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Open Truck
30501628	Industrial Processes; Mineral Products; Lime Manufacture; Pulverizing
30501629	Industrial Processes; Mineral Products; Lime Manufacture; Tertiary Screening After Pulverizing
30501630	Industrial Processes; Mineral Products; Lime Manufacture; Screening After Calcination
30501631	Industrial Processes; Mineral Products; Lime Manufacture; Crushing and Pulverizing After Calcinating
30501632	Industrial Processes; Mineral Products; Lime Manufacture; Milling
30501633	Industrial Processes; Mineral Products; Lime Manufacture; Separator After Hydrator
30501640	Industrial Processes; Mineral Products; Lime Manufacture; Vehicle Traffic
30501650	Industrial Processes; Mineral Products; Lime Manufacture; Quarrying Raw Limestone
30501660	Industrial Processes; Mineral Products; Lime Manufacture; Waste Treatment
30501699	Industrial Processes; Mineral Products; Lime Manufacture; See Comment **
30501701	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cupola
30501702	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Reverberatory Furnace
30501703	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Blow Chamber
30501704	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Curing Oven
30501705	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cooler
30501706	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Granulated Products Processing
30501707	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Handling
30501708	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Packaging
30501709	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Batt Application
30501710	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Storage of Oils and Binders

30501711	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Mixing of Oils and Binders
30501799	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Other Not Classified
30501801	Industrial Processes; Mineral Products; Perlite Manufacturing; Vertical Furnace
30501899	Industrial Processes; Mineral Products; Perlite Manufacturing; Other Not Classified
30501901	Industrial Processes; Mineral Products; Phosphate Rock; Drying
30501902	Industrial Processes; Mineral Products; Phosphate Rock; Grinding
30501903	Industrial Processes; Mineral Products; Phosphate Rock; Transfer/Storage
30501904	Industrial Processes; Mineral Products; Phosphate Rock; Open Storage
30501905	Industrial Processes; Mineral Products; Phosphate Rock; Calcining
30501906	Industrial Processes; Mineral Products; Phosphate Rock; Rotary Dryer
30501907	Industrial Processes; Mineral Products; Phosphate Rock; Ball Mill
30501908	Industrial Processes; Mineral Products; Phosphate Rock; Mineral Products Benification
30501999	Industrial Processes; Mineral Products; Phosphate Rock; Other Not Classified
30502101	Industrial Processes; Mineral Products; Salt Mining; General
30502102	Industrial Processes; Mineral Products; Salt Mining; Granulation: Stack Dryer
30502103	Industrial Processes; Mineral Products; Salt Mining; Filtration: Vacuum Filter
30502104	Industrial Processes; Mineral Products; Salt Mining; Crushing
30502105	Industrial Processes; Mineral Products; Salt Mining; Screening
30502106	Industrial Processes; Mineral Products; Salt Mining; Conveying
30502201	Industrial Processes; Mineral Products; Potash Production; Mine: Grinding/Drying
30502299	Industrial Processes; Mineral Products; Potash Production; Other Not Classified
30502401	Industrial Processes; Mineral Products; Magnesium Carbonate; Mine/Process
30502499	Industrial Processes; Mineral Products; Magnesium Carbonate; Other Not Classified
30502500	Industrial Processes;Mineral Products;Construction Sand and Gravel;undefined
30502501	Industrial Processes; Mineral Products; Construction Sand and Gravel; Total Plant: General **
30502502	Industrial Processes; Mineral Products; Construction Sand and Gravel; Aggregate Storage
30502503	Industrial Processes; Mineral Products; Construction Sand and Gravel; Material Transfer and Conveying
30502504	Industrial Processes; Mineral Products; Construction Sand and Gravel; Hauling
30502505	Industrial Processes; Mineral Products; Construction Sand and Gravel; Pile Forming: Stacker
30502506	Industrial Processes; Mineral Products; Construction Sand and Gravel; Bulk Loading
30502507	Industrial Processes; Mineral Products; Construction Sand and Gravel; Storage Piles
30502508	Industrial Processes; Mineral Products; Construction Sand and Gravel; Dryer ** (See 3-05-027-20 thru -24 for Industrial Sand Dryers)
30502509	Industrial Processes; Mineral Products; Construction Sand and Gravel; Cooler ** (See 3-05-027-30 for Industrial Sand Coolers)
30502510	Industrial Processes; Mineral Products; Construction Sand and Gravel; Crushing
30502511	Industrial Processes; Mineral Products; Construction Sand and Gravel; Screening
30502512	Industrial Processes; Mineral Products; Construction Sand and Gravel; Overburden Removal
30502513	Industrial Processes; Mineral Products; Construction Sand and Gravel; Excavating

30502514	Industrial Processes; Mineral Products; Construction Sand and Gravel; Drilling and Blasting
30502522	Industrial Processes; Mineral Products; Construction Sand and Gravel; Rodmilling: Fine Crushing of Construction Sand
30502523	Industrial Processes; Mineral Products; Construction Sand and Gravel; Fine Screening of Construction Sand Following Dewatering or Rodmilling
30502599	Industrial Processes; Mineral Products; Construction Sand and Gravel; Not Classified **
30502601	Industrial Processes; Mineral Products; Diatomaceous Earth; Handling
30502699	Industrial Processes; Mineral Products; Diatomaceous Earth; Other Not Classified
30502701	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Primary Crushing of Raw Material
30502705	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Secondary Crushing
30502709	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Grinding: Size Reduction to 50 Microns or Smaller
30502713	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Screening: Size Classification
30502717	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Draining: Removal of Moisture to About 6% After Froth Flotation
30502720	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas- or Oil-fired Rotary or Fluidized Bed Dryer
30502721	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Rotary Dryer
30502722	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Rotary Dryer
30502723	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Fluidized Bed Dryer
30502724	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Fluidized Bed Dryer
30502730	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Cooling of Dried Sand
30502740	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Final Classifying: Screening to Classify Sand by Size
30502760	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Handling, Transfer, and Storage
30502910	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Rotary Kiln
30502920	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Clinker Cooler
30503099	Industrial Processes; Mineral Products; Ceramic Electric Parts; Other Not Classified
30503101	Industrial Processes; Mineral Products; Asbestos Mining; Surface Blasting
30503102	Industrial Processes; Mineral Products; Asbestos Mining; Surface Drilling
30503103	Industrial Processes; Mineral Products; Asbestos Mining; Cobbing
30503104	Industrial Processes; Mineral Products; Asbestos Mining; Loading
30503105	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Asbestos
30503106	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Waste
30503107	Industrial Processes; Mineral Products; Asbestos Mining; Unloading
30503108	Industrial Processes; Mineral Products; Asbestos Mining; Overburden Stripping
30503109	Industrial Processes; Mineral Products; Asbestos Mining; Ventilation of Process Operations
30503110	Industrial Processes; Mineral Products; Asbestos Mining; Stockpiling

30503111	Industrial Processes; Mineral Products; Asbestos Mining; Tailing Piles
30503199	Industrial Processes; Mineral Products; Asbestos Mining; Other Not Classified
30503201	Industrial Processes; Mineral Products; Asbestos Milling; Crushing
30503202	Industrial Processes; Mineral Products; Asbestos Milling; Drying
30503203	Industrial Processes; Mineral Products; Asbestos Milling; Recrushing
30503204	Industrial Processes; Mineral Products; Asbestos Milling; Screening
30503205	Industrial Processes; Mineral Products; Asbestos Milling; Fiberizing
30503206	Industrial Processes; Mineral Products; Asbestos Milling; Bagging
30503299	Industrial Processes; Mineral Products; Asbestos Milling; Other Not Classified
30503301	Industrial Processes; Mineral Products; Vermiculite; General
30503312	Industrial Processes; Mineral Products; Vermiculite; Screening of Crude Vermiculite Ore
30503319	Industrial Processes; Mineral Products; Vermiculite; Blending of Vermiculite Ore
30503321	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Gas-fired
30503322	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Oil-fired
30503326	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Gas-fired
30503327	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Oil-fired
30503331	Industrial Processes; Mineral Products; Vermiculite; Crushing of Dried Vermiculite Concentrate
30503336	Industrial Processes; Mineral Products; Vermiculite; Screening: Size Classification of Crushed Vermiculite Concentrate
30503341	Industrial Processes; Mineral Products; Vermiculite; Conveying of Vermiculite Concentrate to Storage
30503351	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Gas-fired Vertical Furnace
30503352	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Oil-fired Vertical Furnace
30503361	Industrial Processes; Mineral Products; Vermiculite; Product Grinding: Grinding of Exfoliated Vermiculite
30503366	Industrial Processes; Mineral Products; Vermiculite; Product Classifying: Air Classification of Exfoliated Vermiculite
30503401	Industrial Processes; Mineral Products; Feldspar; Ball Mill
30503402	Industrial Processes; Mineral Products; Feldspar; Dryer
30503501	Industrial Processes; Mineral Products; Abrasive Grain Processing; Primary Crushing
30503502	Industrial Processes; Mineral Products; Abrasive Grain Processing; Secondary Crushing
30503503	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Crushing
30503504	Industrial Processes; Mineral Products; Abrasive Grain Processing; Crushed Grain Screening
30503505	Industrial Processes; Mineral Products; Abrasive Grain Processing; Washing/Drying
30503506	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Screening
30503507	Industrial Processes; Mineral Products; Abrasive Grain Processing; Air Classification
30503601	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Mixing

30503602	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Molding
30503603	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Steam Autoclaving
30503604	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Drying
30503605	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Firing or Curing
30503606	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Cooling
30503607	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Final Machining
30503701	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Printing of Backing
30503702	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Make Coat Application
30503703	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Grain Application
30503704	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Drying
30503705	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Size Coat Application
30503706	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Drying and Curing
30503707	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Roll Winding
30503708	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Production
30503901	Industrial Processes; Mineral Products; Pyrrhotite; Fluid Bed Roaster
30503902	Industrial Processes; Mineral Products; Pyrrhotite; Reduction Kiln
30504001	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Blasting
30504002	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Drilling
30504003	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Cobbing
30504010	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Underground Ventilation
30504020	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Loading
30504021	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Material
30504022	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Waste
30504023	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Unloading
30504024	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Overburden Stripping
30504025	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Stockpiling
30504030	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Primary Crusher
30504031	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Secondary Crusher
30504032	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Concentrator
30504033	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Dryer
30504034	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Screening
30504036	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Tailing Piles
30504099	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Other Not Classified

30504101	Industrial Processes; Mineral Products; Clay processing: Kaolin; Mining
30504102	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material storage
30504103	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material transfer
30504115	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material crushing, NEC
30504119	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material grinding, NEC
30504129	Industrial Processes; Mineral Products; Clay processing: Kaolin; Screening, NEC
30504130	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, rotary dryer
30504131	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, spray dryer
30504132	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, apron dryer
30504133	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, vibrating grate dryer
30504139	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, dryer NEC
30504140	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, rotary calciner
30504141	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, multiple hearth furnace
30504142	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, flash calciner
30504149	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, calciner NEC
30504150	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product grinding
30504151	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product screening/classification
30504160	Industrial Processes; Mineral Products; Clay processing: Kaolin; Bleaching
30504170	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product transfer
30504171	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product storage
30504172	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product packaging
30504201	Industrial Processes; Mineral Products; Clay processing: Ball clay; Mining
30504202	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material storage
30504203	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material transfer
30504215	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material crushing, NEC
30504219	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material grinding, NEC
30504230	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, rotary dryer
30504231	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, spray dryer
30504232	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, apron dryer
30504233	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, vibrating grate dryer
30504239	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, dryer NEC
30504250	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product grinding
30504270	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product transfer
30504271	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product storage
30504272	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product packaging
30504301	Industrial Processes; Mineral Products; Clay processing: Fire clay; Mining
30504302	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material storage
30504303	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material transfer

30504315	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material crushing, NEC
30504319	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material grinding, NEC
30504329	Industrial Processes; Mineral Products; Clay processing: Fire clay; Screening, NEC
30504330	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, rotary dryer
30504331	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, spray dryer
30504332	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, apron dryer
30504333	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, vibrating grate dryer
30504339	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, dryer NEC
30504340	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, rotary calciner
30504341	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, multiple hearth furnace
30504342	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, flash calciner
30504349	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, calciner NEC
30504350	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product grinding
30504351	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product screening/classification
30504370	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product transfer
30504371	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product storage
30504372	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product packaging
30504401	Industrial Processes; Mineral Products; Clay processing: Bentonite; Mining
30504402	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material storage
30504403	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material transfer
30504415	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material crushing, NEC
30504419	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material grinding, NEC
30504430	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, rotary dryer
30504431	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, spray dryer
30504432	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, apron dryer
30504433	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, vibrating grate dryer
30504439	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, dryer NEC
30504450	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product grinding
30504451	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product screening/classification
30504470	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product transfer
30504471	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product storage
30504472	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product packaging
30504501	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Mining
30504502	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material storage
30504503	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material transfer
30504515	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material crushing, NEC
30504519	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material grinding, NEC

30504530	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, rotary dryer
30504531	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, spray dryer
30504532	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, apron dryer
30504533	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, vibrating grate dryer
30504539	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, dryer NEC
30504550	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product grinding
30504551	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product screening/classification
30504570	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product transfer
30504571	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product storage
30504572	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product packaging
30504601	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Mining
30504602	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material storage
30504603	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material transfer
30504615	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material crushing, NEC
30504619	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material grinding, NEC
30504629	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Screening, NEC
30504630	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, rotary dryer
30504631	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, spray dryer
30504632	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, apron dryer
30504633	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, vibrating grate dryer
30504639	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, dryer NEC
30504670	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product transfer
30504671	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product storage
30504672	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product packaging
30505001	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Processing (Blowing)
30505005	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Storage (Prior to Blowing)
30505010	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Blowing Still
30505020	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Natural Gas
30505021	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Residual Oil
30505022	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Distillate Oil

30505023	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: LP Gas
30508906	Industrial Processes; Mineral Products; Talc Processing; Storage of Raw Mined Talc Before Processing
30508908	Industrial Processes; Mineral Products; Talc Processing; Conveyor Transfer of Raw Talc to Primary Crusher
30508909	Industrial Processes; Mineral Products; Talc Processing; Natural Gas Fired Crude Ore Dryer
30508910	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil Fired Crude Ore Dryer
30508911	Industrial Processes; Mineral Products; Talc Processing; Primary crusher
30508912	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Railcar Loading
30508914	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Storage Bin Loading
30508917	Industrial Processes; Mineral Products; Talc Processing; Screening Oversize Ore to Return to Primary Crusher
30508921	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Dryer
30508923	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Dryer
30508931	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Calciner
30508933	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Calciner
30508941	Industrial Processes; Mineral Products; Talc Processing; Rotary Cooler Following Calciner
30508945	Industrial Processes; Mineral Products; Talc Processing; Grinding of Dried Talc
30508947	Industrial Processes; Mineral Products; Talc Processing; Grinding/Drying of Talc with Heated Makeup Air
30508949	Industrial Processes; Mineral Products; Talc Processing; Ground Talc Storage Bin Loading
30508950	Industrial Processes; Mineral Products; Talc Processing; Air Classifier - Size Classification of Ground Talc
30508953	Industrial Processes; Mineral Products; Talc Processing; Pelletizer
30508955	Industrial Processes; Mineral Products; Talc Processing; Pellet Dryer
30508958	Industrial Processes; Mineral Products; Talc Processing; Pneumatic Conveyor Vents
30508961	Industrial Processes; Mineral Products; Talc Processing; Concentration of Talc Fines Using Shaking Table
30508971	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Flash Drying of Slurry after Flotation
30508973	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Flash Drying of Slurry after Flotation
30508982	Industrial Processes; Mineral Products; Talc Processing; Custom Grinding - Additional Size Reduction
30508985	Industrial Processes; Mineral Products; Talc Processing; Final Product Storage Bin Loading
30508988	Industrial Processes; Mineral Products; Talc Processing; Packaging
30509001	Industrial Processes; Mineral Products; Mica; Rotary Dryer
30509002	Industrial Processes; Mineral Products; Mica; Fluid Energy Mill - Grinding
30509101	Industrial Processes; Mineral Products; Sandspar; Rotary Dryer
30509201	Industrial Processes; Mineral Products; Catalyst Manufacturing; Transferring and Handling
30509202	Industrial Processes; Mineral Products; Catalyst Manufacturing; Mixing and Blending
30509203	Industrial Processes; Mineral Products; Catalyst Manufacturing; Reacting
30509204	Industrial Processes; Mineral Products; Catalyst Manufacturing; Drying

30509205	Industrial Processes; Mineral Products; Catalyst Manufacturing; Storage
30510000	Industrial Processes;Mineral Products;Bulk Materials Elevators;undefined
30510001	Industrial Processes; Mineral Products; Bulk Materials Elevators; Unloading
30510002	Industrial Processes; Mineral Products; Bulk Materials Elevators; Loading
30510003	Industrial Processes; Mineral Products; Bulk Materials Elevators; Removal from Bins
30510004	Industrial Processes; Mineral Products; Bulk Materials Elevators; Drying
30510005	Industrial Processes; Mineral Products; Bulk Materials Elevators; Cleaning
30510006	Industrial Processes; Mineral Products; Bulk Materials Elevators; Elevator Legs (Headhouse)
30510007	Industrial Processes; Mineral Products; Bulk Materials Elevators; Tripper (Gallery Belt)
30510100	Industrial Processes;Mineral Products;Bulk Materials Conveyors;undefined
30510101	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Ammonium Sulfate
30510102	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Cement
30510103	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coal
30510104	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coke
30510105	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Limestone
30510106	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Phosphate Rock
30510107	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Scrap Metal
30510108	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Sulfur
30510196	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Chemical: Specify in Comments
30510197	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Fertilizer: Specify in Comments
30510198	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Mineral: Specify in Comments
30510199	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Other Not Classified
30510200	Industrial Processes;Mineral Products;Bulk Materials Storage Bins;undefined
30510201	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Ammonium Sulfate
30510202	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Cement
30510203	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coal
30510204	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coke
30510205	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Limestone
30510206	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Phosphate Rock
30510207	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Scrap Metal
30510208	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sulfur
30510209	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sand
30510296	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Chemical: Specify in Comments
30510297	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Fertilizer: Specify in Comments
30510298	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Mineral: Specify in Comments
30510299	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Other Not Classified
30510301	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Ammonium Sulfate

30510302	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Cement
30510303	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coal
30510304	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coke
30510305	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Limestone
30510306	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Phosphate Rock
30510307	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Scrap Metal
30510308	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sulfur
30510309	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sand
30510310	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fluxes
30510396	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Chemical: Specify in Comments
30510397	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fertilizer: Specify in Comments
30510398	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Mineral: Specify in Comments
30510399	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Other Not Classified
30510401	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Ammonium Sulfate
30510402	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Cement
30510403	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coal
30510404	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coke
30510405	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Limestone
30510406	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Phosphate Rock
30510407	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Scrap Metal
30510408	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Sulfur
30510496	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Chemical: Specify in Comments
30510497	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Fertilizer: Specify in Comments
30510498	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Mineral: Specify in Comments
30510499	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Other Not Classified
30510501	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Ammonium Sulfate
30510502	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Cement
30510503	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coal
30510504	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coke
30510505	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Limestone
30510506	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Phosphate Rock
30510507	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Scrap Metal
30510508	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Sulfur
30510596	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Chemical: Specify in Comments

30510597	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Fertilizer: Specify in Comments
30510598	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Mineral: Specify in Comments
30510599	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Other Not Classified
30510600	Industrial Processes;Mineral Products;Bulk Materials Screening/Size Classification;undefined
30510604	Industrial Processes; Mineral Products; Bulk Materials Screening/Size Classification; Coke
30510708	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Sulfur
30510709	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Bauxite
30510800	Industrial Processes;Mineral Products;Bulk Materials: Grinding/Crushing;undefined
30510808	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Sulfur
30510809	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Bauxite
30515001	Industrial Processes; Mineral Products; Calcining; Raw Material Handling
30515002	Industrial Processes; Mineral Products; Calcining; General
30515003	Industrial Processes; Mineral Products; Calcining; Grinding/Milling
30515004	Industrial Processes; Mineral Products; Calcining; Finished Product Handling
30515005	Industrial Processes; Mineral Products; Calcining; Mixing
30531001	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Fluidized Bed
30531002	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Flash or Suspension
30531003	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Multilouvered
30531004	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Rotary
30531005	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cascade
30531006	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Continuous Carrier
30531007	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screen
30531008	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Unloading
30531009	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Raw Coal Storage
30531010	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Crushing
30531011	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Coal Transfer
30531012	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screening
30531013	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Air Tables
30531014	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cleaned Coal Storage
30531015	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading

30531016	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading: Clean Coal
30531017	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Secondary Crushing
30531090	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Haul Roads: General
30531099	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Other Not Classified
30532001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Primary Crushing
30532002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Secondary Crushing/Screening
30532003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Tertiary Crushing/Screening
30532004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Recrushing/Screening
30532005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Fines Mill
30532006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Miscellaneous Operations: Screen/Convey/Handling
30532007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Open Storage
30532008	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Cut Stone: General
30532009	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Blasting: General
30532010	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532011	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Hauling
30532012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drying
30532013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Bar Grizzlies
30532014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Shaker Screens
30532015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Vibrating Screens
30532016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Revolving Screens
30532017	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Pugmill
30532018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling with Liquid Injection
30532020	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Unloading
30532032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Conveyor

30532033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Front End Loader
30532090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30580001	Industrial Processes; Mineral Products; Equipment Leaks; Equipment Leaks
30582001	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Area Drains
30582002	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Equipment Drains
30582599	Industrial Processes; Mineral Products; Wastewater, Points of Generation; Specify Point of Generation
30588801	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588802	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588803	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588804	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588805	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30590001	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30590002	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Process Heaters
30590003	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Process Heaters
30590005	Industrial Processes; Mineral Products; Fuel Fired Equipment; Liquified Petroleum Gas (LPG): Process Heaters
30590011	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Incinerators
30590012	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Incinerators
30590013	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Incinerators
30590021	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Flares
30590023	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Flares
30599900	Industrial Processes;Mineral Products;Other Not Defined;undefined
30599999	Industrial Processes; Mineral Products; Other Not Defined; Specify in Comments Field

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.

- EPA, 1995: U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors," AP-42, Volume I, Fifth Edition, Research Triangle Park, NC, January 1995.

Other information:

ADMIN_PCT:	0.91%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for pulse-jet cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $6 to $26 per scfm Typical value is $13 per scfm O&M Costs: Range from $5 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$266/ton
CPTON_L:	$42/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $42 to $266 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $117 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co

ELEC_PCT:	15%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.83%
MNTLBR_PCT:	5%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.45%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.91%
RPLMTL_PCT:	3.9%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	87.9%
TINDIR_PCT:	12.1%
UTIL_PCT:	3.59%
WSTDSP_PCT:	51.33%

Summary:

Control Measure Name: Fabric Filter (Pulse Jet Type);(PM10) Ferrous Metals Processing - Iron & Steel Production

Abbreviation: PFFPJMPIS

Description: Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake.

This control applies to iron and steel production operations.

Discussion: Steel normally is produced in either basic oxygen process furnaces or electric arc furnaces. In the basic oxygen process furnace, a mixture of 70 percent molten iron from the blast furnace and 30 percent iron scrap are melted together. Pure oxygen is blown across the top or through the molten steel to oxidize carbon and oxygen impurities, thus removing these from the steel. Basic oxygen process furnaces are large open-mouthed furnaces that can be tilted to accept a charge or to tap the molten steel to a charging ladle for transfer to an ingot mold or continuous caster.

Because basic oxygen furnaces are open, they produce significant uncontrolled particulate emissions, notably during the refining stage when oxygen is being blown. Electric arc furnaces use the current passing between carbon electrodes to heat molten steel, but also use oxy-fuel burners to accelerate the initial melting process. These furnaces are charged largely with scrap iron. Significant emissions occur during charging, when the furnace roof is open, during melting, as the electrodes are lowered into the scrap and the arc is struck, and during tapping, when alloying elements are added to the melt.

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998).

During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake.

There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake.

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known
Pollutant: PM2_5
Equipment Life: 20.0 years
Control Technology: Fabric Filter (Pulse Jet Type)
Source Group: Ferrous Metals Processing - Iron & Steel Production
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremenental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1998	N/A	1998
CPT:		$158		$158
Ref Yr CPT:		$214		$214
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869

Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:				
PM25-PRI				
PM25-PRI				
PM2_5				
PM2_5				
Locale:				
Effective Date:				
2020-01-01 00:00:00.0				
N/A				
2020-01-01 00:00:00.0				
N/A				
Cost Year:				
N/A				
1998				
N/A				
1998				
CPT:				
$158				
$158				
Ref Yr CPT:				
$214				
$214				
Control Efficiency:				
99.5				
99.0				
99.5				
99.0				
Min Emis:				
N/A				
N/A				
N/A				
N/A				
Max Emis:				

N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:

Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	13.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	380.0
Typical Default CPT Factor - O&M	28.0
Typical Default CPT Factor - Annualized	117.0

Affected SCCs:

Code	Description
30300801	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Ore Charging
30300802	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Agglomerate Charging
30300804	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Hi-Silt
30300805	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Low-Silt
30300808	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Crushing and Sizing
30300809	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Removal and Dumping
30300811	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Stockpiles, Coke Breeze, Limestone, Ore Fines
30300812	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Transfer/Handling

30300813	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Windbox
30300814	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Discharge End
30300815	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Breaker
30300816	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Hot Screening
30300817	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cooler
30300818	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cold Screening
30300819	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Process (Combined Code includes 15,16,17,18)
30300820	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Conveyor: Transfer Station
30300821	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unload Ore, Pellets, Limestone, into Blast Furnace
30300822	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Stockpile: Ore, Pellets, Limestone, Coke, Sinter
30300823	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Charge Materials: Transfer/Handling
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300825	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cast House
30300827	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Lump Ore Unloading
30300828	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Local Evacuation
30300829	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Taphole and Trough
30300831	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unpaved Roads: Light Duty Vehicles
30300834	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Paved Roads: All Vehicle Types
30300841	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Flue Dust Unloading
30300842	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blended Ore Unloading
30300899	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); See Comment **
30300901	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Open Hearth Furnace: Stack
30300904	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Arc Furnace: Alloy Steel (Stack)
30300906	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: Electric Arc Furnace
30300907	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: Electric Arc Furnace

30300908	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Arc Furnace: Carbon Steel (Stack)
30300911	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Soaking Pits
30300912	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Grinding
30300915	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal (Iron) Transfer to Steelmaking Furnace
30300916	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: BOF
30300917	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: BOF
30300918	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: Open Hearth
30300919	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: Open Hearth
30300920	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal Desulfurization
30300921	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Unleaded Steel)
30300922	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Continuous Casting
30300923	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Tapping and Dumping
30300924	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Processing
30300925	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Leaded Steel)
30300926	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Induction Furnace
30300927	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Scrap Preheater
30300928	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Argon-oxygen Decarburization
30300929	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Plate Burner/Torch Cutter
30300930	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Q-BOP Melting and Refining
30300931	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Rolling
30300932	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Scarfing
30300933	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Reheat Furnaces
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing
30300935	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Cold Rolling
30300936	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Coating: Tin, Zinc, etc.

30300998	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified
30300999	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	0.91%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS: The costs for pulse-jet cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $6 to $26 per scfm
Typical value is $13 per scfm

O&M Costs:

Range from $5 to $24 per scfm
Typical value is $11 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.0671	$/kW-hr
Compressed air	0.25	$/1000 scf
Dust disposal	25	$/ton disposed

Note: All costs are in 1998 dollars.

CPTON_H: $266/ton

CPTON_L: $42/ton

CPTON_TEXT: When stack flow is available the cost effectiveness varies from $42 to $266 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $117 per ton PM10 reduced. (1998$)

CTRL_EFF_T: 99%

EC: Co

ELEC_PCT: 15%

ELEC_RT: $0.07/kWh

FUEL_PCT: 0%

HG_CE_T: 99%

INSRNC_PCT: 1.83%

MNTLBR_PCT: 5%

MNTLBR_RT: $17.74/hr

MNTMTL_PCT: 0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.45%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.91%
RPLMTL_PCT:	3.9%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	87.9%
TINDIR_PCT:	12.1%
UTIL_PCT:	3.59%
WSTDSP_PCT:	51.33%

Summary:

Control Measure Name:	Fabric Filter (Pulse Jet Type);(PM10) Ferrous Metals Processing - Steel Foundaries
Abbreviation:	PFFPJMPSF
Description:	Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake. This control applies to ferrous metals processing operations, specifically steel foundries. Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998). During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake. There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake. Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Fabric Filter (Pulse Jet Type)
Source Group:	Ferrous Metals Processing - Steel Foundaries
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI

Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	1998	N/A	N/A	1998
CPT:	$144			$144
Ref Yr CPT:	$195			$195
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	0.09000000357627869	N/A	N/A	0.09000000357627869
Discount Rate:	7.0	N/A	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI

PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0
N/A
Cost Year:
1998
N/A
N/A
1998
CPT:
$144
$144
Ref Yr CPT:
$195
$195
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0

Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A
N/A
0.09000000357627869
Discount Rate:
7.0
N/A
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	13.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	380.0
Typical Default CPT Factor - O&M	28.0
Typical Default CPT Factor - Annualized	117.0

Affected SCCs:

Code	Description
30400701	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace
30400702	Industrial Processes; Secondary Metal Production; Steel Foundries; Open Hearth Furnace
30400703	Industrial Processes; Secondary Metal Production; Steel Foundries; Open Hearth Furnace with Oxygen Lance
30400704	Industrial Processes; Secondary Metal Production; Steel Foundries; Heat Treating Furnace
30400705	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Induction Furnace
30400706	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Grinding/Handling
30400707	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400708	Industrial Processes; Secondary Metal Production; Steel Foundries; Pouring/Casting
30400709	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Shakeout
30400710	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Knock Out
30400711	Industrial Processes; Secondary Metal Production; Steel Foundries; Cleaning
30400712	Industrial Processes; Secondary Metal Production; Steel Foundries; Charge Handling
30400713	Industrial Processes; Secondary Metal Production; Steel Foundries; Castings Cooling
30400714	Industrial Processes; Secondary Metal Production; Steel Foundries; Shakeout Machine
30400715	Industrial Processes; Secondary Metal Production; Steel Foundries; Finishing
30400716	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Grinding/Handling
30400717	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400718	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400720	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Dryer

30400721	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Silo
30400722	Industrial Processes; Secondary Metal Production; Steel Foundries; Muller
30400723	Industrial Processes; Secondary Metal Production; Steel Foundries; Conveyors/Elevators
30400724	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Screens
30400725	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Cleaning/Tumblers
30400726	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Cleaning/Chippers
30400730	Industrial Processes; Secondary Metal Production; Steel Foundries; Shell Core Machine
30400731	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Machines/Other
30400732	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace: Baghouse
30400733	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace: Baghouse Dust Handling
30400735	Industrial Processes; Secondary Metal Production; Steel Foundries; Raw Material Unloading
30400736	Industrial Processes; Secondary Metal Production; Steel Foundries; Conveyors/Elevators: Raw Material
30400737	Industrial Processes; Secondary Metal Production; Steel Foundries; Raw Material Silo
30400739	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Centrifugation
30400740	Industrial Processes; Secondary Metal Production; Steel Foundries; Reheating Furnace: Natural Gas
30400741	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Heating
30400742	Industrial Processes; Secondary Metal Production; Steel Foundries; Crucible
30400743	Industrial Processes; Secondary Metal Production; Steel Foundries; Pneumatic Converter Furnace
30400744	Industrial Processes; Secondary Metal Production; Steel Foundries; Ladle
30400745	Industrial Processes; Secondary Metal Production; Steel Foundries; Fugitive Emissions: Furnace
30400760	Industrial Processes; Secondary Metal Production; Steel Foundries; Alloy Feeding
30400765	Industrial Processes; Secondary Metal Production; Steel Foundries; Billet Cutting
30400768	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Handling
30400770	Industrial Processes; Secondary Metal Production; Steel Foundries; Slag Storage Pile
30400775	Industrial Processes; Secondary Metal Production; Steel Foundries; Slag Crushing
30400780	Industrial Processes; Secondary Metal Production; Steel Foundries; Limerock Handling
30400785	Industrial Processes; Secondary Metal Production; Steel Foundries; Roof Monitors - Hot Metal Transfer
30400799	Industrial Processes; Secondary Metal Production; Steel Foundries; Other Not Classified
30400901	Industrial Processes; Secondary Metal Production; Malleable Iron; Annealing
30400999	Industrial Processes; Secondary Metal Production; Malleable Iron; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	0.91%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for pulse-jet cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $6 to $26 per scfm Typical value is $13 per scfm O&M Costs: Range from $5 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$266/ton
CPTON_L:	$42/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $42 to $266 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $117 per ton PM10 reduced. (1998$)

CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	15%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.83%
MNTLBR_PCT:	5%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.45%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.91%
RPLMTL_PCT:	3.9%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	87.9%
TINDIR_PCT:	12.1%
UTIL_PCT:	3.59%
WSTDSP_PCT:	51.33%

Summary:

Control Measure Name: Fabric Filter (Pulse Jet Type); Utility Boilers - Coal - 25 to 99 MW

Abbreviation: PFFPJUBC1

Description: Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams from coal-fired utility boilers. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake.

This control applies to electricity generation sources powered by pulverized dry-bottom and bituminous/subbituminous coal.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998).

During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake.

There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake.

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 15.0 years

Control Technology: Fabric Filter (Pulse Jet Type)

Source Group: Utility Boilers - Coal

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM10-PRI	PM25-PRI	PM25-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	1998	1998
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	5.699999809265137	5.699999809265137	5.699999809265137	5.699999809265137
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM10	PM10	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	5.699999809265137	5.699999809265137	5.699999809265137	5.699999809265137
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM10

PM10
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
N/A
1998
1998
CPT:
Ref Yr CPT:
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:

100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
N/A
N/A
N/A
Discount Rate:
5.699999809265137
5.699999809265137
5.699999809265137
5.699999809265137
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	PM2_5
Cost Year	2011
Capital Cost Multiplier	274.0
Fixed O&M Cost Multiplier	1.0
Variable O&M Cost Multiplier	0.06
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace

10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

References:

- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.

Other information:

Summary:

Control Measure Name: Fabric Filter (Pulse Jet Type); Utility Boilers - Coal - 100 to 299 MW

Abbreviation: PFFPJUBC2

Description: Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams from coal-fired utility boilers. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake.

This control applies to electricity generation sources powered by pulverized dry-bottom and bituminous/subbituminous coal.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998).

During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake.

There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake.

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 15.0 years

Control Technology: Fabric Filter (Pulse Jet Type)

Source Group: Utility Boilers - Coal

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM10-PRI	PM25-PRI	PM25-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	1998	1998
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	5.699999809265137	5.699999809265137	5.699999809265137	5.699999809265137
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM10	PM10	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	5.699999809265137	5.699999809265137	5.699999809265137	5.699999809265137
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM10

PM10
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
N/A
1998
1998
CPT:
Ref Yr CPT:
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:

100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
N/A
N/A
N/A
Discount Rate:
5.699999809265137
5.699999809265137
5.699999809265137
5.699999809265137
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula:
Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	PM2_5
Cost Year	2011
Capital Cost Multiplier	222.0
Fixed O&M Cost Multiplier	0.8
Variable O&M Cost Multiplier	0.06
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom

10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

References:

- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.

Other information:

Summary:

Control Measure Name: Fabric Filter (Pulse Jet Type); Utility Boilers - Coal - 300 to 499 MW

Abbreviation: PFFPJUBC3

Description: Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams from coal-fired utility boilers. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake.

This control applies to electricity generation sources powered by pulverized dry-bottom and bituminous/subbituminous coal.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998).

During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake.

There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake.

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 15.0 years

Control Technology: Fabric Filter (Pulse Jet Type)

Source Group: Utility Boilers - Coal

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM10-PRI	PM25-PRI	PM25-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	1998	1998
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	5.699999809265137	5.699999809265137	5.699999809265137	5.699999809265137
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrementemental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM10	PM10	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	5.699999809265137	5.699999809265137	5.699999809265137	5.699999809265137
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrementemental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM10

PM10
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
N/A
1998
1998
CPT:
Ref Yr CPT:
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:

100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
N/A
N/A
N/A
Discount Rate:
5.699999809265137
5.699999809265137
5.699999809265137
5.699999809265137
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	PM2_5
Cost Year	2011
Capital Cost Multiplier	202.0
Fixed O&M Cost Multiplier	0.7
Variable O&M Cost Multiplier	0.06
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired

10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace
10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All

References:

- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.

Other information:

Summary:

Control Measure Name: Fabric Filter (Pulse Jet Type); Utility Boilers - Coal - 500 to 699 MW

Abbreviation: PFFPJUBC4

Description: Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams from coal-fired utility boilers. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake.

This control applies to electricity generation sources powered by pulverized dry-bottom and bituminous/subbituminous coal.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998).

During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake.

There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake.

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 15.0 years

Control Technology: Fabric Filter (Pulse Jet Type)

Source Group: Utility Boilers - Coal

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM10-PRI	PM25-PRI	PM25-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	1998	1998
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	5.699999809265137	5.699999809265137	5.699999809265137	5.699999809265137
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM10	PM10	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	5.699999809265137	5.699999809265137	5.699999809265137	5.699999809265137
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM10

PM10
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
N/A
1998
1998
CPT:
Ref Yr CPT:
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:

100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
N/A
N/A
N/A
Discount Rate:
5.699999809265137
5.699999809265137
5.699999809265137
5.699999809265137
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 1

Description: EGU

Inventory Fields: design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator

Formula: Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential)
Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000
Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000
CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1]
Annualized Capital Cost = Capital Cost x CRF
Total Cost = Capital Cost x CRF + O&M Cost

Notes:
Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr.
If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent.
Multipliers and exponents are available for a no control baseline and a RACT baseline.
Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	PM2_5
Cost Year	2011
Capital Cost Multiplier	189.0
Fixed O&M Cost Multiplier	0.7
Variable O&M Cost Multiplier	0.06
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace

10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

References:

- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.

Other information:

Summary:

Control Measure Name: Fabric Filter (Pulse Jet Type); Utility Boilers - Over 700 MW

Abbreviation: PFFPJUBC5

Description: Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams from coal-fired utility boilers. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake.

This control applies to electricity generation sources powered by pulverized dry-bottom and bituminous/subbituminous coal.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998).

During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake.

There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake.

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 15.0 years

Control Technology: Fabric Filter (Pulse Jet Type)

Source Group: Utility Boilers - Coal

Sectors: ptipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10-PRI	PM10-PRI	PM25-PRI	PM25-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	1998	1998
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	5.699999809265137	5.699999809265137	5.699999809265137	5.699999809265137
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM10	PM10	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	5.699999809265137	5.699999809265137	5.699999809265137	5.699999809265137
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM10

PM10
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
N/A
1998
1998
CPT:
Ref Yr CPT:
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:

100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
N/A
N/A
N/A
Discount Rate:
5.699999809265137
5.699999809265137
5.699999809265137
5.699999809265137
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 1

Description:	EGU
Inventory Fields:	design_capacity, design_capacity_unit_numerator, design_capacity_unit_denominator
Formula:	Scaling Factor (SF) = (Model Plant boiler capacity / MW) ^ (Scaling Factor Exponential) Capital Cost = TCC x NETDC x SF x 1000 Fixed O&M Cost = OMF x NETDC x 1000 Variable O&M Cost = OMV x NETDC x 1000 x CAPFAC x 8760 /1000 CRF = I x (1+ I) ^ Eq. Life / [(1+ I) ^ Eq. Life - 1] Annualized Capital Cost = Capital Cost x CRF Total Cost = Capital Cost x CRF + O&M Cost Notes: Cost equations are based on capacity in the range of > 0 to < 2000 mmBTU/hr. If capacity is not within range, a cost per ton value is applied. Capital cost equations are in the form of $ = capital multiplier (capacity) ^ capital exponent. Annual costs are in the form of $ = annual multiplier (capacity) ^ annual exponent. Multipliers and exponents are available for a no control baseline and a RACT baseline. Control measure is not applied if boiler capacity is missing.

Variable Name	Value
Pollutant	PM2_5
Cost Year	2011
Capital Cost Multiplier	177.0
Fixed O&M Cost Multiplier	0.6
Variable O&M Cost Multiplier	0.06
Scaling Factor - Model Size (MW)	0.0
Scaling Factor - Exponent	0.0
Capacity Factor	1.0

Affected SCCs:

Code	Description
10100101	External Combustion Boilers; Electric Generation; Anthracite Coal, Pulverized; Boiler
10100201	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Wet Bottom
10100203	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Cyclone Furnace
10100205	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100212	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100217	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100221	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Wet Bottom
10100223	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cyclone Furnace
10100225	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100235	External Combustion Boilers; Electric Generation; Subbituminous Coal; Cell Burner
10100238	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100301	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Wall-fired
10100303	External Combustion Boilers; Electric Generation; Lignite; Cyclone Furnace

10100306	External Combustion Boilers; Electric Generation; Lignite; Boiler, Spreader Stoker
10100317	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Bubbling Bed
10100401	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Normal Firing
10100405	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Normal Firing
10100501	External Combustion Boilers; Electric Generation; Distillate Oil - Grades 1 and 2; Boiler
10100505	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Tangential-fired
10100602	External Combustion Boilers; Electric Generation; Natural Gas; Boiler < 100 Million BTU, except tangential
10102101	External Combustion Boilers; Electric Generation; Other Oil; All
10100102	External Combustion Boilers; Electric Generation; Anthracite Coal; Boiler, Traveling Grate (Overfeed) Stoker
10100202	External Combustion Boilers; Electric Generation; Bituminous Coal, Pulverized; Boiler, Dry Bottom
10100204	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Spreader Stoker
10100211	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Wet Bottom Tangential-fired
10100215	External Combustion Boilers; Electric Generation; Bituminous Coal; Cell Burner
10100218	External Combustion Boilers; Electric Generation; Bituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Circulating Bed
10100222	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom
10100224	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Spreader Stoker
10100226	External Combustion Boilers; Electric Generation; Subbituminous Coal, Pulverized; Boiler, Dry Bottom Tangential-fired
10100237	External Combustion Boilers; Electric Generation; Subbituminous Coal; Boiler, Atmospheric Fluidized Bed Combustion: Bubbling Bed
10100300	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Wet Bottom
10100302	External Combustion Boilers; Electric Generation; Pulverized Lignite; Boiler, Dry Bottom Tangential-fired
10100304	External Combustion Boilers; Electric Generation; Lignite; Boiler, Traveling Grate (Overfeed) Stoker
10100316	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed ** (See 101003-17 & -18)
10100318	External Combustion Boilers; Electric Generation; Lignite; Boiler, Atmospheric Fluidized Bed Combustion - Circulating Bed
10100404	External Combustion Boilers; Electric Generation; Residual Oil - Grade 6; Boiler, Tangential-fired
10100406	External Combustion Boilers; Electric Generation; Residual Oil; Grade 5 Oil: Tangential Firing
10100504	External Combustion Boilers; Electric Generation; Distillate Oil - Grade 4; Boiler, Normal Firing
10100601	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, >= 100 Million BTU/hr
10100604	External Combustion Boilers; Electric Generation; Natural Gas; Boiler, Tangentially Fired

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References:

- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.

Other information:

Summary:

Control Measure Name: Fabric Filter - Reverse-Air Cleaned Type;(PM10) Asphalt Manufacture

Abbreviation: PFFRAASMN

Description: Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection.

This control applies to asphalt manufacturing operations

Discussion: Hot mix asphalt (HMA) paving material is a scientifically proportioned mixture of graded aggregates and asphalt cement. The process of producing involves drying and heating the aggregates to prepare them for the asphalt cement coating.

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000).

The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter - Reverse-Air Cleaned Type

Source Group: Asphalt Manufacture

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.0	99.5

Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	N/A	1998	N/A
CPT:	$365		$365	
Ref Yr CPT:	$495		$495	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A

2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:
1998
N/A
1998
N/A
CPT:
$365
$365
Ref Yr CPT:
$495
$495
Control Efficiency:
99.0
99.5
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton

cpton
Capital Rec Fac:
0.09000000357627869
N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30500100	Industrial Processes;Mineral Products;Asphalt Roofing Manufacture;undefined
30500104	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Felt Saturation: Dipping/Spraying
30500107	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingles and Rolls: Mineral Dryer
30500112	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Spraying Only
30500113	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Dipping/Spraying
30500114	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Asphaltic Felt: Coating
30500115	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Steam Drying Drums
30500116	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Saturation: Dip Saturator, Drying-in Drum, Hot Looper & Coater
30500118	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Saturation: Dip Saturator, Drying-in Drum and Hot Looper
30500119	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Sation:Spray/Dip Satur,Drying-in Drm,Hot Loopr,Coatr & Str Tk
30500120	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Ferric Chloride
30500121	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Mineral Stabilizer
30500130	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Fixed Roof Tank: Asphalt/Breathing Loss
30500131	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Fixed Roof Tank: Working Loss
30500132	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Floating Roof Tank: Standing Loss
30500133	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Floating Roof Tank: Working Loss
30500134	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Blown Saturant Storage
30500135	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Blown Coating Storage
30500140	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Unloading
30500141	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Storage
30500142	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Unloading

30500143	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Storage
30500144	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Transport Screw Conveyor and Bucket Elevator
30500145	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Transport Screw Conveyor and Bucket Elevator
30500146	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Sand Surge Bin
30500147	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Surge Bin
30500150	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust (Filler) and Asphalt Coating Mixer
30500151	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules
30500152	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Sand Applicator
30500153	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Cooling Rolls
30500154	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Finish Floating Looper
30500198	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Other Not Classified
30500199	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; See Comment **
30500200	Industrial Processes;Mineral Products;Asphalt Concrete;undefined
30500201	Industrial Processes; Mineral Products; Asphalt Concrete; Rotary Dryer: Conventional Plant (see 3-05-002-50 to -53 for subtypes)
30500202	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevs, Screens, Bins&Mixer (also see -45 thru -47
30500203	Industrial Processes; Mineral Products; Asphalt Concrete; Storage Piles
30500204	Industrial Processes; Mineral Products; Asphalt Concrete; Cold Aggregate Handling
30500205	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Dryer: Drum Mix Plant (see 3-05-002-55 thru -63 for subtypes)
30500206	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Natural Gas
30500207	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Residual Oil
30500208	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Distillate Oil
30500209	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: LPG
30500210	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Waste Oil
30500211	Industrial Processes; Mineral Products; Asphalt Concrete; Rotary Dryer Conventional Plant with Cyclone ** use 3-05-002-01 w/CTL
30500212	Industrial Processes; Mineral Products; Asphalt Concrete; Heated Asphalt Storage Tanks
30500213	Industrial Processes; Mineral Products; Asphalt Concrete; Storage Silo
30500214	Industrial Processes; Mineral Products; Asphalt Concrete; Truck Load-out
30500215	Industrial Processes; Mineral Products; Asphalt Concrete; In Place Recycling: Propane
30500216	Industrial Processes; Mineral Products; Asphalt Concrete; Cold Aggregate Feed Bins
30500217	Industrial Processes; Mineral Products; Asphalt Concrete; Cold Aggregate Conveyors and Elevators
30500220	Industrial Processes; Mineral Products; Asphalt Concrete; Elevators: Batch Process (also see -45 thru -47 for combos w/scr,bins
30500221	Industrial Processes; Mineral Products; Asphalt Concrete; Elevators: Continuous Process
30500230	Industrial Processes; Mineral Products; Asphalt Concrete; Hot Bins and Screens: Batch Process (also see -45 thru -47 for combos)

30500231	Industrial Processes; Mineral Products; Asphalt Concrete; Hot Bins and Screens: Continuous Process
30500240	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Batch Process (also see -45 thru -47 for combos w/scr,bins
30500241	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Continuous Mix (outside the drum) Process
30500242	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Drum Mix Process ** (use 3-05-002-005 and subtypes)
30500245	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer & NG Rot Dryer
30500246	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer& #2 Oil Rot Dryer
30500247	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevs, Scrns, Bins, Mixer& Waste/Drain/#6 Oil Rot
30500250	Industrial Processes; Mineral Products; Asphalt Concrete; Conventional Continuous Mix (outside of drum) Plant: Rotary Dryer
30500251	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Natural Gas-Fired (also see -45)
30500252	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Oil-Fired (also see -46)
30500253	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Waste/Drain/# 6 Oil-Fired (also see -47
30500255	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas-Fired
30500256	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas, Parallel Flow
30500257	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas, Counterflow
30500258	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired
30500259	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Parallel Flow
30500260	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Counterflow
30500261	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil-Fired
30500262	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Pl: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil, Parallel Flo
30500263	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Pl: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil, Counterflow
30500270	Industrial Processes; Mineral Products; Asphalt Concrete; Yard Emissions: Emissions from asphalt in truck beds
30500298	Industrial Processes; Mineral Products; Asphalt Concrete; Other Not Classified
30500299	Industrial Processes; Mineral Products; Asphalt Concrete; See Comment **

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-

001, Research Triangle Park, NC., October 1998.

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $9 to $84 per scfm Typical value is $34 per scfm O&M Costs: Range from $6 to $27 per scfm Typical value is $13 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)

CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name:	Fabric Filter - Reverse-Air Cleaned Type;(PM10) Mineral Products - Coal Cleaning
Abbreviation:	PFFRAMICC
Description:	Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection. This control applies to coal cleaning at coal mining operations. . Discussion: Coal mining, cleaning and material handling (305010) consists of the preparation and handling of coal to upgrade its value. For the purpose of this study, thermal dryers, pneumatic coal cleaning and truck/vehicle travel are the sources considered. Thermal dryers are used at the end of the series of cleaning operations to remove moisture from coal, thereby reducing freezing problems and weight, and increasing the heating value. The major portion of water is removed by the use of screens, thickeners, and cyclones. The coal is then dried in a thermal dryer. Particulate emissions result from the entrainment of fine coal particles during the thermal drying process (EPA, 1995). Pneumatic coal-cleaning equipment classifies bituminous coal by size or separates bituminous coal from refuse by application of air streams. Fugitive PM emissions result when haul trucks or other vehicles travel on unpaved roads or surfaces. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000). The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Fabric Filter - Reverse-Air Cleaned Type
Source Group:	Mineral Products - Coal Cleaning
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				

Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	1998	1998	N/A
CPT:		$278	$278	
Ref Yr CPT:		$377	$377	
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton	cpton	
Capital Rec Fac:	N/A	0.09000000357627869	0.09000000357627869	N/A
Discount Rate:	N/A	7.0	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5

PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
N/A
2020-01-01 00:00:00.0
Cost Year:
N/A
1998
1998
N/A
CPT:
$278
$278
Ref Yr CPT:
$377
$377
Control Efficiency:
99.5
99.0
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:

100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
0.09000000357627869
N/A
Discount Rate:
N/A
7.0
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30501000	Industrial Processes;Mineral Products;Coal Mining, Cleaning, and Material Handling (See 305310);undefined
30501003	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Multilouvered Dryer
30501005	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Cascade Dryer
30501006	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Continuous Carrier/Conveyor
30501008	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Unloading
30501009	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Raw Coal Storage
30501011	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Transfer
30501013	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Cleaning: Air Table
30501015	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Loading (For Clean Coal Loading USE 30501016)
30501016	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Clean Coal Loading
30501021	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Removal
30501022	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Drilling/Blasting
30501023	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Loading
30501024	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Hauling
30501030	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Topsoil Removal (See also 305010 -33, -35, -36, -37, -42, -45, -48)

30501031	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Scrapers: Travel Mode
30501032	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Topsoil Unloading
30501033	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden (See also 305010 -30, -35, -36, -37, -42, -45, -48)
30501034	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Seam: Drilling
30501035	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Blasting: Coal Overburden
30501036	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Dragline: Overburden Removal
30501037	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Loading: Overburden
30501038	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Loading: Coal
30501039	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Hauling: Haul Trucks
30501040	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: End Dump - Coal
30501041	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: Bottom Dump - Coal
30501042	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: Bottom Dump - Overburden
30501043	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Open Storage Pile: Coal
30501044	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Train Loading: Coal
30501045	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Bulldozing: Overburden
30501046	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Bulldozing: Coal
30501047	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Grading
30501048	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Replacement
30501049	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Wind Erosion: Exposed Areas
30501050	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Vehicle Traffic: Light/Medium Vehicles
30501051	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Open Storage Pile: Spoils
30501060	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Primary Crusher
30501061	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Secondary Crusher
30501062	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Screens
30501090	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Haul Roads: General
30501099	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.
- EPA, 1995: U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors," AP-42, Volume I, Fifth Edition, Research Triangle Park, NC, January 1995.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $9 to $84 per scfm Typical value is $34 per scfm O&M Costs: Range from $6 to $27 per scfm Typical value is $13 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name: Fabric Filter - Reverse-Air Cleaned Type;(PM10) Mineral Products - Cement Manufacture

Abbreviation: PFFRAMICM

Description: Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection.

This control applies to cement manufacturing operations.

Discussion: The largest source of particulate emissions at a cement plant is the kiln used to produce clinker. Cement kilns are rotary kilns, which are slowly rotating refractory-lined steel cylinders inclined slightly from the horizontal. Raw materials are fed into the top end of the kiln and spend several hours traversing the kiln. In wet process kilns (SCC 30500706), the raw materials are fed as a wet slurry. During this time, the raw materials are heated by a flame at the discharge end of the kiln. This heating dries the raw materials, converts limestone to lime, and promotes reaction between and fusion of the separate ingredients to form clinker. Clinker exiting the kiln is fed to a clinker cooler (SCC 30500714) for cooling before storage and further processing (STAPPA/ALAPCO, 1996).

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000).

The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter - Reverse-Air Cleaned Type

Source Group: Mineral Products - Cement Manufacture

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0

Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1998	N/A	1998
CPT:		$254		$254
Ref Yr CPT:		$344		$344
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5

Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
1998
N/A
1998
CPT:
$254
$254
Ref Yr CPT:
$344
$344
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0

100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln
30500607	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Unloading
30500608	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Piles
30500609	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Primary Crushing
30500610	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Secondary Crushing
30500611	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Screening
30500612	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Transfer
30500613	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Grinding and Drying
30500614	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Cooler
30500615	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Piles
30500616	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Transfer
30500617	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Grinding
30500618	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Silos
30500619	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Load Out
30500620	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Predryer
30500621	Industrial Processes; Mineral Products; Cement Manufacturing (Wet or Dry Process); Pulverized Coal Kiln Feed Units
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln
30500624	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Feed Belt

30500625	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Weigh Hopper
30500626	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Air Separator
30500627	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Feed Belt
30500628	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Weigh Hopper
30500629	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Air Separator
30500699	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Other Not Classified
30500706	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Kilns
30500707	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Raw Material Unloading
30500708	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Raw Material Piles
30500709	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Primary Crushing
30500710	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Secondary Crushing
30500711	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Screening
30500712	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Raw Material Transfer
30500714	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Cooler
30500715	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Piles
30500716	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Transfer
30500717	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Grinding
30500718	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Cement Silos
30500719	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Cement Load Out
30500727	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Feed Belt
30500728	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Weigh Hopper
30500729	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Air Separator
30500799	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Other Not Classified

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References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $9 to $84 per scfm Typical value is $34 per scfm O&M Costs: Range from $6 to $27 per scfm Typical value is $13 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0 .0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)

CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name: Fabric Filter - Reverse-Air Cleaned Type;(PM10) Mineral Products - Other

Abbreviation: PFFRAMIOR

Description: Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection.

This control applies to miscellaneous mineral production operations including (but not limited to) brick manufacture, calcium carbide operations, clay and fly ash sintering, concrete batching, gypsum manufacturing, lime production, phosphate rock operations, sand production, fiberglass manufacturing and glass manufacturing operations. Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions.

Discussion: Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions. Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000).

The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter - Reverse-Air Cleaned Type

Source Group: Mineral Products - Other

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				

Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	N/A	1998	N/A
CPT:	$255		$255	
Ref Yr CPT:	$346		$346	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5

PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:
1998
N/A
1998
N/A
CPT:
$255
$255
Ref Yr CPT:
$346
$346
Control Efficiency:
99.0
99.5
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:

100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30500300	Industrial Processes;Mineral Products;Brick Manufacture;undefined
30500301	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Drying
30500302	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Grinding & Screening
30500303	Industrial Processes; Mineral Products; Brick Manufacture; Storage of Raw Materials
30500304	Industrial Processes; Mineral Products; Brick Manufacture; Curing **
30500305	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Handling and Transferring
30500306	Industrial Processes; Mineral Products; Brick Manufacture; Pulverizing
30500307	Industrial Processes; Mineral Products; Brick Manufacture; Calcining
30500308	Industrial Processes; Mineral Products; Brick Manufacture; Screening
30500309	Industrial Processes; Mineral Products; Brick Manufacture; Blending and Mixing
30500310	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Sawdust Fired Tunnel Kilns
30500311	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Tunnel Kilns
30500312	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Tunnel Kilns
30500313	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Tunnel Kilns
30500314	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Periodic Kilns
30500315	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Periodic Kilns
30500316	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Periodic Kilns

30500317	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Unloading
30500318	Industrial Processes; Mineral Products; Brick Manufacture; Tunnel Kiln: Wood-fired
30500319	Industrial Processes; Mineral Products; Brick Manufacture; Transfer and Conveying
30500321	Industrial Processes; Mineral Products; Brick Manufacture; General
30500322	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing High-Sulfur Material
30500330	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Periodic Kiln
30500331	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel Fired Tunnel Kiln
30500332	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Kiln, Other Type
30500333	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Kiln, Other Type
30500334	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Kiln, Other Type
30500335	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Kiln, Other Type
30500340	Industrial Processes; Mineral Products; Brick Manufacture; Primary Crusher
30500342	Industrial Processes; Mineral Products; Brick Manufacture; Extrusion Line
30500350	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat From Kiln Cooling Zone
30500351	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat And Supplemental Gas Burners
30500355	Industrial Processes; Mineral Products; Brick Manufacture; Coal Crushing And Storage System
30500360	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer
30500361	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer: Heated With Exhaust From Sawdust-fired Kiln
30500370	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing Structural Clay Tile
30500397	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500398	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500399	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500401	Industrial Processes; Mineral Products; Calcium Carbide; Electric Furnace: Hoods and Main Stack
30500402	Industrial Processes; Mineral Products; Calcium Carbide; Coke Dryer
30500403	Industrial Processes; Mineral Products; Calcium Carbide; Furnace Room Vents
30500404	Industrial Processes; Mineral Products; Calcium Carbide; Tap Fume Vents
30500405	Industrial Processes; Mineral Products; Calcium Carbide; Primary/Secondary Crushing
30500406	Industrial Processes; Mineral Products; Calcium Carbide; Circular Charging: Conveyor
30500499	Industrial Processes; Mineral Products; Calcium Carbide; Other Not Classified
30500501	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Dryer
30500502	Industrial Processes; Mineral Products; Castable Refractory; Raw Material Crushing/Processing
30500503	Industrial Processes; Mineral Products; Castable Refractory; Electric Arc Melt Furnace
30500504	Industrial Processes; Mineral Products; Castable Refractory; Curing Oven

30500505	Industrial Processes; Mineral Products; Castable Refractory; Molding and Shakeout
30500506	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Calciner
30500507	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Tunnel Kiln
30500508	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Rotary Dryer
30500509	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Tunnel Kiln
30500598	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500599	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln
30500607	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Unloading
30500608	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Piles
30500609	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Primary Crushing
30500610	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Secondary Crushing
30500611	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Screening
30500612	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Transfer
30500613	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Grinding and Drying
30500614	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Cooler
30500615	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Piles
30500616	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Transfer
30500617	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Grinding
30500618	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Silos
30500619	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Load Out
30500620	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Predryer
30500621	Industrial Processes; Mineral Products; Cement Manufacturing (Wet or Dry Process); Pulverized Coal Kiln Feed Units
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln
30500624	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Feed Belt
30500625	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Weigh Hopper
30500626	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Air Separator
30500627	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Feed Belt
30500628	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Weigh Hopper
30500629	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Air Separator
30500699	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Other Not Classified
30500800	Industrial Processes;Mineral Products;Ceramic Clay/Tile Manufacture;undefined

30500801	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying ** (use SCC 3-05-008-13)
30500802	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Comminution - Crushing, Grinding, & Milling
30500803	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Storage
30500804	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Screening and floating ** (use SCC 3-05-008-16)
30500805	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Direct Mixing of Ceramic Powder and Binder Solution
30500806	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Handling and Transfer
30500807	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Grinding, dry ** (use SCC 3-05-008-02)
30500810	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Natural Gas-fired Spray Dryer
30500811	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Infrared (IR) Drying Prior to Firing
30500812	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glazing and firing kiln ** (use SCCs 3-05-008-45 & -50)
30500813	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Convection Drying Prior to Firing
30500816	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Sizing - Vibrating Screens
30500818	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Air Classifier
30500821	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Rotary Calciner
30500822	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Rotary Calciner
30500823	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Fluidized Bed Calciner
30500824	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Fluidized Bed Calciner
30500828	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Mixing - Raw Matls, Binders, Plasticizers, Surfactants, & Other Agent
30500830	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - General
30500831	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - Tape Casters
30500835	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Green Machining-Grindg, Cutg, or Laminatg Formed Ceramics Prior to Fir
30500840	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Natural Gas-fired Kiln
30500841	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Fuel Oil-fired Kiln
30500843	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glaze Preparation - Ballmill or Attrition Mill
30500845	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Ceramic Glaze Spray Booth
30500850	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Natural Gas-fired Kiln
30500854	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Fuel Oil-fired Kiln

30500856	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Refiring Kiln - Refiring after Decal, Paint, or Ink Applied; Natural-g
30500858	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Cooler - Cooling Ceramics Following Firing
30500860	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Grinding and Polishing
30500870	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Annealing
30500880	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Surface Coating
30500899	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Other Not Classified
30500901	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Fly Ash Sintering
30500902	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay/Coke Sintering
30500903	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Natural Clay/Shale Sintering
30500904	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Crushing/Screening
30500905	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Transfer/Conveying
30500906	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Storage Piles
30500907	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Coke Product Crushing/Screening
30500908	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Shale Product Crushing/Screening
30500909	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Clinker Cooling
30500910	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Storage
30500915	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Rotary Kiln
30500916	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Dryer
30500917	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay Reciprocating Grate Clinker Cooler
30500999	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Other Not Classified
30501101	Industrial Processes; Mineral Products; Concrete Batching; Total Facility Emissions except road dust & wind-blown dust
30501104	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Elevated Storage
30501105	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Elevated Storage
30501106	Industrial Processes; Mineral Products; Concrete Batching; Transfer: Sand/Aggregate to Elevated Bins (See Also -04 & -05)
30501107	Industrial Processes; Mineral Products; Concrete Batching; Cement Unloading to Elevated Storage Silo
30501108	Industrial Processes; Mineral Products; Concrete Batching; Weight Hopper Loading of Sand and Aggregate
30501109	Industrial Processes; Mineral Products; Concrete Batching; Mixer Loading of Cement/Sand/Aggregate
30501110	Industrial Processes; Mineral Products; Concrete Batching; Loading of Transit Mix Truck
30501111	Industrial Processes; Mineral Products; Concrete Batching; Loading of Dry-batch Truck
30501112	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Wet

30501113	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Dry
30501114	Industrial Processes; Mineral Products; Concrete Batching; Transferring: Conveyors/Elevators
30501115	Industrial Processes; Mineral Products; Concrete Batching; Storage: Bins/Hoppers
30501117	Industrial Processes; Mineral Products; Concrete Batching; Cement Supplement Unloading to Elevated Storage Silo
30501120	Industrial Processes; Mineral Products; Concrete Batching; Asbestos/Cement Products
30501121	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Delivery to Ground Storage
30501122	Industrial Processes; Mineral Products; Concrete Batching; Sand Delivery to Ground Storage
30501123	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Conveyor
30501124	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Conveyor
30501199	Industrial Processes; Mineral Products; Concrete Batching; Other Not Classified
30501201	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Wool-type Fiber)
30501202	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Wool-type Fiber)
30501203	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Electric Furnace (Wool-type Fiber)
30501204	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Rotary Spun (Wool-type Fiber)
30501205	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven: Rotary Spun (Wool-type Fiber)
30501206	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Cooling (Wool-type Fiber)
30501207	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Wool-type Fiber)
30501208	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Flame Attenuation (Wool-type Fiber)
30501209	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing: Flame Attenuation (Wool-type Fiber)
30501211	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Textile-type Fiber)
30501212	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Textile-type Fiber)
30501213	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Textile-type Fiber)
30501214	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming Process (Textile-type Fiber)
30501215	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven (Textile-type Fiber)
30501221	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Unloading/Conveying
30501222	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Storage Bins
30501223	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Mixing/Weighing
30501224	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Crushing/Charging
30501299	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Other Not Classified
30501301	Industrial Processes; Mineral Products; Frit Manufacture; General ** (use 3-05-013-05 or 3-05-013-06)

30501302	Industrial Processes; Mineral Products; Frit Manufacture; Weighing of raw materials
30501303	Industrial Processes; Mineral Products; Frit Manufacture; Dry Mixing of raw materials
30501304	Industrial Processes; Mineral Products; Frit Manufacture; Smelting Furnace Charging
30501305	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Smelting Furnace
30501306	Industrial Processes; Mineral Products; Frit Manufacture; Continuous Smelting Furnace
30501310	Industrial Processes; Mineral Products; Frit Manufacture; Water Spray Quenching to shatter material into small particles
30501311	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Dryer (usually not used with a continuous furnace)
30501315	Industrial Processes; Mineral Products; Frit Manufacture; Dry Milling of quenched frit with a ball mill
30501316	Industrial Processes; Mineral Products; Frit Manufacture; Product Screening
30501399	Industrial Processes; Mineral Products; Frit Manufacture; Other Not Classified
30501400	Industrial Processes;Mineral Products;Glass Manufacture;undefined
30501401	Industrial Processes; Mineral Products; Glass Manufacture; Furnace/General**
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace
30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace
30501405	Industrial Processes; Mineral Products; Glass Manufacture; Presintering
30501406	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Forming/Finishing
30501407	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Forming/Finishing
30501408	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Forming/Finishing
30501410	Industrial Processes; Mineral Products; Glass Manufacture; Raw Material Handling (All Types of Glass)
30501411	Industrial Processes; Mineral Products; Glass Manufacture; General **
30501412	Industrial Processes; Mineral Products; Glass Manufacture; Hold Tanks **
30501413	Industrial Processes; Mineral Products; Glass Manufacture; Cullet: Crushing/Grinding
30501414	Industrial Processes; Mineral Products; Glass Manufacture; Ground Cullet Beading Furnace
30501415	Industrial Processes; Mineral Products; Glass Manufacture; Glass Etching with Hydrofluoric Acid Solution
30501416	Industrial Processes; Mineral Products; Glass Manufacture; Glass Manufacturing
30501417	Industrial Processes; Mineral Products; Glass Manufacture; Briquetting
30501418	Industrial Processes; Mineral Products; Glass Manufacture; Pelletizing
30501420	Industrial Processes; Mineral Products; Glass Manufacture; Mirror Plating: General
30501421	Industrial Processes; Mineral Products; Glass Manufacture; Demineralizer: General
30501499	Industrial Processes; Mineral Products; Glass Manufacture; See Comment **
30501500	Industrial Processes;Mineral Products;Gypsum Manufacture;undefined
30501501	Industrial Processes; Mineral Products; Gypsum Manufacture; Rotary Ore Dryer
30501502	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Grinder/Roller Mills
30501503	Industrial Processes; Mineral Products; Gypsum Manufacture; Not Classified **

30501504	Industrial Processes; Mineral Products; Gypsum Manufacture; Conveying
30501505	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Crushing: Gypsum Ore
30501506	Industrial Processes; Mineral Products; Gypsum Manufacture; Secondary Crushing: Gypsum Ore
30501507	Industrial Processes; Mineral Products; Gypsum Manufacture; Screening: Gypsum Ore
30501508	Industrial Processes; Mineral Products; Gypsum Manufacture; Stockpile: Gypsum Ore
30501509	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Gypsum Ore
30501510	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Landplaster
30501511	Industrial Processes; Mineral Products; Gypsum Manufacture; Continuous Kettle: Calciner
30501512	Industrial Processes; Mineral Products; Gypsum Manufacture; Flash Calciner
30501513	Industrial Processes; Mineral Products; Gypsum Manufacture; Impact Mill
30501514	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Stucco
30501515	Industrial Processes; Mineral Products; Gypsum Manufacture; Tube/Ball Mills
30501516	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers
30501517	Industrial Processes; Mineral Products; Gypsum Manufacture; Bagging
30501518	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers/Conveyors
30501519	Industrial Processes; Mineral Products; Gypsum Manufacture; Forming Line
30501520	Industrial Processes; Mineral Products; Gypsum Manufacture; Drying Kiln
30501521	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (8 Ft.)
30501522	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (12 Ft.)
30501599	Industrial Processes; Mineral Products; Gypsum Manufacture; See Comment **
30501601	Industrial Processes; Mineral Products; Lime Manufacture; Primary Crushing
30501602	Industrial Processes; Mineral Products; Lime Manufacture; Secondary Crushing/Screening
30501603	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Vertical Kiln
30501604	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Rotary Kiln ** (See SCC Codes 3-05-016-18,-19,-20,-21)
30501605	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Calcimatic Kiln
30501606	Industrial Processes; Mineral Products; Lime Manufacture; Fluidized Bed Kiln
30501607	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Transfer and Conveying
30501608	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Unloading
30501609	Industrial Processes; Mineral Products; Lime Manufacture; Hydrator: Atmospheric
30501610	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Storage Piles
30501611	Industrial Processes; Mineral Products; Lime Manufacture; Product Cooler
30501612	Industrial Processes; Mineral Products; Lime Manufacture; Pressure Hydrator
30501613	Industrial Processes; Mineral Products; Lime Manufacture; Lime Silos
30501614	Industrial Processes; Mineral Products; Lime Manufacture; Packing/Shipping
30501615	Industrial Processes; Mineral Products; Lime Manufacture; Product Transfer and Conveying
30501616	Industrial Processes; Mineral Products; Lime Manufacture; Primary Screening
30501617	Industrial Processes; Mineral Products; Lime Manufacture; Multiple Hearth Calciner
30501618	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Kiln

30501619	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Rotary Kiln
30501620	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Gas-fired Rotary Kiln
30501621	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Coke-fired Rotary Kiln
30501622	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Preheater Kiln
30501623	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Parallel Flow Regenerative Kiln
30501624	Industrial Processes; Mineral Products; Lime Manufacture; Conveyor Transfer - Primary Crushed Material
30501625	Industrial Processes; Mineral Products; Lime Manufacture; Secondary/Tertiary Screening
30501626	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Enclosed Truck
30501627	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Open Truck
30501628	Industrial Processes; Mineral Products; Lime Manufacture; Pulverizing
30501629	Industrial Processes; Mineral Products; Lime Manufacture; Tertiary Screening After Pulverizing
30501630	Industrial Processes; Mineral Products; Lime Manufacture; Screening After Calcination
30501631	Industrial Processes; Mineral Products; Lime Manufacture; Crushing and Pulverizing After Calcinating
30501632	Industrial Processes; Mineral Products; Lime Manufacture; Milling
30501633	Industrial Processes; Mineral Products; Lime Manufacture; Separator After Hydrator
30501640	Industrial Processes; Mineral Products; Lime Manufacture; Vehicle Traffic
30501650	Industrial Processes; Mineral Products; Lime Manufacture; Quarrying Raw Limestone
30501660	Industrial Processes; Mineral Products; Lime Manufacture; Waste Treatment
30501699	Industrial Processes; Mineral Products; Lime Manufacture; See Comment **
30501701	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cupola
30501702	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Reverberatory Furnace
30501703	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Blow Chamber
30501704	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Curing Oven
30501705	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cooler
30501706	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Granulated Products Processing
30501707	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Handling
30501708	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Packaging
30501709	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Batt Application
30501710	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Storage of Oils and Binders
30501711	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Mixing of Oils and Binders
30501799	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Other Not Classified
30501801	Industrial Processes; Mineral Products; Perlite Manufacturing; Vertical Furnace
30501899	Industrial Processes; Mineral Products; Perlite Manufacturing; Other Not Classified
30501901	Industrial Processes; Mineral Products; Phosphate Rock; Drying
30501902	Industrial Processes; Mineral Products; Phosphate Rock; Grinding

30501903	Industrial Processes; Mineral Products; Phosphate Rock; Transfer/Storage
30501904	Industrial Processes; Mineral Products; Phosphate Rock; Open Storage
30501905	Industrial Processes; Mineral Products; Phosphate Rock; Calcining
30501906	Industrial Processes; Mineral Products; Phosphate Rock; Rotary Dryer
30501907	Industrial Processes; Mineral Products; Phosphate Rock; Ball Mill
30501908	Industrial Processes; Mineral Products; Phosphate Rock; Mineral Products Benification
30501999	Industrial Processes; Mineral Products; Phosphate Rock; Other Not Classified
30502101	Industrial Processes; Mineral Products; Salt Mining; General
30502102	Industrial Processes; Mineral Products; Salt Mining; Granulation: Stack Dryer
30502103	Industrial Processes; Mineral Products; Salt Mining; Filtration: Vacuum Filter
30502104	Industrial Processes; Mineral Products; Salt Mining; Crushing
30502105	Industrial Processes; Mineral Products; Salt Mining; Screening
30502106	Industrial Processes; Mineral Products; Salt Mining; Conveying
30502201	Industrial Processes; Mineral Products; Potash Production; Mine: Grinding/Drying
30502299	Industrial Processes; Mineral Products; Potash Production; Other Not Classified
30502401	Industrial Processes; Mineral Products; Magnesium Carbonate; Mine/Process
30502499	Industrial Processes; Mineral Products; Magnesium Carbonate; Other Not Classified
30502500	Industrial Processes;Mineral Products;Construction Sand and Gravel;undefined
30502501	Industrial Processes; Mineral Products; Construction Sand and Gravel; Total Plant: General **
30502502	Industrial Processes; Mineral Products; Construction Sand and Gravel; Aggregate Storage
30502503	Industrial Processes; Mineral Products; Construction Sand and Gravel; Material Transfer and Conveying
30502504	Industrial Processes; Mineral Products; Construction Sand and Gravel; Hauling
30502505	Industrial Processes; Mineral Products; Construction Sand and Gravel; Pile Forming: Stacker
30502506	Industrial Processes; Mineral Products; Construction Sand and Gravel; Bulk Loading
30502507	Industrial Processes; Mineral Products; Construction Sand and Gravel; Storage Piles
30502508	Industrial Processes; Mineral Products; Construction Sand and Gravel; Dryer ** (See 3-05-027-20 thru -24 for Industrial Sand Dryers)
30502509	Industrial Processes; Mineral Products; Construction Sand and Gravel; Cooler ** (See 3-05-027-30 for Industrial Sand Coolers)
30502510	Industrial Processes; Mineral Products; Construction Sand and Gravel; Crushing
30502511	Industrial Processes; Mineral Products; Construction Sand and Gravel; Screening
30502512	Industrial Processes; Mineral Products; Construction Sand and Gravel; Overburden Removal
30502513	Industrial Processes; Mineral Products; Construction Sand and Gravel; Excavating
30502514	Industrial Processes; Mineral Products; Construction Sand and Gravel; Drilling and Blasting
30502522	Industrial Processes; Mineral Products; Construction Sand and Gravel; Rodmilling: Fine Crushing of Construction Sand
30502523	Industrial Processes; Mineral Products; Construction Sand and Gravel; Fine Screening of Construction Sand Following Dewatering or Rodmilling
30502599	Industrial Processes; Mineral Products; Construction Sand and Gravel; Not Classified **
30502601	Industrial Processes; Mineral Products; Diatomaceous Earth; Handling

30502699	Industrial Processes; Mineral Products; Diatomaceous Earth; Other Not Classified
30502701	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Primary Crushing of Raw Material
30502705	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Secondary Crushing
30502709	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Grinding: Size Reduction to 50 Microns or Smaller
30502713	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Screening: Size Classification
30502717	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Draining: Removal of Moisture to About 6% After Froth Flotation
30502720	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas- or Oil-fired Rotary or Fluidized Bed Dryer
30502721	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Rotary Dryer
30502722	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Rotary Dryer
30502723	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Fluidized Bed Dryer
30502724	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Fluidized Bed Dryer
30502730	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Cooling of Dried Sand
30502740	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Final Classifying: Screening to Classify Sand by Size
30502760	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Handling, Transfer, and Storage
30502910	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Rotary Kiln
30502920	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Clinker Cooler
30503099	Industrial Processes; Mineral Products; Ceramic Electric Parts; Other Not Classified
30503101	Industrial Processes; Mineral Products; Asbestos Mining; Surface Blasting
30503102	Industrial Processes; Mineral Products; Asbestos Mining; Surface Drilling
30503103	Industrial Processes; Mineral Products; Asbestos Mining; Cobbing
30503104	Industrial Processes; Mineral Products; Asbestos Mining; Loading
30503105	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Asbestos
30503106	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Waste
30503107	Industrial Processes; Mineral Products; Asbestos Mining; Unloading
30503108	Industrial Processes; Mineral Products; Asbestos Mining; Overburden Stripping
30503109	Industrial Processes; Mineral Products; Asbestos Mining; Ventilation of Process Operations
30503110	Industrial Processes; Mineral Products; Asbestos Mining; Stockpiling
30503111	Industrial Processes; Mineral Products; Asbestos Mining; Tailing Piles
30503199	Industrial Processes; Mineral Products; Asbestos Mining; Other Not Classified
30503201	Industrial Processes; Mineral Products; Asbestos Milling; Crushing
30503202	Industrial Processes; Mineral Products; Asbestos Milling; Drying
30503203	Industrial Processes; Mineral Products; Asbestos Milling; Recrushing
30503204	Industrial Processes; Mineral Products; Asbestos Milling; Screening

30503205	Industrial Processes; Mineral Products; Asbestos Milling; Fiberizing
30503206	Industrial Processes; Mineral Products; Asbestos Milling; Bagging
30503299	Industrial Processes; Mineral Products; Asbestos Milling; Other Not Classified
30503301	Industrial Processes; Mineral Products; Vermiculite; General
30503312	Industrial Processes; Mineral Products; Vermiculite; Screening of Crude Vermiculite Ore
30503319	Industrial Processes; Mineral Products; Vermiculite; Blending of Vermiculite Ore
30503321	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Gas-fired
30503322	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Oil-fired
30503326	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Gas-fired
30503327	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Oil-fired
30503331	Industrial Processes; Mineral Products; Vermiculite; Crushing of Dried Vermiculite Concentrate
30503336	Industrial Processes; Mineral Products; Vermiculite; Screening: Size Classification of Crushed Vermiculite Concentrate
30503341	Industrial Processes; Mineral Products; Vermiculite; Conveying of Vermiculite Concentrate to Storage
30503351	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Gas-fired Vertical Furnace
30503352	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Oil-fired Vertical Furnace
30503361	Industrial Processes; Mineral Products; Vermiculite; Product Grinding: Grinding of Exfoliated Vermiculite
30503366	Industrial Processes; Mineral Products; Vermiculite; Product Classifying: Air Classification of Exfoliated Vermiculite
30503401	Industrial Processes; Mineral Products; Feldspar; Ball Mill
30503402	Industrial Processes; Mineral Products; Feldspar; Dryer
30503501	Industrial Processes; Mineral Products; Abrasive Grain Processing; Primary Crushing
30503502	Industrial Processes; Mineral Products; Abrasive Grain Processing; Secondary Crushing
30503503	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Crushing
30503504	Industrial Processes; Mineral Products; Abrasive Grain Processing; Crushed Grain Screening
30503505	Industrial Processes; Mineral Products; Abrasive Grain Processing; Washing/Drying
30503506	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Screening
30503507	Industrial Processes; Mineral Products; Abrasive Grain Processing; Air Classification
30503601	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Mixing
30503602	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Molding
30503603	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Steam Autoclaving
30503604	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Drying
30503605	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Firing or Curing
30503606	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Cooling
30503607	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Final Machining

30503701	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Printing of Backing
30503702	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Make Coat Application
30503703	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Grain Application
30503704	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Drying
30503705	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Size Coat Application
30503706	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Drying and Curing
30503707	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Roll Winding
30503708	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Production
30503901	Industrial Processes; Mineral Products; Pyrrhotite; Fluid Bed Roaster
30503902	Industrial Processes; Mineral Products; Pyrrhotite; Reduction Kiln
30504001	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Blasting
30504002	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Drilling
30504003	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Cobbing
30504010	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Underground Ventilation
30504020	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Loading
30504021	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Material
30504022	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Waste
30504023	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Unloading
30504024	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Overburden Stripping
30504025	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Stockpiling
30504030	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Primary Crusher
30504031	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Secondary Crusher
30504032	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Concentrator
30504033	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Dryer
30504034	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Screening
30504036	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Tailing Piles
30504099	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Other Not Classified
30504101	Industrial Processes; Mineral Products; Clay processing: Kaolin; Mining
30504102	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material storage
30504103	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material transfer
30504115	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material crushing, NEC
30504119	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material grinding, NEC
30504129	Industrial Processes; Mineral Products; Clay processing: Kaolin; Screening, NEC

30504130	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, rotary dryer
30504131	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, spray dryer
30504132	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, apron dryer
30504133	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, vibrating grate dryer
30504139	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, dryer NEC
30504140	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, rotary calciner
30504141	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, multiple hearth furnace
30504142	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, flash calciner
30504149	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, calciner NEC
30504150	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product grinding
30504151	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product screening/classification
30504160	Industrial Processes; Mineral Products; Clay processing: Kaolin; Bleaching
30504170	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product transfer
30504171	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product storage
30504172	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product packaging
30504201	Industrial Processes; Mineral Products; Clay processing: Ball clay; Mining
30504202	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material storage
30504203	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material transfer
30504215	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material crushing, NEC
30504219	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material grinding, NEC
30504230	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, rotary dryer
30504231	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, spray dryer
30504232	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, apron dryer
30504233	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, vibrating grate dryer
30504239	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, dryer NEC
30504250	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product grinding
30504270	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product transfer
30504271	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product storage
30504272	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product packaging
30504301	Industrial Processes; Mineral Products; Clay processing: Fire clay; Mining
30504302	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material storage
30504303	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material transfer
30504315	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material crushing, NEC
30504319	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material grinding, NEC
30504329	Industrial Processes; Mineral Products; Clay processing: Fire clay; Screening, NEC
30504330	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, rotary dryer
30504331	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, spray dryer
30504332	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, apron dryer

30504333	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, vibrating grate dryer
30504339	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, dryer NEC
30504340	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, rotary calciner
30504341	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, multiple hearth furnace
30504342	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, flash calciner
30504349	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, calciner NEC
30504350	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product grinding
30504351	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product screening/classification
30504370	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product transfer
30504371	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product storage
30504372	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product packaging
30504401	Industrial Processes; Mineral Products; Clay processing: Bentonite; Mining
30504402	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material storage
30504403	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material transfer
30504415	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material crushing, NEC
30504419	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material grinding, NEC
30504430	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, rotary dryer
30504431	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, spray dryer
30504432	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, apron dryer
30504433	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, vibrating grate dryer
30504439	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, dryer NEC
30504450	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product grinding
30504451	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product screening/classification
30504470	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product transfer
30504471	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product storage
30504472	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product packaging
30504501	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Mining
30504502	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material storage
30504503	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material transfer
30504515	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material crushing, NEC
30504519	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material grinding, NEC
30504530	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, rotary dryer
30504531	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, spray dryer
30504532	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, apron dryer
30504533	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, vibrating grate dryer
30504539	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, dryer NEC
30504550	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product grinding

30504551	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product screening/classification
30504570	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product transfer
30504571	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product storage
30504572	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product packaging
30504601	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Mining
30504602	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material storage
30504603	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material transfer
30504615	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material crushing, NEC
30504619	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material grinding, NEC
30504629	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Screening, NEC
30504630	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, rotary dryer
30504631	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, spray dryer
30504632	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, apron dryer
30504633	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, vibrating grate dryer
30504639	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, dryer NEC
30504670	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product transfer
30504671	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product storage
30504672	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product packaging
30505001	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Processing (Blowing)
30505005	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Storage (Prior to Blowing)
30505010	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Blowing Still
30505020	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Natural Gas
30505021	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Residual Oil
30505022	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Distillate Oil
30505023	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: LP Gas
30508906	Industrial Processes; Mineral Products; Talc Processing; Storage of Raw Mined Talc Before Processing
30508908	Industrial Processes; Mineral Products; Talc Processing; Conveyor Transfer of Raw Talc to Primary Crusher
30508909	Industrial Processes; Mineral Products; Talc Processing; Natural Gas Fired Crude Ore Dryer
30508910	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil Fired Crude Ore Dryer

30508911	Industrial Processes; Mineral Products; Talc Processing; Primary crusher
30508912	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Railcar Loading
30508914	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Storage Bin Loading
30508917	Industrial Processes; Mineral Products; Talc Processing; Screening Oversize Ore to Return to Primary Crusher
30508921	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Dryer
30508923	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Dryer
30508931	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Calciner
30508933	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Calciner
30508941	Industrial Processes; Mineral Products; Talc Processing; Rotary Cooler Following Calciner
30508945	Industrial Processes; Mineral Products; Talc Processing; Grinding of Dried Talc
30508947	Industrial Processes; Mineral Products; Talc Processing; Grinding/Drying of Talc with Heated Makeup Air
30508949	Industrial Processes; Mineral Products; Talc Processing; Ground Talc Storage Bin Loading
30508950	Industrial Processes; Mineral Products; Talc Processing; Air Classifier - Size Classification of Ground Talc
30508953	Industrial Processes; Mineral Products; Talc Processing; Pelletizer
30508955	Industrial Processes; Mineral Products; Talc Processing; Pellet Dryer
30508958	Industrial Processes; Mineral Products; Talc Processing; Pneumatic Conveyor Vents
30508961	Industrial Processes; Mineral Products; Talc Processing; Concentration of Talc Fines Using Shaking Table
30508971	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Flash Drying of Slurry after Flotation
30508973	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Flash Drying of Slurry after Flotation
30508982	Industrial Processes; Mineral Products; Talc Processing; Custom Grinding - Additional Size Reduction
30508985	Industrial Processes; Mineral Products; Talc Processing; Final Product Storage Bin Loading
30508988	Industrial Processes; Mineral Products; Talc Processing; Packaging
30509001	Industrial Processes; Mineral Products; Mica; Rotary Dryer
30509002	Industrial Processes; Mineral Products; Mica; Fluid Energy Mill - Grinding
30509101	Industrial Processes; Mineral Products; Sandspar; Rotary Dryer
30509201	Industrial Processes; Mineral Products; Catalyst Manufacturing; Transferring and Handling
30509202	Industrial Processes; Mineral Products; Catalyst Manufacturing; Mixing and Blending
30509203	Industrial Processes; Mineral Products; Catalyst Manufacturing; Reacting
30509204	Industrial Processes; Mineral Products; Catalyst Manufacturing; Drying
30509205	Industrial Processes; Mineral Products; Catalyst Manufacturing; Storage
30510000	Industrial Processes;Mineral Products;Bulk Materials Elevators;undefined
30510001	Industrial Processes; Mineral Products; Bulk Materials Elevators; Unloading
30510002	Industrial Processes; Mineral Products; Bulk Materials Elevators; Loading
30510003	Industrial Processes; Mineral Products; Bulk Materials Elevators; Removal from Bins
30510004	Industrial Processes; Mineral Products; Bulk Materials Elevators; Drying

30510005	Industrial Processes; Mineral Products; Bulk Materials Elevators; Cleaning
30510006	Industrial Processes; Mineral Products; Bulk Materials Elevators; Elevator Legs (Headhouse)
30510007	Industrial Processes; Mineral Products; Bulk Materials Elevators; Tripper (Gallery Belt)
30510100	Industrial Processes;Mineral Products;Bulk Materials Conveyors;undefined
30510101	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Ammonium Sulfate
30510102	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Cement
30510103	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coal
30510104	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coke
30510105	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Limestone
30510106	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Phosphate Rock
30510107	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Scrap Metal
30510108	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Sulfur
30510196	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Chemical: Specify in Comments
30510197	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Fertilizer: Specify in Comments
30510198	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Mineral: Specify in Comments
30510199	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Other Not Classified
30510200	Industrial Processes;Mineral Products;Bulk Materials Storage Bins;undefined
30510201	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Ammonium Sulfate
30510202	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Cement
30510203	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coal
30510204	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coke
30510205	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Limestone
30510206	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Phosphate Rock
30510207	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Scrap Metal
30510208	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sulfur
30510209	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sand
30510296	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Chemical: Specify in Comments
30510297	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Fertilizer: Specify in Comments
30510298	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Mineral: Specify in Comments
30510299	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Other Not Classified
30510301	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Ammonium Sulfate
30510302	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Cement
30510303	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coal
30510304	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coke
30510305	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Limestone
30510306	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Phosphate Rock
30510307	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Scrap Metal

30510308	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sulfur
30510309	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sand
30510310	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fluxes
30510396	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Chemical: Specify in Comments
30510397	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fertilizer: Specify in Comments
30510398	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Mineral: Specify in Comments
30510399	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Other Not Classified
30510401	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Ammonium Sulfate
30510402	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Cement
30510403	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coal
30510404	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coke
30510405	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Limestone
30510406	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Phosphate Rock
30510407	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Scrap Metal
30510408	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Sulfur
30510496	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Chemical: Specify in Comments
30510497	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Fertilizer: Specify in Comments
30510498	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Mineral: Specify in Comments
30510499	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Other Not Classified
30510501	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Ammonium Sulfate
30510502	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Cement
30510503	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coal
30510504	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coke
30510505	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Limestone
30510506	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Phosphate Rock
30510507	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Scrap Metal
30510508	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Sulfur
30510596	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Chemical: Specify in Comments
30510597	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Fertilizer: Specify in Comments
30510598	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Mineral: Specify in Comments
30510599	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Other Not Classified
30510600	Industrial Processes;Mineral Products;Bulk Materials Screening/Size Classification;undefined
30510604	Industrial Processes; Mineral Products; Bulk Materials Screening/Size Classification; Coke
30510708	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Sulfur

30510709	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Bauxite
30510800	Industrial Processes;Mineral Products;Bulk Materials: Grinding/Crushing;undefined
30510808	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Sulfur
30510809	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Bauxite
30515001	Industrial Processes; Mineral Products; Calcining; Raw Material Handling
30515002	Industrial Processes; Mineral Products; Calcining; General
30515003	Industrial Processes; Mineral Products; Calcining; Grinding/Milling
30515004	Industrial Processes; Mineral Products; Calcining; Finished Product Handling
30515005	Industrial Processes; Mineral Products; Calcining; Mixing
30531001	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Fluidized Bed
30531002	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Flash or Suspension
30531003	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Multilouvered
30531004	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Rotary
30531005	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cascade
30531006	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Continuous Carrier
30531007	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screen
30531008	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Unloading
30531009	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Raw Coal Storage
30531010	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Crushing
30531011	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Coal Transfer
30531012	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screening
30531013	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Air Tables
30531014	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cleaned Coal Storage
30531015	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading
30531016	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading: Clean Coal
30531017	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Secondary Crushing
30531090	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Haul Roads: General
30531099	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Other Not Classified

30532001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Primary Crushing
30532002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Secondary Crushing/Screening
30532003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Tertiary Crushing/Screening
30532004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Recrushing/Screening
30532005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Fines Mill
30532006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Miscellaneous Operations: Screen/Convey/Handling
30532007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Open Storage
30532008	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Cut Stone: General
30532009	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Blasting: General
30532010	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532011	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Hauling
30532012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drying
30532013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Bar Grizzlies
30532014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Shaker Screens
30532015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Vibrating Screens
30532016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Revolving Screens
30532017	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Pugmill
30532018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling with Liquid Injection
30532020	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Unloading
30532032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Conveyor
30532033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Front End Loader
30532090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30580001	Industrial Processes; Mineral Products; Equipment Leaks; Equipment Leaks
30582001	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Area Drains
30582002	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Equipment Drains

30582599	Industrial Processes; Mineral Products; Wastewater, Points of Generation; Specify Point of Generation
30588801	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588802	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588803	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588804	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588805	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30590001	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30590002	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Process Heaters
30590003	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Process Heaters
30590005	Industrial Processes; Mineral Products; Fuel Fired Equipment; Liquified Petroleum Gas (LPG): Process Heaters
30590011	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Incinerators
30590012	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Incinerators
30590013	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Incinerators
30590021	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Flares
30590023	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Flares
30599900	Industrial Processes;Mineral Products;Other Not Defined;undefined
30599999	Industrial Processes; Mineral Products; Other Not Defined; Specify in Comments Field

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $9 to $84 per scfm Typical value is $34 per scfm O&M Costs: Range from $6 to $27 per scfm Typical value is $13 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name:	Fabric Filter - Reverse-Air Cleaned Type;(PM10) Non-Ferrous Metals Processing - Aluminum
Abbreviation:	PFFRAMPAM
Description:	Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection. This control applies to aluminum processing and production operations. Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000). The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Fabric Filter - Reverse-Air Cleaned Type
Source Group:	Non-Ferrous Metals Processing - Aluminum
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A

Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	N/A	1998	N/A
CPT:	$247		$247	
Ref Yr CPT:	$335		$335	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
N/A

2020-01-01 00:00:00.0
Cost Year:
1998
N/A
1998
N/A
CPT:
$247
$247
Ref Yr CPT:
$335
$335
Control Efficiency:
99.0
99.5
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton

Capital Rec Fac:
0.09000000357627869
N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30300201	Industrial Processes; Primary Metal Production; Aluminum Hydroxide Calcining; Overall Process
30300199	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Not otherwise classified
30300111	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Anode Bake Furnace Seocndary Emissions
30300110	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Vertical Stud Soderberg Potline Secondary Emission [See also 30300118]
30300109	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Horizontal Stud Soderberg Potline Secondary Emissions
30300108	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Prebake Potline Secondary Emissions [See also 303001 -19 thru -22]
30300107	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Roof Vents
30300106	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Degassing
30300105	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Anode Baking Furnace Primary Emissions
30300104	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Materials Handling [See also 30300123 and 30300125]
30300103	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Vertical Stud Soderberg Potline Primary Emissions
30300102	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Horizontal Stud Soderberg Potline Primary Emissions
30300101	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Prebaked Potline Primary Emissions [See also 303001-13 thru-16]
30300004	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Loading and Unloading
30300003	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Fine Ore Storage
30300002	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Drying Oven
30300001	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Crushing/Handling

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $9 to $84 per scfm Typical value is $34 per scfm O&M Costs: Range from $6 to $27 per scfm Typical value is $13 per scfm Note: All costs are in 1998 dollars.
CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%

MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name: Fabric Filter - Reverse-Air Cleaned Type;(PM10) Ferrous Metals Processing - Coke

Abbreviation: PFFRAMPCE

Description: Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection.

This control applies to by-product coke metal processing operations.

Discussion: By product coke production is used to manufacture metallurgical coke by heating high-grade bituminous coal (low sulfur and low ash) in an enclosed oven chamber without oxygen. The resulting solid material consists of elemental carbon and any minerals (ash) that were present in the coal blend that did not volatilize during the process. Sources of air emissions consist of coke oven doors, coke oven lids and off-takes, coke oven charging, coke oven pushing, coke oven underfire stack, coke quenching, battery venting, and coke by-product-recovery plants.

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000).

The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter - Reverse-Air Cleaned Type

Source Group: Ferrous Metals Processing - Coke

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				

Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1998	N/A	1998
CPT:		$193		$193
Ref Yr CPT:		$262		$262
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:

Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
1998
N/A
1998
CPT:
$193
$193
Ref Yr CPT:
$262
$262
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0

Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:

Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30300399	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Not Classified **
30300361	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Equipment Leaks
30300353	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Naphthalene Processing/Handling
30300352	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Tar Bottom Final Cooler
30300351	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; By-product Coke Manufacturing
30300344	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Wash-oil Circulation Tank
30300343	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Wash Oil Decanter
30300342	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Light Oil Decanter/Condenser Vent
30300341	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Light Oil Sump
30300336	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Tar Storage
30300335	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Tar Interceding Sump
30300333	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Excess-ammonia Liquor Tank
30300332	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Flushing-liquor Circulation Tank
30300331	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; By-product Coke Manufacturing
30300318	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Combustion Stack: Blast Furnace Gas (BFG)
30300317	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Combustion Stack: Coke Oven Gas (COG)
30300316	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Storage Pile

30300315	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Gas By-product Plant
30300314	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Topside Leaks
30300313	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Preheater
30300312	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coke: Crushing/Screening/Handling
30300311	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Screening
30300310	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Crushing
30300309	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Conveying
30300307	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Crushing/Handling
30300306	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Oven Underfiring
30300305	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Unloading
30300303	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Oven Pushing
30300302	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Oven Charging
30300300	Industrial Processes;Primary Metal Production;By-product Coke Manufacturing;undefined

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $9 to $84 per scfm Typical value is $34 per scfm O&M Costs: Range from $6 to $27 per scfm Typical value is $13 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name: Fabric Filter - Reverse-Air Cleaned Type;(PM10) Non-Ferrous Metals Processing - Copper

Abbreviation: PFFRAMPCR

Description: Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection.

This control applies to copper and copper alloy production operations.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000).

The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter - Reverse-Air Cleaned Type

Source Group: Non-Ferrous Metals Processing - Copper

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A

Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	1998	N/A	N/A	1998
CPT:	$204			$204
Ref Yr CPT:	$277			$277
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	0.09000000357627869	N/A	N/A	0.09000000357627869
Discount Rate:	7.0	N/A	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0

N/A
Cost Year:
1998
N/A
N/A
1998
CPT:
$204
$204
Ref Yr CPT:
$277
$277
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton

Capital Rec Fac:
0.09000000357627869
N/A
N/A
0.09000000357627869
Discount Rate:
7.0
N/A
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30300502	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Multiple Hearth Roaster
30300503	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Smelting Furnace after Roaster
30300504	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Converter (All Configurations)
30300505	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fire (Furnace) Refining
30300506	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Ore Concentrate Dryer
30300507	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Smelting Furnace w/ Ore Charge w/o Roasting
30300508	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Refined Metal Finishing Operations
30300509	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluidized Bed Roaster
30300510	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Smelting Furnace
30300511	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electrolytic Refining
30300512	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Flash Smelting
30300513	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Roasting: Fugitive Emissions
30300514	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace: Fugitive Emissions
30300517	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Slag Cleaning Furnace: Fugitive Emissions
30300518	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Converter Slag Return: Fugitive Emissions
30300521	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Noranda Reactor
30300522	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Slag Cleaning Furnace
30300523	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace with Converter
30300524	Industrial Processes; Primary Metal Production; Primary Copper Smelting; AFT MHR+RF/FBR+EF
30300525	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluid Bed Roaster with Reverberatory Furnace and Converter
30300526	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Dryer with Electric Furnace and Cleaning Furnace and Convertor

30300527	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Dryer with Flash Furnace and Converter
30300528	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Norander Reactor and Converter
30300529	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Multiple Hearth Roaster with Reverberatory Furnace and Converter
30300530	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluid Bed Roaster with Electric Furnace and Converter
30300531	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace After Multiple Hearth Roaster
30300532	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace After Fluid Bed Roaster
30300533	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Furnace After Concentrate Dryer
30300534	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Flash Furnace After Concentrate Dryer
30300535	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Furnace After Fluid Bed Roaster
30300541	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Concentrate Dryer Followed by Noranda Reactors and Converter
30300599	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Other Not Classified
30400200	Industrial Processes;Secondary Metal Production;Copper;undefined
30400204	Industrial Processes; Secondary Metal Production; Copper; Electric Induction Furnace
30400207	Industrial Processes; Secondary Metal Production; Copper; Scrap Dryer (Rotary)
30400208	Industrial Processes; Secondary Metal Production; Copper; Wire Burning: Incinerator
30400209	Industrial Processes; Secondary Metal Production; Copper; Sweating Furnace
30400210	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Copper: Cupolas
30400211	Industrial Processes; Secondary Metal Production; Copper; Charge with Insulated Copper Wire: Cupolas
30400212	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Copper And Brass: Cupolas
30400213	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Iron: Cupolas
30400214	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Reverberatory Furnace
30400215	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Reverberatory Furnace
30400216	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Rotary Furnace
30400217	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Rotary Furnace
30400218	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Crucible and Pot Furnace
30400219	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Crucible and Pot Furnace
30400220	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Electric Arc Furnace
30400221	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Electric Arc Furnace
30400223	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Electric Induction

30400224	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Electric Induction
30400230	Industrial Processes; Secondary Metal Production; Copper; Scrap Metal Pretreatment
30400231	Industrial Processes; Secondary Metal Production; Copper; Scrap Dryer
30400232	Industrial Processes; Secondary Metal Production; Copper; Wire Incinerator
30400233	Industrial Processes; Secondary Metal Production; Copper; Sweating Furnace
30400234	Industrial Processes; Secondary Metal Production; Copper; Cupola Furnace
30400235	Industrial Processes; Secondary Metal Production; Copper; Reverberatory Furnace
30400236	Industrial Processes; Secondary Metal Production; Copper; Rotary Furnace
30400237	Industrial Processes; Secondary Metal Production; Copper; Crucible Furnace
30400238	Industrial Processes; Secondary Metal Production; Copper; Electric Induction Furnace
30400239	Industrial Processes; Secondary Metal Production; Copper; Casting Operations
30400240	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Holding Furnace
30400241	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Holding Furnace
30400242	Industrial Processes; Secondary Metal Production; Copper; Charge with Other Alloy (7%): Reverberatory Furnace
30400243	Industrial Processes; Secondary Metal Production; Copper; Charge with High Lead Alloy (58%): Reverberatory Furnace
30400244	Industrial Processes; Secondary Metal Production; Copper; Charge with Red/Yellow Brass: Reverberatory Furnace
30400250	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Converter
30400251	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Converter
30400299	Industrial Processes; Secondary Metal Production; Copper; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $9 to $84 per scfm Typical value is $34 per scfm O&M Costs: Range from $6 to $27 per scfm Typical value is $13 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name: Fabric Filter - Reverse-Air Cleaned Type;(PM10) Ferrous Metals Processing - Ferroalloy Production

Abbreviation: PFFRAMPFP

Description: Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection.

This control applies to ferroalloy production operations, including (but not limited to) several processes within this industry were selected for control, basic oxygen process furnace (SCC 30300914) and EAF argon O2 decarb vessels (SCC 30300928).

Discussion: Steel normally is produced in either basic oxygen process furnaces or electric arc furnaces. In the basic oxygen process furnace, a mixture of 70 percent molten iron from the blast furnace and 30 percent iron scrap are melted together. Pure oxygen is blown across the top or through the molten steel to oxidize carbon and oxygen impurities, thus removing these from the steel. Basic oxygen process furnaces are large open-mouthed furnaces that can be tilted to accept a charge or to tap the molten steel to a charging ladle for transfer to an ingot mold or continuous caster.

Because basic oxygen furnaces are open, they produce significant uncontrolled particulate emissions, notably during the refining stage when oxygen is being blown. Electric arc furnaces use the current passing between carbon electrodes to heat molten steel, but also use oxy-fuel burners to accelerate the initial melting process. These furnaces are charged largely with scrap iron. Significant emissions occur during charging, when the furnace roof is open, during melting, as the electrodes are lowered into the scrap and the arc is struck, and during tapping, when alloying elements are added to the melt.

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000).

The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter - Reverse-Air Cleaned Type

Source Group: Ferrous Metals Processing - Ferroalloy Production

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	1998	1998	N/A
CPT:		$228	$228	
Ref Yr CPT:		$309	$309	
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton	cpton	
Capital Rec Fac:	N/A	0.09000000357627869	0.09000000357627869	N/A
Discount Rate:	N/A	7.0	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
N/A
2020-01-01 00:00:00.0
Cost Year:
N/A
1998
1998
N/A
CPT:
$228
$228
Ref Yr CPT:
$309
$309
Control Efficiency:
99.5
99.0
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0

100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
0.09000000357627869
N/A
Discount Rate:
N/A
7.0
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30300601	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 50% FeSi
30300602	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 75% FeSi
30300603	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 90% FeSi
30300604	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: Silicon Metal
30300605	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: Silicomanaganese
30300606	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 80% Ferromanganese
30300607	Industrial Processes; Primary Metal Production; Ferroalloy Production; Open Electric Smelting Furnace: 80% Ferrochromium
30300608	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Unloading
30300609	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Crushing
30300610	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ore Screening
30300611	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ore Dryer
30300613	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Storage
30300614	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Transfer
30300615	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ferromanganese: Blast Furnace

30300616	Industrial Processes; Primary Metal Production; Ferroalloy Production; Ferrosilicon: Blast Furnace
30300617	Industrial Processes; Primary Metal Production; Ferroalloy Production; Cast House
30300618	Industrial Processes; Primary Metal Production; Ferroalloy Production; Mix House/Weighing
30300619	Industrial Processes; Primary Metal Production; Ferroalloy Production; Raw Material Charging
30300620	Industrial Processes; Primary Metal Production; Ferroalloy Production; Tapping
30300621	Industrial Processes; Primary Metal Production; Ferroalloy Production; Casting
30300622	Industrial Processes; Primary Metal Production; Ferroalloy Production; Cooling
30300623	Industrial Processes; Primary Metal Production; Ferroalloy Production; Product Crushing
30300624	Industrial Processes; Primary Metal Production; Ferroalloy Production; Product Storage
30300625	Industrial Processes; Primary Metal Production; Ferroalloy Production; Product Loading
30300651	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Ferromanganese: Electric Arc Furnace
30300652	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Ferrochromium: Electric Arc Furnace
30300653	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Ferrochromium Silicon: Electric Arc Furnace
30300654	Industrial Processes; Primary Metal Production; Ferroalloy Production; Sealed Furnace: Other Alloys
30300699	Industrial Processes; Primary Metal Production; Ferroalloy Production; Other Not Classified
30300701	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Ferromanganese
30300702	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Other Alloys
30300703	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Ferrochromium
30300704	Industrial Processes; Primary Metal Production; Ferroalloy Production; Semi-covered Electric Arc Furnace: Ferrochromium Silicon

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5

CHEM_PCT:	0%
COST_BASIS:	The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $9 to $84 per scfm Typical value is $34 per scfm O&M Costs: Range from $6 to $27 per scfm Typical value is $13 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	0.04%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name:	Fabric Filter - Reverse-Air Cleaned Type;(PM10) Ferrous Metals Processing - Gray Iron Foundaries
Abbreviation:	PFFRAMPGI
Description:	Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection. This control applies to gray iron foundry operations. Discussion: Grey iron is an alloy of iron, carbon, and silicon, containing a higher percentage of the last two elements than found in malleable iron. The high strengths are obtained by the proper adjustment of the carbon and silicon contents or by alloying. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000). The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Fabric Filter - Reverse-Air Cleaned Type
Source Group:	Ferrous Metals Processing - Gray Iron Foundaries
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5

Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1998	N/A	1998
CPT:		$202		$202
Ref Yr CPT:		$274		$274
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0

N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
1998
N/A
1998
CPT:
$202
$202
Ref Yr CPT:
$274
$274
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:

cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30400300	Industrial Processes;Secondary Metal Production;Grey Iron Foundries;undefined
30400301	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Cupola
30400302	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Reverberatory Furnace
30400303	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Electric Induction Furnace
30400304	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Electric Arc Furnace
30400305	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Annealing Operation
30400310	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Inoculation
30400314	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Scrap Metal Preheating
30400315	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Charge Handling
30400316	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Tapping
30400317	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring Ladle
30400318	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring, Cooling
30400319	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Making, Baking
30400320	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring/Casting
30400321	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Magnesium Treatment
30400322	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Refining
30400325	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Castings Cooling
30400330	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Miscellaneous Casting-Fabricating **
30400331	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Shakeout
30400332	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Knock Out
30400333	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Shakeout Machine
30400340	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Grinding/Cleaning

30400341	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Cleaning/Tumblers
30400342	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Cleaning/Chippers
30400350	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Grinding/Handling
30400351	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400352	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Grinding/Handling
30400353	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400354	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400355	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Dryer
30400356	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Silo
30400357	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Conveyors/Elevators
30400358	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Screens
30400360	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Castings Finishing
30400370	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Shell Core Machine
30400371	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Machines/Other
30400398	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Other Not Classified
30400399	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $9 to $84 per scfm Typical value is $34 per scfm O&M Costs: Range from $6 to $27 per scfm Typical value is $13 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name: Fabric Filter - Reverse-Air Cleaned Type;(PM10) Ferrous Metals Processing - Iron & Steel Production

Abbreviation: PFFRAMPIS

Description: Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection.

This control applies to iron and steel production operations.

Discussion: Steel normally is produced in either basic oxygen process furnaces or electric arc furnaces. In the basic oxygen process furnace, a mixture of 70 percent molten iron from the blast furnace and 30 percent iron scrap are melted together. Pure oxygen is blown across the top or through the molten steel to oxidize carbon and oxygen impurities, thus removing these from the steel. Basic oxygen process furnaces are large open-mouthed furnaces that can be tilted to accept a charge or to tap the molten steel to a charging ladle for transfer to an ingot mold or continuous caster.

Because basic oxygen furnaces are open, they produce significant uncontrolled particulate emissions, notably during the refining stage when oxygen is being blown. Electric arc furnaces use the current passing between carbon electrodes to heat molten steel, but also use oxy-fuel burners to accelerate the initial melting process. These furnaces are charged largely with scrap iron. Significant emissions occur during charging, when the furnace roof is open, during melting, as the electrodes are lowered into the scrap and the arc is struck, and during tapping, when alloying elements are added to the melt.

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000).

The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter - Reverse-Air Cleaned Type

Source Group: Ferrous Metals Processing - Iron & Steel Production

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1998	N/A	1998
CPT:		$200		$200
Ref Yr CPT:		$271		$271
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI

PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
1998
N/A
1998
CPT:
$200
$200
Ref Yr CPT:
$271
$271
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0

100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrementental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30300801	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Ore Charging
30300802	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Agglomerate Charging
30300804	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Hi-Silt
30300805	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Low-Silt
30300808	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Crushing and Sizing
30300809	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Removal and Dumping
30300811	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Stockpiles, Coke Breeze, Limestone, Ore Fines
30300812	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Transfer/Handling
30300813	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Windbox
30300814	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Discharge End
30300815	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Breaker
30300816	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Hot Screening

30300817	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cooler
30300818	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cold Screening
30300819	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Process (Combined Code includes 15,16,17,18)
30300820	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Conveyor: Transfer Station
30300821	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unload Ore, Pellets, Limestone, into Blast Furnace
30300822	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Stockpile: Ore, Pellets, Limestone, Coke, Sinter
30300823	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Charge Materials: Transfer/Handling
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300825	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cast House
30300827	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Lump Ore Unloading
30300828	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Local Evacuation
30300829	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Taphole and Trough
30300831	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unpaved Roads: Light Duty Vehicles
30300834	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Paved Roads: All Vehicle Types
30300841	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Flue Dust Unloading
30300842	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blended Ore Unloading
30300899	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); See Comment **
30300901	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Open Hearth Furnace: Stack
30300904	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Arc Furnace: Alloy Steel (Stack)
30300906	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: Electric Arc Furnace
30300907	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: Electric Arc Furnace
30300908	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Arc Furnace: Carbon Steel (Stack)
30300911	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Soaking Pits
30300912	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Grinding
30300915	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal (Iron) Transfer to Steelmaking Furnace

30300916	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: BOF
30300917	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: BOF
30300918	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: Open Hearth
30300919	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: Open Hearth
30300920	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal Desulfurization
30300921	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Unleaded Steel)
30300922	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Continuous Casting
30300923	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Tapping and Dumping
30300924	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Processing
30300925	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Leaded Steel)
30300926	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Induction Furnace
30300927	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Scrap Preheater
30300928	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Argon-oxygen Decarburization
30300929	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Plate Burner/Torch Cutter
30300930	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Q-BOP Melting and Refining
30300931	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Rolling
30300932	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Scarfing
30300933	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Reheat Furnaces
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing
30300935	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Cold Rolling
30300936	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Coating: Tin, Zinc, etc.
30300998	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified
30300999	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT: 1.46%

CE_TEXT: 99% from uncontrolled for both PM10 and PM2.5

CHEM_PCT: 0%

COST_BASIS: The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $9 to $84 per scfm
Typical value is $34 per scfm

O&M Costs:

Range from $6 to $27 per scfm
Typical value is $13 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.0671	$/kW-hr
Compressed air	0.25	$/1000 scf
Dust disposal	25	$/ton disposed

Note: All costs are in 1998 dollars.

CPTON_H: $337/ton

CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name: Fabric Filter - Reverse-Air Cleaned Type;(PM10) Non-Ferrous Metals Processing - Lead

Abbreviation: PFFRAMPLD

Description: Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection.

This control applies to lead processing and production applications.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000).

The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter - Reverse-Air Cleaned Type

Source Group: Non-Ferrous Metals Processing - Lead

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A

Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	1998	1998	N/A
CPT:		$428	$428	
Ref Yr CPT:		$580	$580	
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton	cpton	
Capital Rec Fac:	N/A	0.09000000357627869	0.09000000357627869	N/A
Discount Rate:	N/A	7.0	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
N/A

2020-01-01 00:00:00.0
Cost Year:
N/A
1998
1998
N/A
CPT:
$428
$428
Ref Yr CPT:
$580
$580
Control Efficiency:
99.5
99.0
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton

Capital Rec Fac:
N/A
0.09000000357627869
0.09000000357627869
N/A
Discount Rate:
N/A
7.0
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30301001	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Single Stream
30301002	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Operation
30301003	Industrial Processes; Primary Metal Production; Lead Production; Dross Reverberatory Furnace
30301004	Industrial Processes; Primary Metal Production; Lead Production; Ore Crushing
30301005	Industrial Processes; Primary Metal Production; Lead Production; Materials Handling (Includes 11, 12, 13, 04, 14)
30301006	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Dual Stream Feed End
30301007	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Dual Stream Discharge End
30301008	Industrial Processes; Primary Metal Production; Lead Production; Slag Fume Furnace
30301009	Industrial Processes; Primary Metal Production; Lead Production; Lead Drossing
30301010	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Crushing and Grinding
30301011	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Unloading
30301012	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Storage Piles
30301013	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Transfer
30301014	Industrial Processes; Primary Metal Production; Lead Production; Sintering Charge Mixing
30301015	Industrial Processes; Primary Metal Production; Lead Production; Sinter Crushing/Screening
30301016	Industrial Processes; Primary Metal Production; Lead Production; Sinter Transfer
30301017	Industrial Processes; Primary Metal Production; Lead Production; Sinter Fines Return Handling
30301018	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Charging
30301019	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Tapping (Metal and Slag)
30301020	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Lead Pouring
30301021	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Slag Pouring
30301022	Industrial Processes; Primary Metal Production; Lead Production; Lead Refining/Silver Retort
30301023	Industrial Processes; Primary Metal Production; Lead Production; Lead Casting
30301024	Industrial Processes; Primary Metal Production; Lead Production; Reverberatory or Kettle Softening

30301025	Industrial Processes; Primary Metal Production; Lead Production; Sinter Machine Leakage
30301026	Industrial Processes; Primary Metal Production; Lead Production; Sinter Dump Area
30301027	Industrial Processes; Primary Metal Production; Lead Production; Vacuum Distillation
30301028	Industrial Processes; Primary Metal Production; Lead Production; Tetrahedrite Dryer
30301029	Industrial Processes; Primary Metal Production; Lead Production; Sinter Machine (Weak Gas)
30301030	Industrial Processes; Primary Metal Production; Lead Production; Sinter Storage
30301031	Industrial Processes; Primary Metal Production; Lead Production; Speiss Pit
30301032	Industrial Processes; Primary Metal Production; Lead Production; Ore Screening
30301099	Industrial Processes; Primary Metal Production; Lead Production; Other Not Classified
30400401	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace
30400402	Industrial Processes; Secondary Metal Production; Lead; Reverberatory Furnace
30400403	Industrial Processes; Secondary Metal Production; Lead; Blast Furnace (Cupola)
30400404	Industrial Processes; Secondary Metal Production; Lead; Rotary Sweating Furnace
30400405	Industrial Processes; Secondary Metal Production; Lead; Reverberatory Sweating Furnace
30400406	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace Heater: Distillate Oil
30400407	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace Heater: Natural Gas
30400408	Industrial Processes; Secondary Metal Production; Lead; Barton Process Reactor (Oxidation Kettle)
30400409	Industrial Processes; Secondary Metal Production; Lead; Casting
30400410	Industrial Processes; Secondary Metal Production; Lead; Battery Breaking
30400411	Industrial Processes; Secondary Metal Production; Lead; Scrap Crushing
30400412	Industrial Processes; Secondary Metal Production; Lead; Sweating Furnace: Fugitive Emissions
30400413	Industrial Processes; Secondary Metal Production; Lead; Smelting Furnace: Fugitive Emissions
30400414	Industrial Processes; Secondary Metal Production; Lead; Kettle Refining: Fugitive Emissions
30400415	Industrial Processes; Secondary Metal Production; Lead; Agglomeration Furnace
30400416	Industrial Processes; Secondary Metal Production; Lead; Furnace Charging
30400417	Industrial Processes; Secondary Metal Production; Lead; Furnace Lead/Slagtapping
30400418	Industrial Processes; Secondary Metal Production; Lead; Electric Furnace
30400419	Industrial Processes; Secondary Metal Production; Lead; Raw Material Dryer
30400420	Industrial Processes; Secondary Metal Production; Lead; Raw Material Unloading
30400421	Industrial Processes; Secondary Metal Production; Lead; Raw Material Transfer/Conveying
30400422	Industrial Processes; Secondary Metal Production; Lead; Raw Material Storage Pile
30400423	Industrial Processes; Secondary Metal Production; Lead; Slag Breaking
30400424	Industrial Processes; Secondary Metal Production; Lead; Size Separation
30400425	Industrial Processes; Secondary Metal Production; Lead; Casting: Fugitive Emissions
30400426	Industrial Processes; Secondary Metal Production; Lead; Kettle Refining
30400499	Industrial Processes; Secondary Metal Production; Lead; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:

The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $9 to $84 per scfm
Typical value is $34 per scfm

O&M Costs:

Range from $6 to $27 per scfm
Typical value is $13 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.0671	$/kW-hr
Compressed air	0.25	$/1000 scf
Dust disposal	25	$/ton disposed

Note: All costs are in 1998 dollars.

CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name: Fabric Filter - Reverse-Air Cleaned Type;(PM10) Non-Ferrous Metals Processing - Other

Abbreviation: PFFRAMPOR

Description: Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection.

This control applies to miscellaneous non-ferrous metals processing operations, including molybdenum, titanium, gold, barium ore, lead battery, magnesium, nickel, electrode manufacture and metal heat treating operations.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000).

The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Fabric Filter - Reverse-Air Cleaned Type

Source Group: Non-Ferrous Metals Processing - Other

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A

Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	1998	N/A	N/A	1998
CPT:	$208			$208
Ref Yr CPT:	$282			$282
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	0.09000000357627869	N/A	N/A	0.09000000357627869
Discount Rate:	7.0	N/A	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0

2020-01-01 00:00:00.0
N/A
Cost Year:
1998
N/A
N/A
1998
CPT:
$208
$208
Ref Yr CPT:
$282
$282
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton

cpton
Capital Rec Fac:
0.09000000357627869
N/A
N/A
0.09000000357627869
Discount Rate:
7.0
N/A
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30301101	Industrial Processes; Primary Metal Production; Molybdenum; Mining: General
30301102	Industrial Processes; Primary Metal Production; Molybdenum; Milling: General
30301199	Industrial Processes; Primary Metal Production; Molybdenum; Other Not Classified
30301201	Industrial Processes; Primary Metal Production; Titanium; Chlorination
30301202	Industrial Processes; Primary Metal Production; Titanium; Drying Titanium Sand Ore (Cyclone Exit)
30301299	Industrial Processes; Primary Metal Production; Titanium; Other Not Classified
30301301	Industrial Processes; Primary Metal Production; Gold Processing; General Processes
30301302	Industrial Processes; Primary Metal Production; Gold Processing; Fines Crushing
30301401	Industrial Processes; Primary Metal Production; Barium Ore Processing; Ore Grinding
30301402	Industrial Processes; Primary Metal Production; Barium Ore Processing; Reduction Kiln
30301403	Industrial Processes; Primary Metal Production; Barium Ore Processing; Dryers/Calciners
30301499	Industrial Processes; Primary Metal Production; Barium Ore Processing; Other Not Classified
30400501	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process **
30400502	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Casting Furnace **
30400503	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixer **
30400504	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation **
30400505	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process
30400506	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Casting
30400507	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixing
30400508	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Oxide Mill (Baghouse Outlet)
30400509	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation
30400510	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Reclaiming Furnace
30400511	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Small Parts Casting
30400512	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Formation

30400513	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Barton Process: Oxidation Kettle
30400521	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process
30400522	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Casting
30400523	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixing
30400524	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Oxide Mill (Baghouse Outlet)
30400525	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation
30400526	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Reclaiming Furnace
30400527	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Small Parts Casting
30400528	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Formation
30400529	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Cast/Paste Mix: Combined Operation
30400530	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mix/Lead Charge: Combined Operation
30400531	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Wash and Paint
30400599	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Other Not Classified
30400601	Industrial Processes; Secondary Metal Production; Magnesium; Pot Furnace
30400602	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process
30400605	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Neutralization Tank
30400606	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: HCl Absorbers
30400607	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Evaporator
30400608	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Filtering/Concentration
30400609	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Shelf Dryer
30400610	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Rotary Dryer
30400611	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Prilling
30400612	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Granule Storage Tanks
30400613	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Electrolysis
30400614	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Regenerative Furnaces
30400630	Industrial Processes; Secondary Metal Production; Magnesium; Natural Lead Industrial (NLI) Brine Process
30400635	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: MgCl2 Melt/Purification
30400636	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: 2nd Vessel, Further Purification
30400637	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: Electrolysis

30400650	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process
30400655	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Purification II
30400656	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Electrolysis
30400660	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Chlorine Recovery
30400699	Industrial Processes; Secondary Metal Production; Magnesium; Other Not Classified
30401001	Industrial Processes; Secondary Metal Production; Nickel; Flux Furnace
30401002	Industrial Processes; Secondary Metal Production; Nickel; Mixing/Blending/Grinding/Screening
30401004	Industrial Processes; Secondary Metal Production; Nickel; Heat Treat Furnace
30401005	Industrial Processes; Secondary Metal Production; Nickel; Induction Furnace (Inlet Air)
30401006	Industrial Processes; Secondary Metal Production; Nickel; Induction Furnace (Under Vacuum)
30401007	Industrial Processes; Secondary Metal Production; Nickel; Electric Arc Furnace with Carbon Electrode
30401008	Industrial Processes; Secondary Metal Production; Nickel; Electric Arc Furnace
30401010	Industrial Processes; Secondary Metal Production; Nickel; Finishing: Pickling/Neutralizing
30401011	Industrial Processes; Secondary Metal Production; Nickel; Finishing: Grinding
30401015	Industrial Processes; Secondary Metal Production; Nickel; Multiple Hearth Roaster
30401016	Industrial Processes; Secondary Metal Production; Nickel; Converters
30401017	Industrial Processes; Secondary Metal Production; Nickel; Reverberatory Furnace
30401018	Industrial Processes; Secondary Metal Production; Nickel; Electric Furnace
30401019	Industrial Processes; Secondary Metal Production; Nickel; Sinter Machine
30401061	Industrial Processes; Secondary Metal Production; Nickel; Roasting: Fugitive Emissions
30401062	Industrial Processes; Secondary Metal Production; Nickel; Reverberatory Furnace: Fugitive Emissions
30401063	Industrial Processes; Secondary Metal Production; Nickel; Converter: Fugitive Emissions
30401099	Industrial Processes; Secondary Metal Production; Nickel; Other Not Classified
30402001	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Calcination
30402002	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Mixing
30402003	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Pitch Treating
30402004	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Bake Furnaces
30402005	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Grafitization of Coal by Heating Process
30402099	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Other Not Classified
30402201	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Furnace: General
30402210	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Quench Bath
30402211	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Quenching

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:

The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from \$9 to \$84 per scfm
Typical value is \$34 per scfm

O&M Costs:

Range from \$6 to \$27 per scfm
Typical value is \$13 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.0671	\$/kW-hr
Compressed air	0.25	\$/1000 scf
Dust disposal	25	\$/ton disposed

Note: All costs are in 1998 dollars.

CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name:	Fabric Filter - Reverse-Air Cleaned Type;(PM10) Ferrous Metals Processing - Steel Foundaries
Abbreviation:	PFFRAMPSF
Description:	Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection. This control applies to ferrous metals processing operations, specifically steel foundries. Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000). The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Fabric Filter - Reverse-Air Cleaned Type
Source Group:	Ferrous Metals Processing - Steel Foundaries
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A

Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	N/A	1998	N/A
CPT:	$183		$183	
Ref Yr CPT:	$248		$248	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
N/A

2020-01-01 00:00:00.0
Cost Year:
1998
N/A
1998
N/A
CPT:
$183
$183
Ref Yr CPT:
$248
$248
Control Efficiency:
99.0
99.5
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton

Capital Rec Fac:
0.09000000357627869
N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30400701	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace
30400702	Industrial Processes; Secondary Metal Production; Steel Foundries; Open Hearth Furnace
30400703	Industrial Processes; Secondary Metal Production; Steel Foundries; Open Hearth Furnace with Oxygen Lance
30400704	Industrial Processes; Secondary Metal Production; Steel Foundries; Heat Treating Furnace
30400705	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Induction Furnace
30400706	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Grinding/Handling
30400707	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400708	Industrial Processes; Secondary Metal Production; Steel Foundries; Pouring/Casting
30400709	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Shakeout
30400710	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Knock Out
30400711	Industrial Processes; Secondary Metal Production; Steel Foundries; Cleaning
30400712	Industrial Processes; Secondary Metal Production; Steel Foundries; Charge Handling
30400713	Industrial Processes; Secondary Metal Production; Steel Foundries; Castings Cooling
30400714	Industrial Processes; Secondary Metal Production; Steel Foundries; Shakeout Machine
30400715	Industrial Processes; Secondary Metal Production; Steel Foundries; Finishing
30400716	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Grinding/Handling
30400717	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400718	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400720	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Dryer
30400721	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Silo
30400722	Industrial Processes; Secondary Metal Production; Steel Foundries; Muller
30400723	Industrial Processes; Secondary Metal Production; Steel Foundries; Conveyors/Elevators
30400724	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Screens
30400725	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Cleaning/Tumblers
30400726	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Cleaning/Chippers
30400730	Industrial Processes; Secondary Metal Production; Steel Foundries; Shell Core Machine

30400731	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Machines/Other
30400732	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace: Baghouse
30400733	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace: Baghouse Dust Handling
30400735	Industrial Processes; Secondary Metal Production; Steel Foundries; Raw Material Unloading
30400736	Industrial Processes; Secondary Metal Production; Steel Foundries; Conveyors/Elevators: Raw Material
30400737	Industrial Processes; Secondary Metal Production; Steel Foundries; Raw Material Silo
30400739	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Centrifugation
30400740	Industrial Processes; Secondary Metal Production; Steel Foundries; Reheating Furnace: Natural Gas
30400741	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Heating
30400742	Industrial Processes; Secondary Metal Production; Steel Foundries; Crucible
30400743	Industrial Processes; Secondary Metal Production; Steel Foundries; Pneumatic Converter Furnace
30400744	Industrial Processes; Secondary Metal Production; Steel Foundries; Ladle
30400745	Industrial Processes; Secondary Metal Production; Steel Foundries; Fugitive Emissions: Furnace
30400760	Industrial Processes; Secondary Metal Production; Steel Foundries; Alloy Feeding
30400765	Industrial Processes; Secondary Metal Production; Steel Foundries; Billet Cutting
30400768	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Handling
30400770	Industrial Processes; Secondary Metal Production; Steel Foundries; Slag Storage Pile
30400775	Industrial Processes; Secondary Metal Production; Steel Foundries; Slag Crushing
30400780	Industrial Processes; Secondary Metal Production; Steel Foundries; Limerock Handling
30400785	Industrial Processes; Secondary Metal Production; Steel Foundries; Roof Monitors - Hot Metal Transfer
30400799	Industrial Processes; Secondary Metal Production; Steel Foundries; Other Not Classified
30400901	Industrial Processes; Secondary Metal Production; Malleable Iron; Annealing
30400999	Industrial Processes; Secondary Metal Production; Malleable Iron; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $9 to $84 per scfm Typical value is $34 per scfm O&M Costs: Range from $6 to $27 per scfm Typical value is $13 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%

MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name:	Fabric Filter - Reverse-Air Cleaned Type;(PM10) Non-Ferrous Metals Processing - Zinc
Abbreviation:	PFFRAMPZC
Description:	Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection. This control applies to zinc processing and production operations. Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000). The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Fabric Filter - Reverse-Air Cleaned Type
Source Group:	Non-Ferrous Metals Processing - Zinc
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0

Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	1998	N/A	N/A	1998
CPT:	$165			$165
Ref Yr CPT:	$224			$224
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	0.09000000357627869	N/A	N/A	0.09000000357627869
Discount Rate:	7.0	N/A	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0
N/A

Cost Year:
1998
N/A
N/A
1998
CPT:
$165
$165
Ref Yr CPT:
$224
$224
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:

0.09000000357627869
N/A
N/A
0.09000000357627869
Discount Rate:
7.0
N/A
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5

Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30303002	Industrial Processes; Primary Metal Production; Zinc Production; Multiple Hearth Roaster
30303003	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Strand
30303005	Industrial Processes; Primary Metal Production; Zinc Production; Vertical Retort/Electrothermal Furnace
30303006	Industrial Processes; Primary Metal Production; Zinc Production; Electrolytic Processor
30303007	Industrial Processes; Primary Metal Production; Zinc Production; Flash Roaster
30303008	Industrial Processes; Primary Metal Production; Zinc Production; Fluid Bed Roaster
30303009	Industrial Processes; Primary Metal Production; Zinc Production; Raw Material Handling and Transfer
30303010	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Breaking and Cooling
30303011	Industrial Processes; Primary Metal Production; Zinc Production; Zinc Casting
30303012	Industrial Processes; Primary Metal Production; Zinc Production; Raw Material Unloading
30303013	Industrial Processes; Primary Metal Production; Zinc Production; Suspension Roaster
30303014	Industrial Processes; Primary Metal Production; Zinc Production; Crushing/Screening
30303015	Industrial Processes; Primary Metal Production; Zinc Production; Zinc Melting
30303016	Industrial Processes; Primary Metal Production; Zinc Production; Alloying
30303017	Industrial Processes; Primary Metal Production; Zinc Production; Leaching
30303018	Industrial Processes; Primary Metal Production; Zinc Production; Purification
30303019	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant Wind Box
30303020	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant Discharge and Screens
30303021	Industrial Processes; Primary Metal Production; Zinc Production; Retort Furnace
30303022	Industrial Processes; Primary Metal Production; Zinc Production; Flue Dust Handling
30303023	Industrial Processes; Primary Metal Production; Zinc Production; Dross Handling
30303024	Industrial Processes; Primary Metal Production; Zinc Production; Roasting: Fugitive Emissions
30303025	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant, Wind Box: Fugitive Emissions
30303026	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant, Discharge Screens: Fugitive Emissions
30303027	Industrial Processes; Primary Metal Production; Zinc Production; Retort Building: Fugitive Emissions
30303028	Industrial Processes; Primary Metal Production; Zinc Production; Casting: Fugitive Emissions

30303029	Industrial Processes; Primary Metal Production; Zinc Production; Electric Retort
30303099	Industrial Processes; Primary Metal Production; Zinc Production; Other Not Classified
30400801	Industrial Processes; Secondary Metal Production; Zinc; Retort Furnace
30400802	Industrial Processes; Secondary Metal Production; Zinc; Horizontal Muffle Furnace
30400803	Industrial Processes; Secondary Metal Production; Zinc; Pot Furnace
30400805	Industrial Processes; Secondary Metal Production; Zinc; Galvanizing Kettle
30400806	Industrial Processes; Secondary Metal Production; Zinc; Calcining Kiln
30400807	Industrial Processes; Secondary Metal Production; Zinc; Concentrate Dryer
30400809	Industrial Processes; Secondary Metal Production; Zinc; Rotary Sweat Furnace
30400810	Industrial Processes; Secondary Metal Production; Zinc; Muffle Sweat Furnace
30400811	Industrial Processes; Secondary Metal Production; Zinc; Electric Resistance Sweat Furnace
30400812	Industrial Processes; Secondary Metal Production; Zinc; Crushing/Screening of Zinc Residues
30400814	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: Clean Metallic Scrap
30400818	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: Clean Metallic Scrap
30400824	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: General Metallic Scrap
30400828	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: General Metallic Scrap
30400834	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: Residual Metallic Scrap
30400838	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: Residual Metallic Scrap
30400840	Industrial Processes; Secondary Metal Production; Zinc; Alloying
30400841	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Crucible
30400842	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Reverberatory Furnace
30400843	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Electric Induction Furnace
30400851	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation: Pouring
30400852	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation: Casting
30400853	Industrial Processes; Secondary Metal Production; Zinc; Graphite Rod Distillation
30400854	Industrial Processes; Secondary Metal Production; Zinc; Retort Distillation/Oxidation
30400855	Industrial Processes; Secondary Metal Production; Zinc; Muffle Distillation/Oxidation
30400861	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweating
30400862	Industrial Processes; Secondary Metal Production; Zinc; Rotary Sweating
30400863	Industrial Processes; Secondary Metal Production; Zinc; Muffle Sweating
30400864	Industrial Processes; Secondary Metal Production; Zinc; Kettle (Pot) Sweating
30400865	Industrial Processes; Secondary Metal Production; Zinc; Electric Resistance Sweating
30400866	Industrial Processes; Secondary Metal Production; Zinc; Sodium Carbonate Leaching
30400867	Industrial Processes; Secondary Metal Production; Zinc; Kettle (Pot) Melting Furnace
30400868	Industrial Processes; Secondary Metal Production; Zinc; Crucible Melting Furnace

30400869	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Melting Furnace
30400870	Industrial Processes; Secondary Metal Production; Zinc; Electric Induction Melting Furnace
30400871	Industrial Processes; Secondary Metal Production; Zinc; Alloying Retort Distillation
30400872	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation
30400873	Industrial Processes; Secondary Metal Production; Zinc; Casting
30400874	Industrial Processes; Secondary Metal Production; Zinc; Graphite Rod Distillation
30400875	Industrial Processes; Secondary Metal Production; Zinc; Retort Distillation/Oxidation
30400876	Industrial Processes; Secondary Metal Production; Zinc; Muffle Distillation/Oxidation
30400877	Industrial Processes; Secondary Metal Production; Zinc; Retort Reduction
30400899	Industrial Processes; Secondary Metal Production; Zinc; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS: The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $9 to $84 per scfm
Typical value is $34 per scfm

O&M Costs:

Range from $6 to $27 per scfm
Typical value is $13 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.0671	$/kW-hr
Compressed air	0.25	$/1000 scf
Dust disposal	25	$/ton disposed

Note: All costs are in 1998 dollars.

CPTON_H: $337/ton

CPTON_L: $53/ton

CPTON_TEXT: When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)

CTRL_EFF_T: 99%

EC: Co

ELEC_PCT: 30.54%

ELEC_RT: $0.07/kWh

FUEL_PCT: 0%

HG_CE_T: 99%

INSRNC_PCT: 2.91%

MNTLBR_PCT: 4.02%

MNTLBR_RT: $17.74/hr

MNTMTL_PCT: 0.04%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name: Install Cleaner Hydronic Heaters; Hydronic Heaters

Abbreviation: PICHHHHTR

Description: If hydronic heaters are allowed, only allow EPA Phase 2 qualified models. A Partnership Agreement (PA) is in place between EPA and wood-burning hydronic heater manufacturers. Under this PA, cleaner burning hydronic heaters are qualified at or below the Phase 2 particulate emissions level. For a list of Phase 2 qualified hydronic heaters, go to: http://www.epa.gov/burnwise/owhhlist.html. Cost per ton value ($750/ton) indicates value incremental cost of installing a Phase 2 qualified RWC appliance instead of a non-Phase 2 RWC appliance.

Class: Known

Pollutant: PM25-PRI

Equipment Life: N/A years

Control Technology: Install Cleaner Hydronic Heaters

Source Group: Hydronic Heaters

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2006
CPT:				$750
Ref Yr CPT:				$846
Control Efficiency:	90.0	90.0	90.0	90.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2006
CPT:				$750
Ref Yr CPT:				$846
Control Efficiency:	90.0	90.0	90.0	90.0
Min Emis:	N/A	N/A	N/A	N/A

Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104008610	Stationary Source Fuel Combustion; Residential; Wood; Hydronic heater: outdoor

References:

- http://www.epa.gov/burnwise/resources.html

Other information:

Summary:

Control Measure Name: Install Retrofit Devices; Hydronic Heaters

Abbreviation: PIRDSHHTR

Description: Provide incentives to encourage the installation of hydronic heater retrofit devices. Retrofits may significantly reduce and even eliminate visible smoke emissions. This measure should be accompanied by education and outreach (e.g., burn only dry seasoned wood). Implement a program and provide incentives to replace old uncertified wood stoves with new EPA-certified wood stoves. Education on proper wood stove use (e.g., burn only dry wood) and maintenance is critical.

Class: Known

Pollutant: PM25-PRI

Equipment Life: N/A years

Control Technology: Install Retrofit Devices

Source Group: Hydronic Heaters

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	CO2	CO	VOC	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2006
CPT:				$980
Ref Yr CPT:				$1,105
Control Efficiency:	60.0	60.0	60.0	60.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	CO2	CO	VOC	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2006
CPT:				$980
Ref Yr CPT:				$1,105
Control Efficiency:	60.0	60.0	60.0	60.0
Min Emis:	N/A	N/A	N/A	N/A

Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104008610	Stationary Source Fuel Combustion; Residential; Wood; Hydronic heater: outdoor

References:

- http://www.epa.gov/burnwise/resources.html

Other information:

Summary:

Control Measure Name:	Install Retrofit Devices; Fireplaces
Abbreviation:	PIRDVCFPL
Description:	Provide incentives to encourage use of fireplace retrofit devices. Under the EPA Wood-burning Fireplace Program, retrofit devices are qualified when their PM2.5 emissions are at or below the program Phase 2 PM2.5 emissions level. For a list of Phase 2 qualified retrofits, go to: http://www.epa.gov/burnwise/fireplacelist.html.
Class:	Known
Pollutant:	PM25-PRI
Equipment Life:	N/A years
Control Technology:	Install Retrofit Devices
Source Group:	Fireplaces
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2006
CPT:				$9,500
Ref Yr CPT:				$10,714
Control Efficiency:	70.0	70.0	70.0	70.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2006
CPT:				$9,500
Ref Yr CPT:				$10,714
Control Efficiency:	70.0	70.0	70.0	70.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0

Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremenental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104008100	Stationary Source Fuel Combustion; Residential; Wood; Fireplace: general

References:

- http://www.epa.gov/burnwise/resources.html

Other information:

Summary:

Control Measure Name: Impingement-plate scrubber;(PM10) Ferrous Metals Processing - Gray Iron Foundaries

Abbreviation: PISCRMPGI

Description: Application: This control is the use of an impingement-plate scrubber to reduce PM emissions. An impingement-plate scrubber is a vertical chamber with plates mounted horizontally inside a hollow shell. Impingement-plate scrubbers operate as countercurrent PM collection devices. The scrubbing liquid flows down the tower while the gas stream flows upward. Contact between the liquid and the particle-laden gas occurs on the plates. The plates are equipped with openings that allow the gas to pass through. Some plates are perforated or slotted, while more complex plates have valve-like openings (EPA, 1998).

This control applies to iron and steel production operations.

Discussion: In all types of impingement-plate scrubbers, the scrubbing liquid flows across each plate and down the inside of the tower onto the plate below. After the bottom plate, the liquid and collected PM flow out of the bottom of the tower. Impingement-plate scrubbers are usually designed to provide operator access to each tray, making them relatively easy to clean and maintain. Consequently, impingement-plate scrubbers are more suitable for PM collection than packed-bed scrubbers. Particles greater than 1 um in aerodynamic diameter can be collected effectively by impingement-plate scrubbers, but many particles <1 um in aerodynamic diameter will penetrate these devices (EPA, 1998).

The simplest impingement-plate scrubber is the sieve plate, which has round perforations (EPA, 1999). In this type of scrubber, the scrubbing liquid flows over the plates and the gas flows up through the holes. The gas velocity prevents the liquid from flowing down through the perforations. Gas-liquid-particle contact is achieved within the froth generated by the gas passing through the liquid layer. Complex plates, such as bubble cap or baffle plates, introduce an additional means of collecting PM. The bubble caps and baffles placed above the plate perforations force the gas to turn before escaping the layer of liquid. While the gas turns to avoid the obstacles, most PM cannot and is collected by impaction on the caps or baffles. Bubble caps and the like also prevent liquid from flowing down the perforations if the gas flow is reduced (EPA, 1998).

Class: Known

Pollutant: PM2_5

Equipment Life: 10.0 years

Control Technology: Impingement-plate scrubber

Source Group: Ferrous Metals Processing - Gray Iron Foundaries

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$589	$589
Ref Yr CPT:			$836	$836
Control Efficiency:	64.0	64.0	64.0	64.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.14000000059604645	0.14000000059604645

Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$589	$589
Ref Yr CPT:			$836	$836
Control Efficiency:	64.0	64.0	64.0	64.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	7.0
Typical O&M Control Cost Factor	25.0
Typical Default CPT Factor - Capital	87.0

Typical Default CPT Factor - O&M	417.0
Typical Default CPT Factor - Annualized	431.0

Affected SCCs:

Code	Description
30400300	Industrial Processes;Secondary Metal Production;Grey Iron Foundries;undefined
30400301	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Cupola
30400302	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Reverberatory Furnace
30400303	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Electric Induction Furnace
30400304	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Electric Arc Furnace
30400305	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Annealing Operation
30400310	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Inoculation
30400314	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Scrap Metal Preheating
30400315	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Charge Handling
30400316	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Tapping
30400317	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring Ladle
30400318	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring, Cooling
30400319	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Making, Baking
30400320	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring/Casting
30400321	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Magnesium Treatment
30400322	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Refining
30400325	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Castings Cooling
30400330	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Miscellaneous Casting-Fabricating **
30400331	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Shakeout
30400332	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Knock Out
30400333	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Shakeout Machine
30400340	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Grinding/Cleaning
30400341	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Cleaning/Tumblers
30400342	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Cleaning/Chippers
30400350	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Grinding/Handling
30400351	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400352	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Grinding/Handling
30400353	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400354	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400355	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Dryer
30400356	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Silo

30400357	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Conveyors/Elevators
30400358	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Screens
30400360	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Castings Finishing
30400370	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Shell Core Machine
30400371	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Machines/Other
30400398	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Other Not Classified
30400399	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999 U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Impingement-Plate/ Tray-Tower Scrubber," July 1999

Other information:

ADMIN_PCT:	0.56%
CE_TEXT:	64% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS: The following are cost ranges for impingement-plate wet scrubbers of conventional design under typical operating conditions, developed using EPA cost-estimating spreadsheets (EPA, 1996) and referenced to the volumetric flow rate of the waste stream treated. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (10 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $2 to $11 per scfm
Typical value is $7 per scfm

O&M Costs:

Range from $3 to $70 per scfm
Typical value is $25 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for Impingement Plate Scrubbers (EPA, 1996). O&M costs were calculated for two model plants with flow rates of 1,000 and 100,000 acfm. The 1,000 acfm plant required 1 scrubber unit while the 100,000 acfm plant required 2 scrubber units. Both model plants were assumed to have 3 scrubber stages per scrubber unit. The average percentage of the total O&M cost was then calculated for each O&M cost component. The model plants were assumed to have a dust loading of 3.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An inlet water flow rate for the scrubber was assumed to be 9.4 lbs/min. The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.067	$/kW-hr
Process water price	0.20	$/1000 gal
Dust disposal	25	$/ton disposed
Wastewater treatment	3.8	$/ thousand gal treated

Note: All costs are in 1995 dollars.

CPTON_H: $1200/ton

CPTON_L: $46/ton

CPTON_TEXT: When stack flow is available the cost effectiveness varies from $46 to $1,200 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $431 per ton PM10 reduced. (1995$)

CTRL_EFF_T: 64%

EC: Co

ELEC_PCT: 4.2%

ELEC_RT: $0.07/kWh

FUEL_PCT: 0%

HG_CE_T: 64%

INSRNC_PCT: 0.28%

MNTLBR_PCT: 7.24%

MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	7.24%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	28.19%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	28.15%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.28%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	4.23%
STEAM_PCT:	0%
TDIR_PCT:	70.73%
TINDIR_PCT:	29.27%
UTIL_PCT:	0.76%
WSTDSP_PCT:	18.86%

Summary:

Control Measure Name: Substitution of landfilling for open burning; Open Burns
Abbreviation: PLNDFILBRN
Description: Application: This control is the substitution of landfilling for open burning to reduce PM emissions.
Class: Emerging
Pollutant: PM2_5
Equipment Life: N/A years
Control Technology: Substitution of landfilling for open burning
Source Group: Open Burning
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM2_5	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1999	1999
CPT:			$3,500	$3,500
Ref Yr CPT:			$4,674	$4,674
Control Efficiency:	75.0	75.0	75.0	75.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM2_5	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1999	1999
CPT:			$3,500	$3,500
Ref Yr CPT:			$4,674	$4,674
Control Efficiency:	75.0	75.0	75.0	75.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0

Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2801500100	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crops Unspecified
2801500112	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Alfalfa: Backfire Burning
2801500130	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Barley: Burning Techniques Not Significant
2801500142	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Bean (red): Backfire Burning
2801500160	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Cotton: Burning Techniques Not Important
2801500181	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Hay (wild): Headfire Burning
2801500191	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Oats: Headfire Burning
2801500201	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Pea: Headfire Burning
2801500210	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Pineapple: Burning Techniques Not Significant
2801500230	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Safflower: Burning Techniques Not Significant
2801500250	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Sugar Cane: Burning Techniques Not Significant
2801500262	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Wheat: Backfire Burning
2801500310	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Almond
2801500330	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Apricot
2801500350	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Cherry
2801500370	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Date palm

2801500390	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Nectarine
2801500410	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Peach
2801500430	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Prune
2801500450	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Filbert (Hazelnut)
2801500000	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Unspecified crop type and Burn Method
2801500111	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Alfalfa : Headfire Burning
2801500120	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Asparagus: Burning Techniques Not Significant
2801500141	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Bean (red): Headfire Burning
2801500150	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Corn: Burning Techniques Not Important
2801500170	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Grasses: Burning Techniques Not Important
2801500182	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Hay (wild): Backfire Burning
2801500192	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Oats: Backfire Burning
2801500202	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Pea: Backfire Burning
2801500220	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Rice: Burning Techniques Not Significant
2801500240	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Sorghum: Burning Techniques Not Significant
2801500261	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Wheat: Headfire Burning
2801500300	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop Unspecified
2801500320	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Apple
2801500340	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Avocado
2801500360	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Citrus (orange, lemon)
2801500380	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Fig
2801500400	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Olive
2801500420	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Pear
2801500440	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Walnut
2801500500	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Vine Crop Unspecified

References:

- EPA, 2006: U.S. Environmental Protection Agency, "Regulatory Impact Analysis: 2006 National Ambient Air Quality Standards for Particle Pollution". October 6, 2006. http://www.epa.gov/ttn/ecas/ria.html

Other information:

Summary:

Control Measure Name: New gas stove or gas logs; Wood Stoves

Abbreviation: PNGSTWDSTV

Description: Implement an incentive program to replace old, uncertified wood stoves with new gas stoves or gas logs. Incentives to switch to a wood pellet stove are another good option. See for more info: http://www.epa.gov/burnwise/how-to-guide.html.

Class: Known

Pollutant: PM25-PRI

Equipment Life: N/A years

Control Technology: New gas stove or gas logs

Source Group: Wood Stoves

Sectors: nonpt

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2010
CPT:				$7,200
Ref Yr CPT:				$7,606
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrementental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2010
CPT:				$7,200
Ref Yr CPT:				$7,606
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0

Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104008310	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, non-EPA certified

References:

- http://www.epa.gov/burnwise/resources.html

Other information:

Summary:

Control Measure Name: Paper/Nonwoven Filters - Cartridge Collector Type;(PM10) Asphalt Manufacture

Abbreviation: PPFCCASMN

Description: Application: This control is the use of paper or non-woven filters (cartridge collector type) to reduce PM emissions. The waste gas stream is passed through the fibrous filter media causing PM in the gas stream to be collected on the media by sieving and other mechanisms.

This control measure applies to asphalt manufacturing operations.

Discussion: Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions. Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

The cost estimates assume a conventional design under typical operating conditions. Auxiliary equipment, such as fans and ductwork, is not included (EPA, 2000). Pollutants that require an unusually high level of control or that require the filter media or the unit itself to be constructed of special materials, such as Nomex or stainless steel, will increase the costs of the system (EPA, 1998). In general, a small unit controlling a low pollutant loading will not be as cost effective as a large unit controlling a high pollutant loading (EPA, 2000).

Cartridge filters contain either a paper or nonwoven fibrous filter media (EPA, 2000). Paper media is generally made of materials such as cellulose and fiberglass. The dust cake that forms on the filter media from the collected PM can significantly increase collection efficiency (EPA, 1998).

In general, the filter media is pleated to provide a larger surface area to volume flow rate. Close pleating, however, can cause PM to bridge the pleat bottom, effectively reducing the surface collection area (EPA, 1998b). Corrugated aluminum separators are used to prevent the pleats from collapsing (Heumann, 1997). There are variety of cartridge designs and dimensions. Typical designs include flat panels, V-shaped packs or cylindrical packs (Heumann, 1997). For certain applications, two cartridges may be placed in series.

Cartridge collectors are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators (STAPPA/ALAPCO, 1996). For similar air flow rates, cartridge collectors are compact in size compared to traditional bag.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Paper/Nonwoven Filters - Cartridge Collector Type

Source Group: Asphalt Manufacture

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:			$232	$232
Ref Yr CPT:			$315	$315
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A

Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.090000003576278 69	0.090000003576278 69
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:			$232	$232
Ref Yr CPT:			$315	$315
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.090000003576278 69	0.090000003576278 69
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:

Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	9.0
Typical O&M Control Cost Factor	14.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	142.0

Affected SCCs:

Code	Description
30500100	Industrial Processes;Mineral Products;Asphalt Roofing Manufacture;undefined
30500101	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Asphalt Blowing: Saturant (Use 3-05-050-10 for MACT)
30500102	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Asphalt Blowing: Coating (Use 3-05-050-10 for MACT)
30500103	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Felt Saturation: Dipping Only
30500104	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Felt Saturation: Dipping/Spraying
30500105	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; General **
30500106	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingles and Rolls: Spraying Only
30500107	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingles and Rolls: Mineral Dryer
30500108	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingles and Rolls: Coating
30500110	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Blowing (Use 3-05-050-01 for MACT)
30500111	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Dipping Only
30500112	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Spraying Only
30500113	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Dipping/Spraying
30500114	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Asphaltic Felt: Coating
30500115	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Steam Drying Drums
30500116	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Saturation: Dip Saturator, Drying-in Drum, Hot Looper & Coater
30500117	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Saturation: Dip Saturator, Drying-in Drum and Coater
30500118	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Saturation: Dip Saturator, Drying-in Drum and Hot Looper
30500119	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Shingle Sation:Spray/Dip Satur,Drying-in Drm,Hot Loopr,Coatr & Str Tk
30500120	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Ferric Chloride

30500121	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Storage Bins: Mineral Stabilizer
30500130	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Fixed Roof Tank: Asphalt/Breathing Loss
30500131	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Fixed Roof Tank: Working Loss
30500132	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Floating Roof Tank: Standing Loss
30500133	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Floating Roof Tank: Working Loss
30500134	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Blown Saturant Storage
30500135	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Blown Coating Storage
30500140	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Unloading
30500141	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Storage
30500142	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Unloading
30500143	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Storage
30500144	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Transport Screw Conveyor and Bucket Elevator
30500145	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust Transport Screw Conveyor and Bucket Elevator
30500146	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Sand Surge Bin
30500147	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules Surge Bin
30500150	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Mineral Dust (Filler) and Asphalt Coating Mixer
30500151	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Granules
30500152	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Sand Applicator
30500153	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Cooling Rolls
30500154	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Finish Floating Looper
30500198	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; Other Not Classified
30500199	Industrial Processes; Mineral Products; Asphalt Roofing Manufacture; See Comment **
30500200	Industrial Processes;Mineral Products;Asphalt Concrete;undefined
30500201	Industrial Processes; Mineral Products; Asphalt Concrete; Rotary Dryer: Conventional Plant (see 3-05-002-50 to -53 for subtypes)
30500202	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevs, Screens, Bins&Mixer (also see -45 thru -47
30500203	Industrial Processes; Mineral Products; Asphalt Concrete; Storage Piles
30500204	Industrial Processes; Mineral Products; Asphalt Concrete; Cold Aggregate Handling
30500205	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Dryer: Drum Mix Plant (see 3-05-002-55 thru -63 for subtypes)
30500206	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Natural Gas
30500207	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Residual Oil
30500208	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Distillate Oil
30500209	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: LPG
30500210	Industrial Processes; Mineral Products; Asphalt Concrete; Asphalt Heater: Waste Oil

30500211	Industrial Processes; Mineral Products; Asphalt Concrete; Rotary Dryer Conventional Plant with Cyclone ** use 3-05-002-01 w/CTL
30500212	Industrial Processes; Mineral Products; Asphalt Concrete; Heated Asphalt Storage Tanks
30500213	Industrial Processes; Mineral Products; Asphalt Concrete; Storage Silo
30500214	Industrial Processes; Mineral Products; Asphalt Concrete; Truck Load-out
30500215	Industrial Processes; Mineral Products; Asphalt Concrete; In Place Recycling: Propane
30500216	Industrial Processes; Mineral Products; Asphalt Concrete; Cold Aggregate Feed Bins
30500217	Industrial Processes; Mineral Products; Asphalt Concrete; Cold Aggregate Conveyors and Elevators
30500220	Industrial Processes; Mineral Products; Asphalt Concrete; Elevators: Batch Process (also see -45 thru -47 for combos w/scr,bins
30500221	Industrial Processes; Mineral Products; Asphalt Concrete; Elevators: Continuous Process
30500230	Industrial Processes; Mineral Products; Asphalt Concrete; Hot Bins and Screens: Batch Process (also see -45 thru -47 for combos)
30500231	Industrial Processes; Mineral Products; Asphalt Concrete; Hot Bins and Screens: Continuous Process
30500240	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Batch Process (also see -45 thru -47 for combos w/scr,bins
30500241	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Continuous Mix (outside the drum) Process
30500242	Industrial Processes; Mineral Products; Asphalt Concrete; Mixers: Drum Mix Process ** (use 3-05-002-005 and subtypes)
30500245	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer & NG Rot Dryer
30500246	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer& #2 Oil Rot Dryer
30500247	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Hot Elevs, Scrns, Bins, Mixer& Waste/Drain/#6 Oil Rot
30500250	Industrial Processes; Mineral Products; Asphalt Concrete; Conventional Continuous Mix (outside of drum) Plant: Rotary Dryer
30500251	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Natural Gas-Fired (also see -45)
30500252	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Oil-Fired (also see -46)
30500253	Industrial Processes; Mineral Products; Asphalt Concrete; Batch Mix Plant: Rotary Dryer, Waste/Drain/# 6 Oil-Fired (also see -47
30500255	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas-Fired
30500256	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas, Parallel Flow
30500257	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas, Counterflow
30500258	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired
30500259	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Parallel Flow
30500260	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Counterflow

30500261	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Plant: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil-Fired
30500262	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Pl: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil, Parallel Flo
30500263	Industrial Processes; Mineral Products; Asphalt Concrete; Drum Mix Pl: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil, Counterflow
30500270	Industrial Processes; Mineral Products; Asphalt Concrete; Yard Emissions: Emissions from asphalt in truck beds
30500290	Industrial Processes; Mineral Products; Asphalt Concrete; Haul Roads: General
30500298	Industrial Processes; Mineral Products; Asphalt Concrete; Other Not Classified
30500299	Industrial Processes; Mineral Products; Asphalt Concrete; See Comment **

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Cartridge Collector with Pulse-Jet Cleaning," April 2000.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.87%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs are generated using EPAGÇÖs cost-estimating spreadsheets for fabric filters (EPA, 1998a). Costs are primarily driven by the waste stream volumetric flow rate and pollutant loading. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $7 to $13 per scfm Typical value is $9 per scfm O&M Costs: Range from $9 to $25 per scfm Typical value is $14 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average cartridge cost was estimated using the costs for standard cartridge types. Capital recovery for the periodic replacement of cartridges was included in the O&M cost of the cartridges using a cartridge life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$256/ton
CPTON_L:	$85/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $85 to $256 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $142 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	10.14%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.74%
MNTLBR_PCT:	5.71%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	5.71%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.95%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.89%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.87%
RPLMTL_PCT:	17.49%
RULE:	Not Applicable
SPVLBR_PCT:	0.44%
STEAM_PCT:	0%
TDIR_PCT:	87.63%
TINDIR_PCT:	12.37%
UTIL_PCT:	2.96%
WSTDSP_PCT:	42.24%

Summary:

Control Measure Name: Paper/Nonwoven Filters - Cartridge Collector Type;(PM10) Fabricated Metal Products - Abrasive Blasting

Abbreviation: PPFCCFMAB

Description: Application: This control is the use of paper or non-woven filters (cartridge collector type) to reduce PM emissions. The waste gas stream is passed through the fibrous filter media causing PM in the gas stream to be collected on the media by sieving and other mechanisms.

This control measure applies to abrasive blasting operations as a part of fabricated metal products processing and production.

Discussion: The cost estimates assume a conventional design under typical operating conditions. Auxiliary equipment, such as fans and ductwork, is not included (EPA, 2000). Pollutants that require an unusually high level of control or that require the filter media or the unit itself to be constructed of special materials, such as Nomex or stainless steel, will increase the costs of the system (EPA, 1998). In general, a small unit controlling a low pollutant loading will not be as cost effective as a large unit controlling a high pollutant loading (EPA, 2000).

Cartridge filters contain either a paper or nonwoven fibrous filter media (EPA, 2000). Paper media is generally made of materials such as cellulose and fiberglass. The dust cake that forms on the filter media from the collected PM can significantly increase collection efficiency (EPA, 1998).

In general, the filter media is pleated to provide a larger surface area to volume flow rate. Close pleating, however, can cause PM to bridge the pleat bottom, effectively reducing the surface collection area (EPA, 1998b). Corrugated aluminum separators are used to prevent the pleats from collapsing (Heumann, 1997). There are variety of cartridge designs and dimensions. Typical designs include flat panels, V-shaped packs or cylindrical packs (Heumann, 1997). For certain applications, two cartridges may be placed in series.

Cartridge collectors are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators (STAPPA/ALAPCO, 1996). For similar air flow rates, cartridge collectors are compact in size compared to traditional bag.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Paper/Nonwoven Filters - Cartridge Collector Type

Source Group: Fabricated Metal Products - Abrasive Blasting

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0

Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	N/A	1998	N/A
CPT:	$311		$311	
Ref Yr CPT:	$422		$422	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:

1998
N/A
1998
N/A
CPT:
$311
$311
Ref Yr CPT:
$422
$422
Control Efficiency:
99.0
99.5
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869

N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998

Typical Capital Control Cost Factor	9.0
Typical O&M Control Cost Factor	14.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	142.0

Affected SCCs:

Code	Description
30900299	Industrial Processes; Fabricated Metal Products; Abrasive Blasting of Metal Parts; General
30900298	Industrial Processes; Fabricated Metal Products; Abrasive Blasting of Metal Parts; General
30900208	Industrial Processes; Fabricated Metal Products; Abrasive Blasting of Metal Parts; Shotblast w/o Air
30900207	Industrial Processes; Fabricated Metal Products; Abrasive Blasting of Metal Parts; Shotblast with Air
30900206	Industrial Processes; Fabricated Metal Products; Abrasive Blasting of Metal Parts; Walnut Shell Abrasive
30900205	Industrial Processes; Fabricated Metal Products; Abrasive Blasting of Metal Parts; Steel Grit Abrasive
30900204	Industrial Processes; Fabricated Metal Products; Abrasive Blasting of Metal Parts; Garnet Abrasive
30900203	Industrial Processes; Fabricated Metal Products; Abrasive Blasting of Metal Parts; Slag Abrasive
30900202	Industrial Processes; Fabricated Metal Products; Abrasive Blasting of Metal Parts; Sand Abrasive
30900201	Industrial Processes; Fabricated Metal Products; Abrasive Blasting of Metal Parts; General
30900200	Industrial Processes;Fabricated Metal Products;Abrasive Blasting of Metal Parts;undefined

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Cartridge Collector with Pulse-Jet Cleaning," April 2000.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.87%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:

The costs are generated using EPAGÇÖs cost-estimating spreadsheets for fabric filters (EPA, 1998a). Costs are primarily driven by the waste stream volumetric flow rate and pollutant loading. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $7 to $13 per scfm
Typical value is $9 per scfm

O&M Costs:

Range from $9 to $25 per scfm
Typical value is $14 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average cartridge cost was estimated using the costs for standard cartridge types. Capital recovery for the periodic replacement of cartridges was included in the O&M cost of the cartridges using a cartridge life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.0671	$/kW-hr
Compressed air	0.25	$/1000 scf
Dust disposal	25	$/ton disposed

Note: All costs are in 1998 dollars.

CPTON_H:	$256/ton
CPTON_L:	$85/ton
CPTON_TEXT:	When stack flow is available, the cost effectiveness varies from $85 to $256 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $142 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	10.14%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%

INSRNC_PCT:	1.74%
MNTLBR_PCT:	5.71%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	5.71%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.95%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.89%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.87%
RPLMTL_PCT:	17.49%
RULE:	Not Applicable
SPVLBR_PCT:	0.44%
STEAM_PCT:	0%
TDIR_PCT:	87.63%
TINDIR_PCT:	12.37%
UTIL_PCT:	2.96%
WSTDSP_PCT:	42.24%

Summary:

Control Measure Name: Paper/Nonwoven Filters - Cartridge Collector Type;(PM10) Fabricated Metal Products - Machining

Abbreviation: PPFCCFMMG

Description: Application: This control is the use of paper or non-woven filters (cartridge collector type) to reduce PM emissions. The waste gas stream is passed through the fibrous filter media causing PM in the gas stream to be collected on the media by sieving and other mechanisms.

This control measure applies to machining operations as a part of fabricated metal products processing and production.

Discussion: The cost estimates assume a conventional design under typical operating conditions. Auxiliary equipment, such as fans and ductwork, is not included (EPA, 2000). Pollutants that require an unusually high level of control or that require the filter media or the unit itself to be constructed of special materials, such as Nomex or stainless steel, will increase the costs of the system (EPA, 1998a). In general, a small unit controlling a low pollutant loading will not be as cost effective as a large unit controlling a high pollutant loading (EPA, 2000).

Cartridge filters contain either a paper or nonwoven fibrous filter media (EPA, 2000). Paper media is generally made of materials such as cellulose and fiberglass. The dust cake that forms on the filter media from the collected PM can significantly increase collection efficiency (EPA, 1998b).

In general, the filter media is pleated to provide a larger surface area to volume flow rate. Close pleating, however, can cause PM to bridge the pleat bottom, effectively reducing the surface collection area (EPA, 1998b). Corrugated aluminum separators are used to prevent the pleats from collapsing (Heumann, 1997). There are variety of cartridge designs and dimensions. Typical designs include flat panels, V-shaped packs or cylindrical packs (Heumann, 1997). For certain applications, two cartridges may be placed in series.

Cartridge collectors are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators (STAPPA/ALAPCO, 1996). For similar air flow rates, cartridge collectors are compact in size compared to traditional bag.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Paper/Nonwoven Filters - Cartridge Collector Type

Source Group: Fabricated Metal Products - Machining

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0

Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1998	N/A	1998
CPT:		$244		$244
Ref Yr CPT:		$331		$331
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:

N/A
1998
N/A
1998
CPT:
$244
$244
Ref Yr CPT:
$331
$331
Control Efficiency:
99.5
99.0
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A

0.09000000357627869
N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998

Typical Capital Control Cost Factor	9.0
Typical O&M Control Cost Factor	14.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	142.0

Affected SCCs:

Code	Description
30903099	Industrial Processes; Fabricated Metal Products; Machining Operations; See Comment **
30903010	Industrial Processes; Fabricated Metal Products; Machining Operations; Stamping and Drawing (Auto Body Parts)
30903008	Industrial Processes; Fabricated Metal Products; Machining Operations; Plasma Torch
30903007	Industrial Processes; Fabricated Metal Products; Machining Operations; Lubrication: Specify Material
30903006	Industrial Processes; Fabricated Metal Products; Machining Operations; Honing: Specify Material in Comments
30903005	Industrial Processes; Fabricated Metal Products; Machining Operations; Sawing: Specify Material in Comments
30903004	Industrial Processes; Fabricated Metal Products; Machining Operations; Specify Material**

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.

Other information:

Summary:

Control Measure Name:	Paper/Nonwoven Filters - Cartridge Collector Type;(PM10) Fabricated Metal Products - Welding
Abbreviation:	PPFCCFMWG
Description:	Application: This control is the use of paper or non-woven filters (cartridge collector type) to reduce PM emissions. The waste gas stream is passed through the fibrous filter media causing PM in the gas stream to be collected on the media by sieving and other mechanisms. This control measure applies to welding operations as a part of fabricated metal products processing and production, classified under SCCs 30900501 and 30904001. Discussion: The cost estimates assume a conventional design under typical operating conditions. Auxiliary equipment, such as fans and ductwork, is not included (EPA, 2000). Pollutants that require an unusually high level of control or that require the filter media or the unit itself to be constructed of special materials, such as Nomex or stainless steel, will increase the costs of the system (EPA, 1998). In general, a small unit controlling a low pollutant loading will not be as cost effective as a large unit controlling a high pollutant loading (EPA, 2000). Cartridge filters contain either a paper or nonwoven fibrous filter media (EPA, 2000). Paper media is generally made of materials such as cellulose and fiberglass. The dust cake that forms on the filter media from the collected PM can significantly increase collection efficiency (EPA, 1998). In general, the filter media is pleated to provide a larger surface area to volume flow rate. Close pleating, however, can cause PM to bridge the pleat bottom, effectively reducing the surface collection area (EPA, 1998b). Corrugated aluminum separators are used to prevent the pleats from collapsing (Heumann, 1997). There are variety of cartridge designs and dimensions. Typical designs include flat panels, V-shaped packs or cylindrical packs (Heumann, 1997). For certain applications, two cartridges may be placed in series. Cartridge collectors are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators (STAPPA/ALAPCO, 1996). For similar air flow rates, cartridge collectors are compact in size compared to traditional bag.
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Paper/Nonwoven Filters - Cartridge Collector Type
Source Group:	Fabricated Metal Products - Welding
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0

Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	N/A	1998	N/A
CPT:	$244		$244	
Ref Yr CPT:	$331		$331	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:

1998
N/A
1998
N/A
CPT:
$244
$244
Ref Yr CPT:
$331
$331
Control Efficiency:
99.0
99.5
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869

N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998

Typical Capital Control Cost Factor	9.0
Typical O&M Control Cost Factor	14.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	142.0

Affected SCCs:

Code	Description
30900500	Industrial Processes; Fabricated Metal Products; Welding; General
30900501	Industrial Processes; Fabricated Metal Products; Welding; Arc Welding: General ** (See 3-09-050)
30900502	Industrial Processes; Fabricated Metal Products; Welding; Oxyfuel Welding: General ** (See 3-09-044)
30904001	Industrial Processes; Fabricated Metal Products; Metal Deposition Processes; Metallizing: Wire Atomization and Spraying
30904010	Industrial Processes; Fabricated Metal Products; Metal Deposition Processes; Thermal Spraying of Powdered Metal
30904020	Industrial Processes; Fabricated Metal Products; Metal Deposition Processes; Plasma Arc Spraying of Powdered Metal
30904030	Industrial Processes; Fabricated Metal Products; Metal Deposition Processes; Tinning: Batch Process
30904100	Industrial Processes; Fabricated Metal Products; Resistance Welding; General
30904200	Industrial Processes; Fabricated Metal Products; Brazing; General
30904300	Industrial Processes; Fabricated Metal Products; Soldering; General
30904400	Industrial Processes; Fabricated Metal Products; Oxyfuel Welding; General
30904500	Industrial Processes; Fabricated Metal Products; Thermal Spraying; General
30904600	Industrial Processes; Fabricated Metal Products; Oxyfuel Cutting; General
30904700	Industrial Processes; Fabricated Metal Products; Arc Cutting; General
30905000	Industrial Processes; Fabricated Metal Products; Arc Welding: General: Consummable and Non-consummable Electrode; Consumable and Non-consumable Electrode
30905100	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); General
30905104	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); 14Mn-4Cr Electrode
30905108	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E11018 Electrode
30905112	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E308 Electrode
30905116	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E310 Electrode
30905120	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E316 Electrode
30905124	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E410 Electrode
30905128	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E6010 Electrode

30905132	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E6011 Electrode
30905136	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E6012 Electrode
30905140	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E6013 Electrode
30905144	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E7018 Electrode
30905148	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E7024 Electrode
30905152	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E7028 Electrode
30905156	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E8018 Electrode
30905160	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E9015 Electrode
30905164	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); E9018 Electrode
30905168	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); ECoCr-A Electrode
30905172	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); ENi-Cl Electrode
30905176	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); ENiCrMo Electrode
30905180	Industrial Processes; Fabricated Metal Products; Shielded Metal Arc Welding (SMAW); ENi-Cu Electrode
30905200	Industrial Processes; Fabricated Metal Products; Gas Metal Arc Welding (GMAW); General
30905210	Industrial Processes; Fabricated Metal Products; Gas Metal Arc Welding (GMAW); ER1260 Electrode
30905212	Industrial Processes; Fabricated Metal Products; Gas Metal Arc Welding (GMAW); E308l Electrode
30905220	Industrial Processes; Fabricated Metal Products; Gas Metal Arc Welding (GMAW); ER316 Electrode
30905226	Industrial Processes; Fabricated Metal Products; Gas Metal Arc Welding (GMAW); ER5154 Electrode
30905254	Industrial Processes; Fabricated Metal Products; Gas Metal Arc Welding (GMAW); E70S Electrode
30905276	Industrial Processes; Fabricated Metal Products; Gas Metal Arc Welding (GMAW); ERNiCrMo Electrode
30905280	Industrial Processes; Fabricated Metal Products; Gas Metal Arc Welding (GMAW); ERNiCu Electrode
30905300	Industrial Processes; Fabricated Metal Products; Flux Cored Arc Welding (FCAW); General
30905306	Industrial Processes; Fabricated Metal Products; Flux Cored Arc Welding (FCAW); E110 T5-K3 Electrode
30905308	Industrial Processes; Fabricated Metal Products; Flux Cored Arc Welding (FCAW); E11018 Electrode
30905312	Industrial Processes; Fabricated Metal Products; Flux Cored Arc Welding (FCAW); E308LT Electrode
30905320	Industrial Processes; Fabricated Metal Products; Flux Cored Arc Welding (FCAW); E316LT Electrode
30905354	Industrial Processes; Fabricated Metal Products; Flux Cored Arc Welding (FCAW); E70T Electrode

30905355	Industrial Processes; Fabricated Metal Products; Flux Cored Arc Welding (FCAW); E71T Electrode
30905400	Industrial Processes; Fabricated Metal Products; Submerged Arc Welding (SAW); General
30905410	Industrial Processes; Fabricated Metal Products; Submerged Arc Welding (SAW); EM12K Electrode
30905500	Industrial Processes; Fabricated Metal Products; Electrogas Welding (EGW); General
30905600	Industrial Processes; Fabricated Metal Products; Electrostag Welding (ESW); General
30905800	Industrial Processes; Fabricated Metal Products; Gas Tungsten Arc Welding (GTAW); General
30905900	Industrial Processes; Fabricated Metal Products; Plasma Arc Welding (PAW); General

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Cartridge Collector with Pulse-Jet Cleaning," April 2000.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.87%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs are generated using EPAGÇÖs cost-estimating spreadsheets for fabric filters (EPA, 1998a). Costs are primarily driven by the waste stream volumetric flow rate and pollutant loading. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $7 to $13 per scfm Typical value is $9 per scfm O&M Costs: Range from $9 to $25 per scfm Typical value is $14 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average cartridge cost was estimated using the costs for standard cartridge types. Capital recovery for the periodic replacement of cartridges was included in the O&M cost of the cartridges using a cartridge life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$256/ton
CPTON_L:	$85/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $85 to $256 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $142 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	10.14%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.74%
MNTLBR_PCT:	5.71%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	5.71%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.95%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.89%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.87%
RPLMTL_PCT:	17.49%
RULE:	Not Applicable
SPVLBR_PCT:	0.44%
STEAM_PCT:	0%
TDIR_PCT:	87.63%
TINDIR_PCT:	12.37%
UTIL_PCT:	2.96%
WSTDSP_PCT:	42.24%

Summary:

Control Measure Name: Paper/Nonwoven Filters - Cartridge Collector Type;(PM10) Mineral Products - Coal Cleaning

Abbreviation: PPFCCMICC

Description: Application: This control is the use of paper or non-woven filters (cartridge collector type) to reduce PM emissions. The waste gas stream is passed through the fibrous filter media causing PM in the gas stream to be collected on the media by sieving and other mechanisms.

This control measure applies to coal cleaning processes at coal mining operations.

Discussion: Coal mining, cleaning and material handling (305010) consists of the preparation and handling of coal to upgrade its value. For the purpose of this study, thermal dryers, pneumatic coal cleaning and truck/vehicle travel are the sources considered. Thermal dryers are used at the end of the series of cleaning operations to remove moisture from coal, thereby reducing freezing problems and weight, and increasing the heating value. The major portion of water is removed by the use of screens, thickeners, and cyclones. The coal is then dried in a thermal dryer. Particulate emissions result from the entrainment of fine coal particles during the thermal drying process (EPA, 1995). Pneumatic coal-cleaning equipment classifies bituminous coal by size or separates bituminous coal from refuse by application of air streams. Fugitive PM emissions result when haul trucks or other vehicles travel on unpaved roads or surfaces.

The cost estimates assume a conventional design under typical operating conditions. Auxiliary equipment, such as fans and ductwork, is not included (EPA, 2000). Pollutants that require an unusually high level of control or that require the filter media or the unit itself to be constructed of special materials, such as Nomex or stainless steel, will increase the costs of the system (EPA, 1998). In general, a small unit controlling a low pollutant loading will not be as cost effective as a large unit controlling a high pollutant loading (EPA, 2000).

Cartridge filters contain either a paper or nonwoven fibrous filter media (EPA, 2000). Paper media is generally made of materials such as cellulose and fiberglass. The dust cake that forms on the filter media from the collected PM can significantly increase collection efficiency (EPA, 1998).

In general, the filter media is pleated to provide a larger surface area to volume flow rate. Close pleating, however, can cause PM to bridge the pleat bottom, effectively reducing the surface collection area (EPA, 1998b). Corrugated aluminum separators are used to prevent the pleats from collapsing (Heumann, 1997). There are variety of cartridge designs and dimensions. Typical designs include flat panels, V-shaped packs or cylindrical packs (Heumann, 1997). For certain applications, two cartridges may be placed in series.

Cartridge collectors are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators (STAPPA/ALAPCO, 1996). For similar air flow rates, cartridge collectors are compact in size compared to traditional bag.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Paper/Nonwoven Filters - Cartridge Collector Type

Source Group: Mineral Products - Coal Cleaning

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:			$267	$267

Ref Yr CPT:			$362	$362
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.090000003576278 69	0.090000003576278 69
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:			$267	$267
Ref Yr CPT:			$362	$362
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.090000003576278 69	0.090000003576278 69
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	9.0
Typical O&M Control Cost Factor	14.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	142.0

Affected SCCs:

Code	Description
30501000	Industrial Processes;Mineral Products;Coal Mining, Cleaning, and Material Handling (See 305310);undefined
30501003	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Multilouvered Dryer
30501005	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Cascade Dryer
30501006	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Continuous Carrier/Conveyor
30501008	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Unloading
30501009	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Raw Coal Storage
30501011	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Transfer
30501013	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Cleaning: Air Table
30501015	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Loading (For Clean Coal Loading USE 30501016)
30501016	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Clean Coal Loading
30501021	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Removal
30501022	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Drilling/Blasting
30501023	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Loading
30501024	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Hauling
30501030	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Topsoil Removal (See also 305010 -33, -35, -36, -37, -42, -45, -48)
30501031	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Scrapers: Travel Mode

30501032	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Topsoil Unloading
30501033	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden (See also 305010 -30, -35, -36, -37, -42, -45, -48)
30501034	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Seam: Drilling
30501035	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Blasting: Coal Overburden
30501036	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Dragline: Overburden Removal
30501037	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Loading: Overburden
30501038	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Loading: Coal
30501039	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Hauling: Haul Trucks
30501040	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: End Dump - Coal
30501041	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: Bottom Dump - Coal
30501042	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: Bottom Dump - Overburden
30501043	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Open Storage Pile: Coal
30501044	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Train Loading: Coal
30501045	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Bulldozing: Overburden
30501046	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Bulldozing: Coal
30501047	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Grading
30501048	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Replacement
30501049	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Wind Erosion: Exposed Areas
30501050	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Vehicle Traffic: Light/Medium Vehicles
30501051	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Open Storage Pile: Spoils
30501060	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Primary Crusher
30501061	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Secondary Crusher
30501062	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Screens
30501090	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Haul Roads: General
30501099	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Other Not Classified

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Cartridge Collector with Pulse-Jet Cleaning," April 2000.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.
- EPA, 1995: U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors," AP-42, Volume I, Fifth Edition, Research Triangle Park, NC, January 1995.

Other information:

ADMIN_PCT:	0.87%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs are generated using EPAGÇÖs cost-estimating spreadsheets for fabric filters (EPA, 1998a). Costs are primarily driven by the waste stream volumetric flow rate and pollutant loading. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $7 to $13 per scfm Typical value is $9 per scfm O&M Costs: Range from $9 to $25 per scfm Typical value is $14 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average cartridge cost was estimated using the costs for standard cartridge types. Capital recovery for the periodic replacement of cartridges was included in the O&M cost of the cartridges using a cartridge life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$256/ton
CPTON_L:	$85/ton
CPTON_TEXT:	When stack flow is available, the cost effectiveness varies from $85 to $256 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $142 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	10.14%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.74%
MNTLBR_PCT:	5.71%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	5.71%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.95%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.89%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.87%
RPLMTL_PCT:	17.49%
RULE:	Not Applicable
SPVLBR_PCT:	0.44%
STEAM_PCT:	0%
TDIR_PCT:	87.63%
TINDIR_PCT:	12.37%
UTIL_PCT:	2.96%
WSTDSP_PCT:	42.24%

Summary:

Control Measure Name: Paper/Nonwoven Filters - Cartridge Collector Type;(PM10) Mineral Products - Cement Manufacture

Abbreviation: PPFCCMICM

Description: Application: This control is the use of paper or non-woven filters (cartridge collector type) to reduce PM emissions. The waste gas stream is passed through the fibrous filter media causing PM in the gas stream to be collected on the media by sieving and other mechanisms.

This control measure applies to cement manufacturing operations.

Discussion: The largest source of particulate emissions at a cement plant is the kiln used to produce clinker. Cement kilns are rotary kilns, which are slowly rotating refractory-lined steel cylinders inclined slightly from the horizontal. Raw materials are fed into the top end of the kiln and spend several hours traversing the kiln. In wet process kilns (SCC 30500706), the raw materials are fed as a wet slurry. During this time, the raw materials are heated by a flame at the discharge end of the kiln. This heating dries the raw materials, converts limestone to lime, and promotes reaction between and fusion of the separate ingredients to form clinker. Clinker exiting the kiln is fed to a clinker cooler (SCC 30500714) for cooling before storage and further processing (STAPPA/ALAPCO, 1996).

The cost estimates assume a conventional design under typical operating conditions. Auxiliary equipment, such as fans and ductwork, is not included (EPA, 2000). Pollutants that require an unusually high level of control or that require the filter media or the unit itself to be constructed of special materials, such as Nomex or stainless steel, will increase the costs of the system (EPA, 1998). In general, a small unit controlling a low pollutant loading will not be as cost effective as a large unit controlling a high pollutant loading (EPA, 2000).

Cartridge filters contain either a paper or nonwoven fibrous filter media (EPA, 2000). Paper media is generally made of materials such as cellulose and fiberglass. The dust cake that forms on the filter media from the collected PM can significantly increase collection efficiency (EPA, 1998b).

In general, the filter media is pleated to provide a larger surface area to volume flow rate. Close pleating, however, can cause PM to bridge the pleat bottom, effectively reducing the surface collection area (EPA, 1998b). Corrugated aluminum separators are used to prevent the pleats from collapsing (Heumann, 1997). There are variety of cartridge designs and dimensions. Typical designs include flat panels, V-shaped packs or cylindrical packs (Heumann, 1997). For certain applications, two cartridges may be placed in series.

Cartridge collectors are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators (STAPPA/ALAPCO, 1996). For similar air flow rates, cartridge collectors are compact in size compared to traditional bag.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Paper/Nonwoven Filters - Cartridge Collector Type

Source Group: Mineral Products - Cement Manufacture

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:			$244	$244
Ref Yr CPT:			$331	$331

Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:			$244	$244
Ref Yr CPT:			$331	$331
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:

Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	9.0
Typical O&M Control Cost Factor	14.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	142.0

Affected SCCs:

Code	Description
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln
30500607	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Unloading
30500609	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Primary Crushing
30500610	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Secondary Crushing
30500611	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Screening
30500612	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Transfer
30500613	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Grinding and Drying
30500614	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Cooler
30500616	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Transfer
30500617	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Grinding
30500618	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Silos
30500620	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Predryer
30500621	Industrial Processes; Mineral Products; Cement Manufacturing (Wet or Dry Process); Pulverized Coal Kiln Feed Units
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln
30500624	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Feed Belt
30500625	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Weigh Hopper
30500626	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Air Separator
30500627	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Feed Belt

30500628	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Weigh Hopper
30500629	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Air Separator
30500706	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Kilns
30500707	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Raw Material Unloading
30500709	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Primary Crushing
30500710	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Secondary Crushing
30500711	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Screening
30500712	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Raw Material Transfer
30500714	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Cooler
30500715	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Piles
30500716	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Transfer
30500717	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Clinker Grinding
30500718	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Cement Silos
30500719	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Cement Load Out
30500727	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Feed Belt
30500728	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Weigh Hopper
30500729	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Finish Grinding Mill Air Separator

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Cartridge Collector with Pulse-Jet Cleaning," April 2000.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.87%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%
COST_BASIS:	The costs are generated using EPAGÇÖs cost-estimating spreadsheets for fabric filters (EPA, 1998a). Costs are primarily driven by the waste stream volumetric flow rate and pollutant loading. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $7 to $13 per scfm Typical value is $9 per scfm O&M Costs: Range from $9 to $25 per scfm Typical value is $14 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average cartridge cost was estimated using the costs for standard cartridge types. Capital recovery for the periodic replacement of cartridges was included in the O&M cost of the cartridges using a cartridge life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$256/ton
CPTON_L:	$85/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $85 to $256 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $142 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	10.14%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%

INSRNC_PCT:	1.74%
MNTLBR_PCT:	5.71%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	5.71%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.95%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.89%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.87%
RPLMTL_PCT:	17.49%
RULE:	Not Applicable
SPVLBR_PCT:	0.44%
STEAM_PCT:	0%
TDIR_PCT:	87.63%
TINDIR_PCT:	12.37%
UTIL_PCT:	2.96%
WSTDSP_PCT:	42.24%

Summary:

Control Measure Name: Paper/Nonwoven Filters - Cartridge Collector Type;(PM10) Mineral Products - Other

Abbreviation: PPFCCMIOR

Description: Application: This control is the use of paper or non-woven filters (cartridge collector type) to reduce PM emissions. The waste gas stream is passed through the fibrous filter media causing PM in the gas stream to be collected on the media by sieving and other mechanisms.

This control applies to miscellaneous mineral production operations including (but not limited to) brick manufacture, calcium carbide operations, clay and fly ash sintering, concrete batching, gypsum manufacturing, lime production, phosphate rock operations, sand production, fiberglass manufacturing and glass manufacturing operations. Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions.

Discussion: Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions. Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

The cost estimates assume a conventional design under typical operating conditions. Auxiliary equipment, such as fans and ductwork, is not included (EPA, 2000). Pollutants that require an unusually high level of control or that require the filter media or the unit itself to be constructed of special materials, such as Nomex or stainless steel, will increase the costs of the system (EPA, 1998). In general, a small unit controlling a low pollutant loading will not be as cost effective as a large unit controlling a high pollutant loading (EPA, 2000).

Cartridge filters contain either a paper or nonwoven fibrous filter media (EPA, 2000). Paper media is generally made of materials such as cellulose and fiberglass. The dust cake that forms on the filter media from the collected PM can significantly increase collection efficiency (EPA, 1998).

In general, the filter media is pleated to provide a larger surface area to volume flow rate. Close pleating, however, can cause PM to bridge the pleat bottom, effectively reducing the surface collection area (EPA, 1998b). Corrugated aluminum separators are used to prevent the pleats from collapsing (Heumann, 1997). There are variety of cartridge designs and dimensions. Typical designs include flat panels, V-shaped packs or cylindrical packs (Heumann, 1997). For certain applications, two cartridges may be placed in series.

Cartridge collectors are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators (STAPPA/ALAPCO, 1996). For similar air flow rates, cartridge collectors are compact in size compared to traditional bag.

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Paper/Nonwoven Filters - Cartridge Collector Type

Source Group: Mineral Products - Other

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:			$244	$244

Ref Yr CPT:			$331	$331
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1998	1998
CPT:			$244	$244
Ref Yr CPT:			$331	$331
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.09000000357627869	0.09000000357627869
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1998
Typical Capital Control Cost Factor	9.0
Typical O&M Control Cost Factor	14.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	142.0

Affected SCCs:

Code	Description
30500300	Industrial Processes;Mineral Products;Brick Manufacture;undefined
30500301	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Drying
30500302	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Grinding & Screening
30500303	Industrial Processes; Mineral Products; Brick Manufacture; Storage of Raw Materials
30500304	Industrial Processes; Mineral Products; Brick Manufacture; Curing **
30500305	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Handling and Transferring
30500306	Industrial Processes; Mineral Products; Brick Manufacture; Pulverizing
30500307	Industrial Processes; Mineral Products; Brick Manufacture; Calcining
30500308	Industrial Processes; Mineral Products; Brick Manufacture; Screening
30500309	Industrial Processes; Mineral Products; Brick Manufacture; Blending and Mixing
30500310	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Sawdust Fired Tunnel Kilns
30500311	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Tunnel Kilns
30500312	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Tunnel Kilns
30500313	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Tunnel Kilns
30500314	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Periodic Kilns
30500315	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Periodic Kilns
30500316	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Periodic Kilns
30500317	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Unloading
30500318	Industrial Processes; Mineral Products; Brick Manufacture; Tunnel Kiln: Wood-fired

30500319	Industrial Processes; Mineral Products; Brick Manufacture; Transfer and Conveying
30500321	Industrial Processes; Mineral Products; Brick Manufacture; General
30500322	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing High-Sulfur Material
30500330	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Periodic Kiln
30500331	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel Fired Tunnel Kiln
30500332	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Kiln, Other Type
30500333	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Kiln, Other Type
30500334	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Kiln, Other Type
30500335	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Kiln, Other Type
30500340	Industrial Processes; Mineral Products; Brick Manufacture; Primary Crusher
30500342	Industrial Processes; Mineral Products; Brick Manufacture; Extrusion Line
30500350	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat From Kiln Cooling Zone
30500351	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat And Supplemental Gas Burners
30500355	Industrial Processes; Mineral Products; Brick Manufacture; Coal Crushing And Storage System
30500360	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer
30500361	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer: Heated With Exhaust From Sawdust-fired Kiln
30500370	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing Structural Clay Tile
30500397	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500398	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500399	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500401	Industrial Processes; Mineral Products; Calcium Carbide; Electric Furnace: Hoods and Main Stack
30500402	Industrial Processes; Mineral Products; Calcium Carbide; Coke Dryer
30500403	Industrial Processes; Mineral Products; Calcium Carbide; Furnace Room Vents
30500404	Industrial Processes; Mineral Products; Calcium Carbide; Tap Fume Vents
30500405	Industrial Processes; Mineral Products; Calcium Carbide; Primary/Secondary Crushing
30500406	Industrial Processes; Mineral Products; Calcium Carbide; Circular Charging: Conveyor
30500499	Industrial Processes; Mineral Products; Calcium Carbide; Other Not Classified
30500501	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Dryer
30500502	Industrial Processes; Mineral Products; Castable Refractory; Raw Material Crushing/Processing
30500503	Industrial Processes; Mineral Products; Castable Refractory; Electric Arc Melt Furnace
30500504	Industrial Processes; Mineral Products; Castable Refractory; Curing Oven
30500505	Industrial Processes; Mineral Products; Castable Refractory; Molding and Shakeout
30500506	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Calciner

30500507	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Tunnel Kiln
30500508	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Rotary Dryer
30500509	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Tunnel Kiln
30500598	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500599	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln
30500607	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Unloading
30500608	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Piles
30500609	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Primary Crushing
30500610	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Secondary Crushing
30500611	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Screening
30500612	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Transfer
30500613	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Grinding and Drying
30500614	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Cooler
30500615	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Piles
30500616	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Transfer
30500617	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Grinding
30500618	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Silos
30500619	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Load Out
30500620	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Predryer
30500621	Industrial Processes; Mineral Products; Cement Manufacturing (Wet or Dry Process); Pulverized Coal Kiln Feed Units
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln
30500624	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Feed Belt
30500625	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Weigh Hopper
30500626	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Air Separator
30500627	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Feed Belt
30500628	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Weigh Hopper
30500629	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Air Separator
30500699	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Other Not Classified
30500800	Industrial Processes;Mineral Products;Ceramic Clay/Tile Manufacture;undefined
30500801	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying ** (use SCC 3-05-008-13)

30500802	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Comminution - Crushing, Grinding, & Milling
30500803	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Storage
30500804	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Screening and floating ** (use SCC 3-05-008-16)
30500805	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Direct Mixing of Ceramic Powder and Binder Solution
30500806	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Handling and Transfer
30500807	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Grinding, dry ** (use SCC 3-05-008-02)
30500810	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Natural Gas-fired Spray Dryer
30500811	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Infrared (IR) Drying Prior to Firing
30500812	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glazing and firing kiln ** (use SCCs 3-05-008-45 & -50)
30500813	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Convection Drying Prior to Firing
30500816	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Sizing - Vibrating Screens
30500818	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Air Classifier
30500821	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Rotary Calciner
30500822	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Rotary Calciner
30500823	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Fluidized Bed Calciner
30500824	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Fluidized Bed Calciner
30500828	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Mixing - Raw Matls, Binders, Plasticizers, Surfactants, & Other Agent
30500830	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - General
30500831	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - Tape Casters
30500835	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Green Machining-Grindg, Cutg, or Laminatg Formed Ceramics Prior to Fir
30500840	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Natural Gas-fired Kiln
30500841	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Fuel Oil-fired Kiln
30500843	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glaze Preparation - Ballmill or Attrition Mill
30500845	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Ceramic Glaze Spray Booth
30500850	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Natural Gas-fired Kiln
30500854	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Fuel Oil-fired Kiln
30500856	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Refiring Kiln - Refiring after Decal, Paint, or Ink Applied; Natural-g

30500858	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Cooler - Cooling Ceramics Following Firing
30500860	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Grinding and Polishing
30500870	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Annealing
30500880	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Surface Coating
30500899	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Other Not Classified
30500901	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Fly Ash Sintering
30500902	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay/Coke Sintering
30500903	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Natural Clay/Shale Sintering
30500904	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Crushing/Screening
30500905	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Transfer/Conveying
30500906	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Storage Piles
30500907	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Coke Product Crushing/Screening
30500908	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Shale Product Crushing/Screening
30500909	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Clinker Cooling
30500910	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Storage
30500915	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Rotary Kiln
30500916	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Dryer
30500917	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay Reciprocating Grate Clinker Cooler
30500999	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Other Not Classified
30501101	Industrial Processes; Mineral Products; Concrete Batching; Total Facility Emissions except road dust & wind-blown dust
30501104	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Elevated Storage
30501105	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Elevated Storage
30501106	Industrial Processes; Mineral Products; Concrete Batching; Transfer: Sand/Aggregate to Elevated Bins (See Also -04 & -05)
30501107	Industrial Processes; Mineral Products; Concrete Batching; Cement Unloading to Elevated Storage Silo
30501108	Industrial Processes; Mineral Products; Concrete Batching; Weight Hopper Loading of Sand and Aggregate
30501109	Industrial Processes; Mineral Products; Concrete Batching; Mixer Loading of Cement/Sand/Aggregate
30501110	Industrial Processes; Mineral Products; Concrete Batching; Loading of Transit Mix Truck
30501111	Industrial Processes; Mineral Products; Concrete Batching; Loading of Dry-batch Truck
30501112	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Wet
30501113	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Dry

30501114	Industrial Processes; Mineral Products; Concrete Batching; Transferring: Conveyors/Elevators
30501115	Industrial Processes; Mineral Products; Concrete Batching; Storage: Bins/Hoppers
30501117	Industrial Processes; Mineral Products; Concrete Batching; Cement Supplement Unloading to Elevated Storage Silo
30501120	Industrial Processes; Mineral Products; Concrete Batching; Asbestos/Cement Products
30501121	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Delivery to Ground Storage
30501122	Industrial Processes; Mineral Products; Concrete Batching; Sand Delivery to Ground Storage
30501123	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Conveyor
30501124	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Conveyor
30501199	Industrial Processes; Mineral Products; Concrete Batching; Other Not Classified
30501201	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Wool-type Fiber)
30501202	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Wool-type Fiber)
30501203	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Electric Furnace (Wool-type Fiber)
30501204	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Rotary Spun (Wool-type Fiber)
30501205	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven: Rotary Spun (Wool-type Fiber)
30501206	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Cooling (Wool-type Fiber)
30501207	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Wool-type Fiber)
30501208	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Flame Attenuation (Wool-type Fiber)
30501209	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing: Flame Attenuation (Wool-type Fiber)
30501211	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Textile-type Fiber)
30501212	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Textile-type Fiber)
30501213	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Textile-type Fiber)
30501214	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming Process (Textile-type Fiber)
30501215	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven (Textile-type Fiber)
30501221	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Unloading/Conveying
30501222	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Storage Bins
30501223	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Mixing/Weighing
30501224	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Crushing/Charging
30501299	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Other Not Classified
30501301	Industrial Processes; Mineral Products; Frit Manufacture; General ** (use 3-05-013-05 or 3-05-013-06)
30501302	Industrial Processes; Mineral Products; Frit Manufacture; Weighing of raw materials

30501303	Industrial Processes; Mineral Products; Frit Manufacture; Dry Mixing of raw materials
30501304	Industrial Processes; Mineral Products; Frit Manufacture; Smelting Furnace Charging
30501305	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Smelting Furnace
30501306	Industrial Processes; Mineral Products; Frit Manufacture; Continuous Smelting Furnace
30501310	Industrial Processes; Mineral Products; Frit Manufacture; Water Spray Quenching to shatter material into small particles
30501311	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Dryer (usually not used with a continuous furnace)
30501315	Industrial Processes; Mineral Products; Frit Manufacture; Dry Milling of quenched frit with a ball mill
30501316	Industrial Processes; Mineral Products; Frit Manufacture; Product Screening
30501399	Industrial Processes; Mineral Products; Frit Manufacture; Other Not Classified
30501400	Industrial Processes;Mineral Products;Glass Manufacture;undefined
30501401	Industrial Processes; Mineral Products; Glass Manufacture; Furnace/General**
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace
30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace
30501405	Industrial Processes; Mineral Products; Glass Manufacture; Presintering
30501406	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Forming/Finishing
30501407	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Forming/Finishing
30501408	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Forming/Finishing
30501410	Industrial Processes; Mineral Products; Glass Manufacture; Raw Material Handling (All Types of Glass)
30501411	Industrial Processes; Mineral Products; Glass Manufacture; General **
30501412	Industrial Processes; Mineral Products; Glass Manufacture; Hold Tanks **
30501413	Industrial Processes; Mineral Products; Glass Manufacture; Cullet: Crushing/Grinding
30501414	Industrial Processes; Mineral Products; Glass Manufacture; Ground Cullet Beading Furnace
30501415	Industrial Processes; Mineral Products; Glass Manufacture; Glass Etching with Hydrofluoric Acid Solution
30501416	Industrial Processes; Mineral Products; Glass Manufacture; Glass Manufacturing
30501417	Industrial Processes; Mineral Products; Glass Manufacture; Briquetting
30501418	Industrial Processes; Mineral Products; Glass Manufacture; Pelletizing
30501420	Industrial Processes; Mineral Products; Glass Manufacture; Mirror Plating: General
30501421	Industrial Processes; Mineral Products; Glass Manufacture; Demineralizer: General
30501499	Industrial Processes; Mineral Products; Glass Manufacture; See Comment **
30501500	Industrial Processes;Mineral Products;Gypsum Manufacture;undefined
30501501	Industrial Processes; Mineral Products; Gypsum Manufacture; Rotary Ore Dryer
30501502	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Grinder/Roller Mills
30501503	Industrial Processes; Mineral Products; Gypsum Manufacture; Not Classified **
30501504	Industrial Processes; Mineral Products; Gypsum Manufacture; Conveying

30501505	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Crushing: Gypsum Ore
30501506	Industrial Processes; Mineral Products; Gypsum Manufacture; Secondary Crushing: Gypsum Ore
30501507	Industrial Processes; Mineral Products; Gypsum Manufacture; Screening: Gypsum Ore
30501508	Industrial Processes; Mineral Products; Gypsum Manufacture; Stockpile: Gypsum Ore
30501509	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Gypsum Ore
30501510	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Landplaster
30501511	Industrial Processes; Mineral Products; Gypsum Manufacture; Continuous Kettle: Calciner
30501512	Industrial Processes; Mineral Products; Gypsum Manufacture; Flash Calciner
30501513	Industrial Processes; Mineral Products; Gypsum Manufacture; Impact Mill
30501514	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Stucco
30501515	Industrial Processes; Mineral Products; Gypsum Manufacture; Tube/Ball Mills
30501516	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers
30501517	Industrial Processes; Mineral Products; Gypsum Manufacture; Bagging
30501518	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers/Conveyors
30501519	Industrial Processes; Mineral Products; Gypsum Manufacture; Forming Line
30501520	Industrial Processes; Mineral Products; Gypsum Manufacture; Drying Kiln
30501521	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (8 Ft.)
30501522	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (12 Ft.)
30501599	Industrial Processes; Mineral Products; Gypsum Manufacture; See Comment **
30501601	Industrial Processes; Mineral Products; Lime Manufacture; Primary Crushing
30501602	Industrial Processes; Mineral Products; Lime Manufacture; Secondary Crushing/Screening
30501603	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Vertical Kiln
30501604	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Rotary Kiln ** (See SCC Codes 3-05-016-18,-19,-20,-21)
30501605	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Calcimatic Kiln
30501606	Industrial Processes; Mineral Products; Lime Manufacture; Fluidized Bed Kiln
30501607	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Transfer and Conveying
30501608	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Unloading
30501609	Industrial Processes; Mineral Products; Lime Manufacture; Hydrator: Atmospheric
30501610	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Storage Piles
30501611	Industrial Processes; Mineral Products; Lime Manufacture; Product Cooler
30501612	Industrial Processes; Mineral Products; Lime Manufacture; Pressure Hydrator
30501613	Industrial Processes; Mineral Products; Lime Manufacture; Lime Silos
30501614	Industrial Processes; Mineral Products; Lime Manufacture; Packing/Shipping
30501615	Industrial Processes; Mineral Products; Lime Manufacture; Product Transfer and Conveying
30501616	Industrial Processes; Mineral Products; Lime Manufacture; Primary Screening
30501617	Industrial Processes; Mineral Products; Lime Manufacture; Multiple Hearth Calciner
30501618	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Kiln
30501619	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Rotary Kiln

30501620	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Gas-fired Rotary Kiln
30501621	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Coke-fired Rotary Kiln
30501622	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Preheater Kiln
30501623	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Parallel Flow Regenerative Kiln
30501624	Industrial Processes; Mineral Products; Lime Manufacture; Conveyor Transfer - Primary Crushed Material
30501625	Industrial Processes; Mineral Products; Lime Manufacture; Secondary/Tertiary Screening
30501626	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Enclosed Truck
30501627	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Open Truck
30501628	Industrial Processes; Mineral Products; Lime Manufacture; Pulverizing
30501629	Industrial Processes; Mineral Products; Lime Manufacture; Tertiary Screening After Pulverizing
30501630	Industrial Processes; Mineral Products; Lime Manufacture; Screening After Calcination
30501631	Industrial Processes; Mineral Products; Lime Manufacture; Crushing and Pulverizing After Calcinating
30501632	Industrial Processes; Mineral Products; Lime Manufacture; Milling
30501633	Industrial Processes; Mineral Products; Lime Manufacture; Separator After Hydrator
30501640	Industrial Processes; Mineral Products; Lime Manufacture; Vehicle Traffic
30501650	Industrial Processes; Mineral Products; Lime Manufacture; Quarrying Raw Limestone
30501660	Industrial Processes; Mineral Products; Lime Manufacture; Waste Treatment
30501699	Industrial Processes; Mineral Products; Lime Manufacture; See Comment **
30501701	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cupola
30501702	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Reverberatory Furnace
30501703	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Blow Chamber
30501704	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Curing Oven
30501705	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cooler
30501706	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Granulated Products Processing
30501707	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Handling
30501708	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Packaging
30501709	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Batt Application
30501710	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Storage of Oils and Binders
30501711	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Mixing of Oils and Binders
30501799	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Other Not Classified
30501801	Industrial Processes; Mineral Products; Perlite Manufacturing; Vertical Furnace
30501899	Industrial Processes; Mineral Products; Perlite Manufacturing; Other Not Classified
30501901	Industrial Processes; Mineral Products; Phosphate Rock; Drying
30501902	Industrial Processes; Mineral Products; Phosphate Rock; Grinding
30501903	Industrial Processes; Mineral Products; Phosphate Rock; Transfer/Storage

30501904	Industrial Processes; Mineral Products; Phosphate Rock; Open Storage
30501905	Industrial Processes; Mineral Products; Phosphate Rock; Calcining
30501906	Industrial Processes; Mineral Products; Phosphate Rock; Rotary Dryer
30501907	Industrial Processes; Mineral Products; Phosphate Rock; Ball Mill
30501908	Industrial Processes; Mineral Products; Phosphate Rock; Mineral Products Benification
30501999	Industrial Processes; Mineral Products; Phosphate Rock; Other Not Classified
30502101	Industrial Processes; Mineral Products; Salt Mining; General
30502102	Industrial Processes; Mineral Products; Salt Mining; Granulation: Stack Dryer
30502103	Industrial Processes; Mineral Products; Salt Mining; Filtration: Vacuum Filter
30502104	Industrial Processes; Mineral Products; Salt Mining; Crushing
30502105	Industrial Processes; Mineral Products; Salt Mining; Screening
30502106	Industrial Processes; Mineral Products; Salt Mining; Conveying
30502201	Industrial Processes; Mineral Products; Potash Production; Mine: Grinding/Drying
30502299	Industrial Processes; Mineral Products; Potash Production; Other Not Classified
30502401	Industrial Processes; Mineral Products; Magnesium Carbonate; Mine/Process
30502499	Industrial Processes; Mineral Products; Magnesium Carbonate; Other Not Classified
30502500	Industrial Processes;Mineral Products;Construction Sand and Gravel;undefined
30502501	Industrial Processes; Mineral Products; Construction Sand and Gravel; Total Plant: General **
30502502	Industrial Processes; Mineral Products; Construction Sand and Gravel; Aggregate Storage
30502503	Industrial Processes; Mineral Products; Construction Sand and Gravel; Material Transfer and Conveying
30502504	Industrial Processes; Mineral Products; Construction Sand and Gravel; Hauling
30502505	Industrial Processes; Mineral Products; Construction Sand and Gravel; Pile Forming: Stacker
30502506	Industrial Processes; Mineral Products; Construction Sand and Gravel; Bulk Loading
30502507	Industrial Processes; Mineral Products; Construction Sand and Gravel; Storage Piles
30502508	Industrial Processes; Mineral Products; Construction Sand and Gravel; Dryer ** (See 3-05-027-20 thru -24 for Industrial Sand Dryers)
30502509	Industrial Processes; Mineral Products; Construction Sand and Gravel; Cooler ** (See 3-05-027-30 for Industrial Sand Coolers)
30502510	Industrial Processes; Mineral Products; Construction Sand and Gravel; Crushing
30502511	Industrial Processes; Mineral Products; Construction Sand and Gravel; Screening
30502512	Industrial Processes; Mineral Products; Construction Sand and Gravel; Overburden Removal
30502513	Industrial Processes; Mineral Products; Construction Sand and Gravel; Excavating
30502514	Industrial Processes; Mineral Products; Construction Sand and Gravel; Drilling and Blasting
30502522	Industrial Processes; Mineral Products; Construction Sand and Gravel; Rodmilling: Fine Crushing of Construction Sand
30502523	Industrial Processes; Mineral Products; Construction Sand and Gravel; Fine Screening of Construction Sand Following Dewatering or Rodmilling
30502599	Industrial Processes; Mineral Products; Construction Sand and Gravel; Not Classified **
30502601	Industrial Processes; Mineral Products; Diatomaceous Earth; Handling
30502699	Industrial Processes; Mineral Products; Diatomaceous Earth; Other Not Classified

30502701	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Primary Crushing of Raw Material
30502705	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Secondary Crushing
30502709	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Grinding: Size Reduction to 50 Microns or Smaller
30502713	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Screening: Size Classification
30502717	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Draining: Removal of Moisture to About 6% After Froth Flotation
30502720	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas- or Oil-fired Rotary or Fluidized Bed Dryer
30502721	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Rotary Dryer
30502722	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Rotary Dryer
30502723	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Fluidized Bed Dryer
30502724	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Fluidized Bed Dryer
30502730	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Cooling of Dried Sand
30502740	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Final Classifying: Screening to Classify Sand by Size
30502760	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Handling, Transfer, and Storage
30502910	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Rotary Kiln
30502920	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Clinker Cooler
30503099	Industrial Processes; Mineral Products; Ceramic Electric Parts; Other Not Classified
30503101	Industrial Processes; Mineral Products; Asbestos Mining; Surface Blasting
30503102	Industrial Processes; Mineral Products; Asbestos Mining; Surface Drilling
30503103	Industrial Processes; Mineral Products; Asbestos Mining; Cobbing
30503104	Industrial Processes; Mineral Products; Asbestos Mining; Loading
30503105	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Asbestos
30503106	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Waste
30503107	Industrial Processes; Mineral Products; Asbestos Mining; Unloading
30503108	Industrial Processes; Mineral Products; Asbestos Mining; Overburden Stripping
30503109	Industrial Processes; Mineral Products; Asbestos Mining; Ventilation of Process Operations
30503110	Industrial Processes; Mineral Products; Asbestos Mining; Stockpiling
30503111	Industrial Processes; Mineral Products; Asbestos Mining; Tailing Piles
30503199	Industrial Processes; Mineral Products; Asbestos Mining; Other Not Classified
30503201	Industrial Processes; Mineral Products; Asbestos Milling; Crushing
30503202	Industrial Processes; Mineral Products; Asbestos Milling; Drying
30503203	Industrial Processes; Mineral Products; Asbestos Milling; Recrushing
30503204	Industrial Processes; Mineral Products; Asbestos Milling; Screening
30503205	Industrial Processes; Mineral Products; Asbestos Milling; Fiberizing

30503206	Industrial Processes; Mineral Products; Asbestos Milling; Bagging
30503299	Industrial Processes; Mineral Products; Asbestos Milling; Other Not Classified
30503301	Industrial Processes; Mineral Products; Vermiculite; General
30503312	Industrial Processes; Mineral Products; Vermiculite; Screening of Crude Vermiculite Ore
30503319	Industrial Processes; Mineral Products; Vermiculite; Blending of Vermiculite Ore
30503321	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Gas-fired
30503322	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Oil-fired
30503326	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Gas-fired
30503327	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Oil-fired
30503331	Industrial Processes; Mineral Products; Vermiculite; Crushing of Dried Vermiculite Concentrate
30503336	Industrial Processes; Mineral Products; Vermiculite; Screening: Size Classification of Crushed Vermiculite Concentrate
30503341	Industrial Processes; Mineral Products; Vermiculite; Conveying of Vermiculite Concentrate to Storage
30503351	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Gas-fired Vertical Furnace
30503352	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Oil-fired Vertical Furnace
30503361	Industrial Processes; Mineral Products; Vermiculite; Product Grinding: Grinding of Exfoliated Vermiculite
30503366	Industrial Processes; Mineral Products; Vermiculite; Product Classifying: Air Classification of Exfoliated Vermiculite
30503401	Industrial Processes; Mineral Products; Feldspar; Ball Mill
30503402	Industrial Processes; Mineral Products; Feldspar; Dryer
30503501	Industrial Processes; Mineral Products; Abrasive Grain Processing; Primary Crushing
30503502	Industrial Processes; Mineral Products; Abrasive Grain Processing; Secondary Crushing
30503503	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Crushing
30503504	Industrial Processes; Mineral Products; Abrasive Grain Processing; Crushed Grain Screening
30503505	Industrial Processes; Mineral Products; Abrasive Grain Processing; Washing/Drying
30503506	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Screening
30503507	Industrial Processes; Mineral Products; Abrasive Grain Processing; Air Classification
30503601	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Mixing
30503602	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Molding
30503603	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Steam Autoclaving
30503604	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Drying
30503605	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Firing or Curing
30503606	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Cooling
30503607	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Final Machining
30503701	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Printing of Backing

30503702	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Make Coat Application
30503703	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Grain Application
30503704	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Drying
30503705	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Size Coat Application
30503706	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Drying and Curing
30503707	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Roll Winding
30503708	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Production
30503901	Industrial Processes; Mineral Products; Pyrrhotite; Fluid Bed Roaster
30503902	Industrial Processes; Mineral Products; Pyrrhotite; Reduction Kiln
30504001	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Blasting
30504002	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Drilling
30504003	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Cobbing
30504010	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Underground Ventilation
30504020	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Loading
30504021	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Material
30504022	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Waste
30504023	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Unloading
30504024	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Overburden Stripping
30504025	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Stockpiling
30504030	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Primary Crusher
30504031	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Secondary Crusher
30504032	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Concentrator
30504033	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Dryer
30504034	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Screening
30504036	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Tailing Piles
30504099	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Other Not Classified
30504101	Industrial Processes; Mineral Products; Clay processing: Kaolin; Mining
30504102	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material storage
30504103	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material transfer
30504115	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material crushing, NEC
30504119	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material grinding, NEC
30504129	Industrial Processes; Mineral Products; Clay processing: Kaolin; Screening, NEC
30504130	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, rotary dryer

30504131	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, spray dryer
30504132	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, apron dryer
30504133	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, vibrating grate dryer
30504139	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, dryer NEC
30504140	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, rotary calciner
30504141	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, multiple hearth furnace
30504142	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, flash calciner
30504149	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, calciner NEC
30504150	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product grinding
30504151	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product screening/classification
30504160	Industrial Processes; Mineral Products; Clay processing: Kaolin; Bleaching
30504170	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product transfer
30504171	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product storage
30504172	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product packaging
30504201	Industrial Processes; Mineral Products; Clay processing: Ball clay; Mining
30504202	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material storage
30504203	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material transfer
30504215	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material crushing, NEC
30504219	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material grinding, NEC
30504230	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, rotary dryer
30504231	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, spray dryer
30504232	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, apron dryer
30504233	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, vibrating grate dryer
30504239	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, dryer NEC
30504250	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product grinding
30504270	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product transfer
30504271	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product storage
30504272	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product packaging
30504301	Industrial Processes; Mineral Products; Clay processing: Fire clay; Mining
30504302	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material storage
30504303	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material transfer
30504315	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material crushing, NEC
30504319	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material grinding, NEC
30504329	Industrial Processes; Mineral Products; Clay processing: Fire clay; Screening, NEC
30504330	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, rotary dryer
30504331	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, spray dryer
30504332	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, apron dryer
30504333	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, vibrating grate dryer

30504339	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, dryer NEC
30504340	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, rotary calciner
30504341	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, multiple hearth furnace
30504342	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, flash calciner
30504349	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, calciner NEC
30504350	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product grinding
30504351	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product screening/classification
30504370	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product transfer
30504371	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product storage
30504372	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product packaging
30504401	Industrial Processes; Mineral Products; Clay processing: Bentonite; Mining
30504402	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material storage
30504403	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material transfer
30504415	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material crushing, NEC
30504419	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material grinding, NEC
30504430	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, rotary dryer
30504431	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, spray dryer
30504432	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, apron dryer
30504433	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, vibrating grate dryer
30504439	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, dryer NEC
30504450	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product grinding
30504451	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product screening/classification
30504470	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product transfer
30504471	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product storage
30504472	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product packaging
30504501	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Mining
30504502	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material storage
30504503	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material transfer
30504515	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material crushing, NEC
30504519	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material grinding, NEC
30504530	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, rotary dryer
30504531	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, spray dryer
30504532	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, apron dryer
30504533	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, vibrating grate dryer
30504539	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, dryer NEC
30504550	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product grinding

30504551	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product screening/classification
30504570	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product transfer
30504571	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product storage
30504572	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product packaging
30504601	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Mining
30504602	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material storage
30504603	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material transfer
30504615	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material crushing, NEC
30504619	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material grinding, NEC
30504629	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Screening, NEC
30504630	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, rotary dryer
30504631	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, spray dryer
30504632	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, apron dryer
30504633	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, vibrating grate dryer
30504639	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, dryer NEC
30504670	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product transfer
30504671	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product storage
30504672	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product packaging
30505001	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Processing (Blowing)
30505005	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Storage (Prior to Blowing)
30505010	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Blowing Still
30505020	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Natural Gas
30505021	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Residual Oil
30505022	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Distillate Oil
30505023	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: LP Gas
30508906	Industrial Processes; Mineral Products; Talc Processing; Storage of Raw Mined Talc Before Processing
30508908	Industrial Processes; Mineral Products; Talc Processing; Conveyor Transfer of Raw Talc to Primary Crusher
30508909	Industrial Processes; Mineral Products; Talc Processing; Natural Gas Fired Crude Ore Dryer
30508910	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil Fired Crude Ore Dryer

30508911	Industrial Processes; Mineral Products; Talc Processing; Primary crusher
30508912	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Railcar Loading
30508914	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Storage Bin Loading
30508917	Industrial Processes; Mineral Products; Talc Processing; Screening Oversize Ore to Return to Primary Crusher
30508921	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Dryer
30508923	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Dryer
30508931	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Calciner
30508933	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Calciner
30508941	Industrial Processes; Mineral Products; Talc Processing; Rotary Cooler Following Calciner
30508945	Industrial Processes; Mineral Products; Talc Processing; Grinding of Dried Talc
30508947	Industrial Processes; Mineral Products; Talc Processing; Grinding/Drying of Talc with Heated Makeup Air
30508949	Industrial Processes; Mineral Products; Talc Processing; Ground Talc Storage Bin Loading
30508950	Industrial Processes; Mineral Products; Talc Processing; Air Classifier - Size Classification of Ground Talc
30508953	Industrial Processes; Mineral Products; Talc Processing; Pelletizer
30508955	Industrial Processes; Mineral Products; Talc Processing; Pellet Dryer
30508958	Industrial Processes; Mineral Products; Talc Processing; Pneumatic Conveyor Vents
30508961	Industrial Processes; Mineral Products; Talc Processing; Concentration of Talc Fines Using Shaking Table
30508971	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Flash Drying of Slurry after Flotation
30508973	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Flash Drying of Slurry after Flotation
30508982	Industrial Processes; Mineral Products; Talc Processing; Custom Grinding - Additional Size Reduction
30508985	Industrial Processes; Mineral Products; Talc Processing; Final Product Storage Bin Loading
30508988	Industrial Processes; Mineral Products; Talc Processing; Packaging
30509001	Industrial Processes; Mineral Products; Mica; Rotary Dryer
30509002	Industrial Processes; Mineral Products; Mica; Fluid Energy Mill - Grinding
30509101	Industrial Processes; Mineral Products; Sandspar; Rotary Dryer
30509201	Industrial Processes; Mineral Products; Catalyst Manufacturing; Transferring and Handling
30509202	Industrial Processes; Mineral Products; Catalyst Manufacturing; Mixing and Blending
30509203	Industrial Processes; Mineral Products; Catalyst Manufacturing; Reacting
30509204	Industrial Processes; Mineral Products; Catalyst Manufacturing; Drying
30509205	Industrial Processes; Mineral Products; Catalyst Manufacturing; Storage
30510000	Industrial Processes;Mineral Products;Bulk Materials Elevators;undefined
30510001	Industrial Processes; Mineral Products; Bulk Materials Elevators; Unloading
30510002	Industrial Processes; Mineral Products; Bulk Materials Elevators; Loading
30510003	Industrial Processes; Mineral Products; Bulk Materials Elevators; Removal from Bins
30510004	Industrial Processes; Mineral Products; Bulk Materials Elevators; Drying

30510005	Industrial Processes; Mineral Products; Bulk Materials Elevators; Cleaning
30510006	Industrial Processes; Mineral Products; Bulk Materials Elevators; Elevator Legs (Headhouse)
30510007	Industrial Processes; Mineral Products; Bulk Materials Elevators; Tripper (Gallery Belt)
30510100	Industrial Processes;Mineral Products;Bulk Materials Conveyors;undefined
30510101	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Ammonium Sulfate
30510102	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Cement
30510103	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coal
30510104	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coke
30510105	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Limestone
30510106	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Phosphate Rock
30510107	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Scrap Metal
30510108	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Sulfur
30510196	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Chemical: Specify in Comments
30510197	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Fertilizer: Specify in Comments
30510198	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Mineral: Specify in Comments
30510199	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Other Not Classified
30510200	Industrial Processes;Mineral Products;Bulk Materials Storage Bins;undefined
30510201	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Ammonium Sulfate
30510202	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Cement
30510203	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coal
30510204	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coke
30510205	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Limestone
30510206	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Phosphate Rock
30510207	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Scrap Metal
30510208	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sulfur
30510209	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sand
30510296	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Chemical: Specify in Comments
30510297	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Fertilizer: Specify in Comments
30510298	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Mineral: Specify in Comments
30510299	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Other Not Classified
30510301	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Ammonium Sulfate
30510302	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Cement
30510303	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coal
30510304	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coke
30510305	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Limestone
30510306	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Phosphate Rock
30510307	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Scrap Metal

30510308	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sulfur
30510309	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sand
30510310	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fluxes
30510396	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Chemical: Specify in Comments
30510397	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fertilizer: Specify in Comments
30510398	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Mineral: Specify in Comments
30510399	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Other Not Classified
30510401	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Ammonium Sulfate
30510402	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Cement
30510403	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coal
30510404	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coke
30510405	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Limestone
30510406	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Phosphate Rock
30510407	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Scrap Metal
30510408	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Sulfur
30510496	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Chemical: Specify in Comments
30510497	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Fertilizer: Specify in Comments
30510498	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Mineral: Specify in Comments
30510499	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Other Not Classified
30510501	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Ammonium Sulfate
30510502	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Cement
30510503	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coal
30510504	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coke
30510505	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Limestone
30510506	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Phosphate Rock
30510507	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Scrap Metal
30510508	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Sulfur
30510596	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Chemical: Specify in Comments
30510597	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Fertilizer: Specify in Comments
30510598	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Mineral: Specify in Comments
30510599	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Other Not Classified
30510600	Industrial Processes;Mineral Products;Bulk Materials Screening/Size Classification;undefined
30510604	Industrial Processes; Mineral Products; Bulk Materials Screening/Size Classification; Coke
30510708	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Sulfur

30510709	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Bauxite
30510800	Industrial Processes;Mineral Products;Bulk Materials: Grinding/Crushing;undefined
30510808	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Sulfur
30510809	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Bauxite
30515001	Industrial Processes; Mineral Products; Calcining; Raw Material Handling
30515002	Industrial Processes; Mineral Products; Calcining; General
30515003	Industrial Processes; Mineral Products; Calcining; Grinding/Milling
30515004	Industrial Processes; Mineral Products; Calcining; Finished Product Handling
30515005	Industrial Processes; Mineral Products; Calcining; Mixing
30531001	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Fluidized Bed
30531002	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Flash or Suspension
30531003	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Multilouvered
30531004	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Rotary
30531005	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cascade
30531006	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Continuous Carrier
30531007	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screen
30531008	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Unloading
30531009	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Raw Coal Storage
30531010	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Crushing
30531011	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Coal Transfer
30531012	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screening
30531013	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Air Tables
30531014	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cleaned Coal Storage
30531015	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading
30531016	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading: Clean Coal
30531017	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Secondary Crushing
30531090	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Haul Roads: General
30531099	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Other Not Classified

30532001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Primary Crushing
30532002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Secondary Crushing/Screening
30532003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Tertiary Crushing/Screening
30532004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Recrushing/Screening
30532005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Fines Mill
30532006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Miscellaneous Operations: Screen/Convey/Handling
30532007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Open Storage
30532008	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Cut Stone: General
30532009	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Blasting: General
30532010	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532011	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Hauling
30532012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drying
30532013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Bar Grizzlies
30532014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Shaker Screens
30532015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Vibrating Screens
30532016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Revolving Screens
30532017	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Pugmill
30532018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling with Liquid Injection
30532020	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Unloading
30532032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Conveyor
30532033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Front End Loader
30532090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30580001	Industrial Processes; Mineral Products; Equipment Leaks; Equipment Leaks
30582001	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Area Drains
30582002	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Equipment Drains

30582599	Industrial Processes; Mineral Products; Wastewater, Points of Generation; Specify Point of Generation
30588801	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588802	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588803	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588804	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588805	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30590001	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30590002	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Process Heaters
30590003	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Process Heaters
30590005	Industrial Processes; Mineral Products; Fuel Fired Equipment; Liquified Petroleum Gas (LPG): Process Heaters
30590011	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Incinerators
30590012	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Incinerators
30590013	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Incinerators
30590021	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Flares
30590023	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Flares
30599900	Industrial Processes;Mineral Products;Other Not Defined;undefined
30599999	Industrial Processes; Mineral Products; Other Not Defined; Specify in Comments Field

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Cartridge Collector with Pulse-Jet Cleaning," April 2000.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.87%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5

CHEM_PCT:	0%
COST_BASIS:	The costs are generated using EPAGÇÖs cost-estimating spreadsheets for fabric filters (EPA, 1998a). Costs are primarily driven by the waste stream volumetric flow rate and pollutant loading. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $7 to $13 per scfm Typical value is $9 per scfm O&M Costs: Range from $9 to $25 per scfm Typical value is $14 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average cartridge cost was estimated using the costs for standard cartridge types. Capital recovery for the periodic replacement of cartridges was included in the O&M cost of the cartridges using a cartridge life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$256/ton
CPTON_L:	$85/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $85 to $256 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $142 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	10.14%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.74%
MNTLBR_PCT:	5.71%

MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	5.71%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.95%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.89%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.87%
RPLMTL_PCT:	17.49%
RULE:	Not Applicable
SPVLBR_PCT:	0.44%
STEAM_PCT:	0%
TDIR_PCT:	87.63%
TINDIR_PCT:	12.37%
UTIL_PCT:	2.96%
WSTDSP_PCT:	42.24%

Summary:

Control Measure Name: Fuel Moisture Content;Prescribed Forest Burns

Abbreviation: PPRBRNFULM

Description: Application: Prescribed burning is defined as the intentional burning of forest and range lands. For forestry burning, increasing the fuel moisture will decrease particulate emissions by decreasing the amount of fuel burned.

This control is applicable to prescribed burning for forest management.

Discussion: Decreasing PM emissions is accomplished by either removing lighter and drier fuels or burning in early spring when moisture levels are naturally higher. Emission reductions estimates range from 30 to more than 50 percent (EPA, 1992; Hardy, 1997). Reductions will vary significantly depending on a given area. Variation is based on current burn schedule and method, along with the characteristics of the material to be burned.

Class: Known

Pollutant: PM2_5

Equipment Life: N/A years

Control Technology: Increase Fuel Moisture

Source Group: Prescribed Burning

Sectors: ptfire

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM2_5	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1990	1990
CPT:			$3,029	$3,029
Ref Yr CPT:			$4,851	$4,851
Control Efficiency:	50.0	50.0	50.0	50.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM2_5	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1990	1990
CPT:			$3,029	$3,029

Ref Yr CPT:			$4,851	$4,851
Control Efficiency:	50.0	50.0	50.0	50.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2810015000	Miscellaneous Area Sources; Other Combustion; Prescribed Forest Burning; Unspecified

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- EPA, 1992: U.S. Environmental Protection Agency, "Prescribed Burning Background Document," Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 1992.
- BLS, 1994: U.S. Department of Labor, Bureau of Labor Statistics, Producer Price Indices, Washington DC. Various issues 1985 through 1994.
- Hardy, 1997: C. Hardy, Intermountain Research Station, USDA Forest Service, Forest Service Fire Research Library, Missoula, MT, personal communication with M. Cohen, E.H. Pechan & Associates, Inc. February 1997.

Other information:

ADMIN_PCT:	0%
CHEM_PCT:	0%

CE_TEXT:	50% from uncontrolled for both PM10 and PM2.5
ELEC_PCT:	0%
COST_BASIS:	EPA estimated a range of $38 to $161 per acre cost for increasing fuel moisture in 1986 (EPA, 1992). Costs vary based on the current burn schedule and method, along with the type of land under consideration (federal versus private). Based on the emission factor for PM10 emissions and the 50 percent control efficiency, a $826-$3,500 PM10 cost per ton range (in 1986 dollars) is estimated. For PM10: (($38-$161 per acre) / (0.092 tons PM-10/acre)) * ((1 ton emitted) / (0.50 ton reduced)) = $826-$3,500 per ton PM10 reduced (in 1986 dollars) Because this measure entails work practice changes, costs were converted to 1990 dollar terms using the 1986-1990 producer price index for employment costs (BLS, 1994). For PM10: $826-$3,500 per ton in 1986 dollars * 1.21 = $999-$4,235 per ton PM10 reduced (in 1990 dollars) The midpoint of these cost ranges was used in the analysis, PM10 costs are estimated at $2,617 per ton.
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $2,617 per ton PM reduced (1990$).
CTRL_EFF_T:	50%
ELEC_RT:	$0/kWh
EC:	Co
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
OTHR_PCT:	0%
OVRHD_PCT:	0%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%

UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Remove old wood stoves; Wood Stoves
Abbreviation: PROWSWDSTV
Description: Implement an incentive program (usually voluntary) where cash (e.g., $250) is given in return for turning in a wood stove.
Class: Known
Pollutant: PM25-PRI
Equipment Life: N/A years
Control Technology: Remove old wood stoves
Source Group: Wood Stoves
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2011
CPT:				$5,330
Ref Yr CPT:				$5,517
Control Efficiency:	70.0	70.0	70.0	70.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	CO2	VOC	CO	PM25-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	N/A	2011
CPT:				$5,330
Ref Yr CPT:				$5,517
Control Efficiency:	70.0	70.0	70.0	70.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0

Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2104008310	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, non-EPA certified

References:

- http://www.epa.gov/burnwise/resources.html

Other information:

Summary:

Control Measure Name: Venturi scrubber; Catalytic cracking units

Abbreviation: PVENTCCU

Description: Application: The control is the use of a venturi scrubber to reduce PM emissions. A scrubber is a type of technology that removes air pollutants by inertial and diffusional interception. A venturi scrubber accelerates the waste gas stream to atomize the scrubbing liquid and to improve gas-liquid contact.

This control applies to operations with catalytic cracking units.

Discussion: A venturi scrubber accelerates the waste gas stream to improve gas-liquid contact. In a venturi scrubber, a "throat"'

Class: Emerging

Pollutant: PM2_5

Equipment Life: N/A years

Control Technology: Venturi scrubber

Source Group: Catalytic cracking units

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM25-PRI	PM2_5
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$1,300	$1,300
Ref Yr CPT:	$1,736	$1,736
Control Efficiency:	90.0	90.0
Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0
Pollutant:	PM25-PRI	PM2_5
Locale:		
Effective Date:	N/A	N/A
Cost Year:	1999	1999
CPT:	$1,300	$1,300
Ref Yr CPT:	$1,736	$1,736
Control Efficiency:	90.0	90.0

Min Emis:	N/A	N/A
Max Emis:	N/A	N/A
Rule Effectiveness:	100.0	100.0
Rule Penetration:	100.0	100.0
Equation Type:	cpton	cpton
Capital Rec Fac:	N/A	N/A
Discount Rate:	N/A	N/A
Cap Ann Ratio:	N/A	N/A
Incremental CPT:	N/A	N/A
Details:		
Existing Measure:		
Existing NEI Dev:	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
30600202	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Catalyst Handling System
30600201	Industrial Processes; Petroleum Industry; Catalytic Cracking Units; Fluid Catalytic Cracking Unit

References:

- "PMDevelopmentMeasuresList.xls" spreadsheet provided by David Misenheimer (Misenheimer.David@epamail.epa.gov) via email to Alison Eyth (eyth@unc.edu) 27-Aug-2007.

Other information:

Summary:

Control Measure Name: Venturi Scrubber;(PM10) Mineral Products - Coal Cleaning

Abbreviation: PVSCRMICC

Description: Application: The control is the use of a venturi scrubber to reduce PM emissions. A scrubber is a type of technology that removes air pollutants by inertial and diffusional interception. A venturi scrubber accelerates the waste gas stream to atomize the scrubbing liquid and to improve gas-liquid contact.

This control applies to coal cleaning processes at coal mining operations. Coal mining, cleaning and material handling (305010) consists of the preparation and handling of coal to upgrade its value. For the purpose of this study, thermal dryers, pneumatic coal cleaning and truck/vehicle travel are the sources considered.

Discussion: Thermal dryers are used at the end of the series of cleaning operations to remove moisture from coal, thereby reducing freezing problems and weight, and increasing the heating value. The major portion of water is removed by the use of screens, thickeners, and cyclones. The coal is then dried in a thermal dryer. Particulate emissions result from the entrainment of fine coal particles during the thermal drying process (EPA, 1995). Pneumatic coal-cleaning equipment classifies bituminous coal by size or separates bituminous coal from refuse by application of air streams. Fugitive PM emissions result when haul trucks or other vehicles travel on unpaved roads or surfaces.

By product coke production is used to manufacture metallurgical coke by heating high-grade bituminous coal (low sulfur and low ash) in an enclosed oven chamber without oxygen. The resulting solid material consists of elemental carbon and any minerals (ash) that were present in the coal blend that did not volatilize during the process. Sources of air emissions consist of coke oven doors, coke oven lids and off-takes, coke oven charging, coke oven pushing, coke oven underfire stack, coke quenching, battery venting, and coke by-product-recovery plants.

A venturi scrubber accelerates the waste gas stream to improve gas-liquid contact. In a venturi scrubber, a "throat"' section is built into the duct that forces the gas stream to accelerate (EPA, 1999). As the gas enters the venturi throat, both gas velocity and turbulence increase.

After the throat section, the mixture decelerates, and further impacts occur causing the droplets to agglomerate. Once the particles have been captured by the liquid, the wetted PM and excess liquid are separated from the gas stream through entrainment. This section usually consists of a cyclonic separator and/or a mist eliminator (EPA, 1998; Corbitt, 1990).

For PM applications, wet scrubbers generate waste, either a slurry or wet sludge. This creates the need for both wastewater treatment and solid waste disposal. Initially, the slurry is treated to separate the solid waste from the water (EPA, 1999). The treated water can then be reused or discharged. Once the water is removed, the remaining waste will be in the form of a solid or sludge. If the solid waste is inert and nontoxic, it can generally be land filled. Hazardous wastes will have more stringent procedures for disposal. In some cases, the solid waste may have value and can be sold or recycled (EPA, 1998).

Class: Known

Pollutant: PM2_5

Equipment Life: 10.0 years

Control Technology: Venturi Scrubber

Source Group: Mineral Products - Coal Cleaning

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$1,427	$1,427

Ref Yr CPT:			$2,026	$2,026
Control Efficiency:	99.0	99.0	98.0	98.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$1,427	$1,427
Ref Yr CPT:			$2,026	$2,026
Control Efficiency:	99.0	99.0	98.0	98.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	11.0
Typical O&M Control Cost Factor	42.0
Typical Default CPT Factor - Capital	189.0
Typical Default CPT Factor - O&M	713.0
Typical Default CPT Factor - Annualized	751.0

Affected SCCs:

Code	Description
30501000	Industrial Processes;Mineral Products;Coal Mining, Cleaning, and Material Handling (See 305310);undefined
30501003	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Multilouvered Dryer
30501005	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Cascade Dryer
30501006	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Continuous Carrier/Conveyor
30501008	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Unloading
30501009	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Raw Coal Storage
30501011	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Transfer
30501013	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Cleaning: Air Table
30501015	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Loading (For Clean Coal Loading USE 30501016)
30501016	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Clean Coal Loading
30501021	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Removal
30501022	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Drilling/Blasting
30501023	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Loading
30501024	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Hauling
30501030	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Topsoil Removal (See also 305010 -33, -35, -36, -37, -42, -45, -48)
30501031	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Scrapers: Travel Mode

30501032	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Topsoil Unloading
30501033	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden (See also 305010 -30, -35, -36, -37, -42, -45, -48)
30501034	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Coal Seam: Drilling
30501035	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Blasting: Coal Overburden
30501036	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Dragline: Overburden Removal
30501037	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Loading: Overburden
30501038	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Loading: Coal
30501039	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Hauling: Haul Trucks
30501040	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: End Dump - Coal
30501041	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: Bottom Dump - Coal
30501042	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Truck Unloading: Bottom Dump - Overburden
30501043	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Open Storage Pile: Coal
30501044	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Train Loading: Coal
30501045	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Bulldozing: Overburden
30501046	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Bulldozing: Coal
30501047	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Grading
30501048	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Overburden Replacement
30501049	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Wind Erosion: Exposed Areas
30501050	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Vehicle Traffic: Light/Medium Vehicles
30501051	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Open Storage Pile: Spoils
30501060	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Primary Crusher
30501061	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Secondary Crusher
30501062	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Surface Mining Operations: Screens
30501090	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Haul Roads: General
30501099	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling; Other Not Classified

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Venturi Scrubber," July 1999.
- Corbitt, 1990: "Standard Handbook of Environmental Engineering," edited by Robert A. Corbitt, McGraw-Hill, New York, NY, 1990.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.
- EPA, 1995: U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors," AP-42, Volume I, Fifth Edition, Research Triangle Park, NC, January 1995.

Other information:

ADMIN_PCT:	0.67%
CE_TEXT:	PM10 control efficiency is 99% from uncontrolled; PM2.5 control efficiency is 98% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for venturi wet scrubbers, developed using EPA cost-estimating spreadsheets (EPA, 1996) and referenced to the volumetric flow rate of the waste stream treated. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (10 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $3 to $28 per scfm Typical value is $11 per scfm O&M Costs: Range from $4 to $119 per scfm Typical value is $42 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for Impingement Plate Scrubbers (EPA, 1996). O&M costs were calculated for two model plants with flow rates of 2,000 and 150,000 acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. The model plants were assumed to have a dust loading of 3.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An inlet water flow rate for the scrubber was assumed to be 9.4 lbs/min. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 25 $/ton disposed Wastewater treatment 3.8 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$2100/ton
CPTON_L:	$76/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $76 to $2,100 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $751 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	26.81%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	0.33%
MNTLBR_PCT:	8.53%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	8.53%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	22.14%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	25.51%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.33%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	3.32%
STEAM_PCT:	0%
TDIR_PCT:	73.15%
TINDIR_PCT:	26.85%
UTIL_PCT:	0.41%
WSTDSP_PCT:	3.41%

Summary:

Control Measure Name: Venturi Scrubber;(PM10) Ferrous Metals Processing - Coke

Abbreviation: PVSCRMPCE

Description: Application: The control is the use of a venturi scrubber to reduce PM emissions. A scrubber is a type of technology that removes air pollutants by inertial and diffusional interception. A venturi scrubber accelerates the waste gas stream to atomize the scrubbing liquid and to improve gas-liquid contact.

This control applies to by-product coke metal processing operations.

Discussion: By product coke production is used to manufacture metallurgical coke by heating high-grade bituminous coal (low sulfur and low ash) in an enclosed oven chamber without oxygen. The resulting solid material consists of elemental carbon and any minerals (ash) that were present in the coal blend that did not volatilize during the process. Sources of air emissions consist of coke oven doors, coke oven lids and off-takes, coke oven charging, coke oven pushing, coke oven underfire stack, coke quenching, battery venting, and coke by-product-recovery plants.

A venturi scrubber accelerates the waste gas stream to improve gas-liquid contact. In a venturi scrubber, a "throat"' section is built into the duct that forces the gas stream to accelerate (EPA, 1999). As the gas enters the venturi throat, both gas velocity and turbulence increase.

After the throat section, the mixture decelerates, and further impacts occur causing the droplets to agglomerate. Once the particles have been captured by the liquid, the wetted PM and excess liquid are separated from the gas stream through entrainment. This section usually consists of a cyclonic separator and/or a mist eliminator (EPA, 1998; Corbitt, 1990).

For PM applications, wet scrubbers generate waste, either a slurry or wet sludge. This creates the need for both wastewater treatment and solid waste disposal. Initially, the slurry is treated to separate the solid waste from the water (EPA, 1999). The treated water can then be reused or discharged. Once the water is removed, the remaining waste will be in the form of a solid or sludge. If the solid waste is inert and nontoxic, it can generally be land filled. Hazardous wastes will have more stringent procedures for disposal. In some cases, the solid waste may have value and can be sold or recycled (EPA, 1998).

Class: Known

Pollutant: PM2_5

Equipment Life: 10.0 years

Control Technology: Venturi Scrubber

Source Group: Ferrous Metals Processing - Coke

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$1,082	$1,082
Ref Yr CPT:			$1,536	$1,536
Control Efficiency:	93.0	93.0	89.0	89.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton

Capital Rec Fac:	N/A	N/A	0.140000000596046 45	0.140000000596046 45
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$1,082	$1,082
Ref Yr CPT:			$1,536	$1,536
Control Efficiency:	93.0	93.0	89.0	89.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.140000000596046 45	0.140000000596046 45
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	11.0

Typical O&M Control Cost Factor	42.0
Typical Default CPT Factor - Capital	189.0
Typical Default CPT Factor - O&M	713.0
Typical Default CPT Factor - Annualized	751.0

Affected SCCs:

Code	Description
30300401	Industrial Processes; Primary Metal Production; Coke Manufacture: Beehive Process; General
30300399	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Not Classified **
30300361	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Equipment Leaks
30300353	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Naphthalene Processing/Handling
30300352	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Tar Bottom Final Cooler
30300351	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; By-product Coke Manufacturing
30300344	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Wash-oil Circulation Tank
30300343	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Wash Oil Decanter
30300342	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Light Oil Decanter/Condenser Vent
30300341	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Light Oil Sump
30300336	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Tar Storage
30300335	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Tar Interceding Sump
30300334	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Tar Dehydrator
30300333	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Excess-ammonia Liquor Tank
30300332	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Flushing-liquor Circulation Tank
30300331	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; By-product Coke Manufacturing
30300318	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Combustion Stack: Blast Furnace Gas (BFG)
30300317	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Combustion Stack: Coke Oven Gas (COG)
30300316	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Storage Pile
30300315	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Gas By-product Plant
30300314	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Topside Leaks
30300313	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Preheater
30300312	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coke: Crushing/Screening/Handling
30300311	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Screening

30300310	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Crushing
30300309	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Conveying
30300307	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Crushing/Handling
30300306	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Oven Underfiring
30300305	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Coal Unloading
30300303	Industrial Processes; Primary Metal Production; By-product Coke Manufacturing; Oven Pushing
30300300	Industrial Processes;Primary Metal Production;By-product Coke Manufacturing;undefined

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Venturi Scrubber," July 1999.
- Corbitt, 1990: "Standard Handbook of Environmental Engineering," edited by Robert A. Corbitt, McGraw-Hill, New York, NY, 1990.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.67%
CE_TEXT:	PM10 control efficiency is 93% from uncontrolled; PM2.5 control efficiency is 89% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for venturi wet scrubbers, developed using EPA cost-estimating spreadsheets (EPA, 1996) and referenced to the volumetric flow rate of the waste stream treated. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (10 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $3 to $28 per scfm Typical value is $11 per scfm O&M Costs: Range from $4 to $119 per scfm Typical value is $42 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for Impingement Plate Scrubbers (EPA, 1996). O&M costs were calculated for two model plants with flow rates of 2,000 and 150,000 acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. The model plants were assumed to have a dust loading of 3.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An inlet water flow rate for the scrubber was assumed to be 9.4 lbs/min. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 25 $/ton disposed Wastewater treatment 3.8 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$2100/ton
CPTON_L:	$75/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $76 to $2,100 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $751 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	93%
EC:	Co
ELEC_PCT:	26.81%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	93%
INSRNC_PCT:	0.33%
MNTLBR_PCT:	8.53%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	8.53%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	22.14%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	25.51%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.33%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	3.32%
STEAM_PCT:	0%
TDIR_PCT:	73.15%
TINDIR_PCT:	26.85%
UTIL_PCT:	0.41%
WSTDSP_PCT:	3.41%

Summary:

Control Measure Name: Venturi Scrubber;(PM10) Ferrous Metals Processing - Gray Iron Foundaries

Abbreviation: PVSCRMPGI

Description: Application: The control is the use of a venturi scrubber to reduce PM emissions. A scrubber is a type of technology that removes air pollutants by inertial and diffusional interception. A venturi scrubber accelerates the waste gas stream to atomize the scrubbing liquid and to improve gas-liquid contact.

This control applies to iron and steel production operations.

Discussion: Grey iron is an alloy of iron, carbon, and silicon, containing a higher percentage of the last two elements than found in malleable iron. The high strengths are obtained by the proper adjustment of the carbon and silicon contents or by alloying. Oil suppression can provide 75 to 99 percent control of TSP emissions. While the oil suppression system is favored because of costs, for the purpose of this study, fabric filters are being considered because they can achieve greater than 99 percent control of TSP as well as small and light particles (EPA, 1999).

By product coke production is used to manufacture metallurgical coke by heating high-grade bituminous coal (low sulfur and low ash) in an enclosed oven chamber without oxygen. The resulting solid material consists of elemental carbon and any minerals (ash) that were present in the coal blend that did not volatilize during the process. Sources of air emissions consist of coke oven doors, coke oven lids and off-takes, coke oven charging, coke oven pushing, coke oven underfire stack, coke quenching, battery venting, and coke by-product-recovery plants.

A venturi scrubber accelerates the waste gas stream to improve gas-liquid contact. In a venturi scrubber, a "throat'" section is built into the duct that forces the gas stream to accelerate (EPA, 1999). As the gas enters the venturi throat, both gas velocity and turbulence increase.

After the throat section, the mixture decelerates, and further impacts occur causing the droplets to agglomerate. Once the particles have been captured by the liquid, the wetted PM and excess liquid are separated from the gas stream through entrainment. This section usually consists of a cyclonic separator and/or a mist eliminator (EPA, 1998; Corbitt, 1990).

For PM applications, wet scrubbers generate waste, either a slurry or wet sludge. This creates the need for both wastewater treatment and solid waste disposal. Initially, the slurry is treated to separate the solid waste from the water (EPA, 1999). The treated water can then be reused or discharged. Once the water is removed, the remaining waste will be in the form of a solid or sludge. If the solid waste is inert and nontoxic, it can generally be land filled. Hazardous wastes will have more stringent procedures for disposal. In some cases, the solid waste may have value and can be sold or recycled (EPA, 1998).

Class: Known

Pollutant: PM2_5

Equipment Life: 10.0 years

Control Technology: Venturi Scrubber

Source Group: Ferrous Metals Processing - Gray Iron Foundaries

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$1,026	$1,026
Ref Yr CPT:			$1,456	$1,456
Control Efficiency:	94.0	94.0	94.0	94.0

Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$1,026	$1,026
Ref Yr CPT:			$1,456	$1,456
Control Efficiency:	94.0	94.0	94.0	94.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	11.0
Typical O&M Control Cost Factor	42.0
Typical Default CPT Factor - Capital	189.0
Typical Default CPT Factor - O&M	713.0
Typical Default CPT Factor - Annualized	751.0

Affected SCCs:

Code	Description
30400300	Industrial Processes;Secondary Metal Production;Grey Iron Foundries;undefined
30400301	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Cupola
30400302	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Reverberatory Furnace
30400303	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Electric Induction Furnace
30400304	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Electric Arc Furnace
30400305	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Annealing Operation
30400310	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Inoculation
30400314	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Scrap Metal Preheating
30400315	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Charge Handling
30400316	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Tapping
30400317	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring Ladle
30400318	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring, Cooling
30400319	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Making, Baking
30400320	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Pouring/Casting
30400321	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Magnesium Treatment
30400322	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Refining
30400325	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Castings Cooling
30400330	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Miscellaneous Casting-Fabricating **
30400331	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Shakeout
30400332	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Knock Out
30400333	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Shakeout Machine
30400340	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Grinding/Cleaning
30400341	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Cleaning/Tumblers
30400342	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Casting Cleaning/Chippers
30400350	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Grinding/Handling

30400351	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400352	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Grinding/Handling
30400353	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400354	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Ovens
30400355	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Dryer
30400356	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Silo
30400357	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Conveyors/Elevators
30400358	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Sand Screens
30400360	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Castings Finishing
30400370	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Shell Core Machine
30400371	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Core Machines/Other
30400398	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Other Not Classified
30400399	Industrial Processes; Secondary Metal Production; Grey Iron Foundries; Other Not Classified

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Venturi Scrubber," July 1999.
- Corbitt, 1990: "Standard Handbook of Environmental Engineering," edited by Robert A. Corbitt, McGraw-Hill, New York, NY, 1990.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.67%
CE_TEXT:	94% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for venturi wet scrubbers, developed using EPA cost-estimating spreadsheets (EPA, 1996) and referenced to the volumetric flow rate of the waste stream treated. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (10 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $3 to $28 per scfm Typical value is $11 per scfm O&M Costs: Range from $4 to $119 per scfm Typical value is $42 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for Impingement Plate Scrubbers (EPA, 1996). O&M costs were calculated for two model plants with flow rates of 2,000 and 150,000 acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. The model plants were assumed to have a dust loading of 3.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An inlet water flow rate for the scrubber was assumed to be 9.4 lbs/min. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 25 $/ton disposed Wastewater treatment 3.8 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$2100/ton
CPTON_L:	$76/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $76 to $2,100 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $751 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	94%
EC:	Co
ELEC_PCT:	26.81%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	94%
INSRNC_PCT:	0.33%
MNTLBR_PCT:	8.53%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	8.53%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	22.14%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	25.51%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.33%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	3.32%
STEAM_PCT:	0%
TDIR_PCT:	73.15%
TINDIR_PCT:	26.85%
UTIL_PCT:	0.41%
WSTDSP_PCT:	3.41%

Summary:

Control Measure Name: Venturi Scrubber;(PM10) Ferrous Metals Processing - Iron & Steel Production

Abbreviation: PVSCRMPIS

Description: Application: The control is the use of a venturi scrubber to reduce PM emissions. A scrubber is a type of technology that removes air pollutants by inertial and diffusional interception. A venturi scrubber accelerates the waste gas stream to atomize the scrubbing liquid and to improve gas-liquid contact.

This control applies to iron and steel processing and production operations.

Discussion: Steel normally is produced in either basic oxygen process furnaces or electric arc furnaces. In the basic oxygen process furnace, a mixture of 70 percent molten iron from the blast furnace and 30 percent iron scrap are melted together. Pure oxygen is blown across the top or through the molten steel to oxidize carbon and oxygen impurities, thus removing these from the steel. Basic oxygen process furnaces are large open-mouthed furnaces that can be tilted to accept a charge or to tap the molten steel to a charging ladle for transfer to an ingot mold or continuous caster.

Because basic oxygen furnaces are open, they produce significant uncontrolled particulate emissions, notably during the refining stage when oxygen is being blown. Electric arc furnaces use the current passing between carbon electrodes to heat molten steel, but also use oxy-fuel burners to accelerate the initial melting process. These furnaces are charged largely with scrap iron. Significant emissions occur during charging, when the furnace roof is open, during melting, as the electrodes are lowered into the scrap and the arc is struck, and during tapping, when alloying elements are added to the melt.

By product coke production is used to manufacture metallurgical coke by heating high-grade bituminous coal (low sulfur and low ash) in an enclosed oven chamber without oxygen. The resulting solid material consists of elemental carbon and any minerals (ash) that were present in the coal blend that did not volatilize during the process. Sources of air emissions consist of coke oven doors, coke oven lids and off-takes, coke oven charging, coke oven pushing, coke oven underfire stack, coke quenching, battery venting, and coke by-product-recovery plants.

A venturi scrubber accelerates the waste gas stream to improve gas-liquid contact. In a venturi scrubber, a "throat'" section is built into the duct that forces the gas stream to accelerate (EPA, 1999). As the gas enters the venturi throat, both gas velocity and turbulence increase.

After the throat section, the mixture decelerates, and further impacts occur causing the droplets to agglomerate. Once the particles have been captured by the liquid, the wetted PM and excess liquid are separated from the gas stream through entrainment. This section usually consists of a cyclonic separator and/or a mist eliminator (EPA, 1998; Corbitt, 1990).

For PM applications, wet scrubbers generate waste, either a slurry or wet sludge. This creates the need for both wastewater treatment and solid waste disposal. Initially, the slurry is treated to separate the solid waste from the water (EPA, 1999). The treated water can then be reused or discharged. Once the water is removed, the remaining waste will be in the form of a solid or sludge. If the solid waste is inert and nontoxic, it can generally be land filled. Hazardous wastes will have more stringent procedures for disposal. In some cases, the solid waste may have value and can be sold or recycled (EPA, 1998).

Class: Known

Pollutant: PM2_5

Equipment Life: 10.0 years

Control Technology: Venturi Scrubber

Source Group: Ferrous Metals Processing - Iron & Steel Production

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				

Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$2,769	$2,769
Ref Yr CPT:			$3,931	$3,931
Control Efficiency:	73.0	73.0	25.0	25.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$2,769	$2,769
Ref Yr CPT:			$3,931	$3,931
Control Efficiency:	73.0	73.0	25.0	25.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	11.0
Typical O&M Control Cost Factor	42.0
Typical Default CPT Factor - Capital	189.0
Typical Default CPT Factor - O&M	713.0
Typical Default CPT Factor - Annualized	751.0

Affected SCCs:

Code	Description
30300801	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Ore Charging
30300802	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Agglomerate Charging
30300804	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Hi-Silt
30300805	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Low-Silt
30300808	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Crushing and Sizing
30300809	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Removal and Dumping
30300811	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Stockpiles, Coke Breeze, Limestone, Ore Fines
30300812	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Transfer/Handling
30300813	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Windbox
30300814	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Discharge End
30300815	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Breaker
30300816	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Hot Screening
30300817	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cooler
30300818	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cold Screening

30300819	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Process (Combined Code includes 15,16,17,18)
30300820	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Conveyor: Transfer Station
30300821	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unload Ore, Pellets, Limestone, into Blast Furnace
30300822	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Stockpile: Ore, Pellets, Limestone, Coke, Sinter
30300823	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Charge Materials: Transfer/Handling
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300825	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cast House
30300827	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Lump Ore Unloading
30300828	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Local Evacuation
30300829	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Taphole and Trough
30300831	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unpaved Roads: Light Duty Vehicles
30300834	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Paved Roads: All Vehicle Types
30300841	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Flue Dust Unloading
30300842	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blended Ore Unloading
30300899	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); See Comment **
30300901	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Open Hearth Furnace: Stack
30300908	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Arc Furnace: Carbon Steel (Stack)
30300910	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Pickling (See also 303009-02,-03,-05, and -09)
30300911	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Soaking Pits
30300912	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Grinding
30300913	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Open Hood-Stack
30300914	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Closed Hood-Stack
30300915	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal (Iron) Transfer to Steelmaking Furnace
30300916	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: BOF
30300917	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: BOF

30300918	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: Open Hearth
30300919	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: Open Hearth
30300920	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal Desulfurization
30300921	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Unleaded Steel)
30300922	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Continuous Casting
30300923	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Tapping and Dumping
30300924	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Processing
30300925	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Leaded Steel)
30300926	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Induction Furnace
30300927	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Scrap Preheater
30300928	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Argon-oxygen Decarburization
30300929	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Plate Burner/Torch Cutter
30300930	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Q-BOP Melting and Refining
30300931	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Rolling
30300932	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Scarfing
30300933	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Reheat Furnaces
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing
30300935	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Cold Rolling
30300936	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Coating: Tin, Zinc, etc.
30300998	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified
30300999	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-

001, Research Triangle Park, NC., October 1998.

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Venturi Scrubber," July 1999.
- Corbitt, 1990: "Standard Handbook of Environmental Engineering," edited by Robert A. Corbitt, McGraw-Hill, New York, NY, 1990.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.67%
CE_TEXT:	PM10 control efficiency is 73% from uncontrolled; PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for venturi wet scrubbers, developed using EPA cost-estimating spreadsheets (EPA, 1996) and referenced to the volumetric flow rate of the waste stream treated. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (10 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $3 to $28 per scfm Typical value is $11 per scfm O&M Costs: Range from $4 to $119 per scfm Typical value is $42 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for Impingement Plate Scrubbers (EPA, 1996). O&M costs were calculated for two model plants with flow rates of 2,000 and 150,000 acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. The model plants were assumed to have a dust loading of 3.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An inlet water flow rate for the scrubber was assumed to be 9.4 lbs/min. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 25 $/ton disposed Wastewater treatment 3.8 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$2100/ton
CPTON_L:	$76/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $76 to $2,100 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $751 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	73%
EC:	Co
ELEC_PCT:	26.81%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	73%
INSRNC_PCT:	0.33%
MNTLBR_PCT:	8.53%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	8.53%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	22.14%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	25.51%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.33%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	3.32%
STEAM_PCT:	0%
TDIR_PCT:	73.15%
TINDIR_PCT:	26.85%
UTIL_PCT:	0.41%
WSTDSP_PCT:	3.41%

Summary:

Control Measure Name: Venturi Scrubber;(PM10) Ferrous Metals Processing - Steel Foundaries

Abbreviation: PVSCRMPSF

Description: Application: The control is the use of a venturi scrubber to reduce PM emissions. A scrubber is a type of technology that removes air pollutants by inertial and diffusional interception. A venturi scrubber accelerates the waste gas stream to atomize the scrubbing liquid and to improve gas-liquid contact.

This control applies to ferrous metals processing operations, specifically steel foundries.

Discussion: By product coke production is used to manufacture metallurgical coke by heating high-grade bituminous coal (low sulfur and low ash) in an enclosed oven chamber without oxygen. The resulting solid material consists of elemental carbon and any minerals (ash) that were present in the coal blend that did not volatilize during the process. Sources of air emissions consist of coke oven doors, coke oven lids and off-takes, coke oven charging, coke oven pushing, coke oven underfire stack, coke quenching, battery venting, and coke by-product-recovery plants.

A venturi scrubber accelerates the waste gas stream to improve gas-liquid contact. In a venturi scrubber, a "throat"' section is built into the duct that forces the gas stream to accelerate (EPA, 1999). As the gas enters the venturi throat, both gas velocity and turbulence increase.

After the throat section, the mixture decelerates, and further impacts occur causing the droplets to agglomerate. Once the particles have been captured by the liquid, the wetted PM and excess liquid are separated from the gas stream through entrainment. This section usually consists of a cyclonic separator and/or a mist eliminator (EPA, 1998; Corbitt, 1990).

For PM applications, wet scrubbers generate waste, either a slurry or wet sludge. This creates the need for both wastewater treatment and solid waste disposal. Initially, the slurry is treated to separate the solid waste from the water (EPA, 1999). The treated water can then be reused or discharged. Once the water is removed, the remaining waste will be in the form of a solid or sludge. If the solid waste is inert and nontoxic, it can generally be land filled. Hazardous wastes will have more stringent procedures for disposal. In some cases, the solid waste may have value and can be sold or recycled (EPA, 1998).

Class: Known

Pollutant: PM2_5

Equipment Life: 10.0 years

Control Technology: Venturi Scrubber

Source Group: Ferrous Metals Processing - Steel Foundaries

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$2,705	$2,705
Ref Yr CPT:			$3,840	$3,840
Control Efficiency:	73.0	73.0	25.0	25.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0

Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1995	1995
CPT:			$2,705	$2,705
Ref Yr CPT:			$3,840	$3,840
Control Efficiency:	73.0	73.0	25.0	25.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	0.14000000059604645	0.14000000059604645
Discount Rate:	N/A	N/A	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995

Typical Capital Control Cost Factor	11.0
Typical O&M Control Cost Factor	42.0
Typical Default CPT Factor - Capital	189.0
Typical Default CPT Factor - O&M	713.0
Typical Default CPT Factor - Annualized	751.0

Affected SCCs:

Code	Description
30400701	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace
30400702	Industrial Processes; Secondary Metal Production; Steel Foundries; Open Hearth Furnace
30400703	Industrial Processes; Secondary Metal Production; Steel Foundries; Open Hearth Furnace with Oxygen Lance
30400704	Industrial Processes; Secondary Metal Production; Steel Foundries; Heat Treating Furnace
30400705	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Induction Furnace
30400706	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Grinding/Handling
30400707	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400708	Industrial Processes; Secondary Metal Production; Steel Foundries; Pouring/Casting
30400709	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Shakeout
30400710	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Knock Out
30400711	Industrial Processes; Secondary Metal Production; Steel Foundries; Cleaning
30400712	Industrial Processes; Secondary Metal Production; Steel Foundries; Charge Handling
30400713	Industrial Processes; Secondary Metal Production; Steel Foundries; Castings Cooling
30400714	Industrial Processes; Secondary Metal Production; Steel Foundries; Shakeout Machine
30400715	Industrial Processes; Secondary Metal Production; Steel Foundries; Finishing
30400716	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Grinding/Handling
30400717	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400718	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Ovens
30400720	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Dryer
30400721	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Silo
30400722	Industrial Processes; Secondary Metal Production; Steel Foundries; Muller
30400723	Industrial Processes; Secondary Metal Production; Steel Foundries; Conveyors/Elevators
30400724	Industrial Processes; Secondary Metal Production; Steel Foundries; Sand Screens
30400725	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Cleaning/Tumblers
30400726	Industrial Processes; Secondary Metal Production; Steel Foundries; Casting Cleaning/Chippers
30400730	Industrial Processes; Secondary Metal Production; Steel Foundries; Shell Core Machine
30400731	Industrial Processes; Secondary Metal Production; Steel Foundries; Core Machines/Other
30400732	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace: Baghouse

30400733	Industrial Processes; Secondary Metal Production; Steel Foundries; Electric Arc Furnace: Baghouse Dust Handling
30400735	Industrial Processes; Secondary Metal Production; Steel Foundries; Raw Material Unloading
30400736	Industrial Processes; Secondary Metal Production; Steel Foundries; Conveyors/Elevators: Raw Material
30400737	Industrial Processes; Secondary Metal Production; Steel Foundries; Raw Material Silo
30400739	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Centrifugation
30400740	Industrial Processes; Secondary Metal Production; Steel Foundries; Reheating Furnace: Natural Gas
30400741	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Heating
30400742	Industrial Processes; Secondary Metal Production; Steel Foundries; Crucible
30400743	Industrial Processes; Secondary Metal Production; Steel Foundries; Pneumatic Converter Furnace
30400744	Industrial Processes; Secondary Metal Production; Steel Foundries; Ladle
30400745	Industrial Processes; Secondary Metal Production; Steel Foundries; Fugitive Emissions: Furnace
30400760	Industrial Processes; Secondary Metal Production; Steel Foundries; Alloy Feeding
30400765	Industrial Processes; Secondary Metal Production; Steel Foundries; Billet Cutting
30400768	Industrial Processes; Secondary Metal Production; Steel Foundries; Scrap Handling
30400770	Industrial Processes; Secondary Metal Production; Steel Foundries; Slag Storage Pile
30400775	Industrial Processes; Secondary Metal Production; Steel Foundries; Slag Crushing
30400780	Industrial Processes; Secondary Metal Production; Steel Foundries; Limerock Handling
30400785	Industrial Processes; Secondary Metal Production; Steel Foundries; Roof Monitors - Hot Metal Transfer
30400799	Industrial Processes; Secondary Metal Production; Steel Foundries; Other Not Classified
30400901	Industrial Processes; Secondary Metal Production; Malleable Iron; Annealing
30400999	Industrial Processes; Secondary Metal Production; Malleable Iron; Other Not Classified

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Venturi Scrubber," July 1999.
- Corbitt, 1990: "Standard Handbook of Environmental Engineering," edited by Robert A. Corbitt, McGraw-Hill, New York, NY, 1990.

- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.67%
CE_TEXT:	PM10 control efficiency is 73% from uncontrolled; PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The following are cost ranges for venturi wet scrubbers, developed using EPA cost-estimating spreadsheets (EPA, 1996) and referenced to the volumetric flow rate of the waste stream treated. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (10 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $3 to $28 per scfm Typical value is $11 per scfm O&M Costs: Range from $4 to $119 per scfm Typical value is $42 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for Impingement Plate Scrubbers (EPA, 1996). O&M costs were calculated for two model plants with flow rates of 2,000 and 150,000 acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. The model plants were assumed to have a dust loading of 3.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An inlet water flow rate for the scrubber was assumed to be 9.4 lbs/min. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 25 $/ton disposed Wastewater treatment 3.8 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$2100/ton
CPTON_L:	$76/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $76 to $2,100 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $751 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	73%

EC:	Co
ELEC_PCT:	26.81%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	73%
INSRNC_PCT:	0.33%
MNTLBR_PCT:	8.53%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	8.53%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	22.14%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	25.51%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.33%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	3.32%
STEAM_PCT:	0%
TDIR_PCT:	73.15%
TINDIR_PCT:	26.85%
UTIL_PCT:	0.41%
WSTDSP_PCT:	3.41%

Summary:

Control Measure Name: Wet Electrostatic Precipitator - Wire Plate Type;(PM10) Chemical Manufacture

Abbreviation: PWESPCHMN

Description: Application: This control is the use of a wire-plate type electrostatic precipitator (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. Wet ESPs use a stream of water, in place of rapping mechanisms, to dislodge particulate from the plates and into a sump.

This control applies to various chemical manufacturing operations, including (but not limited to) adipic acid, ammonia, carbon black, charcoal, cleaners, phosphoric acids, plastics, sulfuric acid, sodium carbonate, ammonium nitrate, rubbers, ammonium phosphates, and inorganic pigments.

Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. These particles are processed in later sections of the ESP, but the particles from the last section have no chance to be recaptured. Due to the space needed at the top of the ESP for nonelectrified components, part of the stream may flow around the charged zones. This is called "sneakage" and places an upper limit on the collection efficiency of the ESP. Anti-sneakage baffles are used to force the sneakage flow to mix with the main gas stream for collection in later sections (EPA, 1998).

Wire-Plate Type Wet ESPs require a source of wash water near the top of the collector plates. This wash system replaces the rapping mechanism used by dry ESPs. The water flows with the collected particles into a sump from which the fluid is pumped or drained. A portion of the fluid may be recycled to reduce the total amount of water required. The remainder is pumped into a settling pond or passed through a dewatering stage, with subsequent disposal of the sludge (AWMA, 1992).

Unlike dry ESPs, resistivity of the collected material is not a major factor in performance. Because of the high humidity in a wet ESP, the resistivity of particles is lowered, eliminating the "back corona" condition. The frequent washing of the plates also limits particle buildup on the collectors (EPA, 1998).

For wet ESPs, the handling wastewaters must be considered (EPA, 1999). For simple systems with innocuous dusts, water with particles collected by the ESP may be discharged from the ESP system to a solids-removing clarifier. More complicated systems may require skimming and sludge removal, clarification in dedicated equipment, pH adjustment, and/or treatment to remove dissolved solids. Recirculation of treated water to the ESP may approach 100 percent (AWMA, 1992).

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Wet Electrostatic Precipitator - Wire Plate Type

Source Group: Chemical Manufacture

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				

Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1995	N/A	1995	N/A
CPT:	$283		$283	
Ref Yr CPT:	$402		$402	
Control Efficiency:	95.0	99.5	95.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:

Effective Date:
N/A
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:
1995
N/A
1995
N/A
CPT:
$283
$283
Ref Yr CPT:
$402
$402
Control Efficiency:
95.0
99.5
95.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0

Equation Type:
cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	40.0
Typical O&M Control Cost Factor	19.0
Typical Default CPT Factor - Capital	923.0
Typical Default CPT Factor - O&M	135.0
Typical Default CPT Factor - Annualized	220.0

Affected SCCs:

Code	Description
30100101	Industrial Processes; Chemical Manufacturing; Adipic Acid; General
30100102	Industrial Processes; Chemical Manufacturing; Adipic Acid; Raw Material Storage
30100103	Industrial Processes; Chemical Manufacturing; Adipic Acid; Cyclohexane Oxidation
30100104	Industrial Processes; Chemical Manufacturing; Adipic Acid; Nitric Acid Reaction
30100105	Industrial Processes; Chemical Manufacturing; Adipic Acid; Adipic Acid Refining
30100106	Industrial Processes; Chemical Manufacturing; Adipic Acid; Drying, Loading, and Storage
30100107	Industrial Processes; Chemical Manufacturing; Adipic Acid; Absorber
30100108	Industrial Processes; Chemical Manufacturing; Adipic Acid; Dryer
30100109	Industrial Processes; Chemical Manufacturing; Adipic Acid; Cooler
30100110	Industrial Processes; Chemical Manufacturing; Adipic Acid; Loading And Storage
30100180	Industrial Processes; Chemical Manufacturing; Adipic Acid; Fugitive Emissions: General
30100199	Industrial Processes; Chemical Manufacturing; Adipic Acid; Other Not Classified
30100305	Industrial Processes; Chemical Manufacturing; Ammonia Production; Feedstock Desulfurization
30100306	Industrial Processes; Chemical Manufacturing; Ammonia Production; Primary Reformer: Natural Gas Fired
30100307	Industrial Processes; Chemical Manufacturing; Ammonia Production; Primary Reformer: Oil Fired
30100308	Industrial Processes; Chemical Manufacturing; Ammonia Production; Carbon Dioxide Regenerator
30100309	Industrial Processes; Chemical Manufacturing; Ammonia Production; Condensate Stripper
30100310	Industrial Processes; Chemical Manufacturing; Ammonia Production; Storage and Loading Tanks
30100399	Industrial Processes; Chemical Manufacturing; Ammonia Production; Other Not Classified
30100501	Industrial Processes; Chemical Manufacturing; Carbon Black Production; Channel Process
30100502	Industrial Processes; Chemical Manufacturing; Carbon Black Production; Thermal Process
30100503	Industrial Processes; Chemical Manufacturing; Carbon Black Production; Gas Furnace Process: Main Process Vent

30100504	Industrial Processes; Chemical Manufacturing; Carbon Black Production; Oil Furnace Process: Main Process Vent
30100506	Industrial Processes; Chemical Manufacturing; Carbon Black Production; Transport Air Vent
30100507	Industrial Processes; Chemical Manufacturing; Carbon Black Production; Pellet Dryer
30100508	Industrial Processes; Chemical Manufacturing; Carbon Black Production; Bagging/Loading
30100509	Industrial Processes; Chemical Manufacturing; Carbon Black Production; Furnace Process: Fugitive Emissions
30100510	Industrial Processes; Chemical Manufacturing; Carbon Black Production; Main Process Vent with CO Boiler and Incinerator
30100599	Industrial Processes; Chemical Manufacturing; Carbon Black Production; Other Not Classified
30100601	Industrial Processes; Chemical Manufacturing; Charcoal Manufacturing; General
30100603	Industrial Processes; Chemical Manufacturing; Charcoal Manufacturing; Batch Kiln
30100604	Industrial Processes; Chemical Manufacturing; Charcoal Manufacturing; Continuous Kiln
30100605	Industrial Processes; Chemical Manufacturing; Charcoal Manufacturing; Briquetting
30100606	Industrial Processes; Chemical Manufacturing; Charcoal Manufacturing; Raw Material Handling
30100607	Industrial Processes; Chemical Manufacturing; Charcoal Manufacturing; Crushing
30100608	Industrial Processes; Chemical Manufacturing; Charcoal Manufacturing; Handling and Storage
30100699	Industrial Processes; Chemical Manufacturing; Charcoal Manufacturing; Other Not Classified
30100701	Industrial Processes; Chemical Manufacturing; Chlorine; Carbon Reactivation
30100702	Industrial Processes; Chemical Manufacturing; Chlorine; Carbon Reactivation/Impregnation Kiln
30100704	Industrial Processes; Chemical Manufacturing; Chlorine; Carbon Reactivation/Heating Ovens
30100705	Industrial Processes; Chemical Manufacturing; Chlorine; Carbon Reactivation/Fugitives
30100706	Industrial Processes; Chemical Manufacturing; Chlorine; Carbon Reactivation/Afterburner
30100707	Industrial Processes; Chemical Manufacturing; Chlorine; Carbon Reactivation/Multiple Hearth Furnace
30100708	Industrial Processes; Chemical Manufacturing; Chlorine; Carbon Reactivation/Indirect Furnace
30100709	Industrial Processes; Chemical Manufacturing; Chlorine; Carbon Reactivation/Product Handling (Mesh, Prss)
30100799	Industrial Processes; Chemical Manufacturing; Chlorine; Other Not Classified **
30100801	Industrial Processes; Chemical Manufacturing; Chloro-alkali Production; Liquefaction (Diaphragm Cell Process)
30100802	Industrial Processes; Chemical Manufacturing; Chloro-alkali Production; Liquefaction (Mercury Cell Process)
30100803	Industrial Processes; Chemical Manufacturing; Chloro-alkali Production; Chlorine Loading: Tank Car Vent
30100804	Industrial Processes; Chemical Manufacturing; Chloro-alkali Production; Chlorine Loading: Storage Car Vent
30100805	Industrial Processes; Chemical Manufacturing; Chloro-alkali Production; Air Blowing of Mercury Cell Brine
30100899	Industrial Processes; Chemical Manufacturing; Chloro-alkali Production; Other Not Classified
30100901	Industrial Processes; Chemical Manufacturing; Cleaning Chemicals; Spray Drying: Soaps and Detergents
30100902	Industrial Processes; Chemical Manufacturing; Cleaning Chemicals; Specialty Cleaners
30100905	Industrial Processes; Chemical Manufacturing; Cleaning Chemicals; Alkaline Saponification

30100906	Industrial Processes; Chemical Manufacturing; Cleaning Chemicals; Direct Saponification
30100907	Industrial Processes; Chemical Manufacturing; Cleaning Chemicals; Blending And Mixing
30100908	Industrial Processes; Chemical Manufacturing; Cleaning Chemicals; Soap Packaging
30100909	Industrial Processes; Chemical Manufacturing; Cleaning Chemicals; Detergent Slurry Preparation
30100910	Industrial Processes; Chemical Manufacturing; Cleaning Chemicals; Detergent Granule Handling
30100999	Industrial Processes; Chemical Manufacturing; Cleaning Chemicals; Other Not Classified
30101005	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Nitric/Sulfuric Acid Mixing
30101010	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Process Vents: Batch Process
30101011	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Nitration Reactors Fume Recovery
30101012	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Nitration Reactors Acid Recovery
30101013	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Nitric Acid Concentrators
30101014	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Sulfuric Acid Concentrators
30101015	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Red Water Incinerator
30101021	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Nitration Reactor Fume Recover **(Use 3-01-010-51)
30101022	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Nitration Reactor Acid Recover **(Use 3-01-010-52)
30101023	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Red Water Incinerator ** (Use 3-01-010-53)
30101025	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Spent Acid Recovery: Denitrating Tower
30101026	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Spent Acid Recovery: Sulfuric Acid Regenerator
30101027	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Spent Acid Recovery: Bleacher
30101028	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Spent Acid Recovery: Reflux Columns
30101030	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Open Burning: Waste
30101033	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Nitric Acid Concentration: Distillation Tower
30101034	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Nitric Acid Concentration: Bleacher
30101035	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Nitric Acid Concentration: Condenser
30101036	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Nitric Acid Concentration: Absorber Column
30101037	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Nitric Acid Concentration: Dehydrating Unit
30101040	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Purification
30101045	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Finishing: Melt Tank

30101046	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Finishing: Dryers
30101047	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Batch Process: Finishing: Flaker Drum
30101050	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Process Vents: Continuous Process
30101051	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Nitration Reactor Fume Recovery
30101052	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Spent Acid Recovery
30101053	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Red Water Incineration
30101054	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Nitric Acid Concentrators
30101055	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Sulfuric Acid Concentrators
30101061	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Spent Acid Recovery: Denitrating Tower
30101062	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Spent Acid Recovery: Sulfuric Acid Regenerator
30101063	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Spent Acid Recovery: Bleacher
30101064	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Spent Acid Recovery: Reflux Columns
30101073	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Nitric Acid Concentration: Distillation Tower
30101074	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Nitric Acid Concentration: Bleacher
30101075	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Nitric Acid Concentration: Condenser
30101076	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Nitric Acid Concentration: Absorber Column
30101077	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Nitric Acid Concentration: Dehydrating Unit
30101080	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Purification
30101085	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Finishing: Melt Tank
30101086	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Finishing: Dryers
30101087	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Continuous Process: Finishing: Flaker Drum
30101099	Industrial Processes; Chemical Manufacturing; Explosives (Trinitrotoluene); Other Not Classified
30101101	Industrial Processes; Chemical Manufacturing; Hydrochloric Acid; By-product Process
30101198	Industrial Processes; Chemical Manufacturing; Hydrochloric Acid; Handling and Storage (99.9% Removal)
30101199	Industrial Processes; Chemical Manufacturing; Hydrochloric Acid; Other Not Classified
30101202	Industrial Processes; Chemical Manufacturing; Hydroflouric Acid; Rotary Kiln: Acid Reactor
30101203	Industrial Processes; Chemical Manufacturing; Hydroflouric Acid; Fluorspar Grinding/Drying

30101204	Industrial Processes; Chemical Manufacturing; Hydroflouric Acid; Fluorspar Handling Silos
30101205	Industrial Processes; Chemical Manufacturing; Hydroflouric Acid; Fluorspar Transfer
30101206	Industrial Processes; Chemical Manufacturing; Hydroflouric Acid; Tail Gas Vent
30101207	Industrial Processes; Chemical Manufacturing; Hydroflouric Acid; Fluorspar Drying Kiln: Fuel Combustion
30101208	Industrial Processes; Chemical Manufacturing; Hydroflouric Acid; Rotary Kiln: Fuel Combustion
30101299	Industrial Processes; Chemical Manufacturing; Hydroflouric Acid; Other Not Classified
30101301	Industrial Processes; Chemical Manufacturing; Nitric Acid; Absorber Tail Gas (Pre-1970 Facilities)
30101302	Industrial Processes; Chemical Manufacturing; Nitric Acid; Absorber Tail Gas (Post-1970 Facilities)
30101303	Industrial Processes; Chemical Manufacturing; Nitric Acid; Nitric Acid Concentrators (Pre-1970)
30101304	Industrial Processes; Chemical Manufacturing; Nitric Acid; Nitric Acid Concentrators (Post-1970)
30101399	Industrial Processes; Chemical Manufacturing; Nitric Acid; Other Not Classified
30101400	Industrial Processes;Chemical Manufacturing;Paint Manufacture;undefined
30101401	Industrial Processes; Chemical Manufacturing; Paint Manufacture; General Mixing and Handling
30101402	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Handling
30101403	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Solvent Loss: General
30101404	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Raw Material Storage
30101415	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Premix/Preassembly
30101416	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Premix/Preassembly: Mix Tanks and Agitators
30101417	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Premix/Preassembly: Drums
30101418	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Premix/Preassembly: Material Loading
30101430	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling
30101431	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling: Roller Mills
30101432	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling: Ball and Pebble Mills
30101433	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling: Attritors
30101434	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling: Sand Mills
30101435	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling: Bead Mills
30101436	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling: Shot Mills
30101437	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling: Stone Mills
30101438	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling: Colloid Mills
30101439	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling: Kady Mills
30101440	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling: Impingement Mills

30101441	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Pigment Grinding/Milling: Horizontal Media Mills
30101450	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Product Finishing
30101451	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Product Finishing, Tinting: Mix Tank and Disperser
30101452	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Product Finishing, Tinting: Fixed Blend Tank
30101453	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Product Finishing, Thinning: Mix Tank and Disperser
30101454	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Product Finishing, Thinning: Fixed Blend Tank
30101460	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Product Filling
30101461	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Product Filling: Scale System
30101462	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Product Filling: Product Filtering
30101463	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Product Filling: Filling Operations
30101470	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Equipment Cleaning
30101471	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Equipment Cleaning: Hand Wipe
30101472	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Equipment Cleaning: Tanks, Vessels, etc.
30101498	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Other Not Classified
30101499	Industrial Processes; Chemical Manufacturing; Paint Manufacture; Other Not Classified
30101500	Industrial Processes;Chemical Manufacturing;Varnish Manufacturing;undefined
30101501	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Bodying Oil
30101502	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Oleoresinous
30101503	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Alkyd
30101505	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Acrylic
30101510	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Oil Storage
30101515	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Kettle Loading
30101520	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Varnish Cooking
30101521	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Varnish Cooking: Open Kettle
30101522	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Varnish Cooking: Closed Kettle
30101530	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Varnish Thinning
30101540	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Clarification
30101541	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Clarification: Strainer
30101542	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Clarification: Centrifuge
30101543	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Clarification: Filter Press
30101550	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; End Product Transfer
30101560	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; End Product Storage
30101599	Industrial Processes; Chemical Manufacturing; Varnish Manufacturing; Other Not Classified

30101601	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Wet Process; Reactor
30101602	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Wet Process; Gypsum Pond
30101603	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Wet Process; Condenser
30101699	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Wet Process; Other Not Classified
30101700	Industrial Processes;Chemical Manufacturing;Phosphoric Acid: Thermal Process;undefined
30101702	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Thermal Process; Absorber: General
30101703	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Thermal Process; Absorber with Packed Tower
30101704	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Thermal Process; Absorber with Venturi Scrubber
30101705	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Thermal Process; Absorber with Glass Mist Eliminator
30101706	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Thermal Process; Absorber with Wire Mist Eliminator
30101707	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Thermal Process; Absorber with High-pressure Mist Eliminator
30101708	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Thermal Process; Absorber with ESP
30101799	Industrial Processes; Chemical Manufacturing; Phosphoric Acid: Thermal Process; Other Not Classified
30101800	Industrial Processes;Chemical Manufacturing;Plastics Production;undefined
30101801	Industrial Processes; Chemical Manufacturing; Plastics Production; Polyvinyl Chlorides and Copolymers ** (Use 6-46-3X0-XX)
30101802	Industrial Processes; Chemical Manufacturing; Plastics Production; Polypropylene and Copolymers
30101803	Industrial Processes; Chemical Manufacturing; Plastics Production; Ethylene-Propylene Copolymers
30101805	Industrial Processes; Chemical Manufacturing; Plastics Production; Phenolic Resins
30101807	Industrial Processes; Chemical Manufacturing; Plastics Production; General: Polyethylene (High Density)
30101808	Industrial Processes; Chemical Manufacturing; Plastics Production; Monomer and Solvent Storage
30101809	Industrial Processes; Chemical Manufacturing; Plastics Production; Extruder
30101810	Industrial Processes; Chemical Manufacturing; Plastics Production; Conveying
30101811	Industrial Processes; Chemical Manufacturing; Plastics Production; Storage
30101812	Industrial Processes; Chemical Manufacturing; Plastics Production; General: Polyethylene (Low Density)
30101813	Industrial Processes; Chemical Manufacturing; Plastics Production; Recovery and Purification System
30101814	Industrial Processes; Chemical Manufacturing; Plastics Production; Extruder
30101815	Industrial Processes; Chemical Manufacturing; Plastics Production; Pellet Silo
30101816	Industrial Processes; Chemical Manufacturing; Plastics Production; Transferring/Handling/Loading/Packing
30101817	Industrial Processes; Chemical Manufacturing; Plastics Production; General
30101818	Industrial Processes; Chemical Manufacturing; Plastics Production; Reactor

30101819	Industrial Processes; Chemical Manufacturing; Plastics Production; Solvent Recovery
30101820	Industrial Processes; Chemical Manufacturing; Plastics Production; Polymer Drying
30101821	Industrial Processes; Chemical Manufacturing; Plastics Production; Extruding/Pelletizing/Conveying/Storage
30101822	Industrial Processes; Chemical Manufacturing; Plastics Production; Acrylic Resins
30101827	Industrial Processes; Chemical Manufacturing; Plastics Production; Polyamide Resins
30101832	Industrial Processes; Chemical Manufacturing; Plastics Production; Urea-Formaldehyde Resins
30101837	Industrial Processes; Chemical Manufacturing; Plastics Production; Polyester Resins
30101838	Industrial Processes; Chemical Manufacturing; Plastics Production; Reactor Kettle ** (Use 6-45-200-11 or 6-45-210-11)
30101839	Industrial Processes; Chemical Manufacturing; Plastics Production; Resin Thinning Tank ** (Use 6-45-200-21 or 6-45-210-21)
30101840	Industrial Processes; Chemical Manufacturing; Plastics Production; Resin Storage Tank ** (Use 6-45-200-23 or 6-45-210-23)
30101842	Industrial Processes; Chemical Manufacturing; Plastics Production; Melamine Resins
30101847	Industrial Processes; Chemical Manufacturing; Plastics Production; Epoxy Resins
30101849	Industrial Processes; Chemical Manufacturing; Plastics Production; Acrylonitrile-Butadiene-Styrene (ABS) Resin
30101852	Industrial Processes; Chemical Manufacturing; Plastics Production; Polyfluorocarbons
30101860	Industrial Processes; Chemical Manufacturing; Plastics Production; Recovery System (Polyethylene)
30101861	Industrial Processes; Chemical Manufacturing; Plastics Production; Purification System (Polyethylene)
30101863	Industrial Processes; Chemical Manufacturing; Plastics Production; Extruder
30101864	Industrial Processes; Chemical Manufacturing; Plastics Production; Pellet Silo/Storage
30101865	Industrial Processes; Chemical Manufacturing; Plastics Production; Transferring/Conveying
30101866	Industrial Processes; Chemical Manufacturing; Plastics Production; Packing/Shipping
30101870	Industrial Processes; Chemical Manufacturing; Plastics Production; Reactor (Polyether Resins)
30101871	Industrial Processes; Chemical Manufacturing; Plastics Production; Blowing Agent: Freon (Polyether Resins)
30101872	Industrial Processes; Chemical Manufacturing; Plastics Production; Miscellaneous (Polyether Resins)
30101880	Industrial Processes; Chemical Manufacturing; Plastics Production; Reactor (Polyurethane)
30101881	Industrial Processes; Chemical Manufacturing; Plastics Production; Blowing Agent: Freon (Polyurethane)
30101882	Industrial Processes; Chemical Manufacturing; Plastics Production; Blowing Agent: Methylene Chloride (Polyurethane)
30101883	Industrial Processes; Chemical Manufacturing; Plastics Production; Transferring/Conveying/Storage (Polyurethane)
30101884	Industrial Processes; Chemical Manufacturing; Plastics Production; Packing/Shipping (Polyurethane)
30101885	Industrial Processes; Chemical Manufacturing; Plastics Production; Other Not Classified (Polyurethane)
30101890	Industrial Processes; Chemical Manufacturing; Plastics Production; Catalyst Preparation
30101891	Industrial Processes; Chemical Manufacturing; Plastics Production; Reactor Vents

30101892	Industrial Processes; Chemical Manufacturing; Plastics Production; Separation Processes
30101893	Industrial Processes; Chemical Manufacturing; Plastics Production; Raw Material Storage
30101894	Industrial Processes; Chemical Manufacturing; Plastics Production; Solvent Storage
30101899	Industrial Processes; Chemical Manufacturing; Plastics Production; Others Not Specified
30101901	Industrial Processes; Chemical Manufacturing; Phthalic Anhydride; o-Xylene Oxidation: Main Process Stream
30101902	Industrial Processes; Chemical Manufacturing; Phthalic Anhydride; o-Xylene Oxidation: Pre-Treatment
30101904	Industrial Processes; Chemical Manufacturing; Phthalic Anhydride; o-Xylene Oxidation: Distillation
30101905	Industrial Processes; Chemical Manufacturing; Phthalic Anhydride; Naphthalene Oxidation: Main Process Stream
30101906	Industrial Processes; Chemical Manufacturing; Phthalic Anhydride; Naphthalene Oxidation: Pre-Treatment
30101907	Industrial Processes; Chemical Manufacturing; Phthalic Anhydride; Naphthalene Oxidation: Distillation
30101908	Industrial Processes; Chemical Manufacturing; Phthalic Anhydride; Dryer
30101909	Industrial Processes; Chemical Manufacturing; Phthalic Anhydride; Flaking and Bagging
30102000	Industrial Processes;Chemical Manufacturing;Printing Ink Manufacture;undefined
30102001	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Vehicle Cooking: General
30102002	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Vehicle Cooking: Oils
30102003	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Vehicle Cooking: Oleoresin
30102004	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Vehicle Cooking: Alkyds
30102005	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Mixing
30102015	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Premix/Preassembly
30102017	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Premix/Preassembly: Drums
30102018	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Premix/Preassembly: Material Loading
30102030	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling
30102031	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling: Roller Mills
30102032	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling: Ball and Pebble Mills
30102033	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling: Attritors
30102034	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling: Sand Mills
30102035	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling: Bead Mills
30102036	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling: Shot Mills
30102037	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling: Stone Mills
30102038	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling: Colloid Mills

30102039	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling: Kady Mills
30102040	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling: Impingement Mills
30102041	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Pigment Grinding/Milling: Horizontal Media Mills
30102050	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Product Finishing
30102051	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Product Finishing, Tinting: Mix Tank and Disperser
30102052	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Product Finishing, Tinting: Fixed Blend Tank
30102053	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Product Finishing, Thinning: Mix Tank and Disperser
30102054	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Product Finishing, Thinning: Fixed Blend Tank
30102060	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Product Filling
30102061	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Product Filling: Scale System
30102062	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Product Filling: Product Filtering
30102063	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Product Filling: Filling Operations
30102070	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Equipment Cleaning
30102071	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Equipment Cleaning: Hand Wipe
30102072	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Equipment Cleaning: Tanks, Vessels, etc.
30102099	Industrial Processes; Chemical Manufacturing; Printing Ink Manufacture; Other Not Classified
30102101	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Solvay Process: NH3 Recovery
30102102	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Solvay Process: Handling
30102103	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Trona Crushing/Screening
30102104	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Monohydrate Process: Rotary Ore Calciner: Gas-fired
30102105	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Monohydrate Process: Rotary Ore Calciner: Coal-fired
30102106	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Rotary Soda Ash Dryers
30102107	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Fluid-bed Soda Ash Dryers/Coolers
30102108	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Dissolver
30102110	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Trona Calcining **
30102111	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Trona Dryer **
30102112	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Rotary Pre-dryer
30102113	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Bleacher: Gas-fired
30102114	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Rotary Dryer: Steam Tube
30102120	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Brine Evaporation
30102121	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Ore Crushing and Screening

30102122	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Soda Ash Storage: Loading and Unloading
30102123	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Ore Mining
30102124	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Ore Transfer
30102125	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Sesquicarbonate Process: Rotary Calciner
30102126	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Sesquicarbonate Process: Fluid-bed Calciner
30102127	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Soda Ash Screening
30102199	Industrial Processes; Chemical Manufacturing; Sodium Carbonate; Other Not Classified
30102200	Industrial Processes;Chemical Manufacturing;Sulfuric Acid (Chamber Process);undefined
30102201	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Chamber Process); General
30102300	Industrial Processes;Chemical Manufacturing;Sulfuric Acid (Contact Process);undefined
30102301	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 99.9% Conversion
30102304	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 99.5% Conversion
30102306	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 99.0% Conversion
30102308	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 98.0% Conversion
30102310	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 97.0% Conversion
30102312	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 96.0% Conversion
30102314	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 95.0% Conversion
30102316	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 94.0% Conversion
30102318	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Absorber/@ 93.0% Conversion
30102319	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Concentrator
30102320	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Tank Car and Truck Unloading
30102321	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Storage Tank Vent
30102322	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Process Equipment Leaks
30102323	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Sulfur Melting and Filtering
30102324	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Oleum Tower
30102325	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Gas Cleaning and Cooling
30102330	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Combustion Chamber
30102331	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Drying Tower
30102332	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Convertor

30102399	Industrial Processes; Chemical Manufacturing; Sulfuric Acid (Contact Process); Other Not Classified
30102401	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Nylon #6: Staple (Uncontrolled)
30102402	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Polyesters: Staple
30102403	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Polyester: Yarn
30102404	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Nylon #6: Yarn
30102405	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Polyfluorocarbons (e.g., Teflon)
30102406	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Nylon#66: Controlled
30102407	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Nylon #66: Uncontrolled
30102408	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Acrylic: Copolymer (Inorganic)
30102409	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Acrylic: Controlled
30102410	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Acrylic: Uncontrolled
30102411	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Modacrylic: Dry Spun
30102412	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Acrylic and Modacrylic: Wet Spun
30102413	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Acrylic: Homopolymer (Inorganic): Wet Spun
30102414	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Polyolefin: Melt Spun
30102415	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Vinyls (e.g., Saran)
30102416	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Aramid
30102417	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Spandex: Dry Spun ** (Use 6-49-300-XX)
30102418	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Spandex: Reaction Spun ** (Use 6-49-310-XX)
30102419	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Vinyon: Dry Spun
30102421	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Dope Preparation (Use 6-49-300-11 or 6-49-310-11 for Spandex)
30102422	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Filtration (Use 6-49-300-12 or 6-49-310-12 for Spandex)
30102423	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Fiber Extrusion (Use 6-49-300-21 of 6-49-310-21 for Spandex)
30102424	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Washing/Drying/Finishing (Use 6-49-300-30 or 6-49-310-30 for Spandex)
30102425	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Fiber Storage (Use 6-49-300-45 or 6-49-310-45 for Spandex)
30102426	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Equipment Cleanup (Use 6-49-300-50 or 6-49-310-50 for Spandex)

30102427	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Solvent Storage (Use 4-07-004-01 thru 4-07-999-98 for Spandex)
30102428	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Leaching
30102429	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Mixing
30102431	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Heat Treating Furnace: Carbonization
30102432	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Curing Oven: Carbonization
30102434	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Fiber Laminate Process
30102435	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Fiber Handling and Storage
30102499	Industrial Processes; Chemical Manufacturing; Synthetic Organic Fiber Manufacturing; Other Not Classified
30102501	Industrial Processes; Chemical Manufacturing; Cellulosic Fiber Production; Viscose (e.g., Rayon) ** (Use 6-49-200-XX)
30102505	Industrial Processes; Chemical Manufacturing; Cellulosic Fiber Production; Cellulose Acetate: Filer Tow
30102506	Industrial Processes; Chemical Manufacturing; Cellulosic Fiber Production; Cellulose Acetate and Triacetitic, Filament Yarn
30102599	Industrial Processes; Chemical Manufacturing; Cellulosic Fiber Production; Other Not Classified
30102601	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); General
30102602	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Butyl (Isobutylene)
30102608	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Acrylonitrile
30102609	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Dryers
30102610	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Blowdown Tank
30102611	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Steam Stripper
30102612	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Pre-storage Tank
30102613	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Monomer Recovery: Absorber Vent
30102614	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Blending Tanks
30102615	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Isoprene
30102616	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Latex: Monomer Removal
30102617	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Latex: Blending Tank
30102618	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Uninhibited Monomer Storage
30102619	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Inhibited Monomer Storage
30102620	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Monomer Inhibitor Removal

30102621	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Crumb Process: Polymerization
30102622	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Crumb Process: Monomer Recovery: Uncontrolled
30102623	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Crumb Process: Styrene Recovery
30102624	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Crumb Process: Crumb Screens
30102625	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Chloroprene
30102626	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Crumb Process: Crumb Bailing and Weighing
30102627	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Crumb Process: Crumb Storage
30102628	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Crumb Process: Rotary Press
30102630	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Silicone Rubber
30102641	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Latex Process: Polymerization
30102642	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Latex Process: Styrene Condenser
30102643	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Latex Process: Latex Screen Filters
30102644	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Latex Process: Latex Packaging
30102645	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Latex Process: Latex Loading
30102646	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Emulsion Latex Process: Latex Product Storage
30102650	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Fugitive Emissions: Monomer Unloading
30102651	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Fugitive Emissions: Soap Solution Storage
30102652	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Fugitive Emissions: Activated Catalyst Storage
30102653	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Fugitive Emissions: Modifier Storage
30102654	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Fugitive Emissions: Stabilizer Storage
30102655	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Fugitive Emissions: Antioxidant Storage
30102656	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Fugitive Emissions: Carbon Black Storage
30102699	Industrial Processes; Chemical Manufacturing; Synthetic Rubber (Manufacturing Only); Other Not Classified
30102701	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Prilling Tower: Neutralizer **
30102704	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Neutralizer
30102705	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Granulator **

30102706	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Dryers and Coolers **
30102707	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Rotary Drum Granulator
30102708	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Pan Granulator
30102709	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Bulk Loading (General)
30102710	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Bagging of Product
30102711	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Neutralizer: High Density
30102712	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Prilling Tower: High Density
30102713	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; High Density Dryers and Coolers (scb**
30102714	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Prilling Cooler: High Density
30102717	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Evaporator/Concentrator: High Density
30102718	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Coating: High Density
30102720	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Solids Screening
30102721	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Neutralizer: Low Density
30102722	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Prilling Tower: Low Density
30102723	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Low Density Dryers and Coolers (scb**
30102724	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Prilling Cooler: Low Density
30102725	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Prilling Dryer: Low Density
30102727	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Evaporator/Concentrator: Low Density
30102728	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Coating: Low Density
30102729	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Rotary Drum Granulator Coolers
30102730	Industrial Processes; Chemical Manufacturing; Ammonium Nitrate Production; Pan Granulator Coolers
30102801	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Grinding/Drying
30102803	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Rock Unloading
30102804	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Rock Feeder System
30102805	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Mixer/Den
30102806	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Curing/Building
30102807	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Bagging/Handling
30102820	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Mixing
30102821	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Den

30102822	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Curing
30102823	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Ammoniator/Granulator
30102824	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Dryer
30102825	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Cooler
30102826	Industrial Processes; Chemical Manufacturing; Normal Superphosphates; Pulverizer: Granular Phosphate
30102903	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Rock Unloading
30102904	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Rock Feeder System
30102905	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Run of Pile: Mixer/Den/Curing
30102906	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Granulator: Reactor/Dryer
30102907	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Granulator: Curing
30102908	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Bagging/Handling
30102909	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Mechanical Cutting
30102910	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Crushing and Screening
30102920	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Mixing
30102921	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Den
30102922	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Curing
30102923	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Ammoniator/Granulator
30102924	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Dryer
30102925	Industrial Processes; Chemical Manufacturing; Triple Superphosphate; Cooler
30103000	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Entire Plant
30103001	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Dryers and Coolers
30103002	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Ammoniator/Granulator
30103003	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Screening/Transfer
30103004	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Bagging/Handling
30103020	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Mixing
30103021	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Den
30103022	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Curing
30103023	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Ammoniator/Granulator
30103024	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Dryer
30103025	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Cooler
30103099	Industrial Processes; Chemical Manufacturing; Ammonium Phosphates; Other Not Classified
30103101	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; HNO3 - Para-xylene: General
30103102	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; Reactor Vent
30103103	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; Crystallization, Separation, and Drying Vent
30103104	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; Distillation and Recovery Vent

30103105	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; Product Transfer Vent
30103106	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; Gas/Liquid Separator
30103107	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; High Pressure Absorber
30103108	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; Solid/Liquid Separator
30103109	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; Residue Still
30103110	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; C-TPA Purification
30103180	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; Fugitive Emissions
30103199	Industrial Processes; Chemical Manufacturing; Terephthalic Acid/Dimethyl Terephthalate; Other Not Classified
30103201	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Mod. Claus: 2 Stage w/o Control (92-95% Removal)
30103202	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Mod. Claus: 3 Stage w/o Control (95-96% Removal)
30103203	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Mod. Claus: 4 Stage w/o Control (96-97% Removal)
30103204	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Sulfur Removal Process (99.9% Removal)
30103205	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Sulfur Storage
30103299	Industrial Processes; Chemical Manufacturing; Elemental Sulfur Production; Other Not Classified
30103301	Industrial Processes; Chemical Manufacturing; Pesticides; Malathion
30103311	Industrial Processes; Chemical Manufacturing; Pesticides; General
30103312	Industrial Processes; Chemical Manufacturing; Pesticides; General
30103399	Industrial Processes; Chemical Manufacturing; Pesticides; Other Not Classified
30103402	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; General: Aniline
30103403	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Reactor Cycle Purge Vent
30103404	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Dehydration Column Vent
30103405	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Purification Column Vent
30103406	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Fugitive Emissions
30103410	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; General: Ethanolamines
30103411	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Ammonia Scrubber Vent
30103412	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Vacuum Distillation: Jet Vent
30103414	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Fugitive Emissions
30103415	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Ethylenediamine
30103420	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Hexamethylenediamine
30103425	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Hexamethylenetetramine
30103430	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Melamine
30103435	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Methylamines

30103499	Industrial Processes; Chemical Manufacturing; Aniline/Ethanolamines; Other Not Classified
30103501	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; TiO2 Sulfate Process: Calciner
30103502	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; TiO2 Sulfate Process: Digester
30103503	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; TiO2 Chloride Process: Reactor
30103506	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; Lead Oxide: Barton Pot
30103507	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; Lead Oxide: Calciner
30103510	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; Red Lead
30103515	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; White Lead
30103520	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; Lead Chromate
30103550	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; Ore Grinding
30103551	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; Ore Dryer
30103552	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; Pigment Milling
30103553	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; Pigment Dryer
30103554	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; Conveying/Storage/Packing
30103599	Industrial Processes; Chemical Manufacturing; Inorganic Pigments; Other Not Classified
30103801	Industrial Processes; Chemical Manufacturing; Sodium Bicarbonate; General
30103901	Industrial Processes; Chemical Manufacturing; Hydrogen Cyanide; Air Heater: General
30103902	Industrial Processes; Chemical Manufacturing; Hydrogen Cyanide; Ammonia Absorber
30103903	Industrial Processes; Chemical Manufacturing; Hydrogen Cyanide; HCN Absorber
30104001	Industrial Processes; Chemical Manufacturing; Urea Production; General: Specify in Comments
30104002	Industrial Processes; Chemical Manufacturing; Urea Production; Solution Concentration (Controlled)
30104003	Industrial Processes; Chemical Manufacturing; Urea Production; Prilling
30104004	Industrial Processes; Chemical Manufacturing; Urea Production; Drum Granulation
30104005	Industrial Processes; Chemical Manufacturing; Urea Production; Coating
30104006	Industrial Processes; Chemical Manufacturing; Urea Production; Bagging
30104007	Industrial Processes; Chemical Manufacturing; Urea Production; Bulk Loading
30104008	Industrial Processes; Chemical Manufacturing; Urea Production; Non-fluidized Bed Prilling (Agricultural Grade)
30104009	Industrial Processes; Chemical Manufacturing; Urea Production; Non-fluidized Bed Prilling (Feed Grade)
30104010	Industrial Processes; Chemical Manufacturing; Urea Production; Fluidized Bed Prilling (Agricultural Grade)
30104011	Industrial Processes; Chemical Manufacturing; Urea Production; Fluidized Bed Prilling (Feed Grade)
30104012	Industrial Processes; Chemical Manufacturing; Urea Production; Rotary Drum Cooler
30104013	Industrial Processes; Chemical Manufacturing; Urea Production; Solids Screening
30104014	Industrial Processes; Chemical Manufacturing; Urea Production; Pan Granulation
30104020	Industrial Processes; Chemical Manufacturing; Urea Production; Solution Synthesis
30104101	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Nitration Reactor

30104102	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Sulfuric Acid Concentrators
30104103	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Boiling Tubs
30104104	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Nitric Acid Concentrators
30104105	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Nitric/Sulfuric Acid Mixing
30104106	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Purification Beaters
30104107	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Purification Poacher
30104108	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Purification Blender
30104109	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Purification Wringer
30104110	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Raw Cellulose Purification
30104120	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Spent Acid Recovery
30104121	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Spent Acid Recovery: Denitrating Tower
30104122	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Spent Acid Recovery: Sulfuric Acid Regenerator
30104123	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Spent Acid Recovery: Bleacher
30104124	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Spent Acid Recovery: Reflux Columns
30104130	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Nitric Acid Concentration
30104131	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Nitric Acid Concentration: Distillation Tower
30104132	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Nitric Acid Concentration: Bleacher
30104133	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Nitric Acid Concentration: Condenser
30104134	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Nitric Acid Concentration: Absorber Column
30104135	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Batch Process: Nitric Acid Concentration: Dehydrating Unit
30104150	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Nitration Reactors
30104151	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Sulfuric Acid Concentrators
30104152	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Purification Boiling Tubs
30104153	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Nitric Acid Concentrators
30104154	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Purification Beaters
30104155	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Purification Poacher
30104156	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Purification Blender
30104157	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Purification Wringer
30104160	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Spent Acid Recovery

30104161	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Spent Acid Recovery: Denitrating Tower
30104162	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Spent Acid Recovery: Sulfuric Acid Regenerator
30104163	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Spent Acid Recovery: Bleacher
30104164	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Spent Acid Recovery: Reflux Columns
30104170	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Nitric Acid Concentration
30104171	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Nitric Acid Concentration: Distillation Tower
30104172	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Nitric Acid Concentration: Bleacher
30104173	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Nitric Acid Concentration: Condenser
30104174	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Nitric Acid Concentration: Absorber Column
30104175	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Continuous Process: Nitric Acid Concentration: Dehydrating Unit
30104199	Industrial Processes; Chemical Manufacturing; Nitrocellulose; Other Not Classified
30104201	Industrial Processes; Chemical Manufacturing; Lead Alkyl Manufacturing (Sodium/Lead Alloy Process); Recovery Furnace
30104202	Industrial Processes; Chemical Manufacturing; Lead Alkyl Manufacturing (Sodium/Lead Alloy Process); Process Vents: Tetraethyl Lead
30104203	Industrial Processes; Chemical Manufacturing; Lead Alkyl Manufacturing (Sodium/Lead Alloy Process); Process Vents: Tetramethyl Lead
30104204	Industrial Processes; Chemical Manufacturing; Lead Alkyl Manufacturing (Sodium/Lead Alloy Process); Sludge Pits
30104301	Industrial Processes; Chemical Manufacturing; Lead Alkyl Manufacturing (Electrolytic Process); General
30104501	Industrial Processes; Chemical Manufacturing; Organic Fertilizer; General: Mixing/Handling
30105000	Industrial Processes;Chemical Manufacturing;Adhesives;undefined
30105001	Industrial Processes; Chemical Manufacturing; Adhesives; General/Compound Unknown **
30105101	Industrial Processes; Chemical Manufacturing; Animal Adhesives; Animal Adhesives
30105105	Industrial Processes; Chemical Manufacturing; Animal Adhesives; Raw Materials Grinding
30105108	Industrial Processes; Chemical Manufacturing; Animal Adhesives; Degreasing
30105110	Industrial Processes; Chemical Manufacturing; Animal Adhesives; Lining/Plumping
30105112	Industrial Processes; Chemical Manufacturing; Animal Adhesives; Washing
30105114	Industrial Processes; Chemical Manufacturing; Animal Adhesives; Cooking
30105116	Industrial Processes; Chemical Manufacturing; Animal Adhesives; Hot Water Extractions
30105118	Industrial Processes; Chemical Manufacturing; Animal Adhesives; Filtering/Centrifuging
30105120	Industrial Processes; Chemical Manufacturing; Animal Adhesives; Evaporation
30105122	Industrial Processes; Chemical Manufacturing; Animal Adhesives; Chilling
30105124	Industrial Processes; Chemical Manufacturing; Animal Adhesives; Drying
30105130	Industrial Processes; Chemical Manufacturing; Animal Adhesives; End Product Finishing

30105201	Industrial Processes; Chemical Manufacturing; Casein; Casein Manufacture
30105205	Industrial Processes; Chemical Manufacturing; Casein; Precipitation
30105210	Industrial Processes; Chemical Manufacturing; Casein; Draining
30105211	Industrial Processes; Chemical Manufacturing; Casein; Draining: Batch Method
30105212	Industrial Processes; Chemical Manufacturing; Casein; Draining: Continuous Method
30105215	Industrial Processes; Chemical Manufacturing; Casein; Washing
30105220	Industrial Processes; Chemical Manufacturing; Casein; Dewatering
30105221	Industrial Processes; Chemical Manufacturing; Casein; Dewatering: Continuous Power Press
30105222	Industrial Processes; Chemical Manufacturing; Casein; Dewatering: Hand Press
30105230	Industrial Processes; Chemical Manufacturing; Casein; Grinding Curd
30105235	Industrial Processes; Chemical Manufacturing; Casein; Drying
30105240	Industrial Processes; Chemical Manufacturing; Casein; Grinding, Packaging, and Storing
30106000	Industrial Processes;Chemical Manufacturing;Pharmaceutical Preparations;undefined
30106001	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Vacuum Dryers
30106002	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Reactors
30106003	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Distillation Units
30106004	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Filters
30106005	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Extractors
30106006	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Centrifuges
30106007	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Crystallizers
30106008	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Exhaust Systems
30106009	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Air Dryers
30106010	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Storage (For transfer, use 30106018)
30106011	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Coating Process
30106012	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Granulation Process
30106013	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Fermentation Tanks
30106021	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Raw Material Unloading
30106022	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Miscellaneous Fugitives
30106023	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Fugitive emissions
30106099	Industrial Processes; Chemical Manufacturing; Pharmaceutical Production; Other Not Classified
30107000	Industrial Processes;Chemical Manufacturing;Inorganic Chemical Manufacturing (General);undefined
30107001	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Manufacturing (General); Fugitive Leaks
30107002	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Manufacturing (General); Storage/Transfer
30107101	Industrial Processes; Chemical Manufacturing; Hydrogen; Reformers
30107102	Industrial Processes; Chemical Manufacturing; Hydrogen; CO Converter

30107103	Industrial Processes; Chemical Manufacturing; Hydrogen; Hydrogen Storage
30109101	Industrial Processes; Chemical Manufacturing; Acetone/Ketone Production; Acetone: General
30109105	Industrial Processes; Chemical Manufacturing; Acetone/Ketone Production; Methyl Ethyl Ketone
30109110	Industrial Processes; Chemical Manufacturing; Acetone/Ketone Production; Methyl Isobutyl Ketone
30109151	Industrial Processes; Chemical Manufacturing; Acetone/Ketone Production; Acetone: Cumene Oxidation
30109152	Industrial Processes; Chemical Manufacturing; Acetone/Ketone Production; Acetone: CHP Concentrator
30109153	Industrial Processes; Chemical Manufacturing; Acetone/Ketone Production; Acetone: Light-ends Distillation Vent
30109154	Industrial Processes; Chemical Manufacturing; Acetone/Ketone Production; Acetone: Finishing Column
30109180	Industrial Processes; Chemical Manufacturing; Acetone/Ketone Production; Acetone: Fugitive Emissions
30109199	Industrial Processes; Chemical Manufacturing; Acetone/Ketone Production; Ketone: Other Not Classified
30110002	Industrial Processes; Chemical Manufacturing; Maleic Anhydride; Product Recovery Absorber
30110003	Industrial Processes; Chemical Manufacturing; Maleic Anhydride; Vacuum System Vent
30110004	Industrial Processes; Chemical Manufacturing; Maleic Anhydride; Briquetting
30110005	Industrial Processes; Chemical Manufacturing; Maleic Anhydride; Secondary Sources: Dehydration Column, Vacuum System
30110080	Industrial Processes; Chemical Manufacturing; Maleic Anhydride; Fugitive Emissions
30110099	Industrial Processes; Chemical Manufacturing; Maleic Anhydride; Other Not Classified
30111103	Industrial Processes; Chemical Manufacturing; Asbestos Chemical; Brake Line/Grinding **
30111199	Industrial Processes; Chemical Manufacturing; Asbestos Chemical; Not Classified **
30111201	Industrial Processes; Chemical Manufacturing; Elemental Phosphorous; Calciner
30111202	Industrial Processes; Chemical Manufacturing; Elemental Phosphorous; Furnace
30111299	Industrial Processes; Chemical Manufacturing; Elemental Phosphorous; Other Not Classified
30111301	Industrial Processes; Chemical Manufacturing; Boric Acid; Dryer
30111401	Industrial Processes; Chemical Manufacturing; Potassium Chloride; Dryer
30111501	Industrial Processes; Chemical Manufacturing; Aluminum Sulfate Manufacturing; Bauxite Unloading
30111502	Industrial Processes; Chemical Manufacturing; Aluminum Sulfate Manufacturing; Hammer Mill
30111503	Industrial Processes; Chemical Manufacturing; Aluminum Sulfate Manufacturing; Bauxite Storage
30111504	Industrial Processes; Chemical Manufacturing; Aluminum Sulfate Manufacturing; Elevator
30111505	Industrial Processes; Chemical Manufacturing; Aluminum Sulfate Manufacturing; Conveyor
30111506	Industrial Processes; Chemical Manufacturing; Aluminum Sulfate Manufacturing; Cooker
30111507	Industrial Processes; Chemical Manufacturing; Aluminum Sulfate Manufacturing; Alums Storage
30111508	Industrial Processes; Chemical Manufacturing; Aluminum Sulfate Manufacturing; H2SO4 Process Tank
30111509	Industrial Processes; Chemical Manufacturing; Aluminum Sulfate Manufacturing; Alums Loading
30112001	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Formaldehyde: Silver Catalyst

30112002	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Formaldehyde: Mixed Oxide Catalyst
30112005	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Formaldehyde: Absorber Vent
30112006	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Formaldehyde: Fractionator Vent
30112007	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Formaldehyde: Fugitive Emissions
30112011	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Acetaldehyde from Ethylene
30112012	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Acetaldehyde from Ethanol
30112013	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Acetaldehyde: Off-air Absorber Vent
30112014	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Acetaldehyde: Off-gas Absorber Vent
30112017	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Acetaldehyde: Fugitive Emissions
30112021	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Butyraldehyde: General
30112031	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Acrolein: CO2 Stripping Tower
30112032	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Acrolein: Aqueous Acrolein Receiver
30112033	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Acrolein: Distillation System
30112034	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Acrolein: Refrigeration Unit
30112037	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Acrolein: Fugitive Emissions
30112099	Industrial Processes; Chemical Manufacturing; Formaldahyde, Acrolein, Acetaldehyde, Butyraldehyde; Acrolein: Other Not Classified
30112100	Industrial Processes;Chemical Manufacturing;Organic Dyes/Pigments;undefined
30112199	Industrial Processes; Chemical Manufacturing; Organic Dyes/Pigments; Other Not Classified
30112401	Industrial Processes; Chemical Manufacturing; Chloroprene; General
30112402	Industrial Processes; Chemical Manufacturing; Chloroprene; Butadiene Dryer
30112403	Industrial Processes; Chemical Manufacturing; Chloroprene; Chlorination Reactor
30112404	Industrial Processes; Chemical Manufacturing; Chloroprene; Dichlorobutene Still
30112405	Industrial Processes; Chemical Manufacturing; Chloroprene; Isomerization and 3,4-DCB Recovery Vent
30112406	Industrial Processes; Chemical Manufacturing; Chloroprene; Chloroprene Stripper
30112407	Industrial Processes; Chemical Manufacturing; Chloroprene; Brine Stripper
30112480	Industrial Processes; Chemical Manufacturing; Chloroprene; Fugitive Emissions
30112501	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Ethylene Dichloride via Oxychlorination
30112502	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Ethylene Dichloride via Direct Chlorination

30112504	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Ethylene Dichloride: Caustic Scrubber
30112505	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Ethylene Dichloride: Reactor Vessel
30112506	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Ethylene Dichloride: Distillation Unit
30112509	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Ethylene Dichloride: Fugitive Emissions
30112510	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Chloromethanes: General
30112511	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Chloromethanes: Recycled Methane Inert-purge
30112512	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Chloromethanes: Drying Bed Regeneration Vent
30112514	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Chloromethanes: Fugitive Emissions
30112515	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Ethyl Chloride: General
30112520	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Perchloroethylene: General
30112521	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Perchloroethylene: Distillation Vent
30112522	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Perchloroethylene: Caustic Scrubber
30112524	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Perchloroethylene: Fugitive Emissions
30112525	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Trichloroethane: General
30112526	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Trichloroethane: HCl Absorber Vent
30112527	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Trichloroethane: Drying Column Vent
30112528	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Trichloroethane: Distillation Column Vent
30112529	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Trichloroethane: Fugitive Emissions
30112530	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Trichloroethylene: General
30112531	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Trichloroethylene: Distillation Unit
30112532	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Trichloroethylene: Neutralizer
30112533	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Trichloroethylene: Product Drying Column
30112534	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Trichloroethylene: Fugitive Emissions
30112535	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Chlorobenzenes: General
30112540	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinyl Chloride: General
30112541	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinyl Chloride: Cracking Furnace
30112542	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinyl Chloride: HCl Recovery
30112543	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinyl Chloride: Light-ends Recovery

30112544	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Dichloroethane: Drying Column
30112545	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinyl Chloride Monomer: Drying Column
30112546	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinyl Chloride: Product Recovery Still
30112547	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinyl Chloride: Cracking Furnace Decoking
30112550	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinyl Chloride: Fugitive Emissions
30112551	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinylidene Chloride: General
30112552	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinylidene Chloride: Dehydrochlorination Reactor
30112553	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinylidene Chloride: Distillation Column Vent
30112555	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Vinylidene Chloride: Fugitive Emissions
30112556	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Chloromethanes via MH & MCC Processes: Inert-gas Purge Vent
30112557	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Chloromethanes via MH & MCC Processes: Methylene Chloride Condenser
30112558	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Chloromethanes via MH & MCC Processes: Chloroform Condenser
30112599	Industrial Processes; Chemical Manufacturing; Chlorine Derivatives; Other Not Classified
30112600	Industrial Processes;Chemical Manufacturing;Brominated Organics;undefined
30112699	Industrial Processes; Chemical Manufacturing; Brominated Organics; Bromine Organics
30112700	Industrial Processes;Chemical Manufacturing;Fluorocarbons/Chlorofluorocarbons;undefined
30112701	Industrial Processes; Chemical Manufacturing; Fluorocarbons/Chlorofluorocarbons; General
30112702	Industrial Processes; Chemical Manufacturing; Fluorocarbons/Chlorofluorocarbons; Distillation Column
30112703	Industrial Processes; Chemical Manufacturing; Fluorocarbons/Chlorofluorocarbons; HCl Recovery Column
30112720	Industrial Processes; Chemical Manufacturing; Fluorocarbons/Chlorofluorocarbons; Chlorofluorocarbon 12/11
30112730	Industrial Processes; Chemical Manufacturing; Fluorocarbons/Chlorofluorocarbons; Chlorofluorocarbon 23/22
30112740	Industrial Processes; Chemical Manufacturing; Fluorocarbons/Chlorofluorocarbons; Chlorofluorocarbon 113/114
30112780	Industrial Processes; Chemical Manufacturing; Fluorocarbons/Chlorofluorocarbons; Fugitive Emissions
30113001	Industrial Processes; Chemical Manufacturing; Ammonium Sulfate (Use 3-01-210 for Caprolactum Production); Caprolactum By-product Plants
30113003	Industrial Processes; Chemical Manufacturing; Ammonium Sulfate (Use 3-01-210 for Caprolactum Production); Process Vents
30113004	Industrial Processes; Chemical Manufacturing; Ammonium Sulfate (Use 3-01-210 for Caprolactum Production); Caprolactum By-product: Rotary Dryer
30113005	Industrial Processes; Chemical Manufacturing; Ammonium Sulfate (Use 3-01-210 for Caprolactum Production); Caprolactum By-product: Fluid Bed Dryer

30113006	Industrial Processes; Chemical Manufacturing; Ammonium Sulfate (Use 3-01-210 for Caprolactum Production); Caprolactum By-product: Crystallizer (Evaporator)
30113007	Industrial Processes; Chemical Manufacturing; Ammonium Sulfate (Use 3-01-210 for Caprolactum Production); Caprolactum By-product: Screening
30113201	Industrial Processes; Chemical Manufacturing; Organic Acid Manufacturing; Acetic Acid via Methanol
30113205	Industrial Processes; Chemical Manufacturing; Organic Acid Manufacturing; Acetic Acid via Butane
30113210	Industrial Processes; Chemical Manufacturing; Organic Acid Manufacturing; Acetic Acid via Acetaldehyde
30113221	Industrial Processes; Chemical Manufacturing; Organic Acid Manufacturing; General: Acrylic Acid
30113222	Industrial Processes; Chemical Manufacturing; Organic Acid Manufacturing; Quench Absorber
30113223	Industrial Processes; Chemical Manufacturing; Organic Acid Manufacturing; Extraction Column
30113224	Industrial Processes; Chemical Manufacturing; Organic Acid Manufacturing; Vacuum System
30113227	Industrial Processes; Chemical Manufacturing; Organic Acid Manufacturing; Fugitive Emissions
30113299	Industrial Processes; Chemical Manufacturing; Organic Acid Manufacturing; Other Not Classified
30113301	Industrial Processes; Chemical Manufacturing; Acetic Anhydride; General
30113302	Industrial Processes; Chemical Manufacturing; Acetic Anhydride; Reactor By-product Gas Vent
30113303	Industrial Processes; Chemical Manufacturing; Acetic Anhydride; Distillation Column Vent
30113380	Industrial Processes; Chemical Manufacturing; Acetic Anhydride; Fugitive Emissions
30113701	Industrial Processes; Chemical Manufacturing; Esters Production; Ethyl Acrylate
30113710	Industrial Processes; Chemical Manufacturing; Esters Production; Butyl Acrylate
30113799	Industrial Processes; Chemical Manufacturing; Esters Production; Acrylates: Specify in Comments
30114001	Industrial Processes; Chemical Manufacturing; Acetylene Producion; Raw Material Handling
30114002	Industrial Processes; Chemical Manufacturing; Acetylene Producion; Grinding/Milling
30114003	Industrial Processes; Chemical Manufacturing; Acetylene Producion; Mixing
30114004	Industrial Processes; Chemical Manufacturing; Acetylene Producion; Waste Handling
30114005	Industrial Processes; Chemical Manufacturing; Acetylene Producion; General
30115201	Industrial Processes; Chemical Manufacturing; Bisphenol A; General
30115301	Industrial Processes; Chemical Manufacturing; Butadiene; General
30115310	Industrial Processes; Chemical Manufacturing; Butadiene; Houdry Process: Total
30115311	Industrial Processes; Chemical Manufacturing; Butadiene; Houdry Process: Flue Gas Vent
30115312	Industrial Processes; Chemical Manufacturing; Butadiene; Houdry Process: Dehydrogenation Reactor
30115320	Industrial Processes; Chemical Manufacturing; Butadiene; n-Butene Process: Total
30115321	Industrial Processes; Chemical Manufacturing; Butadiene; n-Butene Process: Flue Gas Vent
30115322	Industrial Processes; Chemical Manufacturing; Butadiene; n-Butene Process: Hydrocarbon Absorber Column
30115380	Industrial Processes; Chemical Manufacturing; Butadiene; Fugitive Emissions
30115601	Industrial Processes; Chemical Manufacturing; Cumene; General
30115602	Industrial Processes; Chemical Manufacturing; Cumene; Aluminum Chloride Catalyst Process: Benzene Drying Column

30115603	Industrial Processes; Chemical Manufacturing; Cumene; Aluminum Chloride Catalyst Process: Catalyst Mix Tank Scrubber Vent
30115604	Industrial Processes; Chemical Manufacturing; Cumene; Aluminum Chloride Catalyst Process: Wash-Decant System Vent
30115605	Industrial Processes; Chemical Manufacturing; Cumene; Aluminum Chloride Catalyst Process: Benzene Recovery
30115606	Industrial Processes; Chemical Manufacturing; Cumene; Aluminum Chloride Catalyst Process: Cumene Distillation Vent
30115607	Industrial Processes; Chemical Manufacturing; Cumene; Aluminum Chloride Catalyst Process: DIPB Stripping Vent
30115609	Industrial Processes; Chemical Manufacturing; Cumene; Solid Phosphoric Acid Catalyst Process: Cumene Distillation Sys. Vent
30115680	Industrial Processes; Chemical Manufacturing; Cumene; Fugitive Emissions
30115701	Industrial Processes; Chemical Manufacturing; Cyclohexane; General
30115702	Industrial Processes; Chemical Manufacturing; Cyclohexane; Blowndown Tank Discharge
30115703	Industrial Processes; Chemical Manufacturing; Cyclohexane; Pumps/Valves/Compressors
30115704	Industrial Processes; Chemical Manufacturing; Cyclohexane; Catalyst Replacement
30115780	Industrial Processes; Chemical Manufacturing; Cyclohexane; Fugitive Emissions
30115801	Industrial Processes; Chemical Manufacturing; Cyclohexanone/Cyclohexanol; General
30115802	Industrial Processes; Chemical Manufacturing; Cyclohexanone/Cyclohexanol; High Pressure Scrubber Vent
30115803	Industrial Processes; Chemical Manufacturing; Cyclohexanone/Cyclohexanol; Low Pressure Scrubber Vent
30115821	Industrial Processes; Chemical Manufacturing; Cyclohexanone/Cyclohexanol; Hydrogenation Reactor Vent
30115822	Industrial Processes; Chemical Manufacturing; Cyclohexanone/Cyclohexanol; Distillation Vent
30115880	Industrial Processes; Chemical Manufacturing; Cyclohexanone/Cyclohexanol; Fugitive Emissions
30116701	Industrial Processes; Chemical Manufacturing; Vinyl Acetate; General
30116702	Industrial Processes; Chemical Manufacturing; Vinyl Acetate; Inert-gas Purge Vent
30116703	Industrial Processes; Chemical Manufacturing; Vinyl Acetate; CO2 Purge Vent
30116704	Industrial Processes; Chemical Manufacturing; Vinyl Acetate; Inhibitor Mix Tank Discharge
30116780	Industrial Processes; Chemical Manufacturing; Vinyl Acetate; Fugitive Emissions
30116799	Industrial Processes; Chemical Manufacturing; Vinyl Acetate; Other Not Classified
30116901	Industrial Processes; Chemical Manufacturing; Ethyl Benzene; General
30116902	Industrial Processes; Chemical Manufacturing; Ethyl Benzene; Alkylation Reactor Vent
30116903	Industrial Processes; Chemical Manufacturing; Ethyl Benzene; Benzene Drying
30116904	Industrial Processes; Chemical Manufacturing; Ethyl Benzene; Benzene Recovery/Recycle
30116905	Industrial Processes; Chemical Manufacturing; Ethyl Benzene; Ethylbenzene Recovery
30116906	Industrial Processes; Chemical Manufacturing; Ethyl Benzene; Polyethylbenzene Recovery
30116980	Industrial Processes; Chemical Manufacturing; Ethyl Benzene; Fugitive Emissions
30117401	Industrial Processes; Chemical Manufacturing; Ethylene Oxide; General
30117402	Industrial Processes; Chemical Manufacturing; Ethylene Oxide; Air Oxidation Process Reactor: Main Vent

30117410	Industrial Processes; Chemical Manufacturing; Ethylene Oxide; Oxygen Oxidation Process Reactor: CO2 Purge Vent
30117411	Industrial Processes; Chemical Manufacturing; Ethylene Oxide; Oxygen Oxidation Process Reactor: Argon Purge Vent
30117421	Industrial Processes; Chemical Manufacturing; Ethylene Oxide; Stripper Purge Vent
30117480	Industrial Processes; Chemical Manufacturing; Ethylene Oxide; Fugitive Emissions
30117601	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); General
30117610	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Chlorination Process: General
30117611	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); CO2 Absorber
30117612	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Evaporator
30117613	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Concentrator
30117614	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Stripping Column
30117615	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Light-ends Stripping Column
30117616	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Solvent Stripping Column
30117617	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Product Distillation Column
30117618	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Cooling Tower
30117630	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Oxidation Process: General
30117631	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Light-ends Stripper
30117632	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Concentrator
30117633	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Glycerin Flasher Column
30117634	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Product Distillation Column
30117680	Industrial Processes; Chemical Manufacturing; Glycerin (Glycerol); Fugitive Emissions
30118101	Industrial Processes; Chemical Manufacturing; Toluene Diisocyanate; General
30118102	Industrial Processes; Chemical Manufacturing; Toluene Diisocyanate; Sulfuric Acid Concentrator
30118103	Industrial Processes; Chemical Manufacturing; Toluene Diisocyanate; Nitration Reactor
30118104	Industrial Processes; Chemical Manufacturing; Toluene Diisocyanate; Catalyst Filtration
30118105	Industrial Processes; Chemical Manufacturing; Toluene Diisocyanate; TDA Vacuum Distillation Vent
30118106	Industrial Processes; Chemical Manufacturing; Toluene Diisocyanate; Dichlorobenzene Solvent Recovery
30118107	Industrial Processes; Chemical Manufacturing; Toluene Diisocyanate; TDI Flash Distillation
30118108	Industrial Processes; Chemical Manufacturing; Toluene Diisocyanate; TDI Purification
30118109	Industrial Processes; Chemical Manufacturing; Toluene Diisocyanate; Residue Vacuum Distillation Unit
30118110	Industrial Processes; Chemical Manufacturing; Toluene Diisocyanate; HCl Absorber
30118180	Industrial Processes; Chemical Manufacturing; Toluene Diisocyanate; Fugitive Emissions
30119001	Industrial Processes; Chemical Manufacturing; Methyl Methacrylate; General
30119002	Industrial Processes; Chemical Manufacturing; Methyl Methacrylate; Acetone Cyanohydrin Reactor Off-gas
30119003	Industrial Processes; Chemical Manufacturing; Methyl Methacrylate; Recovery Columns
30119004	Industrial Processes; Chemical Manufacturing; Methyl Methacrylate; Acetone Evaporation Vacuum Vent

30119010	Industrial Processes; Chemical Manufacturing; Methyl Methacrylate; Hydrolysis Reactor
30119011	Industrial Processes; Chemical Manufacturing; Methyl Methacrylate; Distillation Unit
30119012	Industrial Processes; Chemical Manufacturing; Methyl Methacrylate; MMA and Light-ends Distillation Unit
30119013	Industrial Processes; Chemical Manufacturing; Methyl Methacrylate; Acid Distillation
30119014	Industrial Processes; Chemical Manufacturing; Methyl Methacrylate; MMA Purification
30119080	Industrial Processes; Chemical Manufacturing; Methyl Methacrylate; Fugitive Emissions
30119501	Industrial Processes; Chemical Manufacturing; Nitrobenzene; General
30119502	Industrial Processes; Chemical Manufacturing; Nitrobenzene; Reactor and Separator Vent
30119503	Industrial Processes; Chemical Manufacturing; Nitrobenzene; Acid Stripper Vent
30119504	Industrial Processes; Chemical Manufacturing; Nitrobenzene; Washer and Neutralizer Vent
30119505	Industrial Processes; Chemical Manufacturing; Nitrobenzene; Nitrobenzene Stripper Vent
30119506	Industrial Processes; Chemical Manufacturing; Nitrobenzene; Waste Acid Storage
30119580	Industrial Processes; Chemical Manufacturing; Nitrobenzene; Fugitive Emissions
30119701	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Ethylene: General
30119705	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Propylene: General
30119706	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Propylene: Reactor
30119707	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Propylene: Drying Tower
30119708	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Propylene: Light-ends Stripper
30119709	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Propylene: Fugitive Emissions
30119710	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Butylene: General
30119741	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Ethylene: Flue Gas Vent
30119742	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Ethylene: Pyrolysis Furnace Decoking
30119743	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Ethylene: Acid Gas Removal
30119744	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Ethylene: Catalyst Regeneration
30119745	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Ethylene: Compressor Lube Oil Vent
30119749	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Ethylene: Fugitive Emissions
30119799	Industrial Processes; Chemical Manufacturing; Butylene, Ethylene, Propylene, Olefin Production; Other Not Classified
30120201	Industrial Processes; Chemical Manufacturing; Phenol; General
30120202	Industrial Processes; Chemical Manufacturing; Phenol; Cumene Oxidation
30120203	Industrial Processes; Chemical Manufacturing; Phenol; CHP Concentrator
30120204	Industrial Processes; Chemical Manufacturing; Phenol; Light-ends Distillation Vent

30120205	Industrial Processes; Chemical Manufacturing; Phenol; Acetone Finishing
30120206	Industrial Processes; Chemical Manufacturing; Phenol; Phenol Distillation Column
30120210	Industrial Processes; Chemical Manufacturing; Phenol; Oxidate Wash/Separation
30120211	Industrial Processes; Chemical Manufacturing; Phenol; CHP Cleavage Vent
30120280	Industrial Processes; Chemical Manufacturing; Phenol; Fugitive Emissions
30120501	Industrial Processes; Chemical Manufacturing; Propylene Oxide; General
30120502	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Chlorohydronation Process: General
30120503	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Vent Gas Scrubber Vent
30120504	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Saponification Column Vent
30120505	Industrial Processes; Chemical Manufacturing; Propylene Oxide; PO Stripping Column Vent
30120506	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Light-ends Stripping Column Vent
30120507	Industrial Processes; Chemical Manufacturing; Propylene Oxide; PO Final Distillation Column Vent
30120508	Industrial Processes; Chemical Manufacturing; Propylene Oxide; DCP Distillation Column Vent
30120509	Industrial Processes; Chemical Manufacturing; Propylene Oxide; DCIPE Distillation Column Vent
30120520	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Isobutane Hydroperoxide Process: General
30120521	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Oxidation Reactor Scrubber Vent
30120522	Industrial Processes; Chemical Manufacturing; Propylene Oxide; TBA Stripping Column Vent
30120523	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Catalyst Mix Tank Vent
30120524	Industrial Processes; Chemical Manufacturing; Propylene Oxide; PO Stripping Column Vent
30120525	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Crude TBA Recovery Column Vent
30120526	Industrial Processes; Chemical Manufacturing; Propylene Oxide; TBA Wash-Decant System Vent
30120527	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Wastewater Stripping Column Vent
30120528	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Solvent Scrubber Vent
30120529	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Solvent Recovery Column Vent
30120530	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Water Stripping Column Vent
30120531	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Propylene Glycol and Dipropylene Glycol Combined Vent
30120532	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Flue Gas Vent
30120540	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Ethylbenzene Hydroperoxide Process: General
30120541	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Oxidation Reactor Scrubber Vent
30120542	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Falling Film Evaporator Vent
30120543	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Catalyst Mix Tank Vent
30120544	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Separation Column Vent
30120545	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Light-ends Stripping Column Vent
30120546	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Propylene Recovery Column Vent

30120547	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Product Wash-Decant System Vent
30120548	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Mixed Hydrocarbon Wash-Decant System Vent
30120549	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Ethyl Benzene Wash-Decant System Vent
30120550	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Ethyl Benzene Stripping Column Vent
30120551	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Light-hydrocarbon Stripping Column Vent
30120552	Industrial Processes; Chemical Manufacturing; Propylene Oxide; MBA-AP Stripping Column Vent
30120553	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Dehydration Reactor System Vent
30120554	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Light-impurities Stripping Column Vent
30120555	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Styrene Finishing Column Vent
30120580	Industrial Processes; Chemical Manufacturing; Propylene Oxide; Fugitive Emissions
30120601	Industrial Processes; Chemical Manufacturing; Styrene; General
30120602	Industrial Processes; Chemical Manufacturing; Styrene; Benzene Recycle
30120603	Industrial Processes; Chemical Manufacturing; Styrene; Styrene Purification
30120680	Industrial Processes; Chemical Manufacturing; Styrene; Fugitive Emissions
30121001	Industrial Processes; Chemical Manufacturing; Caprolactum (Use 3-01-130 for Ammonium Sulfate By-product Production); General
30121002	Industrial Processes; Chemical Manufacturing; Caprolactum (Use 3-01-130 for Ammonium Sulfate By-product Production); Cyclohexanone Purification Vent
30121003	Industrial Processes; Chemical Manufacturing; Caprolactum (Use 3-01-130 for Ammonium Sulfate By-product Production); Dehydrogenation Reactor Vent
30121004	Industrial Processes; Chemical Manufacturing; Caprolactum (Use 3-01-130 for Ammonium Sulfate By-product Production); Oleum Reactor
30121005	Industrial Processes; Chemical Manufacturing; Caprolactum (Use 3-01-130 for Ammonium Sulfate By-product Production); Neutralization Reactor Vent
30121006	Industrial Processes; Chemical Manufacturing; Caprolactum (Use 3-01-130 for Ammonium Sulfate By-product Production); Solvent Separation/Recovery
30121007	Industrial Processes; Chemical Manufacturing; Caprolactum (Use 3-01-130 for Ammonium Sulfate By-product Production); Oximation Reactor/Separator
30121008	Industrial Processes; Chemical Manufacturing; Caprolactum (Use 3-01-130 for Ammonium Sulfate By-product Production); Caprolactum Purification
30121009	Industrial Processes; Chemical Manufacturing; Caprolactum (Use 3-01-130 for Ammonium Sulfate By-product Production); Ammonium Sulfate Drying ** (Use 3-01-130-04 or 3-01-130-05)
30121010	Industrial Processes; Chemical Manufacturing; Caprolactum (Use 3-01-130 for Ammonium Sulfate By-product Production); AS:Cool/Screen/Storage**(Use 301130-06&07,301870-25&26,301875-25&26)
30121080	Industrial Processes; Chemical Manufacturing; Caprolactum (Use 3-01-130 for Ammonium Sulfate By-product Production); Fugitive Emissions
30121101	Industrial Processes; Chemical Manufacturing; Linear Alkylbenzene; Olefin Process: General
30121102	Industrial Processes; Chemical Manufacturing; Linear Alkylbenzene; Benzene Drying
30121103	Industrial Processes; Chemical Manufacturing; Linear Alkylbenzene; Hydrogen Fluoride Scrubber Vent

30121104	Industrial Processes; Chemical Manufacturing; Linear Alkylbenzene; Vacuum Refining
30121121	Industrial Processes; Chemical Manufacturing; Linear Alkylbenzene; Chlorination Process: General
30121122	Industrial Processes; Chemical Manufacturing; Linear Alkylbenzene; Parafin Drying Column Vent
30121123	Industrial Processes; Chemical Manufacturing; Linear Alkylbenzene; HCl Absorber Vent
30121124	Industrial Processes; Chemical Manufacturing; Linear Alkylbenzene; Atmospheric Wash-Decant Vent
30121125	Industrial Processes; Chemical Manufacturing; Linear Alkylbenzene; Benzene Stripping Column
30121180	Industrial Processes; Chemical Manufacturing; Linear Alkylbenzene; Fugitive Emissions
30125000	Industrial Processes;Chemical Manufacturing;Methanol/Alcohol Production;undefined
30125001	Industrial Processes; Chemical Manufacturing; Methanol/Alcohol Production; Methanol: General
30125002	Industrial Processes; Chemical Manufacturing; Methanol/Alcohol Production; Methanol: Purge Gas Vent
30125003	Industrial Processes; Chemical Manufacturing; Methanol/Alcohol Production; Methanol: Distillation Vent
30125004	Industrial Processes; Chemical Manufacturing; Methanol/Alcohol Production; Methanol: Fugitive Emissions
30125005	Industrial Processes; Chemical Manufacturing; Methanol/Alcohol Production; Ethanol via Ethylene
30125010	Industrial Processes; Chemical Manufacturing; Methanol/Alcohol Production; Ethanol by Fermentation
30125015	Industrial Processes; Chemical Manufacturing; Methanol/Alcohol Production; Isopropanol
30125020	Industrial Processes; Chemical Manufacturing; Methanol/Alcohol Production; Alcohols by Oxo Process
30125025	Industrial Processes; Chemical Manufacturing; Methanol/Alcohol Production; Fatty Alcohols by Hydrogenation
30125099	Industrial Processes; Chemical Manufacturing; Methanol/Alcohol Production; Other Not Classified
30125101	Industrial Processes; Chemical Manufacturing; Ethylene Glycol; General
30125102	Industrial Processes; Chemical Manufacturing; Ethylene Glycol; Evaporator Purge Vent
30125103	Industrial Processes; Chemical Manufacturing; Ethylene Glycol; Water Removal Steam: Jet Ejector
30125104	Industrial Processes; Chemical Manufacturing; Ethylene Glycol; Distillation Column Vent
30125180	Industrial Processes; Chemical Manufacturing; Ethylene Glycol; Fugitive Emissions
30125201	Industrial Processes; Chemical Manufacturing; Etherene Production; General
30125301	Industrial Processes; Chemical Manufacturing; Glycol Ethers; General
30125302	Industrial Processes; Chemical Manufacturing; Glycol Ethers; Vacuum System Vent
30125305	Industrial Processes; Chemical Manufacturing; Glycol Ethers; Catalyst: Methanol Mix Tank
30125306	Industrial Processes; Chemical Manufacturing; Glycol Ethers; Methanol Recovery Column Vent
30125315	Industrial Processes; Chemical Manufacturing; Glycol Ethers; Catalyst: Ethanol Mix Tank
30125316	Industrial Processes; Chemical Manufacturing; Glycol Ethers; Ethanol Recovery Column Vent
30125325	Industrial Processes; Chemical Manufacturing; Glycol Ethers; Catalyst: Butanol Mix Tank
30125326	Industrial Processes; Chemical Manufacturing; Glycol Ethers; Butanol Recovery Column Vent
30125330	Industrial Processes; Chemical Manufacturing; Glycol Ethers; Secondary Emissions: Handling and Disposal of Process Waste Streams
30125380	Industrial Processes; Chemical Manufacturing; Glycol Ethers; Fugitive Emissions

30125401	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Acetonitrile
30125405	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; General: Acrylonitrile
30125406	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Absorber Vent: Normal
30125407	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Absorber Vent: Startup
30125408	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Recovery/Purification Column Vent
30125409	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Fugitive Emissions
30125410	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Via Adipic Acid: General
30125411	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Ammonia Recovery Still
30125412	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Product Fractionator Vent
30125413	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Product Recovery Vent
30125415	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Via Butadiene: General
30125416	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Chlorination Reactor
30125417	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Cyanide Synthesis
30125418	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Cyanation/Isomerization
30125420	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Fugitive Emissions
30125499	Industrial Processes; Chemical Manufacturing; Nitriles, Acrylonitrile, Adiponitrile Production; Other Not Classified
30125800	Industrial Processes;Chemical Manufacturing;Benzene/Toluene/Aromatics/Xylenes;undefined
30125801	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; Benzene: General
30125802	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; Benzene: Reactor
30125803	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; Benzene: Distillation Unit
30125805	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; Toluene: General
30125806	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; Toluene: Reactor
30125807	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; Toluene: Distillation Unit
30125810	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; p-Xylene: General
30125815	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; Xylenes: General
30125816	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; Xylenes: Reactor

30125817	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; Xylenes: Distillation Unit
30125880	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; Aromatics: Fugitive Emissions
30125899	Industrial Processes; Chemical Manufacturing; Benzene/Toluene/Aromatics/Xylenes; Other Not Classified
30130101	Industrial Processes; Chemical Manufacturing; Chlorobenzene; Tail Gas Scrubber
30130102	Industrial Processes; Chemical Manufacturing; Chlorobenzene; Benzene Drying: Distillation
30130103	Industrial Processes; Chemical Manufacturing; Chlorobenzene; Benzene Recovery
30130104	Industrial Processes; Chemical Manufacturing; Chlorobenzene; Heavy-ends Processing
30130105	Industrial Processes; Chemical Manufacturing; Chlorobenzene; MCB Distillation
30130106	Industrial Processes; Chemical Manufacturing; Chlorobenzene; Vacuum System Vent
30130107	Industrial Processes; Chemical Manufacturing; Chlorobenzene; DCB Crystallization
30130108	Industrial Processes; Chemical Manufacturing; Chlorobenzene; DCB Crystal Handling/Loading
30130110	Industrial Processes; Chemical Manufacturing; Chlorobenzene; Catalyst Incineration
30130114	Industrial Processes; Chemical Manufacturing; Chlorobenzene; Secondary Emissions: Handling and Disposal of Wastewater
30130115	Industrial Processes; Chemical Manufacturing; Chlorobenzene; Atmospheric Distillation Vents
30130180	Industrial Processes; Chemical Manufacturing; Chlorobenzene; Fugitive Emissions
30130201	Industrial Processes; Chemical Manufacturing; Carbon Tetrachloride; General
30130202	Industrial Processes; Chemical Manufacturing; Carbon Tetrachloride; Distillation Vent
30130203	Industrial Processes; Chemical Manufacturing; Carbon Tetrachloride; Caustic Scrubber
30130280	Industrial Processes; Chemical Manufacturing; Carbon Tetrachloride; Fugitive Emissions
30130301	Industrial Processes; Chemical Manufacturing; Allyl Chloride; Chlorination Process: General
30130302	Industrial Processes; Chemical Manufacturing; Allyl Chloride; HCl Absorber
30130303	Industrial Processes; Chemical Manufacturing; Allyl Chloride; Light-ends Distillation
30130304	Industrial Processes; Chemical Manufacturing; Allyl Chloride; Allyl Chloride Distillation Column
30130305	Industrial Processes; Chemical Manufacturing; Allyl Chloride; DCP Distillation Column
30130380	Industrial Processes; Chemical Manufacturing; Allyl Chloride; Fugitive Emissions
30130401	Industrial Processes; Chemical Manufacturing; Allyl Alcohol; General
30130402	Industrial Processes; Chemical Manufacturing; Allyl Alcohol; Catalyst Preparation
30130403	Industrial Processes; Chemical Manufacturing; Allyl Alcohol; Filtration System
30130404	Industrial Processes; Chemical Manufacturing; Allyl Alcohol; Light-ends Stripper
30130405	Industrial Processes; Chemical Manufacturing; Allyl Alcohol; Distillation System Condenser
30130480	Industrial Processes; Chemical Manufacturing; Allyl Alcohol; Fugitive Emissions
30130501	Industrial Processes; Chemical Manufacturing; Epichlorohydrin; General
30130502	Industrial Processes; Chemical Manufacturing; Epichlorohydrin; Epoxidation Reactor
30130503	Industrial Processes; Chemical Manufacturing; Epichlorohydrin; Azetrope Column
30130504	Industrial Processes; Chemical Manufacturing; Epichlorohydrin; Light-ends Stripper
30130505	Industrial Processes; Chemical Manufacturing; Epichlorohydrin; Finishing Column

30130580	Industrial Processes; Chemical Manufacturing; Epichlorohydrin; Fugitive Emissions
30140101	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Nitrator
30140102	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Product Purification/Neutralization
30140103	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Nitric Acid Recovery (Use more specific codes 3-01-410-10 thru -25)
30140105	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Nitric/Sulfuric Acid Mixing
30140110	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Separation
30140120	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Spent Acid Recovery
30140121	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Spent Acid Recovery: Denitrating Column
30140122	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Spent Acid Recovery: Sulfuric Acid Regenerator
30140123	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Spent Acid Recovery: Sulfuric Acid Concentrator
30140124	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Spent Acid Recovery: Bleacher
30140125	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Spent Acid Recovery: Reflux Columns
30140130	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Nitric Acid Concentration
30140131	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Nitric Acid Concentration: Distillation Tower
30140132	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Nitric Acid Concentration: Bleacher
30140133	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Nitric Acid Concentration: Condenser
30140134	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Nitric Acid Concentration: Absorber Column
30140135	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Nitric Acid Concentration: Dehydrating Unit
30140136	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Continuous Process: Nitric Acid Conc.: Nitric Acid Concentrators
30140150	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Waste Disposal: Neutralization and Wash
30140151	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Waste Disposal: Separation
30140199	Industrial Processes; Chemical Manufacturing; Nitroglycerin Production; Other Not Classified
30140210	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Process Vents: Batch Process
30140211	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Nitration Reactors and Washers
30140214	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Stabilization
30140217	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Acetone Distillation and Recovery
30140220	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Spent Acid Recovery

30140221	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Spent Acid Recovery: Denitrating Tower
30140222	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Spent Acid Recovery: Sulfuric Acid Regenerator
30140223	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Spent Acid Recovery: Sulfuric Acid Concentrator
30140224	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Spent Acid Recovery: Bleacher
30140225	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Spent Acid Recovery: Reflux Column
30140230	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Nitric Acid Concentration
30140231	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Nitric Acid Concentration: Distillation Column
30140232	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Nitric Acid Concentration: Bleacher
30140233	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Nitric Acid Concentration: Condenser
30140234	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Nitric Acid Concentration: Absorber Column
30140235	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Nitric Acid Concentration: Dehydrating Unit
30140236	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Batch Process: Nitric Acid Concentration: Nitric Acid Concentrators
30140250	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Process Vents: Continuous Process
30140251	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Nitration Reactors and Washers
30140252	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Stabilization
30140253	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Acetone Distillation and Recovery
30140260	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Spent Acid Recovery
30140261	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Spent Acid Recovery: Denitrating Tower
30140262	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Spent Acid Recovery: Sulfuric Acid Regenerator
30140263	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Spent Acid Recovery: Sulfuric Acid Concentrator
30140264	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Spent Acid Recovery: Bleacher
30140265	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Spent Acid Recovery: Reflux Column
30140270	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Nitric Acid Concentration
30140271	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Nitric Acid Concentration: Distillation Column
30140272	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Nitric Acid Concentration: Bleacher

30140273	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Nitric Acid Concentration: Condenser
30140274	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Nitric Acid Concentration: Absorber Column
30140275	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Nitric Acid Concentration: Dehydrating Unit
30140276	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Continuous Process: Nitric Acid Conc.: Nitric Acid Concentrators
30140299	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - Pentaerythritol Tetranitrate (PETN); Other Not Classified
30140306	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Nitric Acid/Ammonium Nitrate Mixing
30140307	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Hexamine/Acetic Acid Mixing
30140310	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Process Vents: Batch Process
30140311	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Batch Process: Nitration Reactor
30140312	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Batch Process: Aging Tank
30140313	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Batch Process: Simmer Tank
30140320	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Batch Process: Refinement
30140330	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Batch Process: Blending
30140340	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Batch Process: Formulation
30140350	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Batch Process: Acetic Acid Recovery
30140360	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Batch Process: Acetone or Cyclohexanone Recovery
30140399	Industrial Processes; Chemical Manufacturing; Explosives Manufacture - RDX/HMX Production; Other Not Classified
30180000	Industrial Processes;Chemical Manufacturing;General Processes;undefined
30180001	Industrial Processes; Chemical Manufacturing; General Processes; Fugitive Leaks
30180002	Industrial Processes; Chemical Manufacturing; General Processes; Pipeline Valves: Gas Stream
30180003	Industrial Processes; Chemical Manufacturing; General Processes; Pipeline Valves: Light Liquid/Gas Stream
30180004	Industrial Processes; Chemical Manufacturing; General Processes; Pipeline Valves: Heavy Liquid Stream
30180005	Industrial Processes; Chemical Manufacturing; General Processes; Pipeline Valves: Hydrogen Stream
30180006	Industrial Processes; Chemical Manufacturing; General Processes; Open-ended Valves: All Streams
30180007	Industrial Processes; Chemical Manufacturing; General Processes; Flanges: All Streams
30180008	Industrial Processes; Chemical Manufacturing; General Processes; Pump Seals: Light Liquid/Gas Stream
30180009	Industrial Processes; Chemical Manufacturing; General Processes; Pump Seals: Heavy Liquid Stream

30180010	Industrial Processes; Chemical Manufacturing; General Processes; Compressor Seals: Gas Stream
30180011	Industrial Processes; Chemical Manufacturing; General Processes; Compressor Seals: Heavy Liquid Stream
30180012	Industrial Processes; Chemical Manufacturing; General Processes; Drains: All Streams
30180013	Industrial Processes; Chemical Manufacturing; General Processes; Vessel Relief Valves: All Streams
30181000	Industrial Processes;Chemical Manufacturing;General Processes;undefined
30181001	Industrial Processes; Chemical Manufacturing; General Processes; Air Oxidation Units
30182000	Industrial Processes;Chemical Manufacturing;Wastewater Treatment;undefined
30182001	Industrial Processes; Chemical Manufacturing; Wastewater Treatment; Wastewater Stripper
30182002	Industrial Processes; Chemical Manufacturing; Wastewater Treatment; Wastewater Treatment
30182003	Industrial Processes; Chemical Manufacturing; Wastewater Treatment; Wastewater Treatment
30182004	Industrial Processes; Chemical Manufacturing; Wastewater Treatment; Chemical Plant Wastewater System: Junction Box
30182005	Industrial Processes; Chemical Manufacturing; Wastewater Treatment; Chemical Plant Wastewater System: Lift Station
30182006	Industrial Processes; Chemical Manufacturing; Wastewater Treatment; Chemical Plant Wastewater System: Aerated Impoundment
30182007	Industrial Processes; Chemical Manufacturing; Wastewater Treatment; Chemical Plant Wastewater System: Non-aerated Impoundment
30182008	Industrial Processes; Chemical Manufacturing; Wastewater Treatment; Chemical Plant Wastewater System: Weir
30182009	Industrial Processes; Chemical Manufacturing; Wastewater Treatment; Chemical Plant Wastewater System: Activated Sludge Impoundment
30182010	Industrial Processes; Chemical Manufacturing; Wastewater Treatment; Chemical Plant Wastewater System: Clarifier
30182011	Industrial Processes; Chemical Manufacturing; Wastewater Treatment; Chemical Plant Wastewater System: Open Trench
30182501	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; TNT: Waterwash of Crude TNT (Yellow Water)
30182502	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; TNT: Sellite Treatment and Subsequent Washing of Crude TNT (Red H2O)
30182503	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; TNT: Nitration Fume Scrubber
30182504	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; TNT: Finishing Operation Fume Scrubber
30182510	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NG: NG/Acid Separator Soda Wash
30182511	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NG: Separator Following Soda Wash
30182512	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NG: Separator Following Fresh Water Wash
30182513	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NG: Emulsifier
30182514	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NG: Refrigeration House
30182515	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NG: Spent Acid Storage

30182516	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NG: Air Compressor House
30182517	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NG: Refrigeration House
30182530	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NC: Nitric Acid Concentrators
30182531	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NC: Nitration Reactor
30182532	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NC: Purification Boiling Tubs
30182533	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NC: Purification Beaters
30182534	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NC: Purification Poacher
30182535	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NC: Purification Blender
30182536	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; NC: Purification Wringer
30182550	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; PETN: Nitration Reactors
30182551	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; PETN: Spent Acid Recovery
30182552	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; PETN: Nitric Acid Concentrators
30182553	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; PETN: Stabilization
30182560	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; RDX/HMX: Nitration
30182561	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; RDX/HMX: Filter/Wash
30182562	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; RDX/HMX: Recrystallization
30182563	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; RDX/HMX: Dewatering
30182599	Industrial Processes; Chemical Manufacturing; Wastewater, Points of Generation; Specify Point of Generation
30183000	Industrial Processes;Chemical Manufacturing;General Processes;undefined
30183001	Industrial Processes; Chemical Manufacturing; General Processes; Storage/Transfer
30184001	Industrial Processes; Chemical Manufacturing; General Processes; Distillation Units
30187000	Industrial Processes;Chemical Manufacturing;Inorganic Chemical Storage (Fixed Roof Tanks);undefined
30187001	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Hydrochloric Acid: Breathing Loss ** (Use 3-01-870-33)
30187002	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Hydrochloric Acid: Working Loss ** (Use 3-01-870-34)
30187003	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Hydrofluoric Acid: Breathing Loss
30187004	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Hydrofluoric Acid: Working Loss

30187005	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Nitric Acid: Breathing Loss
30187006	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Nitric Acid: Working Loss
30187007	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Phosphoric Acid: Breathing Loss
30187008	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Phosphoric Acid: Working Loss
30187009	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Sulfuric Acid: Breathing Loss
30187010	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Sulfuric Acid: Working Loss
30187011	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Ammonium Nitrate: Breathing Loss
30187012	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Ammonium Nitrate: Working Loss
30187013	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Urea: Breathing Loss
30187014	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Urea: Working Loss
30187015	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Copper Sulfate: Breathing Loss
30187016	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Copper Sulfate: Working Loss
30187017	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Aqueous Ammonia: Breathing Loss
30187018	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Aqueous Ammonia: Working Loss
30187019	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Ammonium Bicarbonate: Breathing Loss
30187020	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Ammonium Bicarbonate: Working Loss
30187021	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Hydrazine Hydrate: Breathing Loss
30187022	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Hydrazine Hydrate: Working Loss
30187023	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Anhydrous Hydrazine: Breathing Loss
30187024	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Anhydrous Hydrazine: Working Loss
30187025	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Ammonium Sulfate: Breathing Loss
30187026	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Ammonium Sulfate: Working Loss
30187029	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Fluosilicic Acid: Breathing Loss
30187030	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Fluosilicic Acid: Working Loss
30187031	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Chromic Acid: Breathing Loss

30187032	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Chromic Acid: Working Loss
30187033	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Hydrochloric Acid: Breathing Loss
30187034	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Hydrochloric Acid: Working Loss
30187097	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Specify Liquid: Breathing Loss
30187098	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Fixed Roof Tanks); Specify Liquid: Working Loss
30187501	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Carbon Disulfide: Breathing Loss ** (Use 4-07-296-01)
30187502	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Carbon Disulfide: Withdrawal Loss ** (Use 4-07-296-02)
30187503	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Hydrofluoric Acid: Standing Loss
30187504	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Hydrofluoric Acid: Withdrawal Loss
30187505	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Nitric Acid: Standing Loss
30187506	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Nitric Acid: Withdrawal Loss
30187507	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Phosphoric Acid: Standing Loss
30187508	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Phosphoric Acid: Withdrawal Loss
30187509	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Sulfuric Acid: Standing Loss
30187510	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Sulfuric Acid: Withdrawal Loss
30187511	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Ammonium Nitrate: Standing Loss
30187512	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Ammonium Nitrate: Withdrawal Loss
30187513	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Urea: Standing Loss
30187514	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Urea: Withdrawal Loss
30187515	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Copper Sulfate: Standing Loss
30187516	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Copper Sulfate: Withdrawal Loss
30187517	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Liquid Ammonia: Standing Loss
30187518	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Liquid Ammonia: Withdrawal Loss
30187519	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Ammonium Bicarbonate: Standing Loss
30187520	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Ammonium Bicarbonate: Withdrawal Loss

30187521	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Hydrazine Hydrate: Standing Loss
30187522	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Hydrazine Hydrate: Withdrawal Loss
30187523	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Anhydrous Hydrazine: Standing Loss
30187524	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Anhydrous Hydrazine: Withdrawal Loss
30187525	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Ammonium Sulfate: Standing Loss
30187526	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Ammonium Sulfate: Withdrawal Loss
30187529	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Fluosilicic Acid: Standing Loss
30187530	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Fluosilicic Acid: Withdrawal Loss
30187531	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Chromic Acid: Standing Loss
30187532	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Chromic Acid: Withdrawal Loss
30187533	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Hydrochloric Acid: Standing Loss
30187534	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Hydrochloric Acid: Withdrawal Loss
30187597	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Specify Liquid: Breathing Loss
30187598	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Floating Roof Tank); Specify Liquid: Withdrawal Loss
30188501	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Ammonia: Withdrawal Loss
30188502	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Carbon Monoxide: Withdrawal Loss
30188503	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Chlorine: Withdrawal Loss
30188504	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Hydrogen Cyanide: Withdrawal Loss
30188505	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Sulfur Dioxide: Withdrawal Loss
30188506	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Nitrogen: Withdrawal Loss
30188507	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Carbon Dioxide: Withdrawal Loss
30188508	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Hydrazine Hydrate: Withdrawal Loss
30188509	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Anhydrous Hydrazine: Withdrawal Loss
30188510	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Anhydrous Ammonia: Withdrawal Loss
30188511	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Hydrogen Fluoride: Withdrawal Loss

30188512	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Fluosilicic Acid: Withdrawal Loss
30188513	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Hydrogen Chloride: Withdrawal Loss
30188514	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Fluorine: Withdrawal Loss
30188599	Industrial Processes; Chemical Manufacturing; Inorganic Chemical Storage (Pressure Tanks); Specify Gas: Withdrawal Loss
30188801	Industrial Processes; Chemical Manufacturing; Fugitive Emissions; Specify in Comments Field
30188802	Industrial Processes; Chemical Manufacturing; Fugitive Emissions; Specify in Comments Field
30188803	Industrial Processes; Chemical Manufacturing; Fugitive Emissions; Specify in Comments Field
30188804	Industrial Processes; Chemical Manufacturing; Fugitive Emissions; Specify in Comments Field
30188805	Industrial Processes; Chemical Manufacturing; Fugitive Emissions; Specify in Comments Field
30190000	Industrial Processes;Chemical Manufacturing;Fuel Fired Equipment;undefined
30190001	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30190002	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Residual Oil: Process Heaters
30190003	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Natural Gas: Process Heaters
30190004	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Process Gas: Process Heaters
30190011	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Distillate Oil (No. 2): Incinerators
30190012	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Residual Oil: Incinerators
30190013	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Natural Gas: Incinerators
30190014	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Process Gas: Incinerators
30190021	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Distillate Oil (No. 2): Flares
30190022	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Residual Oil: Flares
30190023	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Natural Gas: Flares
30190099	Industrial Processes; Chemical Manufacturing; Fuel Fired Equipment; Specify in Comments Field
30199900	Industrial Processes;Chemical Manufacturing;Other Not Classified;undefined
30199998	Industrial Processes; Chemical Manufacturing; Other Not Classified; Specify in Comments Field
30199999	Industrial Processes; Chemical Manufacturing; Other Not Classified; Specify in Comments Field

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.

- AWMA, 1992: Air & Waste Management Association, "Air Pollution Engineering Manual," edited by A. Buonicore and W. Davis, Van Nostrand Reinhold, NY, NY, 1992.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Wet Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999

Other information:

ADMIN_PCT: 4.4%

CE_TEXT: PM10 control efficiency is 99% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled

CHEM_PCT: 0%

COST_BASIS: The following are cost ranges for wire-plate ESPs, developed using EPA cost-estimating spreadsheets for dry wire-plate ESPs with adjustments made to reflect wet wire-plate ESPs (EPA, 1999). Capital and operating costs are generally higher due to noncorrosive materials requirements, increased water usage, and treatment and disposal of wet effluent. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1990). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $30 to $60 per scfm
Typical value is $40 per scfm

O&M Costs:

Range from $6 to $45 per scfm
Typical value is $19 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1999). O&M costs were calculated for three model plants with flow rates of 10, 15 and 20 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. A water flow rate for the ESP was assumed to be 5 gal/min per thousand acfm. The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.067	$/kW-hr
Process water price	0.20	$/1000 gal
Dust disposal	20	$/ton disposed
Wastewater treatment	1.5	$/ thousand gal treated

Note: All costs are in 1995 dollars.

CPTON_H: $550/ton

CPTON_L: $55/ton

CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $55 to $550 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $220 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.93%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.2%
MNTLBR_PCT:	2.26%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	2.2%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	5.1%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	7.21%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.2%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	2.46%
STEAM_PCT:	0%
TDIR_PCT:	83.99%
TINDIR_PCT:	16.01%
UTIL_PCT:	4%
WSTDSP_PCT:	64.05%

Summary:

Control Measure Name: Wet Electrostatic Precipitator - Wire Plate Type;(PM10) Mineral Products - Other

Abbreviation: PWESPMIOR

Description: Application: This control is the use of a wire-plate type electrostatic precipitator (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. Wet ESPs use a stream of water, in place of rapping mechanisms, to dislodge particulate from the plates and into a sump.

This control applies to miscellaneous mineral production operations including (but not limited to) brick manufacture, calcium carbide operations, clay and fly ash sintering, concrete batching, gypsum manufacturing, lime production, phosphate rock operations, sand production, fiberglass manufacturing and glass manufacturing operations. Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions.

Discussion: Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions. Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. These particles are processed in later sections of the ESP, but the particles from the last section have no chance to be recaptured. Due to the space needed at the top of the ESP for nonelectrified components, part of the stream may flow around the charged zones. This is called "sneakage" and places an upper limit on the collection efficiency of the ESP. Anti-sneakage baffles are used to force the sneakage flow to mix with the main gas stream for collection in later sections (EPA, 1998).

Wire-Plate Type Wet ESPs require a source of wash water near the top of the collector plates. This wash system replaces the rapping mechanism used by dry ESPs. The water flows with the collected particles into a sump from which the fluid is pumped or drained. A portion of the fluid may be recycled to reduce the total amount of water required. The remainder is pumped into a settling pond or passed through a dewatering stage, with subsequent disposal of the sludge (AWMA, 1992).

Unlike dry ESPs, resistivity of the collected material is not a major factor in performance. Because of the high humidity in a wet ESP, the resistivity of particles is lowered, eliminating the "back corona" condition. The frequent washing of the plates also limits particle buildup on the collectors (EPA, 1998).

For wet ESPs, the handling wastewaters must be considered (EPA, 1999). For simple systems with innocuous dusts, water with particles collected by the ESP may be discharged from the ESP system to a solids-removing clarifier. More complicated systems may require skimming and sludge removal, clarification in dedicated equipment, pH adjustment, and/or treatment to remove dissolved solids. Recirculation of treated water to the ESP may approach 100 percent (AWMA, 1992).

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Wet Electrostatic Precipitator - Wire Plate Type

Source Group: Mineral Products - Other

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	1995	1995	N/A
CPT:		$398	$398	
Ref Yr CPT:		$565	$565	
Control Efficiency:	99.5	95.0	95.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton	cpton	
Capital Rec Fac:	N/A	0.09000000357627869	0.09000000357627869	N/A
Discount Rate:	N/A	7.0	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incrememental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
N/A
2020-01-01 00:00:00.0
Cost Year:
N/A
1995
1995
N/A
CPT:
$398
$398
Ref Yr CPT:
$565
$565
Control Efficiency:
99.5
95.0
95.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0

100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
0.09000000357627869
N/A
Discount Rate:
N/A
7.0
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	40.0
Typical O&M Control Cost Factor	19.0
Typical Default CPT Factor - Capital	923.0
Typical Default CPT Factor - O&M	135.0
Typical Default CPT Factor - Annualized	220.0

Affected SCCs:

Code	Description
30500300	Industrial Processes;Mineral Products;Brick Manufacture;undefined
30500301	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Drying
30500302	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Grinding & Screening
30500303	Industrial Processes; Mineral Products; Brick Manufacture; Storage of Raw Materials
30500304	Industrial Processes; Mineral Products; Brick Manufacture; Curing **
30500305	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Handling and Transferring
30500306	Industrial Processes; Mineral Products; Brick Manufacture; Pulverizing
30500307	Industrial Processes; Mineral Products; Brick Manufacture; Calcining
30500308	Industrial Processes; Mineral Products; Brick Manufacture; Screening
30500309	Industrial Processes; Mineral Products; Brick Manufacture; Blending and Mixing
30500310	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Sawdust Fired Tunnel Kilns
30500311	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Tunnel Kilns
30500312	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Tunnel Kilns
30500313	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Tunnel Kilns
30500314	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Periodic Kilns

30500315	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Periodic Kilns
30500316	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Periodic Kilns
30500317	Industrial Processes; Mineral Products; Brick Manufacture; Raw Material Unloading
30500318	Industrial Processes; Mineral Products; Brick Manufacture; Tunnel Kiln: Wood-fired
30500319	Industrial Processes; Mineral Products; Brick Manufacture; Transfer and Conveying
30500321	Industrial Processes; Mineral Products; Brick Manufacture; General
30500322	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing High-Sulfur Material
30500330	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Periodic Kiln
30500331	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel Fired Tunnel Kiln
30500332	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Gas-fired Kiln, Other Type
30500333	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Oil-fired Kiln, Other Type
30500334	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Coal-fired Kiln, Other Type
30500335	Industrial Processes; Mineral Products; Brick Manufacture; Curing and Firing: Dual Fuel-fired Kiln, Other Type
30500340	Industrial Processes; Mineral Products; Brick Manufacture; Primary Crusher
30500342	Industrial Processes; Mineral Products; Brick Manufacture; Extrusion Line
30500350	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat From Kiln Cooling Zone
30500351	Industrial Processes; Mineral Products; Brick Manufacture; Brick Dryer: Heated With Waste Heat And Supplemental Gas Burners
30500355	Industrial Processes; Mineral Products; Brick Manufacture; Coal Crushing And Storage System
30500360	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer
30500361	Industrial Processes; Mineral Products; Brick Manufacture; Sawdust Dryer: Heated With Exhaust From Sawdust-fired Kiln
30500370	Industrial Processes; Mineral Products; Brick Manufacture; Firing: Natural Gas-fired Tunnel Kiln Firing Structural Clay Tile
30500397	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500398	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500399	Industrial Processes; Mineral Products; Brick Manufacture; Other Not Classified
30500401	Industrial Processes; Mineral Products; Calcium Carbide; Electric Furnace: Hoods and Main Stack
30500402	Industrial Processes; Mineral Products; Calcium Carbide; Coke Dryer
30500403	Industrial Processes; Mineral Products; Calcium Carbide; Furnace Room Vents
30500404	Industrial Processes; Mineral Products; Calcium Carbide; Tap Fume Vents
30500405	Industrial Processes; Mineral Products; Calcium Carbide; Primary/Secondary Crushing
30500406	Industrial Processes; Mineral Products; Calcium Carbide; Circular Charging: Conveyor
30500499	Industrial Processes; Mineral Products; Calcium Carbide; Other Not Classified
30500501	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Dryer

30500502	Industrial Processes; Mineral Products; Castable Refractory; Raw Material Crushing/Processing
30500503	Industrial Processes; Mineral Products; Castable Refractory; Electric Arc Melt Furnace
30500504	Industrial Processes; Mineral Products; Castable Refractory; Curing Oven
30500505	Industrial Processes; Mineral Products; Castable Refractory; Molding and Shakeout
30500506	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Rotary Calciner
30500507	Industrial Processes; Mineral Products; Castable Refractory; Fire Clay: Tunnel Kiln
30500508	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Rotary Dryer
30500509	Industrial Processes; Mineral Products; Castable Refractory; Chromite-Magnesite Ore: Tunnel Kiln
30500598	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500599	Industrial Processes; Mineral Products; Castable Refractory; Other Not Classified
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Long Kiln
30500607	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Unloading
30500608	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Piles
30500609	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Primary Crushing
30500610	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Secondary Crushing
30500611	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Screening
30500612	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Transfer
30500613	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Material Grinding and Drying
30500614	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Cooler
30500615	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Piles
30500616	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Transfer
30500617	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Clinker Grinding
30500618	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Silos
30500619	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Cement Load Out
30500620	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Predryer
30500621	Industrial Processes; Mineral Products; Cement Manufacturing (Wet or Dry Process); Pulverized Coal Kiln Feed Units
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln
30500624	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Feed Belt
30500625	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Weigh Hopper
30500626	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Raw Mill Air Separator
30500627	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Feed Belt
30500628	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Weigh Hopper

30500629	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Finish Grinding Mill Air Separator
30500699	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Other Not Classified
30500800	Industrial Processes;Mineral Products;Ceramic Clay/Tile Manufacture;undefined
30500801	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying ** (use SCC 3-05-008-13)
30500802	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Comminution - Crushing, Grinding, & Milling
30500803	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Storage
30500804	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Screening and floating ** (use SCC 3-05-008-16)
30500805	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Direct Mixing of Ceramic Powder and Binder Solution
30500806	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Raw Material Handling and Transfer
30500807	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Grinding, dry ** (use SCC 3-05-008-02)
30500810	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Granulation - Natural Gas-fired Spray Dryer
30500811	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Infrared (IR) Drying Prior to Firing
30500812	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glazing and firing kiln ** (use SCCs 3-05-008-45 & -50)
30500813	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Drying - Convection Drying Prior to Firing
30500816	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Sizing - Vibrating Screens
30500818	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Air Classifier
30500821	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Rotary Calciner
30500822	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Rotary Calciner
30500823	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Natural Gas-fired Fluidized Bed Calciner
30500824	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Calcining-Fuel Oil-fired Fluidized Bed Calciner
30500828	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Mixing - Raw Matls, Binders, Plasticizers, Surfactants, & Other Agent
30500830	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - General
30500831	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Forming - Tape Casters
30500835	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Green Machining-Grindg, Cutg, or Laminatg Formed Ceramics Prior to Fir
30500840	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Natural Gas-fired Kiln
30500841	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Presinter Thermal Processing - Fuel Oil-fired Kiln
30500843	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Glaze Preparation - Ballmill or Attrition Mill
30500845	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Ceramic Glaze Spray Booth

30500850	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Natural Gas-fired Kiln
30500854	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Firing - Fuel Oil-fired Kiln
30500856	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Refiring Kiln - Refiring after Decal, Paint, or Ink Applied; Natural-g
30500858	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Cooler - Cooling Ceramics Following Firing
30500860	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Grinding and Polishing
30500870	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Annealing
30500880	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Final Processing - Surface Coating
30500899	Industrial Processes; Mineral Products; Ceramic Clay/Tile Manufacture; Other Not Classified
30500901	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Fly Ash Sintering
30500902	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay/Coke Sintering
30500903	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Natural Clay/Shale Sintering
30500904	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Crushing/Screening
30500905	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Transfer/Conveying
30500906	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Raw Clay/Shale Storage Piles
30500907	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Coke Product Crushing/Screening
30500908	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Sintered Clay/Shale Product Crushing/Screening
30500909	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Clinker Cooling
30500910	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Expanded Shale Storage
30500915	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Rotary Kiln
30500916	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Dryer
30500917	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Clay Reciprocating Grate Clinker Cooler
30500999	Industrial Processes; Mineral Products; Clay and Fly Ash Sintering; Other Not Classified
30501101	Industrial Processes; Mineral Products; Concrete Batching; Total Facility Emissions except road dust & wind-blown dust
30501104	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Elevated Storage
30501105	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Elevated Storage
30501106	Industrial Processes; Mineral Products; Concrete Batching; Transfer: Sand/Aggregate to Elevated Bins (See Also -04 & -05)
30501107	Industrial Processes; Mineral Products; Concrete Batching; Cement Unloading to Elevated Storage Silo
30501108	Industrial Processes; Mineral Products; Concrete Batching; Weight Hopper Loading of Sand and Aggregate
30501109	Industrial Processes; Mineral Products; Concrete Batching; Mixer Loading of Cement/Sand/Aggregate

30501110	Industrial Processes; Mineral Products; Concrete Batching; Loading of Transit Mix Truck
30501111	Industrial Processes; Mineral Products; Concrete Batching; Loading of Dry-batch Truck
30501112	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Wet
30501113	Industrial Processes; Mineral Products; Concrete Batching; Mixing: Dry
30501114	Industrial Processes; Mineral Products; Concrete Batching; Transferring: Conveyors/Elevators
30501115	Industrial Processes; Mineral Products; Concrete Batching; Storage: Bins/Hoppers
30501117	Industrial Processes; Mineral Products; Concrete Batching; Cement Supplement Unloading to Elevated Storage Silo
30501120	Industrial Processes; Mineral Products; Concrete Batching; Asbestos/Cement Products
30501121	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Delivery to Ground Storage
30501122	Industrial Processes; Mineral Products; Concrete Batching; Sand Delivery to Ground Storage
30501123	Industrial Processes; Mineral Products; Concrete Batching; Aggregate Transfer to Conveyor
30501124	Industrial Processes; Mineral Products; Concrete Batching; Sand Transfer to Conveyor
30501199	Industrial Processes; Mineral Products; Concrete Batching; Other Not Classified
30501201	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Wool-type Fiber)
30501202	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Wool-type Fiber)
30501203	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Electric Furnace (Wool-type Fiber)
30501204	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Rotary Spun (Wool-type Fiber)
30501205	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven: Rotary Spun (Wool-type Fiber)
30501206	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Cooling (Wool-type Fiber)
30501207	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Wool-type Fiber)
30501208	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming: Flame Attenuation (Wool-type Fiber)
30501209	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing: Flame Attenuation (Wool-type Fiber)
30501211	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Regenerative Furnace (Textile-type Fiber)
30501212	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Recuperative Furnace (Textile-type Fiber)
30501213	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Unit Melter Furnace (Textile-type Fiber)
30501214	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Forming Process (Textile-type Fiber)
30501215	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Curing Oven (Textile-type Fiber)
30501221	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Unloading/Conveying
30501222	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Storage Bins
30501223	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Mixing/Weighing
30501224	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Raw Material: Crushing/Charging

30501299	Industrial Processes; Mineral Products; Fiberglass Manufacturing; Other Not Classified
30501301	Industrial Processes; Mineral Products; Frit Manufacture; General ** (use 3-05-013-05 or 3-05-013-06)
30501302	Industrial Processes; Mineral Products; Frit Manufacture; Weighing of raw materials
30501303	Industrial Processes; Mineral Products; Frit Manufacture; Dry Mixing of raw materials
30501304	Industrial Processes; Mineral Products; Frit Manufacture; Smelting Furnace Charging
30501305	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Smelting Furnace
30501306	Industrial Processes; Mineral Products; Frit Manufacture; Continuous Smelting Furnace
30501310	Industrial Processes; Mineral Products; Frit Manufacture; Water Spray Quenching to shatter material into small particles
30501311	Industrial Processes; Mineral Products; Frit Manufacture; Rotary Dryer (usually not used with a continuous furnace)
30501315	Industrial Processes; Mineral Products; Frit Manufacture; Dry Milling of quenched frit with a ball mill
30501316	Industrial Processes; Mineral Products; Frit Manufacture; Product Screening
30501399	Industrial Processes; Mineral Products; Frit Manufacture; Other Not Classified
30501400	Industrial Processes;Mineral Products;Glass Manufacture;undefined
30501401	Industrial Processes; Mineral Products; Glass Manufacture; Furnace/General**
30501402	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Melting Furnace
30501403	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Melting Furnace
30501404	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Melting Furnace
30501405	Industrial Processes; Mineral Products; Glass Manufacture; Presintering
30501406	Industrial Processes; Mineral Products; Glass Manufacture; Container Glass: Forming/Finishing
30501407	Industrial Processes; Mineral Products; Glass Manufacture; Flat Glass: Forming/Finishing
30501408	Industrial Processes; Mineral Products; Glass Manufacture; Pressed and Blown Glass: Forming/Finishing
30501410	Industrial Processes; Mineral Products; Glass Manufacture; Raw Material Handling (All Types of Glass)
30501411	Industrial Processes; Mineral Products; Glass Manufacture; General **
30501412	Industrial Processes; Mineral Products; Glass Manufacture; Hold Tanks **
30501413	Industrial Processes; Mineral Products; Glass Manufacture; Cullet: Crushing/Grinding
30501414	Industrial Processes; Mineral Products; Glass Manufacture; Ground Cullet Beading Furnace
30501415	Industrial Processes; Mineral Products; Glass Manufacture; Glass Etching with Hydrofluoric Acid Solution
30501416	Industrial Processes; Mineral Products; Glass Manufacture; Glass Manufacturing
30501417	Industrial Processes; Mineral Products; Glass Manufacture; Briquetting
30501418	Industrial Processes; Mineral Products; Glass Manufacture; Pelletizing
30501420	Industrial Processes; Mineral Products; Glass Manufacture; Mirror Plating: General
30501421	Industrial Processes; Mineral Products; Glass Manufacture; Demineralizer: General
30501499	Industrial Processes; Mineral Products; Glass Manufacture; See Comment **
30501500	Industrial Processes;Mineral Products;Gypsum Manufacture;undefined
30501501	Industrial Processes; Mineral Products; Gypsum Manufacture; Rotary Ore Dryer

30501502	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Grinder/Roller Mills
30501503	Industrial Processes; Mineral Products; Gypsum Manufacture; Not Classified **
30501504	Industrial Processes; Mineral Products; Gypsum Manufacture; Conveying
30501505	Industrial Processes; Mineral Products; Gypsum Manufacture; Primary Crushing: Gypsum Ore
30501506	Industrial Processes; Mineral Products; Gypsum Manufacture; Secondary Crushing: Gypsum Ore
30501507	Industrial Processes; Mineral Products; Gypsum Manufacture; Screening: Gypsum Ore
30501508	Industrial Processes; Mineral Products; Gypsum Manufacture; Stockpile: Gypsum Ore
30501509	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Gypsum Ore
30501510	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Landplaster
30501511	Industrial Processes; Mineral Products; Gypsum Manufacture; Continuous Kettle: Calciner
30501512	Industrial Processes; Mineral Products; Gypsum Manufacture; Flash Calciner
30501513	Industrial Processes; Mineral Products; Gypsum Manufacture; Impact Mill
30501514	Industrial Processes; Mineral Products; Gypsum Manufacture; Storage Bins: Stucco
30501515	Industrial Processes; Mineral Products; Gypsum Manufacture; Tube/Ball Mills
30501516	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers
30501517	Industrial Processes; Mineral Products; Gypsum Manufacture; Bagging
30501518	Industrial Processes; Mineral Products; Gypsum Manufacture; Mixers/Conveyors
30501519	Industrial Processes; Mineral Products; Gypsum Manufacture; Forming Line
30501520	Industrial Processes; Mineral Products; Gypsum Manufacture; Drying Kiln
30501521	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (8 Ft.)
30501522	Industrial Processes; Mineral Products; Gypsum Manufacture; End Sawing (12 Ft.)
30501599	Industrial Processes; Mineral Products; Gypsum Manufacture; See Comment **
30501601	Industrial Processes; Mineral Products; Lime Manufacture; Primary Crushing
30501602	Industrial Processes; Mineral Products; Lime Manufacture; Secondary Crushing/Screening
30501603	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Vertical Kiln
30501604	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Rotary Kiln ** (See SCC Codes 3-05-016-18,-19,-20,-21)
30501605	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Calcimatic Kiln
30501606	Industrial Processes; Mineral Products; Lime Manufacture; Fluidized Bed Kiln
30501607	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Transfer and Conveying
30501608	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Unloading
30501609	Industrial Processes; Mineral Products; Lime Manufacture; Hydrator: Atmospheric
30501610	Industrial Processes; Mineral Products; Lime Manufacture; Raw Material Storage Piles
30501611	Industrial Processes; Mineral Products; Lime Manufacture; Product Cooler
30501612	Industrial Processes; Mineral Products; Lime Manufacture; Pressure Hydrator
30501613	Industrial Processes; Mineral Products; Lime Manufacture; Lime Silos
30501614	Industrial Processes; Mineral Products; Lime Manufacture; Packing/Shipping
30501615	Industrial Processes; Mineral Products; Lime Manufacture; Product Transfer and Conveying
30501616	Industrial Processes; Mineral Products; Lime Manufacture; Primary Screening

30501617	Industrial Processes; Mineral Products; Lime Manufacture; Multiple Hearth Calciner
30501618	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Kiln
30501619	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Rotary Kiln
30501620	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Gas-fired Rotary Kiln
30501621	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal- and Coke-fired Rotary Kiln
30501622	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Coal-fired Rotary Preheater Kiln
30501623	Industrial Processes; Mineral Products; Lime Manufacture; Calcining: Gas-fired Parallel Flow Regenerative Kiln
30501624	Industrial Processes; Mineral Products; Lime Manufacture; Conveyor Transfer - Primary Crushed Material
30501625	Industrial Processes; Mineral Products; Lime Manufacture; Secondary/Tertiary Screening
30501626	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Enclosed Truck
30501627	Industrial Processes; Mineral Products; Lime Manufacture; Product Loading, Open Truck
30501628	Industrial Processes; Mineral Products; Lime Manufacture; Pulverizing
30501629	Industrial Processes; Mineral Products; Lime Manufacture; Tertiary Screening After Pulverizing
30501630	Industrial Processes; Mineral Products; Lime Manufacture; Screening After Calcination
30501631	Industrial Processes; Mineral Products; Lime Manufacture; Crushing and Pulverizing After Calcinating
30501632	Industrial Processes; Mineral Products; Lime Manufacture; Milling
30501633	Industrial Processes; Mineral Products; Lime Manufacture; Separator After Hydrator
30501640	Industrial Processes; Mineral Products; Lime Manufacture; Vehicle Traffic
30501650	Industrial Processes; Mineral Products; Lime Manufacture; Quarrying Raw Limestone
30501660	Industrial Processes; Mineral Products; Lime Manufacture; Waste Treatment
30501699	Industrial Processes; Mineral Products; Lime Manufacture; See Comment **
30501701	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cupola
30501702	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Reverberatory Furnace
30501703	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Blow Chamber
30501704	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Curing Oven
30501705	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Cooler
30501706	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Granulated Products Processing
30501707	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Handling
30501708	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Packaging
30501709	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Batt Application
30501710	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Storage of Oils and Binders
30501711	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Mixing of Oils and Binders
30501799	Industrial Processes; Mineral Products; Mineral Wool Manufacturing; Other Not Classified
30501801	Industrial Processes; Mineral Products; Perlite Manufacturing; Vertical Furnace
30501899	Industrial Processes; Mineral Products; Perlite Manufacturing; Other Not Classified

30501901	Industrial Processes; Mineral Products; Phosphate Rock; Drying
30501902	Industrial Processes; Mineral Products; Phosphate Rock; Grinding
30501903	Industrial Processes; Mineral Products; Phosphate Rock; Transfer/Storage
30501904	Industrial Processes; Mineral Products; Phosphate Rock; Open Storage
30501905	Industrial Processes; Mineral Products; Phosphate Rock; Calcining
30501906	Industrial Processes; Mineral Products; Phosphate Rock; Rotary Dryer
30501907	Industrial Processes; Mineral Products; Phosphate Rock; Ball Mill
30501908	Industrial Processes; Mineral Products; Phosphate Rock; Mineral Products Benification
30501999	Industrial Processes; Mineral Products; Phosphate Rock; Other Not Classified
30502101	Industrial Processes; Mineral Products; Salt Mining; General
30502102	Industrial Processes; Mineral Products; Salt Mining; Granulation: Stack Dryer
30502103	Industrial Processes; Mineral Products; Salt Mining; Filtration: Vacuum Filter
30502104	Industrial Processes; Mineral Products; Salt Mining; Crushing
30502105	Industrial Processes; Mineral Products; Salt Mining; Screening
30502106	Industrial Processes; Mineral Products; Salt Mining; Conveying
30502201	Industrial Processes; Mineral Products; Potash Production; Mine: Grinding/Drying
30502299	Industrial Processes; Mineral Products; Potash Production; Other Not Classified
30502401	Industrial Processes; Mineral Products; Magnesium Carbonate; Mine/Process
30502499	Industrial Processes; Mineral Products; Magnesium Carbonate; Other Not Classified
30502500	Industrial Processes;Mineral Products;Construction Sand and Gravel;undefined
30502501	Industrial Processes; Mineral Products; Construction Sand and Gravel; Total Plant: General **
30502502	Industrial Processes; Mineral Products; Construction Sand and Gravel; Aggregate Storage
30502503	Industrial Processes; Mineral Products; Construction Sand and Gravel; Material Transfer and Conveying
30502504	Industrial Processes; Mineral Products; Construction Sand and Gravel; Hauling
30502505	Industrial Processes; Mineral Products; Construction Sand and Gravel; Pile Forming: Stacker
30502506	Industrial Processes; Mineral Products; Construction Sand and Gravel; Bulk Loading
30502507	Industrial Processes; Mineral Products; Construction Sand and Gravel; Storage Piles
30502508	Industrial Processes; Mineral Products; Construction Sand and Gravel; Dryer ** (See 3-05-027-20 thru -24 for Industrial Sand Dryers)
30502509	Industrial Processes; Mineral Products; Construction Sand and Gravel; Cooler ** (See 3-05-027-30 for Industrial Sand Coolers)
30502510	Industrial Processes; Mineral Products; Construction Sand and Gravel; Crushing
30502511	Industrial Processes; Mineral Products; Construction Sand and Gravel; Screening
30502512	Industrial Processes; Mineral Products; Construction Sand and Gravel; Overburden Removal
30502513	Industrial Processes; Mineral Products; Construction Sand and Gravel; Excavating
30502514	Industrial Processes; Mineral Products; Construction Sand and Gravel; Drilling and Blasting
30502522	Industrial Processes; Mineral Products; Construction Sand and Gravel; Rodmilling: Fine Crushing of Construction Sand
30502523	Industrial Processes; Mineral Products; Construction Sand and Gravel; Fine Screening of Construction Sand Following Dewatering or Rodmilling

30502599	Industrial Processes; Mineral Products; Construction Sand and Gravel; Not Classified **
30502601	Industrial Processes; Mineral Products; Diatomaceous Earth; Handling
30502699	Industrial Processes; Mineral Products; Diatomaceous Earth; Other Not Classified
30502701	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Primary Crushing of Raw Material
30502705	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Secondary Crushing
30502709	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Grinding: Size Reduction to 50 Microns or Smaller
30502713	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Screening: Size Classification
30502717	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Draining: Removal of Moisture to About 6% After Froth Flotation
30502720	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas- or Oil-fired Rotary or Fluidized Bed Dryer
30502721	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Rotary Dryer
30502722	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Rotary Dryer
30502723	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Gas-fired Fluidized Bed Dryer
30502724	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Drying: Oil-fired Fluidized Bed Dryer
30502730	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Cooling of Dried Sand
30502740	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Final Classifying: Screening to Classify Sand by Size
30502760	Industrial Processes; Mineral Products; Industrial Sand and Gravel; Sand Handling, Transfer, and Storage
30502910	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Rotary Kiln
30502920	Industrial Processes; Mineral Products; Lightweight Aggregate Manufacture; Clinker Cooler
30503099	Industrial Processes; Mineral Products; Ceramic Electric Parts; Other Not Classified
30503101	Industrial Processes; Mineral Products; Asbestos Mining; Surface Blasting
30503102	Industrial Processes; Mineral Products; Asbestos Mining; Surface Drilling
30503103	Industrial Processes; Mineral Products; Asbestos Mining; Cobbing
30503104	Industrial Processes; Mineral Products; Asbestos Mining; Loading
30503105	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Asbestos
30503106	Industrial Processes; Mineral Products; Asbestos Mining; Convey/Haul Waste
30503107	Industrial Processes; Mineral Products; Asbestos Mining; Unloading
30503108	Industrial Processes; Mineral Products; Asbestos Mining; Overburden Stripping
30503109	Industrial Processes; Mineral Products; Asbestos Mining; Ventilation of Process Operations
30503110	Industrial Processes; Mineral Products; Asbestos Mining; Stockpiling
30503111	Industrial Processes; Mineral Products; Asbestos Mining; Tailing Piles
30503199	Industrial Processes; Mineral Products; Asbestos Mining; Other Not Classified
30503201	Industrial Processes; Mineral Products; Asbestos Milling; Crushing
30503202	Industrial Processes; Mineral Products; Asbestos Milling; Drying

30503203	Industrial Processes; Mineral Products; Asbestos Milling; Recrushing
30503204	Industrial Processes; Mineral Products; Asbestos Milling; Screening
30503205	Industrial Processes; Mineral Products; Asbestos Milling; Fiberizing
30503206	Industrial Processes; Mineral Products; Asbestos Milling; Bagging
30503299	Industrial Processes; Mineral Products; Asbestos Milling; Other Not Classified
30503301	Industrial Processes; Mineral Products; Vermiculite; General
30503312	Industrial Processes; Mineral Products; Vermiculite; Screening of Crude Vermiculite Ore
30503319	Industrial Processes; Mineral Products; Vermiculite; Blending of Vermiculite Ore
30503321	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Gas-fired
30503322	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Rotary Dryer, Oil-fired
30503326	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Gas-fired
30503327	Industrial Processes; Mineral Products; Vermiculite; Vermiculite Concentrate Drying: Fluidized Bed Dryer, Oil-fired
30503331	Industrial Processes; Mineral Products; Vermiculite; Crushing of Dried Vermiculite Concentrate
30503336	Industrial Processes; Mineral Products; Vermiculite; Screening: Size Classification of Crushed Vermiculite Concentrate
30503341	Industrial Processes; Mineral Products; Vermiculite; Conveying of Vermiculite Concentrate to Storage
30503351	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Gas-fired Vertical Furnace
30503352	Industrial Processes; Mineral Products; Vermiculite; Exfoliation of Vermiculite Concentrate: Oil-fired Vertical Furnace
30503361	Industrial Processes; Mineral Products; Vermiculite; Product Grinding: Grinding of Exfoliated Vermiculite
30503366	Industrial Processes; Mineral Products; Vermiculite; Product Classifying: Air Classification of Exfoliated Vermiculite
30503401	Industrial Processes; Mineral Products; Feldspar; Ball Mill
30503402	Industrial Processes; Mineral Products; Feldspar; Dryer
30503501	Industrial Processes; Mineral Products; Abrasive Grain Processing; Primary Crushing
30503502	Industrial Processes; Mineral Products; Abrasive Grain Processing; Secondary Crushing
30503503	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Crushing
30503504	Industrial Processes; Mineral Products; Abrasive Grain Processing; Crushed Grain Screening
30503505	Industrial Processes; Mineral Products; Abrasive Grain Processing; Washing/Drying
30503506	Industrial Processes; Mineral Products; Abrasive Grain Processing; Final Screening
30503507	Industrial Processes; Mineral Products; Abrasive Grain Processing; Air Classification
30503601	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Mixing
30503602	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Molding
30503603	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Steam Autoclaving
30503604	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Drying
30503605	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Firing or Curing

30503606	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Cooling
30503607	Industrial Processes; Mineral Products; Bonded Abrasives Manufacturing; Final Machining
30503701	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Printing of Backing
30503702	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Make Coat Application
30503703	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Grain Application
30503704	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Drying
30503705	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Size Coat Application
30503706	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Drying and Curing
30503707	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Roll Winding
30503708	Industrial Processes; Mineral Products; Coated Abrasives Manufacturing; Final Production
30503901	Industrial Processes; Mineral Products; Pyrrhotite; Fluid Bed Roaster
30503902	Industrial Processes; Mineral Products; Pyrrhotite; Reduction Kiln
30504001	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Blasting
30504002	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Drilling
30504003	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Open Pit Cobbing
30504010	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Underground Ventilation
30504020	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Loading
30504021	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Material
30504022	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Convey/Haul Waste
30504023	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Unloading
30504024	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Overburden Stripping
30504025	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Stockpiling
30504030	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Primary Crusher
30504031	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Secondary Crusher
30504032	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Concentrator
30504033	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Ore Dryer
30504034	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Screening
30504036	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Tailing Piles
30504099	Industrial Processes; Mineral Products; Mining and Quarrying of Nonmetallic Minerals; Other Not Classified
30504101	Industrial Processes; Mineral Products; Clay processing: Kaolin; Mining
30504102	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material storage
30504103	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material transfer
30504115	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material crushing, NEC

30504119	Industrial Processes; Mineral Products; Clay processing: Kaolin; Raw material grinding, NEC
30504129	Industrial Processes; Mineral Products; Clay processing: Kaolin; Screening, NEC
30504130	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, rotary dryer
30504131	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, spray dryer
30504132	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, apron dryer
30504133	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, vibrating grate dryer
30504139	Industrial Processes; Mineral Products; Clay processing: Kaolin; Drying, dryer NEC
30504140	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, rotary calciner
30504141	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, multiple hearth furnace
30504142	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, flash calciner
30504149	Industrial Processes; Mineral Products; Clay processing: Kaolin; Calcining, calciner NEC
30504150	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product grinding
30504151	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product screening/classification
30504160	Industrial Processes; Mineral Products; Clay processing: Kaolin; Bleaching
30504170	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product transfer
30504171	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product storage
30504172	Industrial Processes; Mineral Products; Clay processing: Kaolin; Product packaging
30504201	Industrial Processes; Mineral Products; Clay processing: Ball clay; Mining
30504202	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material storage
30504203	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material transfer
30504215	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material crushing, NEC
30504219	Industrial Processes; Mineral Products; Clay processing: Ball clay; Raw material grinding, NEC
30504230	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, rotary dryer
30504231	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, spray dryer
30504232	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, apron dryer
30504233	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, vibrating grate dryer
30504239	Industrial Processes; Mineral Products; Clay processing: Ball clay; Drying, dryer NEC
30504250	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product grinding
30504270	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product transfer
30504271	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product storage
30504272	Industrial Processes; Mineral Products; Clay processing: Ball clay; Product packaging
30504301	Industrial Processes; Mineral Products; Clay processing: Fire clay; Mining
30504302	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material storage
30504303	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material transfer
30504315	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material crushing, NEC
30504319	Industrial Processes; Mineral Products; Clay processing: Fire clay; Raw material grinding, NEC
30504329	Industrial Processes; Mineral Products; Clay processing: Fire clay; Screening, NEC
30504330	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, rotary dryer

30504331	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, spray dryer
30504332	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, apron dryer
30504333	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, vibrating grate dryer
30504339	Industrial Processes; Mineral Products; Clay processing: Fire clay; Drying, dryer NEC
30504340	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, rotary calciner
30504341	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, multiple hearth furnace
30504342	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, flash calciner
30504349	Industrial Processes; Mineral Products; Clay processing: Fire clay; Calcining, calciner NEC
30504350	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product grinding
30504351	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product screening/classification
30504370	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product transfer
30504371	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product storage
30504372	Industrial Processes; Mineral Products; Clay processing: Fire clay; Product packaging
30504401	Industrial Processes; Mineral Products; Clay processing: Bentonite; Mining
30504402	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material storage
30504403	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material transfer
30504415	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material crushing, NEC
30504419	Industrial Processes; Mineral Products; Clay processing: Bentonite; Raw material grinding, NEC
30504430	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, rotary dryer
30504431	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, spray dryer
30504432	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, apron dryer
30504433	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, vibrating grate dryer
30504439	Industrial Processes; Mineral Products; Clay processing: Bentonite; Drying, dryer NEC
30504450	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product grinding
30504451	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product screening/classification
30504470	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product transfer
30504471	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product storage
30504472	Industrial Processes; Mineral Products; Clay processing: Bentonite; Product packaging
30504501	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Mining
30504502	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material storage
30504503	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material transfer
30504515	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material crushing, NEC
30504519	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Raw material grinding, NEC
30504530	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, rotary dryer
30504531	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, spray dryer
30504532	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, apron dryer
30504533	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, vibrating grate dryer

30504539	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Drying, dryer NEC
30504550	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product grinding
30504551	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product screening/classification
30504570	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product transfer
30504571	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product storage
30504572	Industrial Processes; Mineral Products; Clay processing: Fullers earth; Product packaging
30504601	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Mining
30504602	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material storage
30504603	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material transfer
30504615	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material crushing, NEC
30504619	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Raw material grinding, NEC
30504629	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Screening, NEC
30504630	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, rotary dryer
30504631	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, spray dryer
30504632	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, apron dryer
30504633	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, vibrating grate dryer
30504639	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Drying, dryer NEC
30504670	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product transfer
30504671	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product storage
30504672	Industrial Processes; Mineral Products; Clay processing: Common clay and shale, NEC; Product packaging
30505001	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Processing (Blowing)
30505005	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Storage (Prior to Blowing)
30505010	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Blowing Still
30505020	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Natural Gas
30505021	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Residual Oil
30505022	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: Distillate Oil
30505023	Industrial Processes; Mineral Products; Asphalt Processing (Blowing); Asphalt Heater: LP Gas
30508906	Industrial Processes; Mineral Products; Talc Processing; Storage of Raw Mined Talc Before Processing
30508908	Industrial Processes; Mineral Products; Talc Processing; Conveyor Transfer of Raw Talc to Primary Crusher

30508909	Industrial Processes; Mineral Products; Talc Processing; Natural Gas Fired Crude Ore Dryer
30508910	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil Fired Crude Ore Dryer
30508911	Industrial Processes; Mineral Products; Talc Processing; Primary crusher
30508912	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Railcar Loading
30508914	Industrial Processes; Mineral Products; Talc Processing; Crushed Talc Storage Bin Loading
30508917	Industrial Processes; Mineral Products; Talc Processing; Screening Oversize Ore to Return to Primary Crusher
30508921	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Dryer
30508923	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Dryer
30508931	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Rotary Calciner
30508933	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Rotary Calciner
30508941	Industrial Processes; Mineral Products; Talc Processing; Rotary Cooler Following Calciner
30508945	Industrial Processes; Mineral Products; Talc Processing; Grinding of Dried Talc
30508947	Industrial Processes; Mineral Products; Talc Processing; Grinding/Drying of Talc with Heated Makeup Air
30508949	Industrial Processes; Mineral Products; Talc Processing; Ground Talc Storage Bin Loading
30508950	Industrial Processes; Mineral Products; Talc Processing; Air Classifier - Size Classification of Ground Talc
30508953	Industrial Processes; Mineral Products; Talc Processing; Pelletizer
30508955	Industrial Processes; Mineral Products; Talc Processing; Pellet Dryer
30508958	Industrial Processes; Mineral Products; Talc Processing; Pneumatic Conveyor Vents
30508961	Industrial Processes; Mineral Products; Talc Processing; Concentration of Talc Fines Using Shaking Table
30508971	Industrial Processes; Mineral Products; Talc Processing; Natural Gas-fired Flash Drying of Slurry after Flotation
30508973	Industrial Processes; Mineral Products; Talc Processing; Fuel Oil-fired Flash Drying of Slurry after Flotation
30508982	Industrial Processes; Mineral Products; Talc Processing; Custom Grinding - Additional Size Reduction
30508985	Industrial Processes; Mineral Products; Talc Processing; Final Product Storage Bin Loading
30508988	Industrial Processes; Mineral Products; Talc Processing; Packaging
30509001	Industrial Processes; Mineral Products; Mica; Rotary Dryer
30509002	Industrial Processes; Mineral Products; Mica; Fluid Energy Mill - Grinding
30509101	Industrial Processes; Mineral Products; Sandspar; Rotary Dryer
30509201	Industrial Processes; Mineral Products; Catalyst Manufacturing; Transferring and Handling
30509202	Industrial Processes; Mineral Products; Catalyst Manufacturing; Mixing and Blending
30509203	Industrial Processes; Mineral Products; Catalyst Manufacturing; Reacting
30509204	Industrial Processes; Mineral Products; Catalyst Manufacturing; Drying
30509205	Industrial Processes; Mineral Products; Catalyst Manufacturing; Storage
30510000	Industrial Processes;Mineral Products;Bulk Materials Elevators;undefined
30510001	Industrial Processes; Mineral Products; Bulk Materials Elevators; Unloading
30510002	Industrial Processes; Mineral Products; Bulk Materials Elevators; Loading

30510003	Industrial Processes; Mineral Products; Bulk Materials Elevators; Removal from Bins
30510004	Industrial Processes; Mineral Products; Bulk Materials Elevators; Drying
30510005	Industrial Processes; Mineral Products; Bulk Materials Elevators; Cleaning
30510006	Industrial Processes; Mineral Products; Bulk Materials Elevators; Elevator Legs (Headhouse)
30510007	Industrial Processes; Mineral Products; Bulk Materials Elevators; Tripper (Gallery Belt)
30510100	Industrial Processes;Mineral Products;Bulk Materials Conveyors;undefined
30510101	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Ammonium Sulfate
30510102	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Cement
30510103	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coal
30510104	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Coke
30510105	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Limestone
30510106	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Phosphate Rock
30510107	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Scrap Metal
30510108	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Sulfur
30510196	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Chemical: Specify in Comments
30510197	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Fertilizer: Specify in Comments
30510198	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Mineral: Specify in Comments
30510199	Industrial Processes; Mineral Products; Bulk Materials Conveyors; Other Not Classified
30510200	Industrial Processes;Mineral Products;Bulk Materials Storage Bins;undefined
30510201	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Ammonium Sulfate
30510202	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Cement
30510203	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coal
30510204	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Coke
30510205	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Limestone
30510206	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Phosphate Rock
30510207	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Scrap Metal
30510208	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sulfur
30510209	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Sand
30510296	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Chemical: Specify in Comments
30510297	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Fertilizer: Specify in Comments
30510298	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Mineral: Specify in Comments
30510299	Industrial Processes; Mineral Products; Bulk Materials Storage Bins; Other Not Classified
30510301	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Ammonium Sulfate
30510302	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Cement
30510303	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coal
30510304	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Coke
30510305	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Limestone

30510306	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Phosphate Rock
30510307	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Scrap Metal
30510308	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sulfur
30510309	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Sand
30510310	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fluxes
30510396	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Chemical: Specify in Comments
30510397	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Fertilizer: Specify in Comments
30510398	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Mineral: Specify in Comments
30510399	Industrial Processes; Mineral Products; Bulk Materials Open Stockpiles; Other Not Classified
30510401	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Ammonium Sulfate
30510402	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Cement
30510403	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coal
30510404	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Coke
30510405	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Limestone
30510406	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Phosphate Rock
30510407	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Scrap Metal
30510408	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Sulfur
30510496	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Chemical: Specify in Comments
30510497	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Fertilizer: Specify in Comments
30510498	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Mineral: Specify in Comments
30510499	Industrial Processes; Mineral Products; Bulk Materials Unloading Operation; Other Not Classified
30510501	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Ammonium Sulfate
30510502	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Cement
30510503	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coal
30510504	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Coke
30510505	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Limestone
30510506	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Phosphate Rock
30510507	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Scrap Metal
30510508	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Sulfur
30510596	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Chemical: Specify in Comments
30510597	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Fertilizer: Specify in Comments
30510598	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Mineral: Specify in Comments
30510599	Industrial Processes; Mineral Products; Bulk Materials Loading Operation; Other Not Classified
30510600	Industrial Processes;Mineral Products;Bulk Materials Screening/Size Classification;undefined

30510604	Industrial Processes; Mineral Products; Bulk Materials Screening/Size Classification; Coke
30510708	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Sulfur
30510709	Industrial Processes; Mineral Products; Bulk Materials Separation: Cyclones; Bauxite
30510800	Industrial Processes;Mineral Products;Bulk Materials: Grinding/Crushing;undefined
30510808	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Sulfur
30510809	Industrial Processes; Mineral Products; Bulk Materials: Grinding/Crushing; Bauxite
30515001	Industrial Processes; Mineral Products; Calcining; Raw Material Handling
30515002	Industrial Processes; Mineral Products; Calcining; General
30515003	Industrial Processes; Mineral Products; Calcining; Grinding/Milling
30515004	Industrial Processes; Mineral Products; Calcining; Finished Product Handling
30515005	Industrial Processes; Mineral Products; Calcining; Mixing
30531001	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Fluidized Bed
30531002	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Flash or Suspension
30531003	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Multilouvered
30531004	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Rotary
30531005	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cascade
30531006	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Continuous Carrier
30531007	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screen
30531008	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Unloading
30531009	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Raw Coal Storage
30531010	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Crushing
30531011	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Coal Transfer
30531012	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Screening
30531013	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Air Tables
30531014	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Cleaned Coal Storage
30531015	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading
30531016	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Loading: Clean Coal
30531017	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Secondary Crushing
30531090	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Haul Roads: General

30531099	Industrial Processes; Mineral Products; Coal Mining, Cleaning, and Material Handling (See 305010); Other Not Classified
30532001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Primary Crushing
30532002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Secondary Crushing/Screening
30532003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Tertiary Crushing/Screening
30532004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Recrushing/Screening
30532005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Fines Mill
30532006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Miscellaneous Operations: Screen/Convey/Handling
30532007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Open Storage
30532008	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Cut Stone: General
30532009	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Blasting: General
30532010	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532011	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Hauling
30532012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drying
30532013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Bar Grizzlies
30532014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Shaker Screens
30532015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Vibrating Screens
30532016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Revolving Screens
30532017	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Pugmill
30532018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling with Liquid Injection
30532020	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Drilling
30532031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Unloading
30532032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Conveyor
30532033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Truck Loading: Front End Loader
30532090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30580001	Industrial Processes; Mineral Products; Equipment Leaks; Equipment Leaks
30582001	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Area Drains

30582002	Industrial Processes; Mineral Products; Wastewater, Aggregate; Process Equipment Drains
30582599	Industrial Processes; Mineral Products; Wastewater, Points of Generation; Specify Point of Generation
30588801	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588802	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588803	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588804	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30588805	Industrial Processes; Mineral Products; Fugitive Emissions; Specify in Comments Field
30590001	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Process Heaters
30590002	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Process Heaters
30590003	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Process Heaters
30590005	Industrial Processes; Mineral Products; Fuel Fired Equipment; Liquified Petroleum Gas (LPG): Process Heaters
30590011	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Incinerators
30590012	Industrial Processes; Mineral Products; Fuel Fired Equipment; Residual Oil: Incinerators
30590013	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Incinerators
30590021	Industrial Processes; Mineral Products; Fuel Fired Equipment; Distillate Oil (No. 2): Flares
30590023	Industrial Processes; Mineral Products; Fuel Fired Equipment; Natural Gas: Flares
30599900	Industrial Processes;Mineral Products;Other Not Defined;undefined
30599999	Industrial Processes; Mineral Products; Other Not Defined; Specify in Comments Field

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- AWMA, 1992: Air & Waste Management Association, "Air Pollution Engineering Manual," edited by A. Buonicore and W. Davis, Van Nostrand Reinhold, NY, NY, 1992.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Wet Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999

Other information:

ADMIN_PCT: 4.4%

CE_TEXT:	PM10 control efficiency is 99% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The following are cost ranges for wire-plate ESPs, developed using EPA cost-estimating spreadsheets for dry wire-plate ESPs with adjustments made to reflect wet wire-plate ESPs (EPA, 1999). Capital and operating costs are generally higher due to noncorrosive materials requirements, increased water usage, and treatment and disposal of wet effluent. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1990). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $30 to $60 per scfm Typical value is $40 per scfm O&M Costs: Range from $6 to $45 per scfm Typical value is $19 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1999). O&M costs were calculated for three model plants with flow rates of 10, 15 and 20 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. A water flow rate for the ESP was assumed to be 5 gal/min per thousand acfm. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 20 $/ton disposed Wastewater treatment 1.5 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$550/ton
CPTON_L:	$55/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $55 to $550 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $220 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.93%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%

INSRNC_PCT:	2.2%
MNTLBR_PCT:	2.26%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	2.2%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	5.1%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	7.21%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.2%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	2.46%
STEAM_PCT:	0%
TDIR_PCT:	83.99%
TINDIR_PCT:	16.01%
UTIL_PCT:	4%
WSTDSP_PCT:	64.05%

Summary:

Control Measure Name: Wet Electrostatic Precipitator - Wire Plate Type;(PM10) Non-Ferrous Metals Processing - Aluminum

Abbreviation: PWESPMPAM

Description: Application: This control is the use of a wire-plate type electrostatic precipitator (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. Wet ESPs use a stream of water, in place of rapping mechanisms, to dislodge particulate from the plates and into a sump.

This control applies to aluminum processing and production operations.

Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. These particles are processed in later sections of the ESP, but the particles from the last section have no chance to be recaptured. Due to the space needed at the top of the ESP for nonelectrified components, part of the stream may flow around the charged zones. This is called "sneakage" and places an upper limit on the collection efficiency of the ESP. Anti-sneakage baffles are used to force the sneakage flow to mix with the main gas stream for collection in later sections (EPA, 1998).

Wire-Plate Type Wet ESPs require a source of wash water near the top of the collector plates. This wash system replaces the rapping mechanism used by dry ESPs. The water flows with the collected particles into a sump from which the fluid is pumped or drained. A portion of the fluid may be recycled to reduce the total amount of water required. The remainder is pumped into a settling pond or passed through a dewatering stage, with subsequent disposal of the sludge (AWMA, 1992).

Unlike dry ESPs, resistivity of the collected material is not a major factor in performance. Because of the high humidity in a wet ESP, the resistivity of particles is lowered, eliminating the "back corona" condition. The frequent washing of the plates also limits particle buildup on the collectors (EPA, 1998).

For wet ESPs, the handling wastewaters must be considered (EPA, 1999). For simple systems with innocuous dusts, water with particles collected by the ESP may be discharged from the ESP system to a solids-removing clarifier. More complicated systems may require skimming and sludge removal, clarification in dedicated equipment, pH adjustment, and/or treatment to remove dissolved solids. Recirculation of treated water to the ESP may approach 100 percent (AWMA, 1992).

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Wet Electrostatic Precipitator - Wire Plate Type

Source Group: Non-Ferrous Metals Processing - Aluminum

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				

Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1995	N/A	1995
CPT:		$383		$383
Ref Yr CPT:		$544		$544
Control Efficiency:	99.5	95.0	99.5	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:

2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
1995
N/A
1995
CPT:
$383
$383
Ref Yr CPT:
$544
$544
Control Efficiency:
99.5
95.0
99.5
95.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:

cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	40.0
Typical O&M Control Cost Factor	19.0
Typical Default CPT Factor - Capital	923.0
Typical Default CPT Factor - O&M	135.0
Typical Default CPT Factor - Annualized	220.0

Affected SCCs:

Code	Description
30300201	Industrial Processes; Primary Metal Production; Aluminum Hydroxide Calcining; Overall Process
30300199	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Not otherwise classified
30300111	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Anode Bake Furnace Seocndary Emissions
30300110	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Vertical Stud Soderberg Potline Secondary Emission [See also 30300118]
30300109	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Horizontal Stud Soderberg Potline Secondary Emissions
30300108	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Prebake Potline Secondary Emissions [See also 303001 -19 thru -22]
30300107	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Roof Vents
30300106	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Degassing
30300105	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Anode Baking Furnace Primary Emissions
30300104	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Materials Handling [See also 30300123 and 30300125]
30300103	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Vertical Stud Soderberg Potline Primary Emissions
30300102	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Horizontal Stud Soderberg Potline Primary Emissions
30300101	Industrial Processes; Primary Metal Production; Alumina Electrolytic Reduction; Prebaked Potline Primary Emissions [See also 303001-13 thru-16]
30300004	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Loading and Unloading
30300003	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Fine Ore Storage
30300002	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Drying Oven
30300001	Industrial Processes; Primary Metal Production; Bauxite Ore Processing; Crushing/Handling

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- AWMA, 1992: Air & Waste Management Association, "Air Pollution Engineering Manual," edited by A. Buonicore and W. Davis, Van Nostrand Reinhold, NY, NY, 1992.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Wet Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999

Other information:

ADMIN_PCT:	4.4%
CE_TEXT:	PM10 control efficiency is 99% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for wire-plate ESPs, developed using EPA cost-estimating spreadsheets for dry wire-plate ESPs with adjustments made to reflect wet wire-plate ESPs (EPA, 1999). Capital and operating costs are generally higher due to noncorrosive materials requirements, increased water usage, and treatment and disposal of wet effluent. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1990). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $30 to $60 per scfm Typical value is $40 per scfm O&M Costs: Range from $6 to $45 per scfm Typical value is $19 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1999). O&M costs were calculated for three model plants with flow rates of 10, 15 and 20 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. A water flow rate for the ESP was assumed to be 5 gal/min per thousand acfm. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 20 $/ton disposed Wastewater treatment 1.5 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$550/ton
CPTON_L:	$55/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $55 to $550 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $220 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.93%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.2%
MNTLBR_PCT:	2.26%

MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	2.2%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	5.1%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	7.21%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.2%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	2.46%
STEAM_PCT:	0%
TDIR_PCT:	83.99%
TINDIR_PCT:	16.01%
UTIL_PCT:	4%
WSTDSP_PCT:	64.05%

Summary:

Control Measure Name: Wet Electrostatic Precipitator - Wire Plate Type;(PM10) Non-Ferrous Metals Processing - Copper

Abbreviation: PWESPMPCR

Description: Application: This control is the use of a wire-plate type electrostatic precipitator (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. Wet ESPs use a stream of water, in place of rapping mechanisms, to dislodge particulate from the plates and into a sump.

This control applies to copper and copper alloy processing and production operations.

Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. These particles are processed in later sections of the ESP, but the particles from the last section have no chance to be recaptured. Due to the space needed at the top of the ESP for nonelectrified components, part of the stream may flow around the charged zones. This is called "sneakage" and places an upper limit on the collection efficiency of the ESP. Anti-sneakage baffles are used to force the sneakage flow to mix with the main gas stream for collection in later sections (EPA, 1998).

Wire-Plate Type Wet ESPs require a source of wash water near the top of the collector plates. This wash system replaces the rapping mechanism used by dry ESPs. The water flows with the collected particles into a sump from which the fluid is pumped or drained. A portion of the fluid may be recycled to reduce the total amount of water required. The remainder is pumped into a settling pond or passed through a dewatering stage, with subsequent disposal of the sludge (AWMA, 1992).

Unlike dry ESPs, resistivity of the collected material is not a major factor in performance. Because of the high humidity in a wet ESP, the resistivity of particles is lowered, eliminating the "back corona" condition. The frequent washing of the plates also limits particle buildup on the collectors (EPA, 1998).

For wet ESPs, the handling wastewaters must be considered (EPA, 1999). For simple systems with innocuous dusts, water with particles collected by the ESP may be discharged from the ESP system to a solids-removing clarifier. More complicated systems may require skimming and sludge removal, clarification in dedicated equipment, pH adjustment, and/or treatment to remove dissolved solids. Recirculation of treated water to the ESP may approach 100 percent (AWMA, 1992).

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Wet Electrostatic Precipitator - Wire Plate Type

Source Group: Non-Ferrous Metals Processing - Copper

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				

Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1995	N/A	1995	N/A
CPT:	$316		$316	
Ref Yr CPT:	$449		$449	
Control Efficiency:	95.0	99.5	95.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:

N/A
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:
1995
N/A
1995
N/A
CPT:
$316
$316
Ref Yr CPT:
$449
$449
Control Efficiency:
95.0
99.5
95.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:

cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	40.0
Typical O&M Control Cost Factor	19.0
Typical Default CPT Factor - Capital	923.0
Typical Default CPT Factor - O&M	135.0
Typical Default CPT Factor - Annualized	220.0

Affected SCCs:

Code	Description
30400214	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Reverberatory Furnace
30400215	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Reverberatory Furnace
30400216	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Rotary Furnace
30400217	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Rotary Furnace
30400218	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Crucible and Pot Furnace
30400219	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Crucible and Pot Furnace
30400220	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Electric Arc Furnace
30400221	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Electric Arc Furnace
30400223	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Electric Induction
30300502	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Multiple Hearth Roaster
30300503	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Smelting Furnace after Roaster
30300504	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Converter (All Configurations)
30300505	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fire (Furnace) Refining
30300506	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Ore Concentrate Dryer
30300507	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Smelting Furnace w/ Ore Charge w/o Roasting
30300508	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Refined Metal Finishing Operations
30300509	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluidized Bed Roaster

30300510	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Smelting Furnace
30300511	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electrolytic Refining
30300512	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Flash Smelting
30300513	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Roasting: Fugitive Emissions
30300514	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace: Fugitive Emissions
30300517	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Slag Cleaning Furnace: Fugitive Emissions
30300518	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Converter Slag Return: Fugitive Emissions
30300521	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Noranda Reactor
30300522	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Slag Cleaning Furnace
30300523	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace with Converter
30300524	Industrial Processes; Primary Metal Production; Primary Copper Smelting; AFT MHR+RF/FBR+EF
30300525	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluid Bed Roaster with Reverberatory Furnace and Converter
30300526	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Dryer with Electric Furnace and Cleaning Furnace and Convertor
30300527	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Dryer with Flash Furnace and Converter
30300528	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Norander Reactor and Converter
30300529	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Multiple Hearth Roaster with Reverberatory Furnace and Converter
30300530	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Fluid Bed Roaster with Electric Furnace and Converter
30300531	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace After Multiple Hearth Roaster
30300532	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Reverberatory Furnace After Fluid Bed Roaster
30300533	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Furnace After Concentrate Dryer
30300534	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Flash Furnace After Concentrate Dryer
30300535	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Electric Furnace After Fluid Bed Roaster
30300541	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Concentrate Dryer Followed by Noranda Reactors and Converter
30300599	Industrial Processes; Primary Metal Production; Primary Copper Smelting; Other Not Classified
30400200	Industrial Processes;Secondary Metal Production;Copper;undefined
30400204	Industrial Processes; Secondary Metal Production; Copper; Electric Induction Furnace
30400207	Industrial Processes; Secondary Metal Production; Copper; Scrap Dryer (Rotary)
30400208	Industrial Processes; Secondary Metal Production; Copper; Wire Burning: Incinerator
30400209	Industrial Processes; Secondary Metal Production; Copper; Sweating Furnace

30400210	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Copper: Cupolas
30400211	Industrial Processes; Secondary Metal Production; Copper; Charge with Insulated Copper Wire: Cupolas
30400212	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Copper And Brass: Cupolas
30400213	Industrial Processes; Secondary Metal Production; Copper; Charge with Scrap Iron: Cupolas
30400224	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Electric Induction
30400230	Industrial Processes; Secondary Metal Production; Copper; Scrap Metal Pretreatment
30400231	Industrial Processes; Secondary Metal Production; Copper; Scrap Dryer
30400232	Industrial Processes; Secondary Metal Production; Copper; Wire Incinerator
30400233	Industrial Processes; Secondary Metal Production; Copper; Sweating Furnace
30400234	Industrial Processes; Secondary Metal Production; Copper; Cupola Furnace
30400235	Industrial Processes; Secondary Metal Production; Copper; Reverberatory Furnace
30400236	Industrial Processes; Secondary Metal Production; Copper; Rotary Furnace
30400237	Industrial Processes; Secondary Metal Production; Copper; Crucible Furnace
30400238	Industrial Processes; Secondary Metal Production; Copper; Electric Induction Furnace
30400239	Industrial Processes; Secondary Metal Production; Copper; Casting Operations
30400240	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Holding Furnace
30400241	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Holding Furnace
30400242	Industrial Processes; Secondary Metal Production; Copper; Charge with Other Alloy (7%): Reverberatory Furnace
30400243	Industrial Processes; Secondary Metal Production; Copper; Charge with High Lead Alloy (58%): Reverberatory Furnace
30400244	Industrial Processes; Secondary Metal Production; Copper; Charge with Red/Yellow Brass: Reverberatory Furnace
30400250	Industrial Processes; Secondary Metal Production; Copper; Charge with Copper: Converter
30400251	Industrial Processes; Secondary Metal Production; Copper; Charge with Brass and Bronze: Converter
30400299	Industrial Processes; Secondary Metal Production; Copper; Other Not Classified

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References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- AWMA, 1992: Air & Waste Management Association, "Air Pollution Engineering Manual," edited by A. Buonicore and W. Davis, Van Nostrand Reinhold, NY, NY, 1992.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Wet Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999

Other information:

ADMIN_PCT:	4.4%
CE_TEXT:	PM10 control efficiency is 99% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:

The following are cost ranges for wire-plate ESPs, developed using EPA cost-estimating spreadsheets for dry wire-plate ESPs with adjustments made to reflect wet wire-plate ESPs (EPA, 1999). Capital and operating costs are generally higher due to noncorrosive materials requirements, increased water usage, and treatment and disposal of wet effluent. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1990). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $30 to $60 per scfm
Typical value is $40 per scfm

O&M Costs:

Range from $6 to $45 per scfm
Typical value is $19 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1999). O&M costs were calculated for three model plants with flow rates of 10, 15 and 20 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. A water flow rate for the ESP was assumed to be 5 gal/min per thousand acfm. The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.067	$/kW-hr
Process water price	0.20	$/1000 gal
Dust disposal	20	$/ton disposed
Wastewater treatment	1.5	$/ thousand gal treated

Note: All costs are in 1995 dollars.

CPTON_H:	$550/ton
CPTON_L:	$55/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $55 to $550 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $220 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.93%

ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.2%
MNTLBR_PCT:	2.26%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	2.2%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	5.1%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	7.21%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.2%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	2.46%
STEAM_PCT:	0%
TDIR_PCT:	83.99%
TINDIR_PCT:	16.01%
UTIL_PCT:	4%
WSTDSP_PCT:	64.05%

Summary:

Control Measure Name: Wet Electrostatic Precipitator - Wire Plate Type;(PM10) Ferrous Metals Processing - Iron & Steel Production

Abbreviation: PWESPMPIS

Description: Application: This control is the use of a wire-plate type electrostatic precipitator (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. Wet ESPs use a stream of water, in place of rapping mechanisms, to dislodge particulate from the plates and into a sump.

This control applies to iron and steel production operations.

Discussion: Steel normally is produced in either basic oxygen process furnaces or electric arc furnaces. In the basic oxygen process furnace, a mixture of 70 percent molten iron from the blast furnace and 30 percent iron scrap are melted together. Pure oxygen is blown across the top or through the molten steel to oxidize carbon and oxygen impurities, thus removing these from the steel. Basic oxygen process furnaces are large open-mouthed furnaces that can be tilted to accept a charge or to tap the molten steel to a charging ladle for transfer to an ingot mold or continuous caster.

Because basic oxygen furnaces are open, they produce significant uncontrolled particulate emissions, notably during the refining stage when oxygen is being blown. Electric arc furnaces use the current passing between carbon electrodes to heat molten steel, but also use oxy-fuel burners to accelerate the initial melting process. These furnaces are charged largely with scrap iron. Significant emissions occur during charging, when the furnace roof is open, during melting, as the electrodes are lowered into the scrap and the arc is struck, and during tapping, when alloying elements are added to the melt.

In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. These particles are processed in later sections of the ESP, but the particles from the last section have no chance to be recaptured. Due to the space needed at the top of the ESP for nonelectrified components, part of the stream may flow around the charged zones. This is called "sneakage" and places an upper limit on the collection efficiency of the ESP. Anti-sneakage baffles are used to force the sneakage flow to mix with the main gas stream for collection in later sections (EPA, 1998).

Wire-Plate Type Wet ESPs require a source of wash water near the top of the collector plates. This wash system replaces the rapping mechanism used by dry ESPs. The water flows with the collected particles into a sump from which the fluid is pumped or drained. A portion of the fluid may be recycled to reduce the total amount of water required. The remainder is pumped into a settling pond or passed through a dewatering stage, with subsequent disposal of the sludge (AWMA, 1992).

Unlike dry ESPs, resistivity of the collected material is not a major factor in performance. Because of the high humidity in a wet ESP, the resistivity of particles is lowered, eliminating the "back corona" condition. The frequent washing of the plates also limits particle buildup on the collectors (EPA, 1998).

For wet ESPs, the handling wastewaters must be considered (EPA, 1999). For simple systems with innocuous dusts, water with particles collected by the ESP may be discharged from the ESP system to a solids-removing clarifier. More complicated systems may require skimming and sludge removal, clarification in dedicated equipment, pH adjustment, and/or treatment to remove dissolved solids. Recirculation of treated water to the ESP may approach 100 percent (AWMA, 1992).

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Wet Electrostatic Precipitator - Wire Plate Type

Source Group: Ferrous Metals Processing - Iron & Steel Production

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	1995	N/A	1995
CPT:		$292		$292
Ref Yr CPT:		$415		$415
Control Efficiency:	99.5	95.0	99.5	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton		cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	N/A	7.0	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
1995
N/A
1995
CPT:
$292
$292
Ref Yr CPT:
$415
$415
Control Efficiency:
99.5
95.0
99.5
95.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0

100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
N/A
0.09000000357627869
Discount Rate:
N/A
7.0
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	40.0
Typical O&M Control Cost Factor	19.0
Typical Default CPT Factor - Capital	923.0
Typical Default CPT Factor - O&M	135.0
Typical Default CPT Factor - Annualized	220.0

Affected SCCs:

Code	Description
30300801	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Ore Charging
30300802	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Agglomerate Charging
30300804	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Hi-Silt
30300805	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Loader: Low-Silt
30300808	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Crushing and Sizing
30300809	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Slag Removal and Dumping
30300811	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Stockpiles, Coke Breeze, Limestone, Ore Fines
30300812	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Transfer/Handling
30300813	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Windbox
30300814	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Discharge End
30300815	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Breaker
30300816	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Hot Screening

30300817	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cooler
30300818	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cold Screening
30300819	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Process (Combined Code includes 15,16,17,18)
30300820	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Sinter Conveyor: Transfer Station
30300821	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unload Ore, Pellets, Limestone, into Blast Furnace
30300822	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Raw Material Stockpile: Ore, Pellets, Limestone, Coke, Sinter
30300823	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Charge Materials: Transfer/Handling
30300824	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Heating Stoves
30300825	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Cast House
30300826	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace Slips
30300827	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Lump Ore Unloading
30300828	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Local Evacuation
30300829	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blast Furnace: Taphole and Trough
30300831	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unpaved Roads: Light Duty Vehicles
30300832	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unpaved Roads: Medium Duty Vehicles
30300833	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Unpaved Roads: Heavy Duty Vehicles
30300834	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Paved Roads: All Vehicle Types
30300841	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Flue Dust Unloading
30300842	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); Blended Ore Unloading
30300899	Industrial Processes; Primary Metal Production; Iron Production (See 3-03-015 for Integrated Iron & Steel MACT); See Comment **
30300901	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Open Hearth Furnace: Stack
30300904	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Arc Furnace: Alloy Steel (Stack)
30300906	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: Electric Arc Furnace
30300907	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: Electric Arc Furnace
30300908	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Arc Furnace: Carbon Steel (Stack)

30300910	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Pickling (See also 303009-02,-03,-05, and -09)
30300911	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Soaking Pits
30300912	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Grinding
30300913	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Open Hood-Stack
30300914	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Basic Oxygen Furnace: Closed Hood-Stack
30300915	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal (Iron) Transfer to Steelmaking Furnace
30300916	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: BOF
30300917	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: BOF
30300918	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Charging: Open Hearth
30300919	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Tapping: Open Hearth
30300920	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Metal Desulfurization
30300921	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Unleaded Steel)
30300922	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Continuous Casting
30300923	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Tapping and Dumping
30300924	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Furnace Slag Processing
30300925	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Teeming (Leaded Steel)
30300926	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Electric Induction Furnace
30300927	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Scrap Preheater
30300928	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Argon-oxygen Decarburization
30300929	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Steel Plate Burner/Torch Cutter
30300930	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Q-BOP Melting and Refining
30300931	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Hot Rolling
30300932	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Scarfing
30300933	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Reheat Furnaces
30300934	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Heat Treating Furnaces: Annealing

30300935	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Cold Rolling
30300936	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Coating: Tin, Zinc, etc.
30300998	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified
30300999	Industrial Processes; Primary Metal Production; Steel Manufacturing (See 3-03-015 for Integrated Iron & Steel MACT); Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- AWMA, 1992: Air & Waste Management Association, "Air Pollution Engineering Manual," edited by A. Buonicore and W. Davis, Van Nostrand Reinhold, NY, NY, 1992.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Wet Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999

Other information:

ADMIN_PCT:	4.4%
CE_TEXT:	PM10 control efficiency is 99% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for wire-plate ESPs, developed using EPA cost-estimating spreadsheets for dry wire-plate ESPs with adjustments made to reflect wet wire-plate ESPs (EPA, 1999). Capital and operating costs are generally higher due to noncorrosive materials requirements, increased water usage, and treatment and disposal of wet effluent. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1990). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $30 to $60 per scfm Typical value is $40 per scfm O&M Costs: Range from $6 to $45 per scfm Typical value is $19 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1999). O&M costs were calculated for three model plants with flow rates of 10, 15 and 20 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. A water flow rate for the ESP was assumed to be 5 gal/min per thousand acfm. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 20 $/ton disposed Wastewater treatment 1.5 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$550/ton
CPTON_L:	$55/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $55 to $550 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $220 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.93%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.2%
MNTLBR_PCT:	2.26%

MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	2.2%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	5.1%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	7.21%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.2%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	2.46%
STEAM_PCT:	0%
TDIR_PCT:	83.99%
TINDIR_PCT:	16.01%
UTIL_PCT:	4%
WSTDSP_PCT:	64.05%

Summary:

Control Measure Name:	Wet Electrostatic Precipitator - Wire Plate Type;(PM10) Non-Ferrous Metals Processing - Lead
Abbreviation:	PWESPMPLD
Description:	Application: This control is the use of a wire-plate type electrostatic precipitator (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. Wet ESPs use a stream of water, in place of rapping mechanisms, to dislodge particulate from the plates and into a sump. This control applies to lead processing and production operations. Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona. Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. These particles are processed in later sections of the ESP, but the particles from the last section have no chance to be recaptured. Due to the space needed at the top of the ESP for nonelectrified components, part of the stream may flow around the charged zones. This is called "sneakage" and places an upper limit on the collection efficiency of the ESP. Anti-sneakage baffles are used to force the sneakage flow to mix with the main gas stream for collection in later sections (EPA, 1998). Wire-Plate Type Wet ESPs require a source of wash water near the top of the collector plates. This wash system replaces the rapping mechanism used by dry ESPs. The water flows with the collected particles into a sump from which the fluid is pumped or drained. A portion of the fluid may be recycled to reduce the total amount of water required. The remainder is pumped into a settling pond or passed through a dewatering stage, with subsequent disposal of the sludge (AWMA, 1992). Unlike dry ESPs, resistivity of the collected material is not a major factor in performance. Because of the high humidity in a wet ESP, the resistivity of particles is lowered, eliminating the "back corona" condition. The frequent washing of the plates also limits particle buildup on the collectors (EPA, 1998). For wet ESPs, the handling wastewaters must be considered (EPA, 1999). For simple systems with innocuous dusts, water with particles collected by the ESP may be discharged from the ESP system to a solids-removing clarifier. More complicated systems may require skimming and sludge removal, clarification in dedicated equipment, pH adjustment, and/or treatment to remove dissolved solids. Recirculation of treated water to the ESP may approach 100 percent (AWMA, 1992).
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Wet Electrostatic Precipitator - Wire Plate Type
Source Group:	Non-Ferrous Metals Processing - Lead
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				

Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	1995	N/A	N/A	1995
CPT:	$663			$663
Ref Yr CPT:	$941			$941
Control Efficiency:	95.0	99.5	99.5	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	0.09000000357627869	N/A	N/A	0.09000000357627869
Discount Rate:	7.0	N/A	N/A	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:

N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0
N/A
Cost Year:
1995
N/A
N/A
1995
CPT:
$663
$663
Ref Yr CPT:
$941
$941
Control Efficiency:
95.0
99.5
99.5
95.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:

cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A
N/A
0.09000000357627869
Discount Rate:
7.0
N/A
N/A
7.0
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	40.0
Typical O&M Control Cost Factor	19.0
Typical Default CPT Factor - Capital	923.0
Typical Default CPT Factor - O&M	135.0
Typical Default CPT Factor - Annualized	220.0

Affected SCCs:

Code	Description
30301001	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Single Stream
30301002	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Operation
30301003	Industrial Processes; Primary Metal Production; Lead Production; Dross Reverberatory Furnace
30301004	Industrial Processes; Primary Metal Production; Lead Production; Ore Crushing
30301005	Industrial Processes; Primary Metal Production; Lead Production; Materials Handling (Includes 11, 12, 13, 04, 14)
30301006	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Dual Stream Feed End
30301007	Industrial Processes; Primary Metal Production; Lead Production; Sintering: Dual Stream Discharge End
30301008	Industrial Processes; Primary Metal Production; Lead Production; Slag Fume Furnace
30301009	Industrial Processes; Primary Metal Production; Lead Production; Lead Drossing
30301010	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Crushing and Grinding
30301011	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Unloading
30301012	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Storage Piles
30301013	Industrial Processes; Primary Metal Production; Lead Production; Raw Material Transfer
30301014	Industrial Processes; Primary Metal Production; Lead Production; Sintering Charge Mixing
30301015	Industrial Processes; Primary Metal Production; Lead Production; Sinter Crushing/Screening
30301016	Industrial Processes; Primary Metal Production; Lead Production; Sinter Transfer
30301017	Industrial Processes; Primary Metal Production; Lead Production; Sinter Fines Return Handling
30301018	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Charging
30301019	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Tapping (Metal and Slag)
30301020	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Lead Pouring

30301021	Industrial Processes; Primary Metal Production; Lead Production; Blast Furnace Slag Pouring
30301022	Industrial Processes; Primary Metal Production; Lead Production; Lead Refining/Silver Retort
30301023	Industrial Processes; Primary Metal Production; Lead Production; Lead Casting
30301024	Industrial Processes; Primary Metal Production; Lead Production; Reverberatory or Kettle Softening
30301025	Industrial Processes; Primary Metal Production; Lead Production; Sinter Machine Leakage
30301026	Industrial Processes; Primary Metal Production; Lead Production; Sinter Dump Area
30301027	Industrial Processes; Primary Metal Production; Lead Production; Vacuum Distillation
30301028	Industrial Processes; Primary Metal Production; Lead Production; Tetrahedrite Dryer
30301029	Industrial Processes; Primary Metal Production; Lead Production; Sinter Machine (Weak Gas)
30301030	Industrial Processes; Primary Metal Production; Lead Production; Sinter Storage
30301031	Industrial Processes; Primary Metal Production; Lead Production; Speiss Pit
30301032	Industrial Processes; Primary Metal Production; Lead Production; Ore Screening
30301099	Industrial Processes; Primary Metal Production; Lead Production; Other Not Classified
30400401	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace
30400402	Industrial Processes; Secondary Metal Production; Lead; Reverberatory Furnace
30400403	Industrial Processes; Secondary Metal Production; Lead; Blast Furnace (Cupola)
30400404	Industrial Processes; Secondary Metal Production; Lead; Rotary Sweating Furnace
30400405	Industrial Processes; Secondary Metal Production; Lead; Reverberatory Sweating Furnace
30400406	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace Heater: Distillate Oil
30400407	Industrial Processes; Secondary Metal Production; Lead; Pot Furnace Heater: Natural Gas
30400408	Industrial Processes; Secondary Metal Production; Lead; Barton Process Reactor (Oxidation Kettle)
30400409	Industrial Processes; Secondary Metal Production; Lead; Casting
30400410	Industrial Processes; Secondary Metal Production; Lead; Battery Breaking
30400411	Industrial Processes; Secondary Metal Production; Lead; Scrap Crushing
30400412	Industrial Processes; Secondary Metal Production; Lead; Sweating Furnace: Fugitive Emissions
30400413	Industrial Processes; Secondary Metal Production; Lead; Smelting Furnace: Fugitive Emissions
30400414	Industrial Processes; Secondary Metal Production; Lead; Kettle Refining: Fugitive Emissions
30400415	Industrial Processes; Secondary Metal Production; Lead; Agglomeration Furnace
30400416	Industrial Processes; Secondary Metal Production; Lead; Furnace Charging
30400417	Industrial Processes; Secondary Metal Production; Lead; Furnace Lead/Slagtapping
30400418	Industrial Processes; Secondary Metal Production; Lead; Electric Furnace
30400419	Industrial Processes; Secondary Metal Production; Lead; Raw Material Dryer
30400420	Industrial Processes; Secondary Metal Production; Lead; Raw Material Unloading
30400421	Industrial Processes; Secondary Metal Production; Lead; Raw Material Transfer/Conveying
30400422	Industrial Processes; Secondary Metal Production; Lead; Raw Material Storage Pile
30400423	Industrial Processes; Secondary Metal Production; Lead; Slag Breaking
30400424	Industrial Processes; Secondary Metal Production; Lead; Size Separation

30400425	Industrial Processes; Secondary Metal Production; Lead; Casting: Fugitive Emissions
30400426	Industrial Processes; Secondary Metal Production; Lead; Kettle Refining
30400499	Industrial Processes; Secondary Metal Production; Lead; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- AWMA, 1992: Air & Waste Management Association, "Air Pollution Engineering Manual," edited by A. Buonicore and W. Davis, Van Nostrand Reinhold, NY, NY, 1992.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Wet Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999

Other information:

ADMIN_PCT:	4.4%
CE_TEXT:	PM10 control efficiency is 99% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for wire-plate ESPs, developed using EPA cost-estimating spreadsheets for dry wire-plate ESPs with adjustments made to reflect wet wire-plate ESPs (EPA, 1999). Capital and operating costs are generally higher due to noncorrosive materials requirements, increased water usage, and treatment and disposal of wet effluent. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1990). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $30 to $60 per scfm Typical value is $40 per scfm O&M Costs: Range from $6 to $45 per scfm Typical value is $19 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1999). O&M costs were calculated for three model plants with flow rates of 10, 15 and 20 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. A water flow rate for the ESP was assumed to be 5 gal/min per thousand acfm. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 20 $/ton disposed Wastewater treatment 1.5 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$550/ton
CPTON_L:	$55/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $55 to $550 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $220 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.93%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.2%
MNTLBR_PCT:	2.26%

MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	2.2%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	5.1%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	7.21%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.2%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	2.46%
STEAM_PCT:	0%
TDIR_PCT:	83.99%
TINDIR_PCT:	16.01%
UTIL_PCT:	4%
WSTDSP_PCT:	64.05%

Summary:

Control Measure Name: Wet Electrostatic Precipitator - Wire Plate Type;(PM10) Non-Ferrous Metals Processing - Other

Abbreviation: PWESPMPOR

Description: Application: This control is the use of a wire-plate type electrostatic precipitator (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. Wet ESPs use a stream of water, in place of rapping mechanisms, to dislodge particulate from the plates and into a sump.

This control applies to miscellaneous non-ferrous metals processing operations, including molybdenum, titanium, gold, barium ore, lead battery, magnesium, nickel, electrode manufacture and metal heat treating operations.

Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. These particles are processed in later sections of the ESP, but the particles from the last section have no chance to be recaptured. Due to the space needed at the top of the ESP for nonelectrified components, part of the stream may flow around the charged zones. This is called "sneakage" and places an upper limit on the collection efficiency of the ESP. Anti-sneakage baffles are used to force the sneakage flow to mix with the main gas stream for collection in later sections (EPA, 1998).

Wire-Plate Type Wet ESPs require a source of wash water near the top of the collector plates. This wash system replaces the rapping mechanism used by dry ESPs. The water flows with the collected particles into a sump from which the fluid is pumped or drained. A portion of the fluid may be recycled to reduce the total amount of water required. The remainder is pumped into a settling pond or passed through a dewatering stage, with subsequent disposal of the sludge (AWMA, 1992).

Unlike dry ESPs, resistivity of the collected material is not a major factor in performance. Because of the high humidity in a wet ESP, the resistivity of particles is lowered, eliminating the "back corona" condition. The frequent washing of the plates also limits particle buildup on the collectors (EPA, 1998).

For wet ESPs, the handling wastewaters must be considered (EPA, 1999). For simple systems with innocuous dusts, water with particles collected by the ESP may be discharged from the ESP system to a solids-removing clarifier. More complicated systems may require skimming and sludge removal, clarification in dedicated equipment, pH adjustment, and/or treatment to remove dissolved solids. Recirculation of treated water to the ESP may approach 100 percent (AWMA, 1992).

Class: Known

Pollutant: PM2_5

Equipment Life: 20.0 years

Control Technology: Wet Electrostatic Precipitator - Wire Plate Type

Source Group: Non-Ferrous Metals Processing - Other

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				

Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	1995	1995	N/A
CPT:		$322	$322	
Ref Yr CPT:		$457	$457	
Control Efficiency:	99.5	95.0	95.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:		cpton	cpton	
Capital Rec Fac:	N/A	0.09000000357627869	0.09000000357627869	N/A
Discount Rate:	N/A	7.0	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:

Effective Date:
2020-01-01 00:00:00.0
N/A
N/A
2020-01-01 00:00:00.0
Cost Year:
N/A
1995
1995
N/A
CPT:
$322
$322
Ref Yr CPT:
$457
$457
Control Efficiency:
99.5
95.0
95.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0

Equation Type:
cpton
cpton
Capital Rec Fac:
N/A
0.09000000357627869
0.09000000357627869
N/A
Discount Rate:
N/A
7.0
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	40.0
Typical O&M Control Cost Factor	19.0
Typical Default CPT Factor - Capital	923.0
Typical Default CPT Factor - O&M	135.0
Typical Default CPT Factor - Annualized	220.0

Affected SCCs:

Code	Description
30301101	Industrial Processes; Primary Metal Production; Molybdenum; Mining: General
30301102	Industrial Processes; Primary Metal Production; Molybdenum; Milling: General
30301199	Industrial Processes; Primary Metal Production; Molybdenum; Other Not Classified
30301201	Industrial Processes; Primary Metal Production; Titanium; Chlorination
30301202	Industrial Processes; Primary Metal Production; Titanium; Drying Titanium Sand Ore (Cyclone Exit)
30301299	Industrial Processes; Primary Metal Production; Titanium; Other Not Classified
30301301	Industrial Processes; Primary Metal Production; Gold Processing; General Processes
30301302	Industrial Processes; Primary Metal Production; Gold Processing; Fines Crushing
30301401	Industrial Processes; Primary Metal Production; Barium Ore Processing; Ore Grinding
30301402	Industrial Processes; Primary Metal Production; Barium Ore Processing; Reduction Kiln
30301403	Industrial Processes; Primary Metal Production; Barium Ore Processing; Dryers/Calciners
30301499	Industrial Processes; Primary Metal Production; Barium Ore Processing; Other Not Classified
30400501	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process **
30400502	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Casting Furnace **
30400503	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixer **
30400504	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation **
30400505	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process
30400506	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Casting
30400507	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixing
30400508	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Oxide Mill (Baghouse Outlet)
30400509	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation

30400510	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Reclaiming Furnace
30400511	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Small Parts Casting
30400512	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Formation
30400513	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Barton Process: Oxidation Kettle
30400521	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Overall Process
30400522	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Casting
30400523	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mixing
30400524	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Oxide Mill (Baghouse Outlet)
30400525	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Three Process Operation
30400526	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Lead Reclaiming Furnace
30400527	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Small Parts Casting
30400528	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Formation
30400529	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Grid Cast/Paste Mix: Combined Operation
30400530	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Paste Mix/Lead Charge: Combined Operation
30400531	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Wash and Paint
30400599	Industrial Processes; Secondary Metal Production; Lead Battery Manufacture; Other Not Classified
30400601	Industrial Processes; Secondary Metal Production; Magnesium; Pot Furnace
30400602	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process
30400605	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Neutralization Tank
30400606	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: HCl Absorbers
30400607	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Evaporator
30400608	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Filtering/Concentration
30400609	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Shelf Dryer
30400610	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Rotary Dryer
30400611	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Prilling
30400612	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Granule Storage Tanks
30400613	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Electrolysis
30400614	Industrial Processes; Secondary Metal Production; Magnesium; Dow Seawater Process: Regenerative Furnaces
30400630	Industrial Processes; Secondary Metal Production; Magnesium; Natural Lead Industrial (NLI) Brine Process

30400635	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: MgCl2 Melt/Purification
30400636	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: 2nd Vessel, Further Purification
30400637	Industrial Processes; Secondary Metal Production; Magnesium; NLI Brine Process: Electrolysis
30400650	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process
30400655	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Purification II
30400656	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Electrolysis
30400660	Industrial Processes; Secondary Metal Production; Magnesium; American Magnesium Process: Chlorine Recovery
30400699	Industrial Processes; Secondary Metal Production; Magnesium; Other Not Classified
30401001	Industrial Processes; Secondary Metal Production; Nickel; Flux Furnace
30401002	Industrial Processes; Secondary Metal Production; Nickel; Mixing/Blending/Grinding/Screening
30401004	Industrial Processes; Secondary Metal Production; Nickel; Heat Treat Furnace
30401005	Industrial Processes; Secondary Metal Production; Nickel; Induction Furnace (Inlet Air)
30401006	Industrial Processes; Secondary Metal Production; Nickel; Induction Furnace (Under Vacuum)
30401007	Industrial Processes; Secondary Metal Production; Nickel; Electric Arc Furnace with Carbon Electrode
30401008	Industrial Processes; Secondary Metal Production; Nickel; Electric Arc Furnace
30401010	Industrial Processes; Secondary Metal Production; Nickel; Finishing: Pickling/Neutralizing
30401011	Industrial Processes; Secondary Metal Production; Nickel; Finishing: Grinding
30401015	Industrial Processes; Secondary Metal Production; Nickel; Multiple Hearth Roaster
30401016	Industrial Processes; Secondary Metal Production; Nickel; Converters
30401017	Industrial Processes; Secondary Metal Production; Nickel; Reverberatory Furnace
30401018	Industrial Processes; Secondary Metal Production; Nickel; Electric Furnace
30401019	Industrial Processes; Secondary Metal Production; Nickel; Sinter Machine
30401061	Industrial Processes; Secondary Metal Production; Nickel; Roasting: Fugitive Emissions
30401062	Industrial Processes; Secondary Metal Production; Nickel; Reverberatory Furnace: Fugitive Emissions
30401063	Industrial Processes; Secondary Metal Production; Nickel; Converter: Fugitive Emissions
30401099	Industrial Processes; Secondary Metal Production; Nickel; Other Not Classified
30402001	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Calcination
30402002	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Mixing
30402003	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Pitch Treating
30402004	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Bake Furnaces
30402005	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Grafitization of Coal by Heating Process
30402099	Industrial Processes; Secondary Metal Production; Furnace Electrode Manufacture; Other Not Classified
30402201	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Furnace: General

30402210	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Quench Bath
30402211	Industrial Processes; Secondary Metal Production; Metal Heat Treating; Quenching

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- AWMA, 1992: Air & Waste Management Association, "Air Pollution Engineering Manual," edited by A. Buonicore and W. Davis, Van Nostrand Reinhold, NY, NY, 1992.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Wet Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999

Other information:

ADMIN_PCT:	4.4%
CE_TEXT:	PM10 control efficiency is 99% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for wire-plate ESPs, developed using EPA cost-estimating spreadsheets for dry wire-plate ESPs with adjustments made to reflect wet wire-plate ESPs (EPA, 1999). Capital and operating costs are generally higher due to noncorrosive materials requirements, increased water usage, and treatment and disposal of wet effluent. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1990). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from \$30 to \$60 per scfm Typical value is \$40 per scfm O&M Costs: Range from \$6 to \$45 per scfm Typical value is \$19 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1999). O&M costs were calculated for three model plants with flow rates of 10, 15 and 20 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. A water flow rate for the ESP was assumed to be 5 gal/min per thousand acfm. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 \$/kW-hr Process water price 0.20 \$/1000 gal Dust disposal 20 \$/ton disposed Wastewater treatment 1.5 \$/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	\$550/ton
CPTON_L:	\$55/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from \$55 to \$550 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is \$220 per ton PM10 reduced. (1995\$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.93%
ELEC_RT:	\$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.2%
MNTLBR_PCT:	2.26%

MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	2.2%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	5.1%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	7.21%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.2%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	2.46%
STEAM_PCT:	0%
TDIR_PCT:	83.99%
TINDIR_PCT:	16.01%
UTIL_PCT:	4%
WSTDSP_PCT:	64.05%

Summary:

Control Measure Name:	Wet Electrostatic Precipitator - Wire Plate Type;(PM10) Non-Ferrous Metals Processing - Zinc
Abbreviation:	PWESPMPZC
Description:	Application: This control is the use of a wire-plate type electrostatic precipitator (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. Wet ESPs use a stream of water, in place of rapping mechanisms, to dislodge particulate from the plates and into a sump. This control applies to zinc processing and production operations. Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona. Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. These particles are processed in later sections of the ESP, but the particles from the last section have no chance to be recaptured. Due to the space needed at the top of the ESP for nonelectrified components, part of the stream may flow around the charged zones. This is called "sneakage" and places an upper limit on the collection efficiency of the ESP. Anti-sneakage baffles are used to force the sneakage flow to mix with the main gas stream for collection in later sections (EPA, 1998). Wire-Plate Type Wet ESPs require a source of wash water near the top of the collector plates. This wash system replaces the rapping mechanism used by dry ESPs. The water flows with the collected particles into a sump from which the fluid is pumped or drained. A portion of the fluid may be recycled to reduce the total amount of water required. The remainder is pumped into a settling pond or passed through a dewatering stage, with subsequent disposal of the sludge (AWMA, 1992). Unlike dry ESPs, resistivity of the collected material is not a major factor in performance. Because of the high humidity in a wet ESP, the resistivity of particles is lowered, eliminating the "back corona" condition. The frequent washing of the plates also limits particle buildup on the collectors (EPA, 1998). For wet ESPs, the handling wastewaters must be considered (EPA, 1999). For simple systems with innocuous dusts, water with particles collected by the ESP may be discharged from the ESP system to a solids-removing clarifier. More complicated systems may require skimming and sludge removal, clarification in dedicated equipment, pH adjustment, and/or treatment to remove dissolved solids. Recirculation of treated water to the ESP may approach 100 percent (AWMA, 1992).
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Wet Electrostatic Precipitator - Wire Plate Type
Source Group:	Non-Ferrous Metals Processing - Zinc
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				

Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1995	N/A	1995	N/A
CPT:	$255		$255	
Ref Yr CPT:	$362		$362	
Control Efficiency:	95.0	99.5	95.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:

N/A
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:
1995
N/A
1995
N/A
CPT:
$255
$255
Ref Yr CPT:
$362
$362
Control Efficiency:
95.0
99.5
95.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:

cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:

Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	40.0
Typical O&M Control Cost Factor	19.0
Typical Default CPT Factor - Capital	923.0
Typical Default CPT Factor - O&M	135.0
Typical Default CPT Factor - Annualized	220.0

Affected SCCs:

Code	Description
30303002	Industrial Processes; Primary Metal Production; Zinc Production; Multiple Hearth Roaster
30303003	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Strand
30303005	Industrial Processes; Primary Metal Production; Zinc Production; Vertical Retort/Electrothermal Furnace
30303006	Industrial Processes; Primary Metal Production; Zinc Production; Electrolytic Processor
30303007	Industrial Processes; Primary Metal Production; Zinc Production; Flash Roaster
30303008	Industrial Processes; Primary Metal Production; Zinc Production; Fluid Bed Roaster
30303009	Industrial Processes; Primary Metal Production; Zinc Production; Raw Material Handling and Transfer
30303010	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Breaking and Cooling
30303011	Industrial Processes; Primary Metal Production; Zinc Production; Zinc Casting
30303012	Industrial Processes; Primary Metal Production; Zinc Production; Raw Material Unloading
30303013	Industrial Processes; Primary Metal Production; Zinc Production; Suspension Roaster
30303014	Industrial Processes; Primary Metal Production; Zinc Production; Crushing/Screening
30303015	Industrial Processes; Primary Metal Production; Zinc Production; Zinc Melting
30303016	Industrial Processes; Primary Metal Production; Zinc Production; Alloying
30303017	Industrial Processes; Primary Metal Production; Zinc Production; Leaching
30303018	Industrial Processes; Primary Metal Production; Zinc Production; Purification
30303019	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant Wind Box
30303020	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant Discharge and Screens
30303021	Industrial Processes; Primary Metal Production; Zinc Production; Retort Furnace
30303022	Industrial Processes; Primary Metal Production; Zinc Production; Flue Dust Handling
30303023	Industrial Processes; Primary Metal Production; Zinc Production; Dross Handling

30303024	Industrial Processes; Primary Metal Production; Zinc Production; Roasting: Fugitive Emissions
30303025	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant, Wind Box: Fugitive Emissions
30303026	Industrial Processes; Primary Metal Production; Zinc Production; Sinter Plant, Discharge Screens: Fugitive Emissions
30303027	Industrial Processes; Primary Metal Production; Zinc Production; Retort Building: Fugitive Emissions
30303028	Industrial Processes; Primary Metal Production; Zinc Production; Casting: Fugitive Emissions
30303029	Industrial Processes; Primary Metal Production; Zinc Production; Electric Retort
30303099	Industrial Processes; Primary Metal Production; Zinc Production; Other Not Classified
30400801	Industrial Processes; Secondary Metal Production; Zinc; Retort Furnace
30400802	Industrial Processes; Secondary Metal Production; Zinc; Horizontal Muffle Furnace
30400803	Industrial Processes; Secondary Metal Production; Zinc; Pot Furnace
30400805	Industrial Processes; Secondary Metal Production; Zinc; Galvanizing Kettle
30400806	Industrial Processes; Secondary Metal Production; Zinc; Calcining Kiln
30400807	Industrial Processes; Secondary Metal Production; Zinc; Concentrate Dryer
30400809	Industrial Processes; Secondary Metal Production; Zinc; Rotary Sweat Furnace
30400810	Industrial Processes; Secondary Metal Production; Zinc; Muffle Sweat Furnace
30400811	Industrial Processes; Secondary Metal Production; Zinc; Electric Resistance Sweat Furnace
30400812	Industrial Processes; Secondary Metal Production; Zinc; Crushing/Screening of Zinc Residues
30400814	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: Clean Metallic Scrap
30400818	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: Clean Metallic Scrap
30400824	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: General Metallic Scrap
30400828	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: General Metallic Scrap
30400834	Industrial Processes; Secondary Metal Production; Zinc; Kettle-Sweat Furnace: Residual Metallic Scrap
30400838	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweat Furnace: Residual Metallic Scrap
30400840	Industrial Processes; Secondary Metal Production; Zinc; Alloying
30400841	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Crucible
30400842	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Reverberatory Furnace
30400843	Industrial Processes; Secondary Metal Production; Zinc; Scrap Melting: Electric Induction Furnace
30400851	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation: Pouring
30400852	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation: Casting
30400853	Industrial Processes; Secondary Metal Production; Zinc; Graphite Rod Distillation
30400854	Industrial Processes; Secondary Metal Production; Zinc; Retort Distillation/Oxidation
30400855	Industrial Processes; Secondary Metal Production; Zinc; Muffle Distillation/Oxidation
30400861	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Sweating
30400862	Industrial Processes; Secondary Metal Production; Zinc; Rotary Sweating

30400863	Industrial Processes; Secondary Metal Production; Zinc; Muffle Sweating
30400864	Industrial Processes; Secondary Metal Production; Zinc; Kettle (Pot) Sweating
30400865	Industrial Processes; Secondary Metal Production; Zinc; Electric Resistance Sweating
30400866	Industrial Processes; Secondary Metal Production; Zinc; Sodium Carbonate Leaching
30400867	Industrial Processes; Secondary Metal Production; Zinc; Kettle (Pot) Melting Furnace
30400868	Industrial Processes; Secondary Metal Production; Zinc; Crucible Melting Furnace
30400869	Industrial Processes; Secondary Metal Production; Zinc; Reverberatory Melting Furnace
30400870	Industrial Processes; Secondary Metal Production; Zinc; Electric Induction Melting Furnace
30400871	Industrial Processes; Secondary Metal Production; Zinc; Alloying Retort Distillation
30400872	Industrial Processes; Secondary Metal Production; Zinc; Retort and Muffle Distillation
30400873	Industrial Processes; Secondary Metal Production; Zinc; Casting
30400874	Industrial Processes; Secondary Metal Production; Zinc; Graphite Rod Distillation
30400875	Industrial Processes; Secondary Metal Production; Zinc; Retort Distillation/Oxidation
30400876	Industrial Processes; Secondary Metal Production; Zinc; Muffle Distillation/Oxidation
30400877	Industrial Processes; Secondary Metal Production; Zinc; Retort Reduction
30400899	Industrial Processes; Secondary Metal Production; Zinc; Other Not Classified

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- AWMA, 1992: Air & Waste Management Association, "Air Pollution Engineering Manual," edited by A. Buonicore and W. Davis, Van Nostrand Reinhold, NY, NY, 1992.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Wet Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999

Other information:

ADMIN_PCT:	4.4%
CE_TEXT:	PM10 control efficiency is 99% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for wire-plate ESPs, developed using EPA cost-estimating spreadsheets for dry wire-plate ESPs with adjustments made to reflect wet wire-plate ESPs (EPA, 1999). Capital and operating costs are generally higher due to noncorrosive materials requirements, increased water usage, and treatment and disposal of wet effluent. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1990). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $30 to $60 per scfm Typical value is $40 per scfm O&M Costs: Range from $6 to $45 per scfm Typical value is $19 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1999). O&M costs were calculated for three model plants with flow rates of 10, 15 and 20 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. A water flow rate for the ESP was assumed to be 5 gal/min per thousand acfm. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 20 $/ton disposed Wastewater treatment 1.5 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$550/ton
CPTON_L:	$55/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $55 to $550 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $220 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.93%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.2%
MNTLBR_PCT:	2.26%

MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	2.2%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	5.1%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	7.21%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.2%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	2.46%
STEAM_PCT:	0%
TDIR_PCT:	83.99%
TINDIR_PCT:	16.01%
UTIL_PCT:	4%
WSTDSP_PCT:	64.05%

Summary:

Control Measure Name:	Wet Electrostatic Precipitator - Wire Plate Type; Wood Pulp & Paper
Abbreviation:	PWESPWDPP
Description:	Application: This control is the use of a wire-plate type electrostatic precipitator (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. Wet ESPs use a stream of water, in place of rapping mechanisms, to dislodge particulate from the plates and into a sump. This control measure applies to wood pulp and paper processing and production operations. Discussion: In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona. Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. These particles are processed in later sections of the ESP, but the particles from the last section have no chance to be recaptured. Due to the space needed at the top of the ESP for nonelectrified components, part of the stream may flow around the charged zones. This is called "sneakage" and places an upper limit on the collection efficiency of the ESP. Anti-sneakage baffles are used to force the sneakage flow to mix with the main gas stream for collection in later sections (EPA, 1998). Wire-Plate Type Wet ESPs require a source of wash water near the top of the collector plates. This wash system replaces the rapping mechanism used by dry ESPs. The water flows with the collected particles into a sump from which the fluid is pumped or drained. A portion of the fluid may be recycled to reduce the total amount of water required. The remainder is pumped into a settling pond or passed through a dewatering stage, with subsequent disposal of the sludge (AWMA, 1992). Unlike dry ESPs, resistivity of the collected material is not a major factor in performance. Because of the high humidity in a wet ESP, the resistivity of particles is lowered, eliminating the "back corona" condition. The frequent washing of the plates also limits particle buildup on the collectors (EPA, 1998). For wet ESPs, the handling wastewaters must be considered (EPA, 1999). For simple systems with innocuous dusts, water with particles collected by the ESP may be discharged from the ESP system to a solids-removing clarifier. More complicated systems may require skimming and sludge removal, clarification in dedicated equipment, pH adjustment, and/or treatment to remove dissolved solids. Recirculation of treated water to the ESP may approach 100 percent (AWMA, 1992).
Class:	Known
Pollutant:	PM2_5
Equipment Life:	20.0 years
Control Technology:	Wet Electrostatic Precipitator - Wire Plate Type
Source Group:	Wood Pulp & Paper
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				

Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1995	N/A	1995	N/A
CPT:	$267		$267	
Ref Yr CPT:	$379		$379	
Control Efficiency:	95.0	99.5	95.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton		cpton	
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	N/A	7.0	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:

N/A
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:
1995
N/A
1995
N/A
CPT:
$267
$267
Ref Yr CPT:
$379
$379
Control Efficiency:
95.0
99.5
95.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:

cpton
cpton
Capital Rec Fac:
0.09000000357627869
N/A
0.09000000357627869
N/A
Discount Rate:
7.0
N/A
7.0
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM2_5
Cost Year	1995
Typical Capital Control Cost Factor	40.0
Typical O&M Control Cost Factor	19.0
Typical Default CPT Factor - Capital	923.0
Typical Default CPT Factor - O&M	135.0
Typical Default CPT Factor - Annualized	220.0

Affected SCCs:

Code	Description
30700120	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Stock Washing/Screening
30700119	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Salt Cake Mix Tank (Boiler Ash Handling)
30700117	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Venting of condensate stripper off-gases
30700116	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Turpentine Storage and Loading (incl decanting, storage and loading)
30700115	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Chlorine Dioxide Generator
30700114	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Bleach Plant
30700113	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Lime Mud Filter System
30700112	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Lime Mud Washers
30700111	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Filtrate Tanks
30700110	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Recovery Furnace/Indirect Contact Evaporator
30700109	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Black Liquor Oxidation System
30700108	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Fluid Bed Calciner
30700107	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Turpentine Condenser
30700106	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Lime Kiln
30700104	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Recovery Furnace/Direct Contact Evaporator
30700103	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Multiple Effect Evaporators and Concentrators

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- AWMA, 1992: Air & Waste Management Association, "Air Pollution Engineering Manual," edited by A. Buonicore and W. Davis, Van Nostrand Reinhold, NY, NY, 1992.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Wet Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999

Other information:

ADMIN_PCT:	4.4%
CE_TEXT:	PM10 control efficiency is 99% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for wire-plate ESPs, developed using EPA cost-estimating spreadsheets for dry wire-plate ESPs with adjustments made to reflect wet wire-plate ESPs (EPA, 1999). Capital and operating costs are generally higher due to noncorrosive materials requirements, increased water usage, and treatment and disposal of wet effluent. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1990). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $30 to $60 per scfm Typical value is $40 per scfm O&M Costs: Range from $6 to $45 per scfm Typical value is $19 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1999). O&M costs were calculated for three model plants with flow rates of 10, 15 and 20 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. A water flow rate for the ESP was assumed to be 5 gal/min per thousand acfm. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 20 $/ton disposed Wastewater treatment 1.5 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$550/ton
CPTON_L:	$55/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $55 to $550 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $220 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.93%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.2%
MNTLBR_PCT:	2.26%

MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	2.2%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	5.1%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	7.21%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.2%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	2.46%
STEAM_PCT:	0%
TDIR_PCT:	83.99%
TINDIR_PCT:	16.01%
UTIL_PCT:	4%
WSTDSP_PCT:	64.05%

PM10 Control Measures

There are 34 PM10 control measures included in this report

Summary:

Control Measure Name:	Chemical Stabilization;Unpaved Roads (UnKnown 1)
Abbreviation:	PUCHS150
Description:	Application: Chemical stabilization is a surface treatment option for unpaved roads. Unpaved roads comprise a sizable percentage of total PM10/PM2.5 emissions. Unpaved roads, especially rural roads, do not generally experience the type of traffic volume associated with paved roads. This control applies to unpaved roads classified under SCC 2296000000. Discussion: Chemical stabilization was investigated as a supplemental control option to hot asphalt paving for urban areas. For rural areas, chemical stabilization was evaluated as an alternative to watering (Pechan, 1995). The control application parameters that affect the control efficiency of chemical dust suppressants are application intensity, application frequency, dilution ratio and application procedure (EPA, 1986). Other factors that influence the control efficiency are the silt content of the soil, weather conditions and the weight and level of traffic. An increase in vehicle weight and speed serves to accelerate the decay in efficiency for chemical suppression.
Class:	Known
Pollutant:	PM10
Equipment Life:	N/A years
Control Technology:	Chemical Stabilization
Source Group:	Unpaved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10-PRI	PM25-PRI	PM10	PM2_5
Maximum Control Efficiency:	38.0	25.0	38.0	25.0
Minimum Control Efficiency:	38.0	25.0	38.0	25.0
Average Control Efficiency:	38.0	25.0	38.0	25.0
Maximum CPT:	$1,936		$1,936	
Minimum CPT:	$1,933		$1,933	
Average CPT:	$1,934		$1,934	
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2296010000	Mobile Sources; Unpaved Roads; Industrial Unpaved Roads; Total: Fugitives
2296005000	Mobile Sources; Unpaved Roads; Public Unpaved Roads; Total: Fugitives
2296000000	Mobile Sources; Unpaved Roads; All Unpaved Roads; Total: Fugitives

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1995: E.H. Pechan & Associates, Inc., "Regional Particulate Strategies - Draft Report," prepared for U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation, Washington, DC, September 1995.
- EPA, 1986: U.S. Environmental Protection Agency, Air and Engineering Research Laboratory, Identification, Assessment, and Control of Fugitive Particulate Emissions, EPA/600/8-86/023, prepared by Midwest Research Institute, August 1986.
- SCAQMD, 1994: South Coast Air Quality Management District, "1994 Air Quality Management Plan, Appendix I-D: Best Available Control Measures PM-10 SIP for the South Coast Air Basin," April 1994.

Other information:

COST_BASIS:	SCAQMD estimated a $17,000 per mile cost estimate for chemical stabilization of unpaved roads for the 1994 Air Quality Management Plan (SCAQMD, 1994). From this, Pechan estimated a cost effectiveness of $2,753 per ton PM removed.
WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	37.5%
OMATL_PCT:	0%
OMCPTON:	$69/ton
OPLBR_PCT:	0%
PM25:	Co

ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 38% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%
CPTON_TEXT:	The cost effectiveness is $2,753 per ton PM removed (1990$).
OPLBR_RT:	$0/hr
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	37.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OTHR_PCT:	0%
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Chemical Stabilization;Unpaved Roads (UnKnown 2)
Abbreviation:	PUCHS170
Description:	Application: Chemical stabilization is a surface treatment option for unpaved roads. Unpaved roads comprise a sizable percentage of total PM10/PM2.5 emissions. Unpaved roads, especially rural roads, do not generally experience the type of traffic volume associated with paved roads. This control applies to unpaved roads classified under SCC 2296000000. Discussion: Chemical stabilization was investigated as a supplemental control option to hot asphalt paving for urban areas. For rural areas, chemical stabilization was evaluated as an alternative to watering (Pechan, 1995). The control application parameters that affect the control efficiency of chemical dust suppressants are application intensity, application frequency, dilution ratio and application procedure (EPA, 1986). Other factors that influence the control efficiency are the silt content of the soil, weather conditions and the weight and level of traffic. An increase in vehicle weight and speed serves to accelerate the decay in efficiency for chemical suppression.
Class:	Known
Pollutant:	PM10
Equipment Life:	N/A years
Control Technology:	Chemical Stabilization
Source Group:	Unpaved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM25-PRI	PM10-PRI	PM10	PM2_5
Maximum Control Efficiency:	25.0	38.0	38.0	25.0
Minimum Control Efficiency:	25.0	38.0	38.0	25.0
Average Control Efficiency:	25.0	38.0	38.0	25.0
Maximum CPT:		$8,979	$8,979	
Minimum CPT:		$1,981	$1,981	
Average CPT:		$4,623	$4,623	
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2296010000	Mobile Sources; Unpaved Roads; Industrial Unpaved Roads; Total: Fugitives
2296005000	Mobile Sources; Unpaved Roads; Public Unpaved Roads; Total: Fugitives
2296000000	Mobile Sources; Unpaved Roads; All Unpaved Roads; Total: Fugitives

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1995: E.H. Pechan & Associates, Inc., "Regional Particulate Strategies - Draft Report," prepared for U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation, Washington, DC, September 1995.
- EPA, 1986: U.S. Environmental Protection Agency, Air and Engineering Research Laboratory, Identification, Assessment, and Control of Fugitive Particulate Emissions, EPA/600/8-86/023, prepared by Midwest Research Institute, August 1986.
- SCAQMD, 1994: South Coast Air Quality Management District, "1994 Air Quality Management Plan, Appendix I-D: Best Available Control Measures PM-10 SIP for the South Coast Air Basin," April 1994.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	37.5%
OMATL_PCT:	0%
OMCPTON:	$69/ton
OPLBR_PCT:	0%
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 38% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	SCAQMD estimated a $17,000 per mile cost estimate for chemical stabilization of unpaved roads for the 1994 Air Quality Management Plan (SCAQMD, 1994). From this, Pechan estimated a cost effectiveness of $2,753 per ton PM removed.
CPTON_TEXT:	The cost effectiveness is $2,753 per ton PM removed (1990$).

OPLBR_RT:	$0/hr
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	37.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OTHR_PCT:	0%
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Chemical Stabilization;Unpaved Roads (UnKnown 3)
Abbreviation:	PUCHS190
Description:	Application: Chemical stabilization is a surface treatment option for unpaved roads. Unpaved roads comprise a sizable percentage of total PM10/PM2.5 emissions. Unpaved roads, especially rural roads, do not generally experience the type of traffic volume associated with paved roads. This control applies to unpaved roads classified under SCC 2296000000. Discussion: Chemical stabilization was investigated as a supplemental control option to hot asphalt paving for urban areas. For rural areas, chemical stabilization was evaluated as an alternative to watering (Pechan, 1995). The control application parameters that affect the control efficiency of chemical dust suppressants are application intensity, application frequency, dilution ratio and application procedure (EPA, 1986). Other factors that influence the control efficiency are the silt content of the soil, weather conditions and the weight and level of traffic. An increase in vehicle weight and speed serves to accelerate the decay in efficiency for chemical suppression.
Class:	Known
Pollutant:	PM10
Equipment Life:	N/A years
Control Technology:	Chemical Stabilization
Source Group:	Unpaved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM25-PRI	PM10-PRI	PM10	PM2_5
Maximum Control Efficiency:	25.0	38.0	38.0	25.0
Minimum Control Efficiency:	25.0	38.0	38.0	25.0
Average Control Efficiency:	25.0	38.0	38.0	25.0
Maximum CPT:		$10,183	$10,183	
Minimum CPT:		$2,247	$2,247	
Average CPT:		$5,050	$5,050	
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2296010000	Mobile Sources; Unpaved Roads; Industrial Unpaved Roads; Total: Fugitives
2296005000	Mobile Sources; Unpaved Roads; Public Unpaved Roads; Total: Fugitives
2296000000	Mobile Sources; Unpaved Roads; All Unpaved Roads; Total: Fugitives

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1995: E.H. Pechan & Associates, Inc., "Regional Particulate Strategies - Draft Report," prepared for U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation, Washington, DC, September 1995.
- EPA, 1986: U.S. Environmental Protection Agency, Air and Engineering Research Laboratory, Identification, Assessment, and Control of Fugitive Particulate Emissions, EPA/600/8-86/023, prepared by Midwest Research Institute, August 1986.
- SCAQMD, 1994: South Coast Air Quality Management District, "1994 Air Quality Management Plan, Appendix I-D: Best Available Control Measures PM-10 SIP for the South Coast Air Basin," April 1994.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	37.5%
OMATL_PCT:	0%
OMCPTON:	$69/ton
OPLBR_PCT:	0%
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 38% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	SCAQMD estimated a $17,000 per mile cost estimate for chemical stabilization of unpaved roads for the 1994 Air Quality Management Plan (SCAQMD, 1994). From this, Pechan estimated a cost effectiveness of $2,753 per ton PM removed.
CPTON_TEXT:	The cost effectiveness is $2,753 per ton PM removed (1990$).

OPLBR_RT:	$0/hr
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	37.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OTHR_PCT:	0%
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Chemical Stabilization;Unpaved Roads (UnKnown 4)
Abbreviation:	PUCHS210
Description:	Application: Chemical stabilization is a surface treatment option for unpaved roads. Unpaved roads comprise a sizable percentage of total PM10/PM2.5 emissions. Unpaved roads, especially rural roads, do not generally experience the type of traffic volume associated with paved roads. This control applies to unpaved roads classified under SCC 2296000000. Discussion: Chemical stabilization was investigated as a supplemental control option to hot asphalt paving for urban areas. For rural areas, chemical stabilization was evaluated as an alternative to watering (Pechan, 1995). The control application parameters that affect the control efficiency of chemical dust suppressants are application intensity, application frequency, dilution ratio and application procedure (EPA, 1986). Other factors that influence the control efficiency are the silt content of the soil, weather conditions and the weight and level of traffic. An increase in vehicle weight and speed serves to accelerate the decay in efficiency for chemical suppression.
Class:	Known
Pollutant:	PM10
Equipment Life:	N/A years
Control Technology:	Chemical Stabilization
Source Group:	Unpaved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10	PM2_5	PM25-PRI	PM10-PRI
Maximum Control Efficiency:	38.0	25.0	25.0	38.0
Minimum Control Efficiency:	38.0	25.0	25.0	38.0
Average Control Efficiency:	38.0	25.0	25.0	38.0
Maximum CPT:	$10,183			$10,183
Minimum CPT:	$2,247			$2,247
Average CPT:	$4,986			$4,986
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2296010000	Mobile Sources; Unpaved Roads; Industrial Unpaved Roads; Total: Fugitives
2296005000	Mobile Sources; Unpaved Roads; Public Unpaved Roads; Total: Fugitives
2296000000	Mobile Sources; Unpaved Roads; All Unpaved Roads; Total: Fugitives

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1995: E.H. Pechan & Associates, Inc., "Regional Particulate Strategies - Draft Report," prepared for U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation, Washington, DC, September 1995.
- EPA, 1986: U.S. Environmental Protection Agency, Air and Engineering Research Laboratory, Identification, Assessment, and Control of Fugitive Particulate Emissions, EPA/600/8-86/023, prepared by Midwest Research Institute, August 1986.
- SCAQMD, 1994: South Coast Air Quality Management District, "1994 Air Quality Management Plan, Appendix I-D: Best Available Control Measures PM-10 SIP for the South Coast Air Basin," April 1994.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	37.5%
PM10:	Co*
OMATL_PCT:	0%
OMCPTON:	$69/ton
OPLBR_PCT:	0%
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 38% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	SCAQMD estimated a $17,000 per mile cost estimate for chemical stabilization of unpaved roads for the 1994 Air Quality Management Plan (SCAQMD, 1994). From this, Pechan estimated a cost effectiveness of $2,753 per ton PM removed.

CPTON_TEXT:	The cost effectiveness is $2,753 per ton PM removed (1990$).
OPLBR_RT:	$0/hr
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	37.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name: Dry Electrostatic Precipitator-Wire Plate Type;(PM10) Mineral Products - Stone Quarrying & Processing

Abbreviation: PDESPMISQ

Description: Application: This control is the use of dry electrostatic precipitators (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. In dry ESPs, the collectors are knocked by various mechanical means to dislodge the particulate, which slides downward into a hopper.

This control applies to stone quarrying and processing operations. Nonmetallic Mineral Processing (305020) - ore crushing, grinding, and screening, and Calciners (SCC 305150) and Dryers (SCC 30502012) are considered in this category. Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions.

Discussion: Minerals processing operations include drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. Another factor in the performance of ESPs is the resistivity of the collected material. Dusts with high resistivities are also not well-suited for collection in dry ESPs. These particles are not easily charged nor easily collected.

Class: Known

Pollutant: PM10

Equipment Life: 20.0 years

Control Technology: Dry Electrostatic Precipitator-Wire Plate Type

Source Group: Mineral Products - Stone Quarrying & Processing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	1995	1995	N/A	N/A
CPT:	$297	$297		
Ref Yr CPT:	$422	$422		
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton		

Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	1995	1995	N/A	N/A
CPT:	$297	$297		
Ref Yr CPT:	$422	$422		
Control Efficiency:	98.0	98.0	95.0	95.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton		
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM10
Cost Year	1995
Typical Capital Control Cost Factor	27.0
Typical O&M Control Cost Factor	16.0

Typical Default CPT Factor - Capital	710.0
Typical Default CPT Factor - O&M	41.0
Typical Default CPT Factor - Annualized	110.0

Affected SCCs:

Code	Description
30502099	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Not Classified **
30502090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30502033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Front End Loader
30502032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Conveyor
30502031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Unloading
30502021	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Screening
30502018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drilling with Liquid Injection
30502016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Revolving Screens
30502015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Vibrating Screens
30502014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Shaker Screens
30502013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Bar Grizzlies
30502012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drying
30502007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Open Storage
30502006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Miscellaneous Operations: Screen/Convey/Handling
30502005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Mill
30502004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Recrushing/Screening
30502003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Tertiary Crushing/Screening
30502002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Secondary Crushing/Screening
30502001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Primary Crushing
30502000	Industrial Processes;Mineral Products;Stone Quarrying - Processing (See also 305320);undefined

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Dry Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999.

Other information:

ADMIN_PCT:	7.29%
CE_TEXT:	PM10 control efficiency is 98% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	The costs for ESPs of conventional design under typical operating conditions are developed using EPA cost estimating spreadsheets (EPA, 1996). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan, 2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $15 to $50 per scfm Typical value is $27 per scfm O&M Costs: Range from $4 to $40 per scfm Typical value is $16 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1996). O&M costs were calculated for three model plants with flow rates of 200 and 500 thousand acfm and 1 million acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Dust disposal 25 $/ton disposed Note: All costs are in 1995 dollars.

CPTON_H:	$250/ton
CPTON_L:	$40/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $40 to $250 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $110 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	98%
EC:	Co
ELEC_PCT:	7.02%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	98%
INSRNC_PCT:	3.65%
MNTLBR_PCT:	0.46%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	1.63%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	0.78%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	1.95%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	3.65%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0.37%
STEAM_PCT:	0%
TDIR_PCT:	83.47%
TINDIR_PCT:	16.53%
UTIL_PCT:	0%
WSTDSP_PCT:	73.21%

Summary:

Control Measure Name: Dust Control Plan;Residential, Industrial, Commercial, Institutional, Road Construction

Abbreviation: PCONWATCHM

Description: Application: The dust control plan includes chemical suppression and water treatment of disturbed soil at construction sites.

This control is useful in the reduction of PM from construction areas, including heavy construction sites and road construction operations.

Discussion: The most complete information available pertaining to construction PM emissions control is for site watering. Site watering is an attractive option because many construction jobs already have necessary equipment and facilities and need only more personnel for this task (EPA, 1974). The length of PM emission reduction from site watering is brief, requiring more than one application a day. Chemical suppressants provide a higher level of control which is longer-lasting than site watering. The higher cost of suppressants versus watering generally precludes their use in construction areas that undergo substantial improvements (e.g., earthmoving).

Chemical stabilization efficiency is dependent upon application rates. The EPA recommends that at least dilute reapplications be employed every month (EPA, 1994).

Class: Known

Pollutant: PM10

Equipment Life: N/A years

Control Technology: Dust Control Plan

Source Group: Construction Activities

Sectors: afdust

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM2_5	PM25-PRI	PM10	PM10-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1990	1990
CPT:			$3,600	$3,600
Ref Yr CPT:			$5,765	$5,765
Control Efficiency:	38.0	38.0	62.0	62.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM2_5	PM25-PRI	PM10	PM10-PRI
Locale:				

Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	N/A	N/A	1990	1990
CPT:			$3,600	$3,600
Ref Yr CPT:			$5,765	$5,765
Control Efficiency:	38.0	38.0	62.0	62.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:			cpton	cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2311040100	Industrial Processes; Construction: SIC 15 - 17; Special Trade Construction; Wind Erosion
2311040080	Industrial Processes; Construction: SIC 15 - 17; Special Trade Construction; Welding Operations
2311030100	Industrial Processes; Construction: SIC 15 - 17; Road Construction; Wind Erosion
2311030080	Industrial Processes; Construction: SIC 15 - 17; Road Construction; Welding Operations
2311030070	Industrial Processes; Construction: SIC 15 - 17; Road Construction; Vehicle Traffic
2311030060	Industrial Processes; Construction: SIC 15 - 17; Road Construction; Construction
2311030050	Industrial Processes; Construction: SIC 15 - 17; Road Construction; Cut and Fill Operations
2311030040	Industrial Processes; Construction: SIC 15 - 17; Road Construction; Ground Excavations
2311030030	Industrial Processes; Construction: SIC 15 - 17; Road Construction; Blasting
2311030020	Industrial Processes; Construction: SIC 15 - 17; Road Construction; Demolition
2311030010	Industrial Processes; Construction: SIC 15 - 17; Road Construction; Land Clearing
2311030000	Industrial Processes; Construction: SIC 15 - 17; Road Construction; Total
2311020100	Industrial Processes; Construction: SIC 15 - 17; Industrial/Commercial/Institutional; Wind Erosion
2311020080	Industrial Processes; Construction: SIC 15 - 17; Industrial/Commercial/Institutional; Welding Operations
2311020070	Industrial Processes; Construction: SIC 15 - 17; Industrial/Commercial/Institutional; Vehicle Traffic
2311020060	Industrial Processes; Construction: SIC 15 - 17; Industrial/Commercial/Institutional; Construction

2311020050	Industrial Processes; Construction: SIC 15 - 17; Industrial/Commercial/Institutional; Cut and Fill Operations
2311020040	Industrial Processes; Construction: SIC 15 - 17; Industrial/Commercial/Institutional; Ground Excavations
2311020030	Industrial Processes; Construction: SIC 15 - 17; Industrial/Commercial/Institutional; Blasting
2311020020	Industrial Processes; Construction: SIC 15 - 17; Industrial/Commercial/Institutional; Demolition
2311020010	Industrial Processes; Construction: SIC 15 - 17; Industrial/Commercial/Institutional; Land Clearing
2311020000	Industrial Processes; Construction: SIC 15 - 17; Industrial/Commercial/Institutional; Total
2311010100	Industrial Processes; Construction: SIC 15 - 17; Residential; Wind Erosion
2311010080	Industrial Processes; Construction: SIC 15 - 17; Residential; Welding Operations
2311010060	Industrial Processes; Construction: SIC 15 - 17; Residential; Construction
2311010050	Industrial Processes; Construction: SIC 15 - 17; Residential; Cut and Fill Operations
2311010040	Industrial Processes; Construction: SIC 15 - 17; Residential; Ground Excavations
2311010030	Industrial Processes; Construction: SIC 15 - 17; Residential; Blasting
2311010020	Industrial Processes; Construction: SIC 15 - 17; Residential; Demolition
2311010010	Industrial Processes; Construction: SIC 15 - 17; Residential; Land Clearing
2311010000	Industrial Processes; Construction: SIC 15 - 17; Residential; Total
2311000100	Industrial Processes; Construction: SIC 15 - 17; All Processes; Wind Erosion

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1997: E.H. Pechan & Associates, "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for U.S. Environmental Protection Agency, July 1997.
- EPA, 1974: U.S. Environmental Protection Agency, "Investigation of Fugitive Dust, Volume I Sources, Emissions, and Control," EPA-450/3-74-036a. June 1974.
- EPA, 1994: U.S. Environmental Protection Agency, Office of Policy, Planning, and Evaluation, National PM Study: "OPPE Particulate Programs Implementation Evaluation System," Washington, DC. September 1994.

Other information:

Summary:

Control Measure Name: Fabric Filter (Mech. Shaker Type);(PM10) Mineral Products - Stone Quarrying & Processing

Abbreviation: PFFMSMISQ

Description: Application: This control is the addition of a mechanical shaker type fabric filter to reduce PM emissions. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags. The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly to clean the bags.

This control applies to stone quarrying and processing operations. Nonmetallic Mineral Processing (305020) - ore crushing, grinding, and screening, and Calciners (SCC 305150) and Dryers (SCC 30502012), among others, are considered in this category.

Discussion: Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions. Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Mechanical shaking is a popular cleaning method because it is both simple and effective. In typical operation, dusty gas enters an inlet pipe to the fabric filter and very large particles are removed using a baffle plate fall into the hopper. The gas stream is drawn from beneath a cell plate in the floor and into the filter bags (EPA, 2000). The gas proceeds from the inside to the outside of the filter bags. The particles collect on the inside of the bags, forming a filter cake. In mechanical shaking units, the tops of bags are attached to a shaker bar, moved briskly (usually in a horizontal direction) to clean the bags. The shaker bars are operated by mechanical motors or by hand (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM10

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Mech. Shaker Type)

Source Group: Mineral Products - Stone Quarrying & Processing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	1998	1998	1998
CPT:		$126	$126	

Ref Yr CPT:		$171	$171	
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	0.09000000357627869	0.09000000357627869	N/A
Discount Rate:	7.0	7.0	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:

Effective Date:
N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
N/A
N/A
N/A
CPT:
Ref Yr CPT:
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:

Capital Rec Fac:
N/A
N/A
N/A
N/A
Discount Rate:
N/A
N/A
N/A
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremenental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM10
Cost Year	1998
Typical Capital Control Cost Factor	29.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	412.0
Typical Default CPT Factor - O&M	62.0
Typical Default CPT Factor - Annualized	126.0

Affected SCCs:

Code	Description
30502099	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Not Classified **
30502090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30502033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Front End Loader
30502032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Conveyor
30502031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Unloading
30502021	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Screening
30502018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drilling with Liquid Injection
30502016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Revolving Screens
30502015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Vibrating Screens
30502014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Shaker Screens
30502013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Bar Grizzlies
30502012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drying
30502007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Open Storage
30502006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Miscellaneous Operations: Screen/Convey/Handling
30502005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Mill
30502004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Recrushing/Screening
30502003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Tertiary Crushing/Screening
30502002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Secondary Crushing/Screening

30502001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Primary Crushing
30502000	Industrial Processes;Mineral Products;Stone Quarrying - Processing (See also 305320);undefined

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Mechanical Shaker Cleaned Type," August 2000.

Other information:

ADMIN_PCT:	2.07%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS: The costs for mechanical shaker cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $8 to $71 per scfm
Typical value is $29 per scfm

O&M Costs:

Range from $4 to $24 per scfm
Typical value is $11 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.0671	$/kW-hr
Compressed air	0.25	$/1000 scf
Dust disposal	25	$/ton disposed

Note: All costs are in 1998 dollars.

CPTON_H:	$303/ton
CPTON_L:	$37/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $37 to $303 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $126 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.56%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	4.15%
MNTLBR_PCT:	5.25%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.97%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.07%
RPLMTL_PCT:	9.03%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	82.74%
TINDIR_PCT:	17.26%
UTIL_PCT:	0%
WSTDSP_PCT:	55.19%

Summary:

Control Measure Name:	Fabric Filter (Pulse Jet Type);(PM10) Grain Milling
Abbreviation:	PFFPJGRMG
Description:	Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake. This control applies to grain milling operations, including (but not limited to), wheat, dry corn, wet corn, rice, and soybean operations. Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998). During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake. There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake. Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM10
Equipment Life:	20.0 years
Control Technology:	Fabric Filter (Pulse Jet Type)
Source Group:	Grain Milling
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI

Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A
Cost Year:	1998	1998	1998	1998
CPT:		$117		$117
Ref Yr CPT:		$159		$159
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	7.0	7.0	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI

PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0
N/A
Cost Year:
N/A
N/A
N/A
N/A
CPT:
Ref Yr CPT:
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0

100.0
100.0
100.0
Equation Type:
Capital Rec Fac:
N/A
N/A
N/A
N/A
Discount Rate:
N/A
N/A
N/A
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM10
Cost Year	1998
Typical Capital Control Cost Factor	13.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	380.0
Typical Default CPT Factor - O&M	28.0
Typical Default CPT Factor - Annualized	117.0

Affected SCCs:

Code	Description
30200701	Industrial Processes; Food and Agriculture; Grain Millings; General **
30200702	Industrial Processes; Food and Agriculture; Grain Millings; General **
30200703	Industrial Processes; Food and Agriculture; Grain Millings; Barley Cleaning
30200704	Industrial Processes; Food and Agriculture; Grain Millings; Milo Cleaning
30200705	Industrial Processes; Food and Agriculture; Grain Millings; Barley Flour Mill
30200706	Industrial Processes; Food and Agriculture; Grain Millings; Barley: Receiving
30200707	Industrial Processes; Food and Agriculture; Grain Millings; Barley: Bulk Loading
30200708	Industrial Processes; Food and Agriculture; Grain Millings; Barley Malting: Grain Receiving
30200709	Industrial Processes; Food and Agriculture; Grain Millings; Barley Malting: Gas-fired Malt Kiln
30200710	Industrial Processes; Food and Agriculture; Grain Millings; Milo: Receiving
30200711	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Grain Receiving
30200712	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Precleaning/Handling
30200713	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Cleaning House
30200714	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Millhouse
30200721	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Grain Receiving
30200722	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Precleaning/Handling
30200723	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Cleaning House
30200724	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Millhouse
30200730	Industrial Processes; Food and Agriculture; Grain Millings; General **
30200731	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Grain Receiving
30200732	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Precleaning/Handling
30200733	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Cleaning House
30200734	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Millhouse

30200740	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Silo Storage
30200741	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Grain Receiving
30200742	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Grain Drying
30200743	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Precleaning/Handling
30200744	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Cleaning House
30200745	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Degerming and Milling
30200746	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Bulk Loading
30200747	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Pneumatic Conveyor
30200748	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Grinding
30200751	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Grain Receiving
30200752	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Grain Handling
30200753	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Grain Cleaning
30200754	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Dryers
30200755	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Bulk Loading
30200756	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Milling
30200757	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Mixing Tank
30200758	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Extruder
30200759	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Kettle Cooker
30200760	Industrial Processes; Food and Agriculture; Grain Millings; Oat: General
30200761	Industrial Processes; Food and Agriculture; Grain Millings; Steeping: Grain Conditioning in Tanks Containing Dilute Sulfurous Acid
30200762	Industrial Processes; Food and Agriculture; Grain Millings; Evaporators: Concentrate Steepwater to 30-55 % Solids by Evaporation
30200763	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Feed Drying: Direct-fired Dryer - Produces Corn Gluten Feed
30200764	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Feed Drying: Indirect-fired Dryer - Produces Corn Gluten Feed
30200765	Industrial Processes; Food and Agriculture; Grain Millings; Degerminating Mills: Separates Germ from Starch and Gluten
30200766	Industrial Processes; Food and Agriculture; Grain Millings; Germ Drying: Drying Germ from Degerminating Mills
30200767	Industrial Processes; Food and Agriculture; Grain Millings; Fiber Drying: Drying Corn Hulls after Separation from Starch & Gluten
30200768	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Drying: Direct-fired Dryer - Produces Corn Gluten Meal
30200769	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Drying: Indirect-fired Dryer - Produces Corn Gluten Meal
30200770	Industrial Processes; Food and Agriculture; Grain Millings; Dextrose Drying
30200771	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Grain Receiving
30200772	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Precleaning/Handling
30200773	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Drying
30200774	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Cleaning/Millhouse
30200775	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Paddy Cleaning

30200776	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Mill House
30200777	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Aspirator
30200778	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Cleaning/Millhouse
30200781	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Grain Receiving
30200782	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Grain Handling
30200783	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Grain Cleaning
30200784	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Drying
30200785	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Cracking and Dehulling
30200786	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Hull Grinding
30200787	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Bean Conditioning
30200788	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Flaking
30200789	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Meal Dryer
30200790	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Meal Cooler
30200791	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Bulk Loading
30200792	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: White Flake Cooler
30200793	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Meal Grinder/Sizing
30200799	Industrial Processes; Food and Agriculture; Grain Millings; See Comments **

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	0.91%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for pulse-jet cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $6 to $26 per scfm Typical value is $13 per scfm O&M Costs: Range from $5 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$266/ton
CPTON_L:	$42/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $42 to $266 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $117 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	15%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.83%
MNTLBR_PCT:	5%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.45%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.91%
RPLMTL_PCT:	3.9%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	87.9%
TINDIR_PCT:	12.1%
UTIL_PCT:	3.59%
WSTDSP_PCT:	51.33%

Summary:

Control Measure Name: Fabric Filter (Pulse Jet Type);(PM10) Mineral Products - Stone Quarrying & Processing

Abbreviation: PFFPJMISQ

Description: Application: This control is the addition of a pulse-jet cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Particulate-laden gas flows into the filter bag from the outside to the inside. The particles collected on the outside drop into a hopper below the fabric filter. During pulse-jet cleaning, a short burst of high pressure air is injected into the bags, dislodging the dust cake.

This control applies to stone quarrying and processing operations. Nonmetallic Mineral Processing (305020) - ore crushing, grinding, and screening, and Calciners (SCC 305150) and Dryers (SCC 30502012) are considered in this category, among others. Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions.

Discussion: Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Pulse-jet cleaning of fabric filters is a relatively new type of fabric filter, as they have only been used for the past 30 years. This cleaning mechanism has grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters (EPA, 2000). Particulate-laden gas flows into the bag. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles collected on the outside drop into a hopper below the fabric filter (EPA, 1998b).

During pulse-jet cleaning, a short burst of high pressure air is injected into the bags (EPA, 1998b). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric dislodging the dust cake.

There are several unique attributes of pulse-jet cleaning. The cleaning pulse is very brief allowing the flow of dusty gas to continue during cleaning. The bags not being cleaned continue to filter, taking on extra duty from the bags being cleaned (EPA, 2000). Pulse-jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods. The cleaning dislodges nearly all of the dust cake each time the bag is pulsed. Pulse-jet filters, as a result, do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in these types of filters because they do not require a dust cake.

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulsejet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable (EPA, 1998).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM10

Equipment Life: 20.0 years

Control Technology: Fabric Filter (Pulse Jet Type)

Source Group: Mineral Products - Stone Quarrying & Processing
Sectors: ptnonipm
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	1998	1998	1998
CPT:	$117		$117	
Ref Yr CPT:	$159		$159	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	7.0	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A

Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:				
PM25-PRI				
PM25-PRI				
PM2_5				
PM2_5				
Locale:				
Effective Date:				
2020-01-01 00:00:00.0				
N/A				
N/A				
2020-01-01 00:00:00.0				
Cost Year:				
N/A				
N/A				
N/A				
N/A				
CPT:				
Ref Yr CPT:				
Control Efficiency:				
99.5				
99.0				
99.0				
99.5				
Min Emis:				
N/A				
N/A				
N/A				
N/A				
Max Emis:				
N/A				
N/A				
N/A				
N/A				
Rule Effectiveness:				

100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
Capital Rec Fac:
N/A
N/A
N/A
N/A
Discount Rate:
N/A
N/A
N/A
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM10
Cost Year	1998
Typical Capital Control Cost Factor	13.0
Typical O&M Control Cost Factor	11.0
Typical Default CPT Factor - Capital	380.0
Typical Default CPT Factor - O&M	28.0
Typical Default CPT Factor - Annualized	117.0

Affected SCCs:

Code	Description
30502099	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Not Classified **
30502090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30502033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Front End Loader
30502032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Conveyor
30502031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Unloading
30502021	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Screening
30502018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drilling with Liquid Injection
30502016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Revolving Screens
30502015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Vibrating Screens
30502014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Shaker Screens
30502013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Bar Grizzlies
30502012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drying

30502007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Open Storage
30502006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Miscellaneous Operations: Screen/Convey/Handling
30502005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Mill
30502004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Recrushing/Screening
30502003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Tertiary Crushing/Screening
30502002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Secondary Crushing/Screening
30502001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Primary Crushing
30502000	Industrial Processes;Mineral Products;Stone Quarrying - Processing (See also 305320);undefined

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Pulse-Jet Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	0.91%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for pulse-jet cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $6 to $26 per scfm Typical value is $13 per scfm O&M Costs: Range from $5 to $24 per scfm Typical value is $11 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$266/ton
CPTON_L:	$42/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $42 to $266 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $117 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	15%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.83%
MNTLBR_PCT:	5%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.05%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	3.86%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.45%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.91%
RPLMTL_PCT:	3.9%
RULE:	Not Applicable
SPVLBR_PCT:	0.01%
STEAM_PCT:	0%
TDIR_PCT:	87.9%
TINDIR_PCT:	12.1%
UTIL_PCT:	3.59%
WSTDSP_PCT:	51.33%

Summary:

Control Measure Name: Fabric Filter - Reverse-Air Cleaned Type;(PM10) Grain Milling

Abbreviation: PFFRAGRMG

Description: Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection.

This control applies to grain milling operations, including (but not limited to), wheat, dry corn, wet corn, rice, and soybean operations.

Discussion: In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000)

Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000).

The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b).

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)

Class: Known

Pollutant: PM10

Equipment Life: 20.0 years

Control Technology: Fabric Filter - Reverse-Air Cleaned Type

Source Group: Grain Milling

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	1998	1998	1998	1998
CPT:	$148		$148	
Ref Yr CPT:	$201		$201	
Control Efficiency:	99.0	99.5	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A

Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	0.09000000357627869	N/A	0.09000000357627869	N/A
Discount Rate:	7.0	7.0	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
2020-01-01 00:00:00.0

N/A
Cost Year:
N/A
N/A
N/A
N/A
CPT:
Ref Yr CPT:
Control Efficiency:
99.0
99.5
99.5
99.0
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0
100.0
Equation Type:
Capital Rec Fac:
N/A
N/A

N/A
N/A
Discount Rate:
N/A
N/A
N/A
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM10
Cost Year	1998
Typical Capital Control Cost Factor	34.0

Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30200701	Industrial Processes; Food and Agriculture; Grain Millings; General **
30200702	Industrial Processes; Food and Agriculture; Grain Millings; General **
30200703	Industrial Processes; Food and Agriculture; Grain Millings; Barley Cleaning
30200704	Industrial Processes; Food and Agriculture; Grain Millings; Milo Cleaning
30200705	Industrial Processes; Food and Agriculture; Grain Millings; Barley Flour Mill
30200706	Industrial Processes; Food and Agriculture; Grain Millings; Barley: Receiving
30200707	Industrial Processes; Food and Agriculture; Grain Millings; Barley: Bulk Loading
30200708	Industrial Processes; Food and Agriculture; Grain Millings; Barley Malting: Grain Receiving
30200709	Industrial Processes; Food and Agriculture; Grain Millings; Barley Malting: Gas-fired Malt Kiln
30200710	Industrial Processes; Food and Agriculture; Grain Millings; Milo: Receiving
30200711	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Grain Receiving
30200712	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Precleaning/Handling
30200713	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Cleaning House
30200714	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Millhouse
30200721	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Grain Receiving
30200722	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Precleaning/Handling
30200723	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Cleaning House
30200724	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Millhouse
30200730	Industrial Processes; Food and Agriculture; Grain Millings; General **
30200731	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Grain Receiving
30200732	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Precleaning/Handling
30200733	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Cleaning House
30200734	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Millhouse
30200740	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Silo Storage
30200741	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Grain Receiving
30200742	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Grain Drying
30200743	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Precleaning/Handling
30200744	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Cleaning House
30200745	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Degerming and Milling
30200746	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Bulk Loading
30200747	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Pneumatic Conveyor

30200748	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Grinding
30200751	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Grain Receiving
30200752	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Grain Handling
30200753	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Grain Cleaning
30200754	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Dryers
30200755	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Bulk Loading
30200756	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Milling
30200757	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Mixing Tank
30200758	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Extruder
30200759	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Kettle Cooker
30200760	Industrial Processes; Food and Agriculture; Grain Millings; Oat: General
30200761	Industrial Processes; Food and Agriculture; Grain Millings; Steeping: Grain Conditioning in Tanks Containing Dilute Sulfurous Acid
30200762	Industrial Processes; Food and Agriculture; Grain Millings; Evaporators: Concentrate Steepwater to 30-55 % Solids by Evaporation
30200763	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Feed Drying: Direct-fired Dryer - Produces Corn Gluten Feed
30200764	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Feed Drying: Indirect-fired Dryer - Produces Corn Gluten Feed
30200765	Industrial Processes; Food and Agriculture; Grain Millings; Degerminating Mills: Separates Germ from Starch and Gluten
30200766	Industrial Processes; Food and Agriculture; Grain Millings; Germ Drying: Drying Germ from Degerminating Mills
30200767	Industrial Processes; Food and Agriculture; Grain Millings; Fiber Drying: Drying Corn Hulls after Separation from Starch & Gluten
30200768	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Drying: Direct-fired Dryer - Produces Corn Gluten Meal
30200769	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Drying: Indirect-fired Dryer - Produces Corn Gluten Meal
30200770	Industrial Processes; Food and Agriculture; Grain Millings; Dextrose Drying
30200771	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Grain Receiving
30200772	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Precleaning/Handling
30200773	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Drying
30200774	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Cleaning/Millhouse
30200775	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Paddy Cleaning
30200776	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Mill House
30200777	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Aspirator
30200778	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Cleaning/Millhouse
30200781	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Grain Receiving
30200782	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Grain Handling
30200783	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Grain Cleaning
30200784	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Drying
30200785	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Cracking and Dehulling

30200786	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Hull Grinding
30200787	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Bean Conditioning
30200788	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Flaking
30200789	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Meal Dryer
30200790	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Meal Cooler
30200791	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Bulk Loading
30200792	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: White Flake Cooler
30200793	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Meal Grinder/Sizing
30200799	Industrial Processes; Food and Agriculture; Grain Millings; See Comments **

References:

- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS: The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001).

Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001).

The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included.

Capital Costs:

Range from $9 to $84 per scfm
Typical value is $34 per scfm

O&M Costs:

Range from $6 to $27 per scfm
Typical value is $13 per scfm

O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal:

Electricity price	0.0671	$/kW-hr
Compressed air	0.25	$/1000 scf
Dust disposal	25	$/ton disposed

Note: All costs are in 1998 dollars.

CPTON_H: $337/ton

CPTON_L: $53/ton

CPTON_TEXT: When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)

CTRL_EFF_T: 99%

EC: Co

ELEC_PCT: 30.54%

ELEC_RT: $0.07/kWh

FUEL_PCT: 0%

HG_CE_T: 99%

INSRNC_PCT: 2.91%

MNTLBR_PCT: 4.02%

MNTLBR_RT: $17.74/hr

MNTMTL_PCT: 0.04%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name:	Fabric Filter - Reverse-Air Cleaned Type;(PM10) Mineral Products - Stone Quarrying & Processing
Abbreviation:	PFFRAMISQ
Description:	Application: This control is the use of a reverse-air cleaned fabric filter to reduce PM emissions from waste streams. In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection. This control applies to ferroalloy production operations, including (but not limited to) nonmetallic mineral processing (305020) - ore crushing, grinding, and screening, and calciners (SCC 305150) and dryers (SCC 30502012). Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions. Discussion: Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996). In a fabric filter, flue gas is passed through a tightly woven or felted fabric, collecting PM by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with many individual filter units together in a group. Bags are the most common type of filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. (EPA, 2000) Reverse-air cleaning is a popular filter cleaning method as it has been used extensively and improved over the years. It is a gentler but sometimes less effective clearing mechanism than mechanical shaking. Reverse-air cleaning is performed by forcing clean air through the filters in the opposite direction of the dusty gas flow. The change in direction of the gas flow causes the bag to flex and crack the filter cake allowing for internal cake collection (EPA, 2000). The most common design is to have separate compartments within the fabric filter so that each can be isolated and cleaned separately while the others continue to treat the dusty gas. There are several methods of reversing the flow through the filters. One method of providing the reverse flow is by the use of a fan or cleaned gas from other compartments. Reverse-air cleaning only used alone in cases where the dust releases easily from the fabric. In many instances, reverse-air is used along with shaking, pulsing or sonic horns (EPA, 1998b). Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters are useful in controlling particulate matter less than or equal to 10 micrometers (m) in diameter (PM10) and particulate matter less than or equal to 2.5 m in diameter (PM2.5). Fabric filters may be good candidates for collecting fly ash from low-sulfur coals or containing high unburned carbon levels and are relatively difficult to collect with electrostatic precipitators. (EPA, 2000)
Class:	Known
Pollutant:	PM10
Equipment Life:	20.0 years
Control Technology:	Fabric Filter - Reverse-Air Cleaned Type
Source Group:	Mineral Products - Stone Quarrying & Processing
Sectors:	ptnonipm
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0	N/A

Cost Year:	1998	1998	1998	1998
CPT:		$148		$148
Ref Yr CPT:		$201		$201
Control Efficiency:	99.5	99.0	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	N/A	0.09000000357627869	N/A	0.09000000357627869
Discount Rate:	7.0	7.0	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	2020-01-01 00:00:00.0	N/A	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	99.5	99.0	99.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI
PM25-PRI
PM2_5
PM2_5

Locale:
Effective Date:
2020-01-01 00:00:00.0
N/A
N/A
2020-01-01 00:00:00.0
Cost Year:
N/A
N/A
N/A
N/A
CPT:
Ref Yr CPT:
Control Efficiency:
99.5
99.0
99.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:
100.0
100.0
100.0

100.0
Equation Type:
Capital Rec Fac:
N/A
N/A
N/A
N/A
Discount Rate:
N/A
N/A
N/A
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incrememental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM10
Cost Year	1998
Typical Capital Control Cost Factor	34.0
Typical O&M Control Cost Factor	13.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	148.0

Affected SCCs:

Code	Description
30502099	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Not Classified **
30502090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30502033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Front End Loader
30502032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Conveyor
30502031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Unloading
30502021	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Screening
30502018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drilling with Liquid Injection
30502016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Revolving Screens
30502015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Vibrating Screens
30502014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Shaker Screens
30502013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Bar Grizzlies
30502012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drying
30502007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Open Storage
30502006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Miscellaneous Operations: Screen/Convey/Handling
30502005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Mill

30502004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Recrushing/Screening
30502003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Tertiary Crushing/Screening
30502002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Secondary Crushing/Screening
30502001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Primary Crushing
30502000	Industrial Processes;Mineral Products;Stone Quarrying - Processing (See also 305320);undefined

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Fabric Filter - Reverse-Air Cleaned Type," April 2000.

Other information:

ADMIN_PCT:	1.46%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs for reverse-air cleaned systems are generated using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $9 to $84 per scfm Typical value is $34 per scfm O&M Costs: Range from $6 to $27 per scfm Typical value is $13 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average bag cost was estimated using the costs for standard bag types. Capital recovery for the periodic replacement of bags was included in the O&M cost of the bags using a bag life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$337/ton
CPTON_L:	$53/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $53 to $337 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $148 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	30.54%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.91%
MNTLBR_PCT:	4.02%
MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	0.04%

NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.89%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	6.82%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	1.46%
RPLMTL_PCT:	3.92%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	87.36%
TINDIR_PCT:	12.64%
UTIL_PCT:	0%
WSTDSP_PCT:	41.53%

Summary:

Control Measure Name: Hot Asphalt Paving;Unpaved Roads (UnKnown 1)

Abbreviation: PUHAP270

Description: Application: This control is the paving of unpaved roads with hot asphalt. Hot asphalt paving is based on the use of paving materials which meet RACT requirements and thereby do not emit VOCs. Hot asphalt paving was selected as the control option for urban areas.

This control measure applies to all unpaved roads classified under SCC 2296000000.

Discussion: This control technique is not applied in rural areas because of the high cost relative to the emission reduction potential.

Class: Known

Pollutant: PM10

Equipment Life: 40.0 years

Control Technology: Hot Asphalt Paving

Source Group: Unpaved Road

Sectors: afdust

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM25-PRI	PM10-PRI	PM10	PM2_5
Maximum Control Efficiency:	82.0	69.0	69.0	82.0
Minimum Control Efficiency:	59.0	66.0	66.0	59.0
Average Control Efficiency:	69.78431701660156	67.94117736816406	67.94117736816406	69.78431701660156
Maximum CPT:		$1,342	$1,342	
Minimum CPT:		$440	$440	
Average CPT:		$873	$873	
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2296010000	Mobile Sources; Unpaved Roads; Industrial Unpaved Roads; Total: Fugitives
2296005000	Mobile Sources; Unpaved Roads; Public Unpaved Roads; Total: Fugitives
2296000000	Mobile Sources; Unpaved Roads; All Unpaved Roads; Total: Fugitives

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1995: E.H. Pechan & Associates, Inc., "Regional Particulate Strategies - Draft Report," prepared for U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation, Washington, DC, September 1995.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	67.5%
OMATL_PCT:	0%
OMCPTON:	$346/ton
OPLBR_PCT:	0%
PM10:	Co*
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 68% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	In determining per VMT cost, average daily traffic (ADT) is assumed to be 400 for urban roads (Pechan, 1995). The cost of hot asphalt paving is $0.08 per VMT (Pechan, 1995). Once the control options have been weighted the annual cost for urban areas is $0.09 per VMT. The capital cost is determined in a similar manner to the annual costs, resulting in a total capital cost of $0.43 per VMT.
CPTON_TEXT:	The cost effectiveness per ton PM10 reduced is $537 (1990$).
OPLBR_RT:	$0/hr
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	67.5%
INSRNC_PCT:	0%

MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Hot Asphalt Paving;Unpaved Roads (UnKnown 2)
Abbreviation:	PUHAP290
Description:	Application: This control is the paving of unpaved roads with hot asphalt. Hot asphalt paving is based on the use of paving materials which meet RACT requirements and thereby do not emit VOCs. Hot asphalt paving was selected as the control option for urban areas. This control measure applies to all unpaved roads classified under SCC 2296000000. Discussion: This control technique is not applied in rural areas because of the high cost relative to the emission reduction potential.
Class:	Known
Pollutant:	PM10
Equipment Life:	40.0 years
Control Technology:	Hot Asphalt Paving
Source Group:	Unpaved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM25-PRI	PM10-PRI	PM2_5	PM10
Maximum Control Efficiency:	85.0	69.0	85.0	69.0
Minimum Control Efficiency:	53.0	61.0	53.0	61.0
Average Control Efficiency:	64.66666412353516	66.78431701660156	64.66666412353516	66.78431701660156
Maximum CPT:		$2,155		$2,155
Minimum CPT:		$197		$197
Average CPT:		$914		$914
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2296010000	Mobile Sources; Unpaved Roads; Industrial Unpaved Roads; Total: Fugitives
2296005000	Mobile Sources; Unpaved Roads; Public Unpaved Roads; Total: Fugitives
2296000000	Mobile Sources; Unpaved Roads; All Unpaved Roads; Total: Fugitives

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1995: E.H. Pechan & Associates, Inc., "Regional Particulate Strategies - Draft Report," prepared for U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation, Washington, DC, September 1995.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	67.5%
OC:	Co
OMATL_PCT:	0%
OMCPTON:	$346/ton
OPLBR_PCT:	0%
PM10:	Co*
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 68% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	In determining per VMT cost, average daily traffic (ADT) is assumed to be 400 for urban roads (Pechan, 1995). The cost of hot asphalt paving is $0.08 per VMT (Pechan, 1995). Once the control options have been weighted the annual cost for urban areas is $0.09 per VMT. The capital cost is determined in a similar manner to the annual costs, resulting in a total capital cost of $0.43 per VMT.
CPTON_TEXT:	The cost effectiveness per ton PM10 reduced is $537 (1990$).
OPLBR_RT:	$0/hr
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	67.5%

INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Hot Asphalt Paving;Unpaved Roads (UnKnown 3)
Abbreviation:	PUHAP310
Description:	Application: This control is the paving of unpaved roads with hot asphalt. Hot asphalt paving is based on the use of paving materials which meet RACT requirements and thereby do not emit VOCs. Hot asphalt paving was selected as the control option for urban areas. This control measure applies to all unpaved roads classified under SCC 2296000000. Discussion: This control technique is not applied in rural areas because of the high cost relative to the emission reduction potential.
Class:	Known
Pollutant:	PM10
Equipment Life:	40.0 years
Control Technology:	Hot Asphalt Paving
Source Group:	Unpaved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10	PM2_5	PM10-PRI	PM25-PRI
Maximum Control Efficiency:	69.0	91.0	69.0	91.0
Minimum Control Efficiency:	52.0	41.0	52.0	41.0
Average Control Efficiency:	66.2549057006836	61.09803771972656	66.2549057006836	61.09803771972656
Maximum CPT:	$2,178		$2,178	
Minimum CPT:	$354		$354	
Average CPT:	$960		$960	
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2296010000	Mobile Sources; Unpaved Roads; Industrial Unpaved Roads; Total: Fugitives
2296005000	Mobile Sources; Unpaved Roads; Public Unpaved Roads; Total: Fugitives
2296000000	Mobile Sources; Unpaved Roads; All Unpaved Roads; Total: Fugitives

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1995: E.H. Pechan & Associates, Inc., "Regional Particulate Strategies - Draft Report," prepared for U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation, Washington, DC, September 1995.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	67.5%
OC:	Co
OMATL_PCT:	0%
OMCPTON:	$346/ton
OPLBR_PCT:	0%
PM10:	Co*
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 68% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	In determining per VMT cost, average daily traffic (ADT) is assumed to be 400 for urban roads (Pechan, 1995). The cost of hot asphalt paving is $0.08 per VMT (Pechan, 1995). Once the control options have been weighted the annual cost for urban areas is $0.09 per VMT. The capital cost is determined in a similar manner to the annual costs, resulting in a total capital cost of $0.43 per VMT.
CPTON_TEXT:	The cost effectiveness per ton PM10 reduced is $537 (1990$).
OPLBR_RT:	$0/hr
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	67.5%

INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Hot Asphalt Paving;Unpaved Roads (UnKnown 4)
Abbreviation:	PUHAP330
Description:	Application: This control is the paving of unpaved roads with hot asphalt. Hot asphalt paving is based on the use of paving materials which meet RACT requirements and thereby do not emit VOCs. Hot asphalt paving was selected as the control option for urban areas. This control measure applies to all unpaved roads classified under SCC 2296000000. Discussion: This control technique is not applied in rural areas because of the high cost relative to the emission reduction potential.
Class:	Known
Pollutant:	PM10
Equipment Life:	40.0 years
Control Technology:	Hot Asphalt Paving
Source Group:	Unpaved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM25-PRI	PM10-PRI	PM10	PM2_5
Maximum Control Efficiency:	62.0	68.0	68.0	62.0
Minimum Control Efficiency:	42.0	52.0	52.0	42.0
Average Control Efficiency:	58.39215850830078	66.35294342041016	66.35294342041016	58.39215850830078
Maximum CPT:		$2,168	$2,168	
Minimum CPT:		$450	$450	
Average CPT:		$1,011	$1,011	
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2296010000	Mobile Sources; Unpaved Roads; Industrial Unpaved Roads; Total: Fugitives
2296005000	Mobile Sources; Unpaved Roads; Public Unpaved Roads; Total: Fugitives
2296000000	Mobile Sources; Unpaved Roads; All Unpaved Roads; Total: Fugitives

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1995: E.H. Pechan & Associates, Inc., "Regional Particulate Strategies - Draft Report," prepared for U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation, Washington, DC, September 1995.

Other information:

OPLBR_RT:	$0/hr
WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	67.5%
OC:	Co
OMATL_PCT:	0%
OMCPTON:	$346/ton
OPLBR_PCT:	0%
PM10:	Co*
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 68% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	In determining per VMT cost, average daily traffic (ADT) is assumed to be 400 for urban roads (Pechan, 1995). The cost of hot asphalt paving is $0.08 per VMT (Pechan, 1995). Once the control options have been weighted the annual cost for urban areas is $0.09 per VMT. The capital cost is determined in a similar manner to the annual costs, resulting in a total capital cost of $0.43 per VMT.
CPTON_TEXT:	The cost effectiveness per ton PM10 reduced is $537 (1990$).
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	67.5%

INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OTHR_PCT:	0%
OVRHD_PCT:	0%
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name: Paper/Nonwoven Filters - Cartridge Collector Type;(PM10) Grain Milling

Abbreviation: PPFCCGRMG

Description: Application: This control is the use of paper or non-woven filters (cartridge collector type) to reduce PM emissions. The waste gas stream is passed through the fibrous filter media causing PM in the gas stream to be collected on the media by sieving and other mechanisms.

This control measure applies to grain milling operations, including those involved with the production of wheat, corn, rice, and soybeans, among others.

Discussion: The cost estimates assume a conventional design under typical operating conditions. Auxiliary equipment, such as fans and ductwork, is not included (EPA, 2000). Pollutants that require an unusually high level of control or that require the filter media or the unit itself to be constructed of special materials, such as Nomex or stainless steel, will increase the costs of the system (EPA, 1998). In general, a small unit controlling a low pollutant loading will not be as cost effective as a large unit controlling a high pollutant loading (EPA, 2000).

Cartridge filters contain either a paper or nonwoven fibrous filter media (EPA, 2000). Paper media is generally made of materials such as cellulose and fiberglass. The dust cake that forms on the filter media from the collected PM can significantly increase collection efficiency (EPA, 1998b).

In general, the filter media is pleated to provide a larger surface area to volume flow rate. Close pleating, however, can cause PM to bridge the pleat bottom, effectively reducing the surface collection area (EPA, 1998b). Corrugated aluminum separators are used to prevent the pleats from collapsing (Heumann, 1997). There are variety of cartridge designs and dimensions. Typical designs include flat panels, V-shaped packs or cylindrical packs (Heumann, 1997). For certain applications, two cartridges may be placed in series.

Cartridge collectors are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators (STAPPA/ALAPCO, 1996). For similar air flow rates, cartridge collectors are compact in size compared to traditional bag

Class: Known

Pollutant: PM10

Equipment Life: 20.0 years

Control Technology: Paper/Nonwoven Filters - Cartridge Collector Type

Source Group: Grain Milling

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	1998	1998	N/A	N/A
CPT:	$142	$142		
Ref Yr CPT:	$193	$193		
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton		

Capital Rec Fac:	0.09000000357627869	0.09000000357627869	N/A	N/A
Discount Rate:	7.0	7.0	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	1998	1998	N/A	N/A
CPT:	$142	$142		
Ref Yr CPT:	$193	$193		
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton		
Capital Rec Fac:	0.09000000357627869	0.09000000357627869	N/A	N/A
Discount Rate:	7.0	7.0	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:
Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM10
Cost Year	1998
Typical Capital Control Cost Factor	9.0

Typical O&M Control Cost Factor	14.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	142.0

Affected SCCs:

Code	Description
30200701	Industrial Processes; Food and Agriculture; Grain Millings; General **
30200702	Industrial Processes; Food and Agriculture; Grain Millings; General **
30200703	Industrial Processes; Food and Agriculture; Grain Millings; Barley Cleaning
30200704	Industrial Processes; Food and Agriculture; Grain Millings; Milo Cleaning
30200705	Industrial Processes; Food and Agriculture; Grain Millings; Barley Flour Mill
30200706	Industrial Processes; Food and Agriculture; Grain Millings; Barley: Receiving
30200707	Industrial Processes; Food and Agriculture; Grain Millings; Barley: Bulk Loading
30200708	Industrial Processes; Food and Agriculture; Grain Millings; Barley Malting: Grain Receiving
30200709	Industrial Processes; Food and Agriculture; Grain Millings; Barley Malting: Gas-fired Malt Kiln
30200710	Industrial Processes; Food and Agriculture; Grain Millings; Milo: Receiving
30200711	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Grain Receiving
30200712	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Precleaning/Handling
30200713	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Cleaning House
30200714	Industrial Processes; Food and Agriculture; Grain Millings; Durum Milling: Millhouse
30200721	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Grain Receiving
30200722	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Precleaning/Handling
30200723	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Cleaning House
30200724	Industrial Processes; Food and Agriculture; Grain Millings; Rye: Millhouse
30200730	Industrial Processes; Food and Agriculture; Grain Millings; General **
30200731	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Grain Receiving
30200732	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Precleaning/Handling
30200733	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Cleaning House
30200734	Industrial Processes; Food and Agriculture; Grain Millings; Wheat: Millhouse
30200740	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Silo Storage
30200741	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Grain Receiving
30200742	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Grain Drying
30200743	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Precleaning/Handling
30200744	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Cleaning House
30200745	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Degerming and Milling
30200746	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Bulk Loading
30200747	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Pneumatic Conveyor

30200748	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Grinding
30200751	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Grain Receiving
30200752	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Grain Handling
30200753	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Grain Cleaning
30200754	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Dryers
30200755	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Bulk Loading
30200756	Industrial Processes; Food and Agriculture; Grain Millings; Wet Corn Milling: Milling
30200757	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Mixing Tank
30200758	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Extruder
30200759	Industrial Processes; Food and Agriculture; Grain Millings; Dry Corn Milling: Kettle Cooker
30200760	Industrial Processes; Food and Agriculture; Grain Millings; Oat: General
30200761	Industrial Processes; Food and Agriculture; Grain Millings; Steeping: Grain Conditioning in Tanks Containing Dilute Sulfurous Acid
30200762	Industrial Processes; Food and Agriculture; Grain Millings; Evaporators: Concentrate Steepwater to 30-55 % Solids by Evaporation
30200763	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Feed Drying: Direct-fired Dryer - Produces Corn Gluten Feed
30200764	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Feed Drying: Indirect-fired Dryer - Produces Corn Gluten Feed
30200765	Industrial Processes; Food and Agriculture; Grain Millings; Degerminating Mills: Separates Germ from Starch and Gluten
30200766	Industrial Processes; Food and Agriculture; Grain Millings; Germ Drying: Drying Germ from Degerminating Mills
30200767	Industrial Processes; Food and Agriculture; Grain Millings; Fiber Drying: Drying Corn Hulls after Separation from Starch & Gluten
30200768	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Drying: Direct-fired Dryer - Produces Corn Gluten Meal
30200769	Industrial Processes; Food and Agriculture; Grain Millings; Gluten Drying: Indirect-fired Dryer - Produces Corn Gluten Meal
30200770	Industrial Processes; Food and Agriculture; Grain Millings; Dextrose Drying
30200771	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Grain Receiving
30200772	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Precleaning/Handling
30200773	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Drying
30200774	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Cleaning/Millhouse
30200775	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Paddy Cleaning
30200776	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Mill House
30200777	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Aspirator
30200778	Industrial Processes; Food and Agriculture; Grain Millings; Rice: Cleaning/Millhouse
30200781	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Grain Receiving
30200782	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Grain Handling
30200783	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Grain Cleaning
30200784	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Drying
30200785	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Cracking and Dehulling

30200786	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Hull Grinding
30200787	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Bean Conditioning
30200788	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Flaking
30200789	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Meal Dryer
30200790	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Meal Cooler
30200791	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Bulk Loading
30200792	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: White Flake Cooler
30200793	Industrial Processes; Food and Agriculture; Grain Millings; Soybean: Meal Grinder/Sizing
30200799	Industrial Processes; Food and Agriculture; Grain Millings; See Comments **

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Cartridge Collector with Pulse-Jet Cleaning," April 2000.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.87%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs are generated using EPAGÇÖs cost-estimating spreadsheets for fabric filters (EPA, 1998a). Costs are primarily driven by the waste stream volumetric flow rate and pollutant loading. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $7 to $13 per scfm Typical value is $9 per scfm O&M Costs: Range from $9 to $25 per scfm Typical value is $14 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average cartridge cost was estimated using the costs for standard cartridge types. Capital recovery for the periodic replacement of cartridges was included in the O&M cost of the cartridges using a cartridge life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$256/ton
CPTON_L:	$85/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $85 to $256 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $142 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	10.14%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.74%
MNTLBR_PCT:	5.71%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	5.71%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.95%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.89%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.87%
RPLMTL_PCT:	17.49%
RULE:	Not Applicable
SPVLBR_PCT:	0.44%
STEAM_PCT:	0%
TDIR_PCT:	87.63%
TINDIR_PCT:	12.37%
UTIL_PCT:	2.96%
WSTDSP_PCT:	42.24%

Summary:

Control Measure Name: Paper/Nonwoven Filters - Cartridge Collector Type;(PM10) Mineral Products - Stone Quarrying & Processing

Abbreviation: PPFCCMISQ

Description: Application: This control is the use of paper or non-woven filters (cartridge collector type) to reduce PM emissions. The waste gas stream is passed through the fibrous filter media causing PM in the gas stream to be collected on the media by sieving and other mechanisms.

This control measure applies to stone quarrying and processing operations. Nonmetallic mineral processing (305020) operations include, but are not limited to, ore crushing, grinding, and screening, and calciners (SCC 305150) and dryers (SCC 30502012).

Discussion: Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions. Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

The cost estimates assume a conventional design under typical operating conditions. Auxiliary equipment, such as fans and ductwork, is not included (EPA, 2000). Pollutants that require an unusually high level of control or that require the filter media or the unit itself to be constructed of special materials, such as Nomex or stainless steel, will increase the costs of the system (EPA, 1998). In general, a small unit controlling a low pollutant loading will not be as cost effective as a large unit controlling a high pollutant loading (EPA, 2000).

Cartridge filters contain either a paper or nonwoven fibrous filter media (EPA, 2000). Paper media is generally made of materials such as cellulose and fiberglass. The dust cake that forms on the filter media from the collected PM can significantly increase collection efficiency (EPA, 1998).

In general, the filter media is pleated to provide a larger surface area to volume flow rate. Close pleating, however, can cause PM to bridge the pleat bottom, effectively reducing the surface collection area (EPA, 1998b). Corrugated aluminum separators are used to prevent the pleats from collapsing (Heumann, 1997). There are variety of cartridge designs and dimensions. Typical designs include flat panels, V-shaped packs or cylindrical packs (Heumann, 1997). For certain applications, two cartridges may be placed in series.

Cartridge collectors are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators (STAPPA/ALAPCO, 1996). For similar air flow rates, cartridge collectors are compact in size compared to traditional bag

Class: Known

Pollutant: PM10

Equipment Life: 20.0 years

Control Technology: Paper/Nonwoven Filters - Cartridge Collector Type

Source Group: Mineral Products - Stone Quarrying & Processing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	1998	1998	N/A	N/A
CPT:	$142	$142		
Ref Yr CPT:	$193	$193		

Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton		
Capital Rec Fac:	0.09000000357627869	0.09000000357627869	N/A	N/A
Discount Rate:	7.0	7.0	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	1998	1998	N/A	N/A
CPT:	$142	$142		
Ref Yr CPT:	$193	$193		
Control Efficiency:	99.0	99.0	99.0	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton		
Capital Rec Fac:	0.09000000357627869	0.09000000357627869	N/A	N/A
Discount Rate:	7.0	7.0	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM10
Cost Year	1998
Typical Capital Control Cost Factor	9.0
Typical O&M Control Cost Factor	14.0
Typical Default CPT Factor - Capital	0.0
Typical Default CPT Factor - O&M	0.0
Typical Default CPT Factor - Annualized	142.0

Affected SCCs:

Code	Description
30502099	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Not Classified **
30502090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30502033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Front End Loader
30502032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Conveyor
30502031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Unloading
30502021	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Screening
30502018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drilling with Liquid Injection
30502016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Revolving Screens
30502015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Vibrating Screens
30502014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Shaker Screens
30502013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Bar Grizzlies
30502012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drying
30502007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Open Storage
30502006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Miscellaneous Operations: Screen/Convey/Handling
30502005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Mill

30502004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Recrushing/Screening
30502003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Tertiary Crushing/Screening
30502002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Secondary Crushing/Screening
30502001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Primary Crushing
30502000	Industrial Processes;Mineral Products;Stone Quarrying - Processing (See also 305320);undefined

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 2000: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Cartridge Collector with Pulse-Jet Cleaning," April 2000.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.87%
CE_TEXT:	99% from uncontrolled for both PM10 and PM2.5
CHEM_PCT:	0%

COST_BASIS:	The costs are generated using EPAGÇÖs cost-estimating spreadsheets for fabric filters (EPA, 1998a). Costs are primarily driven by the waste stream volumetric flow rate and pollutant loading. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 2000). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $7 to $13 per scfm Typical value is $9 per scfm O&M Costs: Range from $9 to $25 per scfm Typical value is $14 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for fabric filters (EPA, 1998a). O&M costs were calculated for three model plants with flow rates of 25, 75 and 150 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 4.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An average cartridge cost was estimated using the costs for standard cartridge types. Capital recovery for the periodic replacement of cartridges was included in the O&M cost of the cartridges using a cartridge life of 2 years (EPA, 1998a). The following assumptions apply to the cost of utilities and disposal: Electricity price 0.0671 $/kW-hr Compressed air 0.25 $/1000 scf Dust disposal 25 $/ton disposed Note: All costs are in 1998 dollars.
CPTON_H:	$256/ton
CPTON_L:	$85/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $85 to $256 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $142 per ton PM10 reduced. (1998$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	10.14%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	1.74%
MNTLBR_PCT:	5.71%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	5.71%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	2.95%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	8.89%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.87%
RPLMTL_PCT:	17.49%
RULE:	Not Applicable
SPVLBR_PCT:	0.44%
STEAM_PCT:	0%
TDIR_PCT:	87.63%
TINDIR_PCT:	12.37%
UTIL_PCT:	2.96%
WSTDSP_PCT:	42.24%

Summary:

Control Measure Name:	Soil Conservation;Agricultural Tilling
Abbreviation:	PAGTL
Description:	Application: The soil conservation plan measure would require farmers and farmland owners to develop soil conservation plans with the assistance of the U.S. Department of Agriculture's (USDA) Natural Resource Conservation Service. Soil conservation plans could include: establishment of rows of vegetation across the prevailing wind, cessation of tilling on high-wind days, establishment of snow (sand) fences, establishment of end-of-row turn-around areas, deep furrowing of fallow parcels, prohibition of disking and improved tillage practices. This control applies to the SCC for agricultural tilling, 2801000003. Discussion: Agricultural tilling is used for soil preparation and maintenance, and generally produces the bulk of fugitive dust emissions from agricultural activities. Tilling includes plowing, harrowing, land leveling, disking, and cultivating.
Class:	Known
Pollutant:	PM10
Equipment Life:	N/A years
Control Technology:	Soil Conservation Plans
Source Group:	Agricultural Tilling
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10	PM2_5	PM10-PRI	PM25-PRI
Maximum Control Efficiency:	21.0	21.0	21.0	21.0
Minimum Control Efficiency:	8.0	8.0	8.0	8.0
Average Control Efficiency:	11.882352828979492	11.882352828979492	11.882352828979492	11.882352828979492
Maximum CPT:	$221		$221	
Minimum CPT:	$221		$221	
Average CPT:	$221		$221	
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2801000003	Miscellaneous Area Sources; Agriculture Production - Crops; Agriculture - Crops; Tilling

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1997: E.H. Pechan & Associates, "Additional Control Measure Evaluation for the Integrated Implementation of the Ozone and Particulate Matter National Ambient Air Quality Standards, and Regional Haze Program," prepared for U.S. Environmental Protection Agency, July 1997.
- SCAQMD, 1996: South Coast Air Quality Management District, "1997 Air Quality Management Plan, Appendix IV-A: Stationary and Mobile Source Control Measures." August 1996.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Soil Conservation Plans
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	11.7%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
PROPTX_PCT:	0%
ADMIN_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	PM10 control efficiency is 12% from uncontrolled, PM2.5 control efficiency is 25% from uncontrolled
ELEC_PCT:	0%
COST_BASIS:	SCAQMD estimated control costs associated with wind erosion prevention requirements to be $100 per acre or $154 per ton PM10 reduced (1993 dollars). This estimate was derived from cost estimates developed for stabilization of fallow fields, which along with the cessation of tilling on high-wind days, is considered to be the most likely control included in the soil conservation plans (SCAQMD, 1996). No capital expenditures have been identified, as most of the potential control actions include a change in agricultural methods using equipment already possessed by farm owners/operators. Conversion to 1990 dollars was done using the U.S. Department of Agriculture's index for prices paid for farm services/operations (Pechan, 1997).
CPTON_TEXT:	The cost effectiveness is $138 per ton PM10 reduced (1990$).
OTHR_PCT:	0%
EC:	Co

ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	11.7%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Vacuum Sweeping;Paved Roads (UnKnown 1)
Abbreviation:	PPVAC110
Description:	Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface. This control applies to all paved roads classified under SCC 2294000000. Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.
Class:	Known
Pollutant:	PM10
Equipment Life:	8.0 years
Control Technology:	Vacuum Sweeping
Source Group:	Paved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10-PRI	PM25-PRI	PM10	PM2_5
Maximum Control Efficiency:	44.0	44.0	44.0	44.0
Minimum Control Efficiency:	43.0	43.0	43.0	43.0
Average Control Efficiency:	43.80392074584961	43.686275482177734	43.80392074584961	43.686275482177734
Maximum CPT:	$2,292		$2,292	
Minimum CPT:	$1,059		$1,059	
Average CPT:	$1,692		$1,692	
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
OTHR_PCT:	0%
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Vacuum Sweeping;Paved Roads (UnKnown 10)
Abbreviation:	PPVAC290
Description:	Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface. This control applies to all paved roads classified under SCC 2294000000. Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.
Class:	Known
Pollutant:	PM10
Equipment Life:	8.0 years
Control Technology:	Vacuum Sweeping
Source Group:	Paved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10-PRI	PM25-PRI	PM2_5	PM10
Maximum Control Efficiency:	53.0	53.0	53.0	53.0
Minimum Control Efficiency:	53.0	53.0	53.0	53.0
Average Control Efficiency:	53.0	53.0	53.0	53.0
Maximum CPT:	$367			$367
Minimum CPT:	$223			$223
Average CPT:	$292			$292
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OTHR_PCT:	0%
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Vacuum Sweeping;Paved Roads (UnKnown 11)
Abbreviation:	PPVAC310
Description:	Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface. This control applies to all paved roads classified under SCC 2294000000. Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.
Class:	Known
Pollutant:	PM10
Equipment Life:	8.0 years
Control Technology:	Vacuum Sweeping
Source Group:	Paved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM2_5	PM10	PM10-PRI	PM25-PRI
Maximum Control Efficiency:	51.0	51.0	51.0	51.0
Minimum Control Efficiency:	50.0	51.0	51.0	50.0
Average Control Efficiency:	50.843135833740234	51.0	51.0	50.843135833740234
Maximum CPT:		$546	$546	
Minimum CPT:		$296	$296	
Average CPT:		$384	$384	
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OTHR_PCT:	0%
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Vacuum Sweeping;Paved Roads (UnKnown 12)
Abbreviation:	PPVAC330
Description:	Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface. This control applies to all paved roads classified under SCC 2294000000. Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.
Class:	Known
Pollutant:	PM10
Equipment Life:	8.0 years
Control Technology:	Vacuum Sweeping
Source Group:	Paved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10-PRI	PM25-PRI	PM2_5	PM10
Maximum Control Efficiency:	70.0	70.0	70.0	70.0
Minimum Control Efficiency:	70.0	69.0	69.0	70.0
Average Control Efficiency:	70.0	69.98039245605469	69.98039245605469	70.0
Maximum CPT:	$1,744			$1,744
Minimum CPT:	$623			$623
Average CPT:	$1,266			$1,266
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OTHR_PCT:	0%
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Vacuum Sweeping;Paved Roads (UnKnown 2)
Abbreviation:	PPVAC130
Description:	Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface. This control applies to all paved roads classified under SCC 2294000000. Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.
Class:	Known
Pollutant:	PM10
Equipment Life:	8.0 years
Control Technology:	Vacuum Sweeping
Source Group:	Paved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10	PM2_5	PM25-PRI	PM10-PRI
Maximum Control Efficiency:	29.0	29.0	29.0	29.0
Minimum Control Efficiency:	29.0	29.0	29.0	29.0
Average Control Efficiency:	29.0	29.0	29.0	29.0
Maximum CPT:	$359			$359
Minimum CPT:	$149			$149
Average CPT:	$255			$255
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
OTHR_PCT:	0%
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name: Vacuum Sweeping;Paved Roads (UnKnown 3)

Abbreviation: PPVAC150

Description: Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface.

This control applies to all paved roads classified under SCC 2294000000.

Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.

Class: Known

Pollutant: PM10

Equipment Life: 8.0 years

Control Technology: Vacuum Sweeping

Source Group: Paved Road

Sectors: afdust

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM2_5	PM10	PM25-PRI	PM10-PRI
Maximum Control Efficiency:	56.0	56.0	56.0	56.0
Minimum Control Efficiency:	56.0	56.0	56.0	56.0
Average Control Efficiency:	56.0	56.0	56.0	56.0
Maximum CPT:		$767		$767
Minimum CPT:		$317		$317
Average CPT:		$545		$545
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
OTHR_PCT:	0%
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Vacuum Sweeping;Paved Roads (UnKnown 4)
Abbreviation:	PPVAC170
Description:	Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface. This control applies to all paved roads classified under SCC 2294000000. Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.
Class:	Known
Pollutant:	PM10
Equipment Life:	8.0 years
Control Technology:	Vacuum Sweeping
Source Group:	Paved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10	PM2_5	PM25-PRI	PM10-PRI
Maximum Control Efficiency:	66.0	66.0	66.0	66.0
Minimum Control Efficiency:	66.0	66.0	66.0	66.0
Average Control Efficiency:	66.0	66.0	66.0	66.0
Maximum CPT:	$977			$977
Minimum CPT:	$288			$288
Average CPT:	$624			$624
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
OTHR_PCT:	0%
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name: Vacuum Sweeping;Paved Roads (UnKnown 5)

Abbreviation: PPVAC190

Description: Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface.

This control applies to all paved roads classified under SCC 2294000000.

Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.

Class: Known

Pollutant: PM10

Equipment Life: 8.0 years

Control Technology: Vacuum Sweeping

Source Group: Paved Road

Sectors: afdust

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10	PM2_5	PM25-PRI	PM10-PRI
Maximum Control Efficiency:	47.0	47.0	47.0	47.0
Minimum Control Efficiency:	47.0	47.0	47.0	47.0
Average Control Efficiency:	47.0	47.0	47.0	47.0
Maximum CPT:	$1,131			$1,131
Minimum CPT:	$333			$333
Average CPT:	$723			$723
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
OTHR_PCT:	0%
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name: Vacuum Sweeping;Paved Roads (UnKnown 6)

Abbreviation: PPVAC210

Description: Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface.

This control applies to all paved roads classified under SCC 2294000000.

Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.

Class: Known

Pollutant: PM10

Equipment Life: 8.0 years

Control Technology: Vacuum Sweeping

Source Group: Paved Road

Sectors: afdust

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10-PRI	PM25-PRI	PM2_5	PM10
Maximum Control Efficiency:	28.0	28.0	28.0	28.0
Minimum Control Efficiency:	28.0	28.0	28.0	28.0
Average Control Efficiency:	28.0	28.0	28.0	28.0
Maximum CPT:	$1,140			$1,140
Minimum CPT:	$420			$420
Average CPT:	$780			$780
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%

CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%
COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
OTHR_PCT:	0%
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*

Summary:

Control Measure Name:	Vacuum Sweeping;Paved Roads (UnKnown 7)
Abbreviation:	PPVAC230
Description:	Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface. This control applies to all paved roads classified under SCC 2294000000. Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.
Class:	Known
Pollutant:	PM10
Equipment Life:	8.0 years
Control Technology:	Vacuum Sweeping
Source Group:	Paved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM25-PRI	PM10-PRI	PM2_5	PM10
Maximum Control Efficiency:	34.0	33.0	34.0	33.0
Minimum Control Efficiency:	33.0	33.0	33.0	33.0
Average Control Efficiency:	33.05882263183594	33.0	33.05882263183594	33.0
Maximum CPT:		$1,520		$1,520
Minimum CPT:		$400		$400
Average CPT:		$996		$996
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
OTHR_PCT:	0%
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Vacuum Sweeping;Paved Roads (UnKnown 8)
Abbreviation:	PPVAC250
Description:	Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface. This control applies to all paved roads classified under SCC 2294000000. Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.
Class:	Known
Pollutant:	PM10
Equipment Life:	8.0 years
Control Technology:	Vacuum Sweeping
Source Group:	Paved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10-PRI	PM25-PRI	PM2_5	PM10
Maximum Control Efficiency:	54.0	60.0	60.0	54.0
Minimum Control Efficiency:	52.0	52.0	52.0	52.0
Average Control Efficiency:	53.0	53.156864166259766	53.156864166259766	53.0
Maximum CPT:	$591			$591
Minimum CPT:	$179			$179
Average CPT:	$444			$444
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
OTHR_PCT:	0%
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name:	Vacuum Sweeping;Paved Roads (UnKnown 9)
Abbreviation:	PPVAC270
Description:	Application: Vacuum sweeping is a road surface cleaning operation that removes loose material from the roadway, preventing it from becoming airborne particulate when vehicles travel over the road surface. This control applies to all paved roads classified under SCC 2294000000. Discussion: The closed-loop regenerative air vacuum systems use an air jet generated by a blower and distributed by the floating pickup head to loosen particles in the surface cracks and crevices before drawing them into an internal hopper. A mechanical broom precedes the vacuum section (Pechan, 1999). No water is used. An internal centrifugal dust separator retains and collects the PM for proper disposal.
Class:	Known
Pollutant:	PM10
Equipment Life:	8.0 years
Control Technology:	Vacuum Sweeping
Source Group:	Paved Road
Sectors:	afdust
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10	PM2_5	PM10-PRI	PM25-PRI
Maximum Control Efficiency:	71.0	71.0	71.0	71.0
Minimum Control Efficiency:	71.0	71.0	71.0	71.0
Average Control Efficiency:	71.0	71.0	71.0	71.0
Maximum CPT:	$560		$560	
Minimum CPT:	$341		$341	
Average CPT:	$446		$446	
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2294015002	Mobile Sources; Paved Roads; Industrial Roads; Total: Sanding/Salting - Fugitives
2294015001	Mobile Sources; Paved Roads; Industrial Roads; Total: Average Conditions - Fugitives
2294015000	Mobile Sources; Paved Roads; Industrial Roads; Total: Fugitives

2294010002	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Sanding/Salting - Fugitives
2294010001	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Average Conditions - Fugitives
2294010000	Mobile Sources; Paved Roads; All Other Public Paved Roads; Total: Fugitives
2294005002	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Sanding/Salting - Fugitives
2294005001	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Average Conditions - Fugitives
2294005000	Mobile Sources; Paved Roads; Interstate/Arterial; Total: Fugitives
2294000002	Mobile Sources; Paved Roads; All Paved Roads; Total: Sanding/Salting - Fugitives
2294000001	Mobile Sources; Paved Roads; All Paved Roads; Total: Average Conditions - Fugitives
2294000000	Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives

References:

- Harrison, 1999: J. Harrison, GCS Western Power, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.
- Pechan, 1999: E.H. Pechan & Associates, Inc., "Control Measure Evaluations: The Control Measure Data Base for the National Emissions Trends Inventory (Control NET)," prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, Research Triangle Park, NC, September 1999
- Clapper, 1999: W. Clapper, Sunline Transit Services, personal communication with J. Reisman, E.H. Pechan & Associates, Inc., August 18, 1999.

Other information:

WSTDSP_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
STEAM_PCT:	0%
CTRL_EFF_T:	50.5%
OMATL_PCT:	0%
OMCPTON:	$426/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 51% from uncontrolled;PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	Capital costs vary from $150K to $190K (1999 dollars) for compressed natural gas (CNG) fueled units. Diesel-powered units are approximately $30K less (Harrison, 1999). Unit life is approximately 5 years; however, with thorough maintenance, life can be extended to 8 years. For best performance, operating speed is limited to 5 miles per hour. Based on a 7 percent discount rate and 8-year life, annualized costs are $25K to $32K. O&M costs are approximately $16 to $18 per curb mile, based on operation with CNG, a thorough maintenance regimen, and a wage scale of approximately $13/hr (Clapper, 1999). Note: All costs are in 1999 dollars.
CPTON_TEXT:	The cost effectiveness for this control is $485 per ton PM reduced. (1999$)
EC:	Co
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50.5%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OTHR_PCT:	0%
OVRHD_PCT:	0%
PM10:	Co*
PROPTX_PCT:	0%
TDIR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name: Venturi Scrubber;(PM10) Mineral Products - Stone Quarrying & Processing

Abbreviation: PVSCRMISQ

Description: Application: The control is the use of a venturi scrubber to reduce PM emissions. A scrubber is a type of technology that removes air pollutants by inertial and diffusional interception. A venturi scrubber accelerates the waste gas stream to atomize the scrubbing liquid and to improve gas-liquid contact.

This control applies to stone quarrying an processing operations, including (but not limited to) nonmetallic mineral processing (305020) - ore crushing, grinding, and screening, and calciners (SCC 305150) and dryers (SCC 30502012).

Discussion: Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions. Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

By product coke production is used to manufacture metallurgical coke by heating high-grade bituminous coal (low sulfur and low ash) in an enclosed oven chamber without oxygen. The resulting solid material consists of elemental carbon and any minerals (ash) that were present in the coal blend that did not volatilize during the process. Sources of air emissions consist of coke oven doors, coke oven lids and off-takes, coke oven charging, coke oven pushing, coke oven underfire stack, coke quenching, battery venting, and coke by-product-recovery plants.

A venturi scrubber accelerates the waste gas stream to improve gas-liquid contact. In a venturi scrubber, a "throat'" section is built into the duct that forces the gas stream to accelerate (EPA, 1999). As the gas enters the venturi throat, both gas velocity and turbulence increase.

After the throat section, the mixture decelerates, and further impacts occur causing the droplets to agglomerate. Once the particles have been captured by the liquid, the wetted PM and excess liquid are separated from the gas stream through entrainment. This section usually consists of a cyclonic separator and/or a mist eliminator (EPA, 1998; Corbitt, 1990).

For PM applications, wet scrubbers generate waste, either a slurry or wet sludge. This creates the need for both wastewater treatment and solid waste disposal. Initially, the slurry is treated to separate the solid waste from the water (EPA, 1999). The treated water can then be reused or discharged. Once the water is removed, the remaining waste will be in the form of a solid or sludge. If the solid waste is inert and nontoxic, it can generally be land filled. Hazardous wastes will have more stringent procedures for disposal. In some cases, the solid waste may have value and can be sold or recycled (EPA, 1998).

Class: Known

Pollutant: PM10

Equipment Life: 10.0 years

Control Technology: Venturi Scrubber

Source Group: Mineral Products - Stone Quarrying & Processing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	1995	1995	N/A	N/A
CPT:	$751	$751		
Ref Yr CPT:	$1,066	$1,066		

Control Efficiency:	95.0	95.0	90.0	90.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton		
Capital Rec Fac:	0.14000000059604645	0.14000000059604645	N/A	N/A
Discount Rate:	7.0	7.0	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM10-PRI	PM25-PRI	PM2_5
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	1995	1995	N/A	N/A
CPT:	$751	$751		
Ref Yr CPT:	$1,066	$1,066		
Control Efficiency:	95.0	95.0	90.0	90.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton		
Capital Rec Fac:	0.14000000059604645	0.14000000059604645	N/A	N/A
Discount Rate:	7.0	7.0	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula:	Capital Cost= Typical Capital Cost x Min. Stack Flow Rate O&M Cost= Typical O&M Cost x Min. Stack Flow Rate Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost Notes: For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used. Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM10
Cost Year	1995
Typical Capital Control Cost Factor	11.0
Typical O&M Control Cost Factor	42.0
Typical Default CPT Factor - Capital	189.0
Typical Default CPT Factor - O&M	713.0
Typical Default CPT Factor - Annualized	751.0

Affected SCCs:

Code	Description
30502099	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Not Classified **
30502090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30502033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Front End Loader
30502032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Conveyor
30502031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Unloading
30502021	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Screening
30502018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drilling with Liquid Injection
30502016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Revolving Screens
30502015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Vibrating Screens
30502014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Shaker Screens
30502013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Bar Grizzlies
30502012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drying
30502007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Open Storage
30502006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Miscellaneous Operations: Screen/Convey/Handling
30502005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Mill

30502004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Recrushing/Screening
30502003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Tertiary Crushing/Screening
30502002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Secondary Crushing/Screening
30502001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Primary Crushing
30502000	Industrial Processes;Mineral Products;Stone Quarrying - Processing (See also 305320);undefined

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Venturi Scrubber," July 1999.
- Corbitt, 1990: "Standard Handbook of Environmental Engineering," edited by Robert A. Corbitt, McGraw-Hill, New York, NY, 1990.
- Heumann, 1997: W. L. Heumann, "Industrial Air Pollution Control Systems," McGraw Hill Publishers, Inc., Washington, D.C., 1997.

Other information:

ADMIN_PCT:	0.67%
CE_TEXT:	PM10 control efficiency is 95% from uncontrolled; PM2.5 control efficiency is 90% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for venturi wet scrubbers, developed using EPA cost-estimating spreadsheets (EPA, 1996) and referenced to the volumetric flow rate of the waste stream treated. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1999). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (10 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $3 to $28 per scfm Typical value is $11 per scfm O&M Costs: Range from $4 to $119 per scfm Typical value is $42 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for Impingement Plate Scrubbers (EPA, 1996). O&M costs were calculated for two model plants with flow rates of 2,000 and 150,000 acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. The model plants were assumed to have a dust loading of 3.0 grains per cubic feet. The operating time was assumed to be 8760 hours per year. An inlet water flow rate for the scrubber was assumed to be 9.4 lbs/min. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 25 $/ton disposed Wastewater treatment 3.8 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$2100/ton
CPTON_L:	$76/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $76 to $2,100 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $751 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	95%
EC:	Co
ELEC_PCT:	26.81%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	95%
INSRNC_PCT:	0.33%
MNTLBR_PCT:	8.53%
MNTLBR_RT:	$17.74/hr

MNTMTL_PCT:	8.53%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	22.14%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	25.51%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	0.33%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	3.32%
STEAM_PCT:	0%
TDIR_PCT:	73.15%
TINDIR_PCT:	26.85%
UTIL_PCT:	0.41%
WSTDSP_PCT:	3.41%

Summary:

Control Measure Name: Watering;Beef Cattle Feedlots (Dust Kickup)
Abbreviation: PCATFWAT
Description: Application: Control of fugitive dust emissions from agricultural (cattle) feedlots is most often performed by watering from either stationary sprinklers or from water trucks.

This control is applicable to all beef cattle feedlots classified under SCC 2805001000.
Class: Known
Pollutant: PM10
Equipment Life: 10.0 years
Control Technology: Watering
Source Group: Beef Cattle Feedlots
Sectors: nonpt
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM2_5	PM25-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	1990	N/A	N/A	1990
CPT:	$307			$307
Ref Yr CPT:	$492			$492
Control Efficiency:	50.0	25.0	25.0	50.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremenental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0
Pollutant:	PM10	PM2_5	PM25-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	N/A	N/A	N/A
Cost Year:	1990	N/A	N/A	1990
CPT:	$307			$307
Ref Yr CPT:	$492			$492
Control Efficiency:	50.0	25.0	25.0	50.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0

Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton			cpton
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2805001000	Miscellaneous Area Sources; Agriculture Production - Livestock; Beef cattle - finishing operations on feedlots (drylots); Dust Kicked-up by Hooves (use 28-05-020, -001, -002, or -003 for Waste

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.
- Peters, 1977: J.A. Peters, and T. R. Blackwood, Monsanto Research Corporation, "Source Assessment: Beef Cattle Feedlots," prepared for U.S. Environmental Agency, Office of Research and Development, Research Triangle Park, NC, June 1977.

Other information:

SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	50%
OMATL_PCT:	0%

OMCPTON:	$100/ton
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
PROPTX_PCT:	0%
ADMIN_PCT:	0%
CE_TEXT:	PM10 control efficiency is 50% from uncontrolled; PM2.5 control efficiency is 25% from uncontrolled
CHEM_PCT:	0%
CAPCPTON:	$1500/ton
ELEC_PCT:	0%
COST_BASIS:	Control costs were estimated by assuming that installation of a stationary sprinkler system is required. Peters profiled estimates of capital and O&M costs (Peters, 1977). The mid-range capital cost was $6.50 per head and the mid-range O&M cost was $0.30 per head. Both of these figures are in 1975 dollars. Assuming a 10-year life and 5% discount rate for the sprinkler system, the TACs are $1.58 per head (1975$). To estimate cost per ton of PM10 reduced the emission factor (0.017 tons/head) and the control efficiency (50%) are applied to yield $186 per ton PM10 reduced (1975$).
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $307 per ton PM reduced (1990$).
OTHR_PCT:	0%
EC:	Co
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

Summary:

Control Measure Name: Wet Electrostatic Precipitator - Wire Plate Type;(PM10) Mineral Products - Stone Quarrying & Processing

Abbreviation: PWESPMISQ

Description: Application: This control is the use of a wire-plate type electrostatic precipitator (ESP) to reduce PM emissions. An ESP uses electrical forces to move particles in an exhaust stream onto collector plates. Electrodes in the center of the flow are maintained at high voltage and generate an electrical field forcing particles to the collector walls. Wet ESPs use a stream of water, in place of rapping mechanisms, to dislodge particulate from the plates and into a sump.

This control applies to stone quarrying and processing operations, including (but not limited to) nonmetallic mineral processing (305020) - ore crushing, grinding, and screening, and calciners (SCC 305150) and dryers (SCC 30502012).

Discussion: Materials handling operations including crushing, grinding, and screening, can produce significant PM emissions. Drying, the heating of minerals or mineral products to remove water, and calcination, heating to higher temperatures to remove chemically bound water and other compounds, are normally performed in dedicated, closed units. Emissions from these units will be through process vents, to which PM controls can be applied relatively simply. Fugitive dust emissions may come from paved and unpaved roads in plants and from raw material and product loading, unloading, and storage (STAPPA/ALAPCO, 1996).

In the wire-plate ESP, the gas flows around vertical, metal plates. The electrodes are long, weighted wires hanging between the plates. The voltage applied to the electrodes causes the gas between the electrodes to break down, known as a "corona." The electrodes are most often given a negative polarity because a negative corona supports a higher voltage than a positive corona.

Certain types of losses affect control efficiency. The dislodging of the accumulated layer also projects some of the particles back into the gas stream. These particles are processed in later sections of the ESP, but the particles from the last section have no chance to be recaptured. Due to the space needed at the top of the ESP for nonelectrified components, part of the stream may flow around the charged zones. This is called "sneakage" and places an upper limit on the collection efficiency of the ESP. Anti-sneakage baffles are used to force the sneakage flow to mix with the main gas stream for collection in later sections (EPA, 1998).

Wire-Plate Type Wet ESPs require a source of wash water near the top of the collector plates. This wash system replaces the rapping mechanism used by dry ESPs. The water flows with the collected particles into a sump from which the fluid is pumped or drained. A portion of the fluid may be recycled to reduce the total amount of water required. The remainder is pumped into a settling pond or passed through a dewatering stage, with subsequent disposal of the sludge (AWMA, 1992).

Unlike dry ESPs, resistivity of the collected material is not a major factor in performance. Because of the high humidity in a wet ESP, the resistivity of particles is lowered, eliminating the "back corona" condition. The frequent washing of the plates also limits particle buildup on the collectors (EPA, 1998).

For wet ESPs, the handling wastewaters must be considered (EPA, 1999). For simple systems with innocuous dusts, water with particles collected by the ESP may be discharged from the ESP system to a solids-removing clarifier. More complicated systems may require skimming and sludge removal, clarification in dedicated equipment, pH adjustment, and/or treatment to remove dissolved solids. Recirculation of treated water to the ESP may approach 100 percent (AWMA, 1992).

Class: Known

Pollutant: PM10

Equipment Life: 20.0 years

Control Technology: Wet Electrostatic Precipitator - Wire Plate Type

Source Group: Mineral Products - Stone Quarrying & Processing

Sectors: ptnonipm

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	PM10	PM10	PM10-PRI	PM10-PRI
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	2020-01-01 00:00:00.0	N/A
Cost Year:	1995	1995	1995	1995
CPT:	$220			$220
Ref Yr CPT:	$312			$312
Control Efficiency:	99.0	99.5	99.5	99.0
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:	cpton	cpton	cpton	cpton
Capital Rec Fac:	0.09000000357627869	N/A	N/A	0.09000000357627869
Discount Rate:	7.0	7.0	7.0	7.0
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

N/A

Pollutant:	PM25-PRI	PM25-PRI	PM2_5	PM2_5
Locale:				
Effective Date:	N/A	2020-01-01 00:00:00.0	N/A	2020-01-01 00:00:00.0
Cost Year:	N/A	N/A	N/A	N/A
CPT:				
Ref Yr CPT:				
Control Efficiency:	95.0	99.5	95.0	99.5
Min Emis:	N/A	N/A	N/A	N/A
Max Emis:	N/A	N/A	N/A	N/A
Rule Effectiveness:	100.0	100.0	100.0	100.0
Rule Penetration:	100.0	100.0	100.0	100.0
Equation Type:				
Capital Rec Fac:	N/A	N/A	N/A	N/A
Discount Rate:	N/A	N/A	N/A	N/A
Cap Ann Ratio:	N/A	N/A	N/A	N/A
Incremental CPT:	N/A	N/A	N/A	N/A
Details:				
Existing Measure:				
Existing NEI Dev:	0	0	0	0

Pollutant:
PM25-PRI

PM25-PRI
PM2_5
PM2_5
Locale:
Effective Date:
N/A
2020-01-01 00:00:00.0
N/A
2020-01-01 00:00:00.0
Cost Year:
N/A
N/A
N/A
N/A
CPT:
Ref Yr CPT:
Control Efficiency:
95.0
99.5
95.0
99.5
Min Emis:
N/A
N/A
N/A
N/A
Max Emis:
N/A
N/A
N/A
N/A
Rule Effectiveness:
100.0
100.0
100.0
100.0
Rule Penetration:

100.0
100.0
100.0
100.0
Equation Type:
Capital Rec Fac:
N/A
N/A
N/A
N/A
Discount Rate:
N/A
N/A
N/A
N/A
Cap Ann Ratio:
N/A
N/A
N/A
N/A
Incremental CPT:
N/A
N/A
N/A
N/A
Details:
Existing Measure:
Existing NEI Dev:
0
0
0
0

Cost Equations:

Name: Type 8

Description: Non-EGU PM

Inventory Fields: stack_flow_rate

Formula: Capital Cost= Typical Capital Cost x Min. Stack Flow Rate
O&M Cost= Typical O&M Cost x Min. Stack Flow Rate
Total Cost = Capital Cost x CRF + 0.04 x capital cost + O&M Cost

Notes:
For Min. Stack flow rate less than 5 cfm , default cost per ton cost effectiveness is used.
Min. Stack Flow Rate > 5

Variable Name	Value
Pollutant	PM10
Cost Year	1995
Typical Capital Control Cost Factor	40.0
Typical O&M Control Cost Factor	19.0
Typical Default CPT Factor - Capital	923.0
Typical Default CPT Factor - O&M	135.0
Typical Default CPT Factor - Annualized	220.0

Affected SCCs:

Code	Description
30502099	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Not Classified **
30502090	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305020 for diff. units); Haul Roads - General
30502033	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Front End Loader
30502032	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Loading: Conveyor
30502031	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Truck Unloading
30502021	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Screening
30502018	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drilling with Liquid Injection
30502016	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Revolving Screens
30502015	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Vibrating Screens
30502014	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Shaker Screens
30502013	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Bar Grizzlies
30502012	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Drying
30502007	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Open Storage
30502006	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Miscellaneous Operations: Screen/Convey/Handling
30502005	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Fines Mill

30502004	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Recrushing/Screening
30502003	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Tertiary Crushing/Screening
30502002	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Secondary Crushing/Screening
30502001	Industrial Processes; Mineral Products; Stone Quarrying - Processing (See also 305320); Primary Crushing
30502000	Industrial Processes;Mineral Products;Stone Quarrying - Processing (See also 305320);undefined

References:

- STAPPA/ALAPCO, 2006: State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options", March 2006.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Stationary Source Control Techniques Document for Fine Particulate Matter,:EPA-452/R-97-001, Research Triangle Park, NC., October 1998.
- EPA, 1998: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "OAQPS Control Cost Manual," Fifth Edition, Chapter 5, EPA 453/B-96-001, Research Triangle Park, NC. December 1998.
- AWMA, 1992: Air & Waste Management Association, "Air Pollution Engineering Manual," edited by A. Buonicore and W. Davis, Van Nostrand Reinhold, NY, NY, 1992.
- EPA, 1999: U.S. Environmental Protection Agency, Center on Air Pollution, "Air Pollution Technology Fact Sheet - Wet Electrostatic Precipitator (ESP) - Wire-Plate Type," May 1999

Other information:

ADMIN_PCT:	4.4%
CE_TEXT:	PM10 control efficiency is 99% from uncontrolled; PM2.5 control efficiency is 95% from uncontrolled
CHEM_PCT:	0%

COST_BASIS:	The following are cost ranges for wire-plate ESPs, developed using EPA cost-estimating spreadsheets for dry wire-plate ESPs with adjustments made to reflect wet wire-plate ESPs (EPA, 1999). Capital and operating costs are generally higher due to noncorrosive materials requirements, increased water usage, and treatment and disposal of wet effluent. When stack gas flow rate data was available, the costs and cost effectiveness were calculated using the typical values of capital and O&M costs. When stack gas flow rate data was not available, default typical capital and O&M cost values based on a tons per year of PM10 removed were used (Pechan,2001). Total annualized costs were determined by adding the annualized O&M costs, fixed capital recovery charges, and a fixed annual charge for taxes, insurance and administrative costs. The fixed annual charge for taxes, insurance and administrative costs was estimated as 4 percent of the total capital investment (EPA, 1990). Total installed capital costs were annualized using a capital recovery factor, with is based on a 7 percent discount rate and the expected life of the control equipment (20 years) (Pechan, 2001). The range of high and low capital costs and O&M costs presented in the fact sheets were calculated based on the OAQPS Control Cost Manual and associated spreadsheets (EPA, 1996). The low costs in the ranges below are representative of equipment sized based on the maximum flow rate recommended in the cost manual, with no exotic materials. The high costs in the ranges below are representative of equipment sized based on the minimum flow rate recommended in the cost manual, with not exotic materials. No optional pre- or post treatment equipment costs are included. Capital Costs: Range from $30 to $60 per scfm Typical value is $40 per scfm O&M Costs: Range from $6 to $45 per scfm Typical value is $19 per scfm O&M Cost Components: The percentages of each O&M cost component were developed using EPAGÇÖs cost-estimating spreadsheet for ESP (EPA, 1999). O&M costs were calculated for three model plants with flow rates of 10, 15 and 20 thousand acfm. The average percentage of the total O&M cost was then calculated for each O&M cost component. All the model plants were assumed to have a dust loading of 6.0 grains per cubic feet. The operating time was assumed to be 8640 hours per year. A water flow rate for the ESP was assumed to be 5 gal/min per thousand acfm. The following assumptions apply to the cost of utilities and disposal: Electricity price 0.067 $/kW-hr Process water price 0.20 $/1000 gal Dust disposal 20 $/ton disposed Wastewater treatment 1.5 $/ thousand gal treated Note: All costs are in 1995 dollars.
CPTON_H:	$550/ton
CPTON_L:	$55/ton
CPTON_TEXT:	When stack flow is available the cost effectiveness varies from $55 to $550 per ton PM10 removed, depending on stack flow. The default cost effectiveness value, used when stack flow is not available, is $220 per ton PM10 reduced. (1995$)
CTRL_EFF_T:	99%
EC:	Co
ELEC_PCT:	3.93%
ELEC_RT:	$0.07/kWh
FUEL_PCT:	0%
HG_CE_T:	99%
INSRNC_PCT:	2.2%
MNTLBR_PCT:	2.26%

MNTLBR_RT:	$17.74/hr
MNTMTL_PCT:	2.2%
NG_RT:	$0/cf
OC:	Co
OMATL_PCT:	0%
OPLBR_PCT:	5.1%
OPLBR_RT:	$17.26/hr
OTHR_PCT:	0%
OVRHD_PCT:	7.21%
PM10:	Co*
PM25:	Co
PROPTX_PCT:	2.2%
RPLMTL_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	2.46%
STEAM_PCT:	0%
TDIR_PCT:	83.99%
TINDIR_PCT:	16.01%
UTIL_PCT:	4%
WSTDSP_PCT:	64.05%

Summary:

Control Measure Name:	Whole Field, Propaning, Stack;Agricultural Burning
Abbreviation:	PAGBU
Description:	Application: Two control measures applied to area source agricultural burning sources are propane and bale/stack burning. Propane flamers are an alternative to open filed burning. The bale/stack burning technique is designed to increase the fire efficiency by stacking or baling the fuel before burning. Burning in piles or stacks tends to foster more complete combustion, thereby reducing PM emissions. This control is applicable to field burning where the entire field would be set on fire, and can be applied to all crop types. These sources are classified under 2801500000.
Class:	Known
Pollutant:	PM10
Equipment Life:	N/A years
Control Technology:	Bale Stack/Propane Burning
Source Group:	Agricultural Burning
Sectors:	nonpt
Months:	All Months

Affected Pollutants, and their Control Efficiencies and Costs:

This section only contains an aggregrated view of the efficiency records since the measure has a large number of efficiency records (204 records).

Pollutant:	PM10-PRI	PM25-PRI	PM2_5	PM10
Maximum Control Efficiency:	63.0	63.0	63.0	63.0
Minimum Control Efficiency:	49.0	49.0	49.0	49.0
Average Control Efficiency:	61.6274528503418	61.588233947753906	61.588233947753906	61.6274528503418
Maximum CPT:	$13,074			$13,074
Minimum CPT:	$2,934			$2,934
Average CPT:	$5,772			$5,772
Average Rule Effectiveness:	100.0	100.0	100.0	100.0
Average Rule Penetration:	100.0	100.0	100.0	100.0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2801500100	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crops Unspecified
2801500112	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Alfalfa: Backfire Burning
2801500130	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Barley: Burning Techniques Not Significant

2801500142	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Bean (red): Backfire Burning
2801500160	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Cotton: Burning Techniques Not Important
2801500181	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Hay (wild): Headfire Burning
2801500191	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Oats: Headfire Burning
2801500201	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Pea: Headfire Burning
2801500210	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Pineapple: Burning Techniques Not Significant
2801500230	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Safflower: Burning Techniques Not Significant
2801500250	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Sugar Cane: Burning Techniques Not Significant
2801500262	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Wheat: Backfire Burning
2801500310	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Almond
2801500330	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Apricot
2801500350	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Cherry
2801500370	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Date palm
2801500390	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Nectarine
2801500410	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Peach
2801500430	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Prune
2801500450	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Filbert (Hazelnut)
2801500600	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Forest Residues Unspecified (see also 28-10-015-000)
2801500620	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Forest Residues: Species is Ponderosa Pine (see also 28-10-015-000)
2801501105	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Cereal Grains, Total
2801501170	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Grass
2801501270	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Mint
2801502105	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Cereal Grains, Total
2801502170	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Grass
2801502270	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Mint

2801500000	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Unspecified crop type and Burn Method
2801500111	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Alfalfa : Headfire Burning
2801500120	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Asparagus: Burning Techniques Not Significant
2801500141	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Bean (red): Headfire Burning
2801500150	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Corn: Burning Techniques Not Important
2801500170	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Grasses: Burning Techniques Not Important
2801500182	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Hay (wild): Backfire Burning
2801500192	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Oats: Backfire Burning
2801500202	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Pea: Backfire Burning
2801500220	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Rice: Burning Techniques Not Significant
2801500240	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Sorghum: Burning Techniques Not Significant
2801500261	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Field Crop is Wheat: Headfire Burning
2801500300	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop Unspecified
2801500320	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Apple
2801500340	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Avocado
2801500360	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Citrus (orange, lemon)
2801500380	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Fig
2801500400	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Olive
2801500420	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Pear
2801500440	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Orchard Crop is Walnut
2801500500	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Vine Crop Unspecified
2801500610	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Field Burning - whole field set on fire; Forest Residues: Species are Hemlock, Douglas fir, Cedar
2801501000	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Unspecified crop types
2801501130	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Barley
2801501260	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Propaning - tractor-pulled burners to burn stubble only; Wheat

2801502000	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Unspecified crop types
2801502130	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Barley
2801502260	Miscellaneous Area Sources; Agriculture Production - Crops - as nonpoint; Agricultural Stack Burning - straw stacks moved from field for burning; Wheat

References:

- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- EPA, 1992: U.S. Environmental Protection Agency, "Prescribed Burning Background Document," Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 1992.
- Pechan, 1995: E.H. Pechan & Associates, Inc., "Regional Particulate Strategies - Draft Report," prepared for U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation, Washington, DC, September 1995.
- Pechan, 1998: E.H. Pechan & Associates, Inc., "Clean Air Act Section 812 Prospective Cost Analysis - Draft Report," prepared for Industrial Economics, Inc., Cambridge, MA, September 1998.

Other information:

COST_BASIS:	The cost of using a propane burner includes the cost for physical removal of residue, and the costs for operating the flamer, which vary with the speed of operation. The average cost of propane burning is $56 per acre, which includes the cost for residue removal and for the propane flaming (Pechan, 1998). The costs for baling and burning average $25 per ton of residue baled and $0.50 per ton to burn, or approximately $25.50 per ton of residue burned (EPA, 1992). Capital costs for both of these techniques are assumed to be zero. Costs vary by state and crop type. The cost effectiveness ranges from $1,832 for Georgia to $8,164 for Florida The PM10 control efficiency ranges from 49% for Louisiana to 63% for Alabama, Georgia, Kansas, Mississippi, and North Carolina. Note: All costs are in 1992 dollars.
SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
RULE:	Not Applicable
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_L:	49%
CTRL_EFF_T:	63%
OMATL_PCT:	0%

OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PM25:	Co
PROPTX_PCT:	0%
ADMIN_PCT:	0%
CHEM_PCT:	0%
CE_TEXT:	PM10 control efficiency is 49-63% from uncontrolled; PM2.5 control efficiency is 25% from uncontrolled
ELEC_PCT:	0%
CPTON_TEXT:	The cost effectiveness per ton PM10 reduced is $2,591. (1992$)
CTRL_EFF_H:	63%
OTHR_PCT:	0%
EC:	Co
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	63%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
OC:	Co
OVRHD_PCT:	0%
PM10:	Co*
WSTDSP_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%

NH3 Control Measures

There are 5 NH3 control measures included in this report

Summary:

Control Measure Name: Chemical Additives to Waste;Cattle Feedlots
Abbreviation: ACHMADDBFL
Description: Application: This control is the adding of chemicals to cattle waste to reduce ammonia emissions from cattle feedlots.

The control applies to all cattle and calve operations classified under SCC 2805020000.
Class: Known
Pollutant: NH3
Equipment Life: N/A years
Control Technology: Chemical Additives to Waste
Source Group: Cattle Feedlots
Sectors: ag
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NH3
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$228
Ref Yr CPT:	$305
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NH3
Locale:	
Effective Date:	N/A
Cost Year:	1999

CPT:	$228
Ref Yr CPT:	$305
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2805020004	Miscellaneous Area Sources; Agriculture Production - Livestock; Cattle and Calves Waste Emissions; Steers, Steer Calves, Bulls, and Bull Calves
2805020003	Miscellaneous Area Sources; Agriculture Production - Livestock; Cattle and Calves Waste Emissions; Heifers and Heifer Calves
2805020002	Miscellaneous Area Sources; Agriculture Production - Livestock; Cattle and Calves Waste Emissions; Beef Cows
2805020001	Miscellaneous Area Sources; Agriculture Production - Livestock; Cattle and Calves Waste Emissions; Milk Cows
2805020000	Miscellaneous Area Sources; Agriculture Production - Livestock; Cattle and Calves Waste Emissions; Total (see also 28-05-001, -002, -003)

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.
- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Axe, 1999: D. Axe, IMC Agrico Feed Ingredients, personal communication with S. Roe, E.H. Pechan & Associates, Inc., June 1999.

Other information:

TDIR_PCT:	0%
CTRL_EFF_T:	50%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
CHEM_PCT:	0%
COST_BASIS:	Pechan contacted the manufacturer of the chemical inhibitor, N-(n-butyl) thiophosphoric triamide (NBPT; trade name Conserve-Nr). According to the manufacturer, the control effectiveness at cattle feedlots is 50 percent and the cost per head-day is $0.0062 ($2.26/head-yr; Axe, 1999). The manufacturer also reports that field tests are ongoing at dairies and that the product should perform the same (50 percent control), but cost slightly more $0.0094/head-day ($3.43/head-yr; Axe, 1999). It was not clear why the costs would be higher at dairies. To estimate costs, an average per head cost between dairy cattle and feedlot cattle would be $2.85/head-yr (from the above estimates). The emission factor for cattle is about 23 kg/head-yr (0.025 ton/head-yr). A 50 percent control efficiency yields 0.0125 ton/head-yr reduced). Hence, the cost factor would be $2.85/0.0125 ton or $228/ton of NH3 reduced.
CPTON_TEXT:	The cost effectiveness is $228 per ton NH3 reduced. (1999$)
CE_TEXT:	50% from uncontrolled
OTHR_PCT:	0%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	Co*
OVRHD_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%
ADMIN_PCT:	0%
RPLMTL_PCT:	0%
STEAM_PCT:	0%

Summary:

Control Measure Name: Chemical Additives to Waste;Hog Operations
Abbreviation: ACHMADDHOG
Description: Application: This control is the adding of chemicals to hog waste to reduce ammonia emissions from hog feedlots. Assessment of control measures applicable to ammonia emissions for hog operations is based on procedures used for cattle operations.

The control applies to all hog and pig operations classified under SCC 2805025000.

Discussion: There is assumed to be 100 percent penetration; however, the modeling parameters are probably most applicable to large hog farming operations. Hence, it may be more reasonable to apply the control in counties with large hog raising operations (i.e., using COA data).

Class: Known
Pollutant: NH3
Equipment Life: N/A years
Control Technology: Chemical Additives to Waste
Source Group: Hog Operations
Sectors: ag
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NH3
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$73
Ref Yr CPT:	$97
Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NH3
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$73
Ref Yr CPT:	$97

Control Efficiency:	50.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2805025000	Miscellaneous Area Sources; Agriculture Production - Livestock; Swine production composite; Not Elsewhere Classified (see also 28-05-039, -047, -053)

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.
- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005. www.epa.gov/ttnecas1/models/DocumenationReport.pdf
- Axe, 1999: D. Axe, IMC Agrico Feed Ingredients, personal communication with S. Roe, E.H. Pechan & Associates, Inc., June 1999.

Other information:

COST_BASIS: Pechan contacted the manufacturer of the chemical inhibitor, N-(n-butyl) thiophosphoric triamide (NBPT; trade name Conserve-Nr). According to the manufacturer, the control effectiveness at cattle feedlots is 50 percent and the cost per head-day is $0.0062 ($2.26/head-yr; Axe, 1999).

According to the manufacturer, the same 50 percent control efficiency derived for cattle can be assumed for hogs (Axe, 1999). The emission factor for hogs is 20.3 lb/head-yr. With the 50 percent control efficiency, this equates to 10.15 lb/head-yr reduced (5.08 x 10-3 ton/head-yr reduced). Therefore, the cost parameter would be $0.37/5.08E-3 ton or $73/ton NH3 reduced.

ADMIN_PCT:	0%
SPVLBR_PCT:	0%
RPLMTL_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	50%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
CHEM_PCT:	0%
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $73 per ton NH3 reduced. (1999$)
CE_TEXT:	50% from uncontrolled
OTHR_PCT:	0%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	50%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	Co*
OVRHD_PCT:	0%
RULE:	Not Applicable
TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Chemical Additives to Waste;Poultry Operations

Abbreviation: ACHMADDCHK

Description: Application: This control is the chemical addition of alum to poultry litter. Alum is used to stabilize poultry litter to reduce ammonia emissions. Alum, an acid-forming compounds, keeps the pH of the poultry litter below 7, which inhibits ammonia volatilization.

The control applies to all poultry and chicken operations classified under SCC 2805030000.

Discussion: The control effectiveness for alum treatment is estimated to be 75 percent (Moore, 1999). The control effectiveness is highest during the early part of the growing cycle (i.e., >95 percent), when the young chickens are most susceptible to health problems from high ammonia levels. The control effectiveness drops off during the grow-out (about two months). Alum is then reapplied to the litter before the next grow-out begins (typically, there are 5 or 6 grow-outs per year). There is assumed to be 100 percent penetration.

Class: Known

Pollutant: NH3

Equipment Life: N/A years

Control Technology: Chemical Additives to Waste

Source Group: Poultry Operations

Sectors: ag

Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NH3
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$1,014
Ref Yr CPT:	$1,354
Control Efficiency:	75.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NH3
Locale:	
Effective Date:	N/A

Cost Year:	1999
CPT:	$1,014
Ref Yr CPT:	$1,354
Control Efficiency:	75.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2805030009	Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry Waste Emissions; Turkeys
2805030008	Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry Waste Emissions; Geese
2805030007	Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry Waste Emissions; Ducks
2805030004	Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry Waste Emissions; Broilers
2805030003	Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry Waste Emissions; Layers
2805030002	Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry Waste Emissions; Pullets 13 weeks old and older but less than 20 weeks old
2805030001	Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry Waste Emissions; Pullet Chicks and Pullets less than 13 weeks old
2805030000	Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry Waste Emissions; Not Elsewhere Classified (see also 28-05-007, -008, -009)

References:

- "AirControlNET Database, May 2006" Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. May 2006.
- "AirControlNET v.4.1 Documentation Report." Prepared for US EPA, OAQPS, RTP, NC 27711. Prepared by Pechan & Associates, Inc., 5528-B Hempstead Way, Springfield, VA 22151. Pechan Report No. 05.09.009/9010.463. September 2005.

www.epa.gov/ttnecas1/models/DocumenationReport.pdf

- Axe, 1999: D. Axe, IMC Agrico Feed Ingredients, personal communication with S. Roe, E.H. Pechan & Associates, Inc., June 1999.
- Moore, 1999: P.A. Moore, Jr., University of Arkansas, personal communication with S. Roe, E.H. Pechan & Associates, Inc., June 1999

Other information:

ADMIN_PCT:	0%
RPLMTL_PCT:	0%
STEAM_PCT:	0%
TDIR_PCT:	0%
CTRL_EFF_T:	75%
OMATL_PCT:	0%
OPLBR_PCT:	0%
OPLBR_RT:	$0/hr
PROPTX_PCT:	0%
CHEM_PCT:	0%
COST_BASIS:	Treatment costs are estimated to be about $0.025/head (Moore, 1999). These costs do not factor in some benefits to the grower (e.g., reduced heating/ventilation costs due to lower ammonia levels; higher value for fertilizer due to higher nitrogen levels). Assuming six grow-outs per year, the costs would be $0.15/head-yr. The emission factor used for all poultry is 0.394 lb/head-yr (1.97 x 10-4 ton/head-yr). Assuming a 75 percent control efficiency for alum treatment, the emission reduction would be 1.48 x 10-4 ton/head-yr reduced. Hence, the cost parameter would be $0.15/1.48E-04 ton reduced or $1,014/ton NH3 reduced.
CPTON_TEXT:	The cost effectiveness used in AirControlNET is $1,014 per ton NH3 reduced. (1999$)
CE_TEXT:	75% from uncontrolled
OTHR_PCT:	0%
ELEC_PCT:	0%
ELEC_RT:	$0/kWh
FUEL_PCT:	0%
HG_CE_T:	75%
INSRNC_PCT:	0%
MNTLBR_PCT:	0%
MNTLBR_RT:	$0/hr
MNTMTL_PCT:	0%
NG_RT:	$0/cf
NH3:	Co*
OVRHD_PCT:	0%
RULE:	Not Applicable
SPVLBR_PCT:	0%

TINDIR_PCT:	0%
UTIL_PCT:	0%
WSTDSP_PCT:	0%

Summary:

Control Measure Name: Emergent Control; Dairy
Abbreviation: AEMRGDIARY
Description: Application: This control consists of a composite of the following: solids separations/nutrient removal systems, a phototrophic lagoon processing system, a liquid manure injection and spreading system, and a man-made wetlands system for nitrogen removal. The control efficiency and costs used in CoST area an average across all of these control technologies.
Class: Emerging
Pollutant: NH3
Equipment Life: N/A years
Control Technology: Emergent Control
Source Group: Dairy Operations
Sectors: ag
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NH3
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$10,000
Ref Yr CPT:	$13,355
Control Efficiency:	55.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incrememental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NH3
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$10,000
Ref Yr CPT:	$13,355
Control Efficiency:	55.0
Min Emis:	N/A
Max Emis:	N/A

Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2805019300	Miscellaneous Area Sources; Agriculture Production - Livestock; Dairy cattle - flush dairy; Land application of manure
2805019200	Miscellaneous Area Sources; Agriculture Production - Livestock; Dairy cattle - flush dairy; Manure handling and storage
2805019100	Miscellaneous Area Sources; Agriculture Production - Livestock; Dairy cattle - flush dairy; Confinement
2805018000	Miscellaneous Area Sources; Agriculture Production - Livestock; Dairy cattle composite; Not Elsewhere Classified

References:

- EPA, 2006: U.S. Environmental Protection Agency, "Regulatory Impact Analysis: 2006 National Ambient Air Quality Standards for Particle Pollution". October 6, 2006. http://www.epa.gov/ttn/ecas/ria.html

Other information:

Summary:

Control Measure Name: Emergent Control; Swine
Abbreviation: AEMRGHOG
Description: Application: This control is a solids separation-tangential flow separator combined with a fan separation system. The system treats swine waste from finishing barns. Manure flushed from the barns flows first to a collection pit, then to an above-ground feed tank, then to the fan separator which is on a raised platform.
Class: Emerging
Pollutant: NH_3
Equipment Life: N/A years
Control Technology: Emergent Control
Source Group: Hog Operations
Sectors: ag
Months: All Months

Affected Pollutants, and their Control Efficiencies and Costs:

Pollutant:	NH3
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$10,000
Ref Yr CPT:	$13,355
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0
Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0
Pollutant:	NH3
Locale:	
Effective Date:	N/A
Cost Year:	1999
CPT:	$10,000
Ref Yr CPT:	$13,355
Control Efficiency:	70.0
Min Emis:	N/A
Max Emis:	N/A
Rule Effectiveness:	100.0

Rule Penetration:	100.0
Equation Type:	cpton
Capital Rec Fac:	N/A
Discount Rate:	N/A
Cap Ann Ratio:	N/A
Incremental CPT:	N/A
Details:	
Existing Measure:	
Existing NEI Dev:	0

Cost Equations:

N/A

Affected SCCs:

Code	Description
2805015001	Miscellaneous Area Sources; Agriculture Production - Livestock; Hog Operations; Feed Preparation
2805015000	Miscellaneous Area Sources; Agriculture Production - Livestock; Hog Operations; Total (use 2805025000)

References:

- EPA, 2006: U.S. Environmental Protection Agency, "Regulatory Impact Analysis: 2006 National Ambient Air Quality Standards for Particle Pollution". October 6, 2006. http://www.epa.gov/ttn/ecas/ria.html

Other information: