Commonwealth of Pennsylvania
Environmental Resources
August 9, 1990

Subject: Source Test Review

To: Data File
TPC Paving and Supply (Tresco Paving Corporation)
Salem Township, Westmoreland County

From: Richard St. Louis, Chief
Source Testing Unit
Division of Technical Services and Monitoring
Bureau of Air Quality Control

Through: Chief, Source Testing and Monitoring Section

Tresco Paving Corporation operates a batch mix asphaltic concrete facility in Salem Township, Westmoreland County. Aggregate from cold feed bins is charged to a rotary drier heated by a No. 2 fuel oil-fired burner. The hot aggregate is separated by size and proportioned into a pugmill where heated asphaltic oil is introduced and mixed to produce the final product.

The effluent from the drier is directed to a primary cyclone followed by an Astec baghouse consisting of eight compartments and 384 polyester bags. The material collected by this unit is either stored to be metered back into the pugmill or transported to the hot bucket elevator for sizing.

Comprehensive Safety Compliance, Inc. (CSC) conducted a series of three particulate emission tests in the discharge stack servicing the baghouse. The "revised" test report submitted by CSC, Inc. is acceptable to the Department. The only error in the report was in the calculation of the posttest Y value for the dry gas meter. The report indicates an average Y = 1.0 but should be a value of 0.982. Using the corrected Y value will increase the particulate emission rate by approximately 0.1 pound/hour for each of the test runs. The remaining calculations are correct and the rates reported should be indicative of the emissions from this facility at the operating conditions of the facility during the testing period.

The following results were extracted from the test report:

Test No.	Conc. gr/dscf	Emission Rate lb/hr.	Allowable Rate lbs/hr.
1	0.052	5.0	11.3
2	0.056	5.6	11.3
3	0.052	5.4	11.3

cc: Richard Murray, Greensburg District Office
File - 65-303-015
EPA/RSL
Doug Lesher
Reading File

RSL:dlg

COMPREHENSIVE SAFETY COMPLIANCE, INC.

295 William Pitt Way Pittsburgh, PA 15238
Telephone 412/826-5480

Safety Health Legal Environmental

TRESCO Paving
65-303-075

July 12, 1990

Mr. Rick St. Louis
P.A. D.E.R.
Bureau of Air Quality Control
Executive House
South 2nd & Chestnut St. (Room 108)
P. O. Box 2357
Harrisburg, PA 17120

Dear Mr. St. Louis:

Enclosed is the test report for TPC Paving and Supply asphalt plant located in Delmont, PA. If you have any questions, please do not hesitate to contact me.

Sincerely,

Richard L. Campbell

Richard L. Campbell
Division Manager
Source Testing

RLC/jab

Enclosure

cc: Mr. Richard Murray, DER-Greensburg

PARTICULATE EMISSION TESTING
ASPHALT PLANT BAGHOUSE
T.P.C. PAVING AND SUPPLY
DELMONT, PA

Report to:

Mr. Sonny Tresco
T.P.C. Paving and Supply
P. O. Box 14004
Pittsburgh, PA 15239

Report by:

Mr. Richard L. Campbell
Division Manager

Comprehensive Safety Compliance, Inc.
295 William Pitt Way
Pittsburgh, PA 15238

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APPENDIX

1.0 INTRODUCTION

On May 31, 1990, particulate emission testing and opacity observations were performed on the Asphalt Plant Baghouse at T.P.C. Paving and Supply Company's plant in Delmont, PA.

The test program was authorized by Mr. Sonny Tresco of T.P.C. Paving and Supply Company. Testing was performed by Mr. Richard Campbell, Mr. Darren Midberry and a visible emission reading by Mr. Kevin Kennedy of Comprehensive Safety Compliance, Inc. (CSC). Testing was observed by Mr. Dick Murray of the Pennsylvania Department of Environmental Resources Air Pollution Control Bureau.

2.0 SUMMARY OF RESULTS

Table No. 1 below is a summary of Particulate Emission Data and Opacity Data from tests on the Asphalt Plant Baghouse.

Table No. 2 is a summary of flue gas parameters.

TABLE NO. 1

Particulate Emissions and Opacity Data

Test Data 1990	Test No.	Test Location	Particulate Emission Data			Opacity Data[c]		
			Conc.[a] Gr/dscf	Emission Rate[b] lb/hr.	Allowable lb/hr	Min. %	Max. %	Highest 6 min. Avg. %
5/31	TP-1	Baghouse Outlet	0.0033	4.9	11.3	5	5	5
5/31	TP-2	Baghouse Outlet	0.0036	5.5	11.3	0	10	5
5/31	TP-3	Baghouse Outlet	0.0033	5.3	11.3	0	10	5

(a) Grains per dry standard cubic foot
(b) Pounds per hour
(c) Opacity data from EPA Method 9 observations

TABLE NO. 2

Summary of Flue Gas Parameters

Test Date 1990	Test No.	Test Location	Percent Moisture	Stack Temp. °F	Percent		Flow Rates	
					CO_2 [a]	O_2 [b]	ACFM[c]	DSCFM[d]
5/31	TP-1	Baghouse Outlet	22.9	197	4.3	14.7	18,900	11,300
5/31	TP-2	Baghouse Outlet	22.1	201	4.7	16.5	20,000	11,600
5/31	TP-3	Baghouse Outlet	21.5	205	5.2	14.2	21,000	12,200

a percent carbon dioxide by volume
b percent oxygen by volume
c actual cubic feet per minute
d dry standard cubic feet per minute

3.0 PROCESS AND TEST PROGRAM DESCRIPTION

The process begins with the loading of different sized aggregate from stockpiles, usually into four "cold" bins as shown in Figure No. 1. From these cold bins calibrated vibratory feeders control the amounts of each aggregate falling onto a conveyor that leads, either directly or by means of a bucket elevator, to the inlet of the dryer. The function of the dryer is to remove surface moisture and heat the aggregate in order to be coated with asphalt cement in the pugmill.

The dryer is an inclined rotary drum, about 9 feet in diameter and 28 feet long, in which the aggregate is dried and heated by an oil burner. The dryer is designed with "flights" on the inside that tumble the aggregate and increase exposure to the hot gases. The burner is located at the aggregate discharge or low end of the dryer; therefore, the combustion gases flow counter current to aggregate flow.

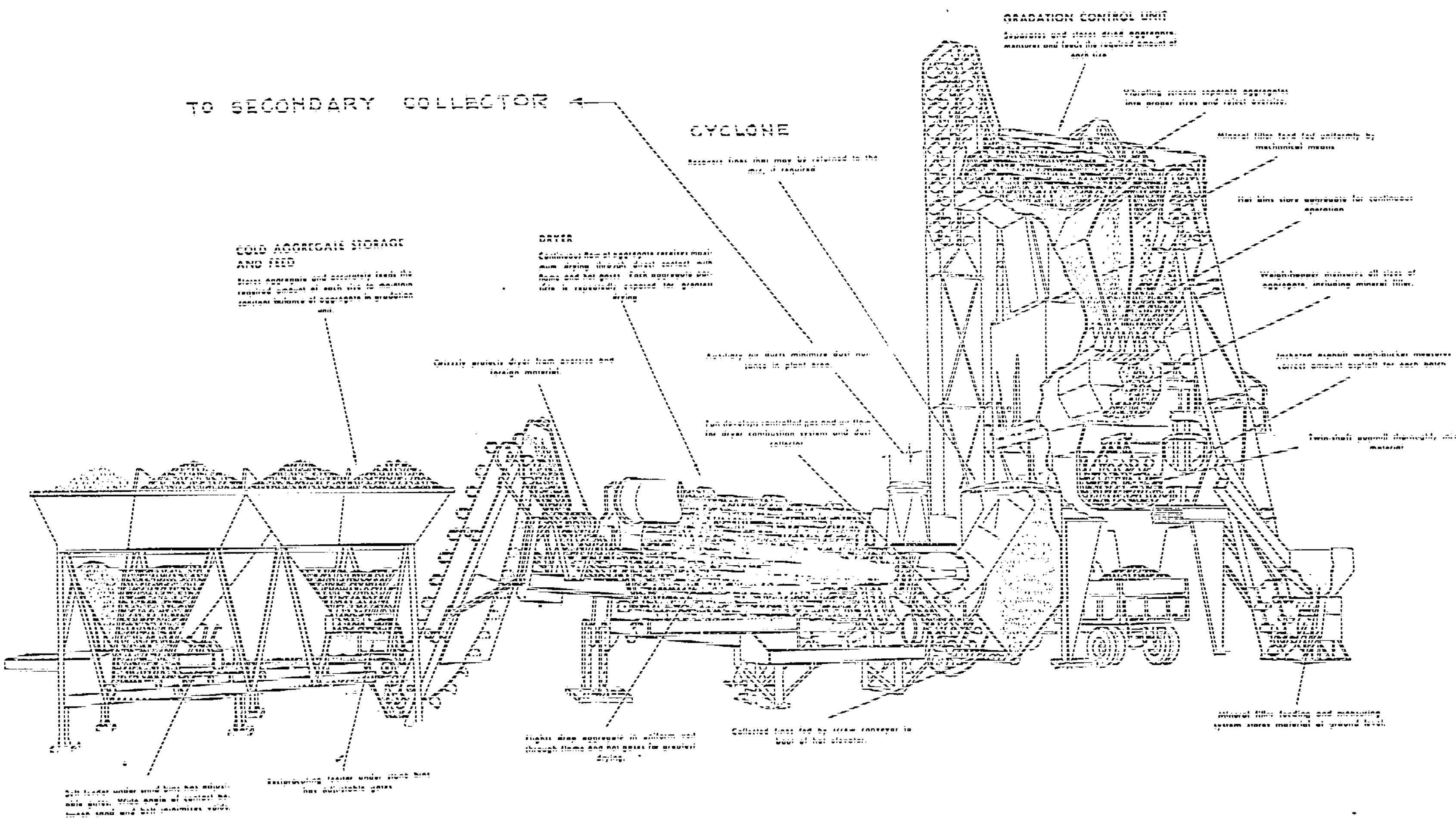
The effluent gases from the dryer are directed to a primary cyclone and a fabric filter secondary collector. The collector is an Astec baghouse with 8 compartments and 384 polyester bags. The dry collected material is either stored to be partially metered back into the weigh hopper or transported directly to the hot elevator.

From the discharge end of the dryer the heated aggregate is transported by the "hot elevator" to a set of vibrating screens located over the hot bins in the batching tower. These screens sort the aggregate according to size and drop it into the appropriate hot bin. Over size material and material from overfilled bins is discharged via a reject chute. It is from these hot bins that each size aggregate is weighed in the weigh hopper according to mix specifications and dropped into the pugmill. Additional mineral filler, when necessary, is added onto the hot elevator or onto the weight hopper. The aggregate is then mixed dry for a few seconds before a fixed percentage of asphalt cement is pumped in from heated storage. Mixing then lasts an additional thirty to forty seconds after which the completed batch of asphalt is dropped into waiting trucks. Process data for each test is provided in Table No. 3.

Test Program Description

Testing was conducted on the Particulate Emissions from the Asphalt Plant Baghouse.

The sampling location is shown in Figure No. 2 Sample duration was 72 minutes for all three tests.



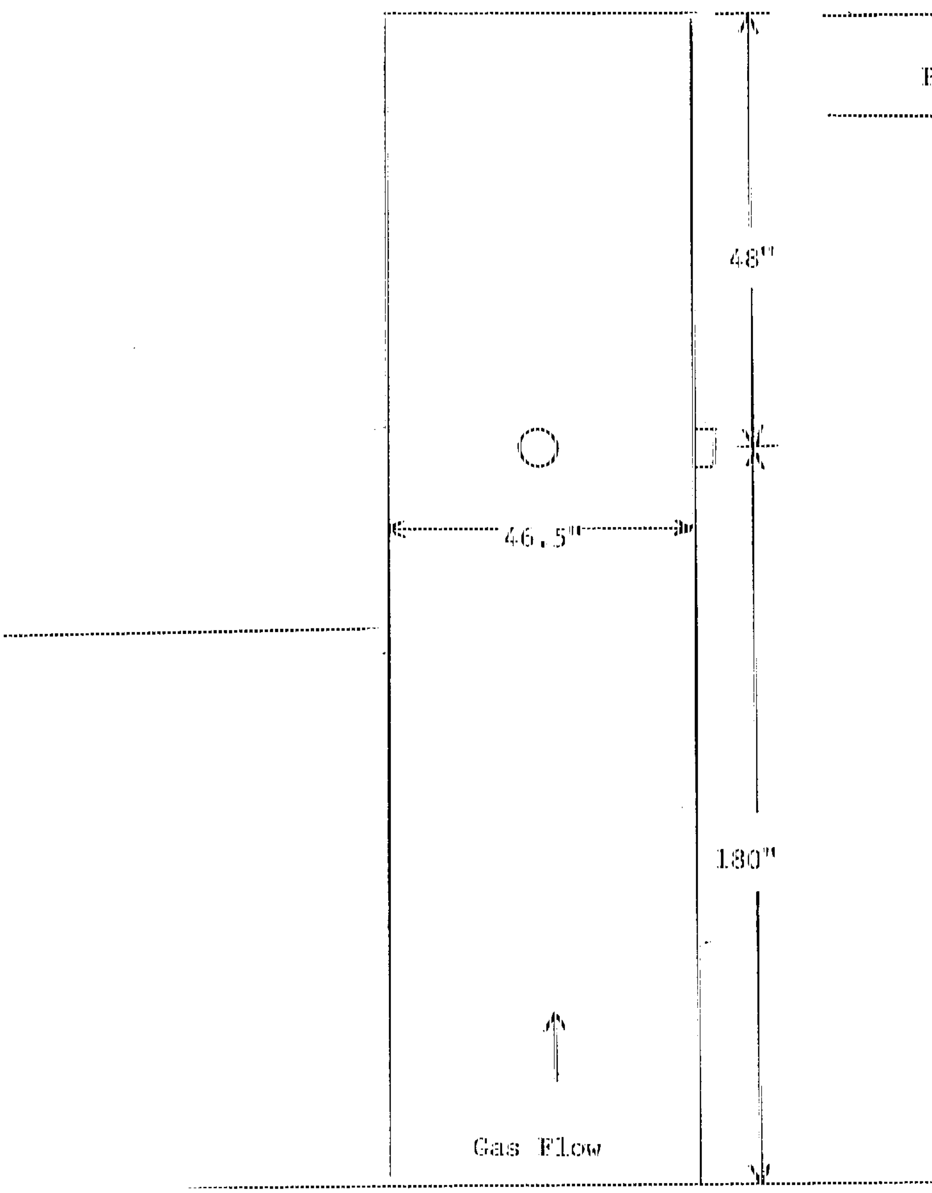
TO SECONDARY COLLECTOR
CYCLONE
GRADATION CONTROL UNIT
Hot bins store aggregate for continuous operation
Twin-shaft pugmill thoroughly mixes material
Mineral filler feeding and measuring system stores material at ground level.
COLD AGGREGATE STORAGE AND FEED
DRYER

Figure No. 1

TABEL NO. 3

Process Production

DATE 1990	TEST NO	PRODUCTION RATE TONS/HR	TYPE MIX
5/31	TP-1	102.4	Top
5/31	TP-2	103.9	Top
5/31	TP-3	102.8	Top



Traverse Point Location

Traverse Point No.	Percent of Diameter
1	2.1
2	6.7
3	11.8
4	17.7
5	25.0
6	35.6
7	64.4
8	75.0
9	82.3
10	88.2
11	93.3
12	97.9

Two sample ports 90° apart
12 points per port
24 total sample points

Figure No. 2
Baghouse Outlet
Sampling Location

Method 5 Sampling Procedures

After selecting the sampling site and the minimum number of traverse points, the stack pressure, temperature, moisture and range of velocity head were measured according to the procedures described in the Federal Register*.

Approximately 200 grams of silica gel was weighed in a sealed impinger prior to each test. Glass fiber filters** (4 inch diameter) desiccated for at least 24 hours, dried at 105°C for 2 hours and weighed to the nearest 0.1mg. on an analytical balance. One hundred ml of distilled water was placed in each of the first two impingers; the third impinger was initially empty; and the impinger containing the silica gel was placed next in series. The sampling train was leak-checked at the sampling site prior to each test run by plugging the inlet to the nozzle and pulling 15-inch Hg vacuum, at the conclusion of the test by plugging the inlet to the nozzle and pulling a vacuum equal to the highest vacuum reached during the test run. A more detailed description of the sampling and analytical procedures is provided in Appendix B.

A. FORMULAS AND CALCULATIONS

NOMENCLATURE AND DIMENSIONS

A_s	=	cross-sectional area of stack, ft^2
A_n	=	area of sampling nozzle, ft^2
B_{ws}	=	proportional by volume of water vapor in the gas stream, dimensionless
C_p	=	pitot tube coefficient, diamensionless = .84
C_s	=	concentration of particulate matter in stack gas, gr/scf, dry basis
%CO	=	percent of carbon monoxide by volume, dry basis
$\%CO^2$	=	percent of carbon dioxide by volume, dry basis
H	=	average pressure drop across the orifice meter, inches of H_2O
I	=	percent of isokinetic sampling
M_d	=	dry molecular weight, lb/lb-mole
M_n	=	total amount of particulate matter collected, mg.
M_s	=	molecular weight of stack gas (wet basis), lb/lb-mole
$\%N_2$	=	percent of nitrogen by volume, dry basis
$\%O_2$	=	percent of oxygen by volume, dry basis
p	=	velocity head of stack gas, inches of H_2O
P_{bar}	=	barometric pressure, inches of Hg
P_s	=	absolute stack gas pressure, inches of Hg
pmr	=	particulate matter emission rate, lbs/hr
Q_s	=	volumetric flow rate, wet basis, standard conditions
$Q_{s\,std}$	=	volumetric flow rate, dry basis, standard
T_m	=	average temperature of dry gas meter, R
T_s	=	average temperature of stack gas, R

V_{lc} = total volume of liquid collected in impingers and silica gel, ml.

V_m = volume of sample through the dry gas meter at meter conditions, ft^3

$V_{m_{std}}$ = volume of gas sample through the dry gas meter at standard conditions, ft^3

V_s = stack gas velocity at stack conditions, fps

$V_{w_{std}}$ = volume of water in the gas sample at standard conditions, ft^3

θ = total sampling time, minutes

Note: Standard conditions = 70 F and 29.92 inches of Hg.

Example Calculations for Particulate Emissions

Test No. TP-1

1. Volume of dry gas sampled corrected to standard conditions. Note: V_m must be corrected for leakage if any leakage rates exceed L_a.)

$$V_{m_{std}} = 17.65 \times V_m \times Y \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] =$$

$$V_{m_{std}} = 17.65 \times 53.831 \times 1.0 \left[\frac{28.85 + \frac{1.73}{13.6}}{547} \right] = 50.332$$

2. Volume of water vapor at standard conditions, ft^3.

$$V_{w_{std}} = 0.04707 V_{1_c} =$$

$$V_{w_{std}} = 0.04707 \times 316.1 = 14.88$$

3. Moisture content in stack gas.

$$B_{ws} = \frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{m_{std}} + V_{wc_{std}} + V_{wsg_{std}}} = B_{ws} = \frac{14.88}{50.332 + 14.88} = .228$$

4. Dry molecular weight of stack gas.

$$M_d = 0.440\ (\%\ CO_2) + 0.320\ (\%O_2) + 0.280\ (\%\ N_2 + \%\ CO) =$$

$$M_d = 0.440\ (4.3) + 0.32\ (14.7) + 0.280\ (81) = 29.28$$

5. Molecular weight of stack gas

$$M_s = M_d\ (1 - B_{ws}) + 18\ B_{ws} =$$

$$M_s = 29.28\ (1 - .228) + 18(.228) = 26.71$$

6. Stack velocity at stack conditions, fps

$$V_s = 85.49\ C_p \sqrt{\Delta p}\ \text{avg.} \sqrt{\frac{T_s}{P_s\ M_s}} =$$

$$V_s = 85.49 \times .84 \times (.403) \times \sqrt{\frac{657}{28.86 \times 26.71}} = 26.72$$

7. Stack gas volumetric flow rate at stack conditions, cfh

$$Q_s = 3600 \times V_s \times A_s$$

$$Q_s = 60 \times 26.72 \times 11.793 = 18{,}906 \text{ ACFM}$$

1,134,360 ACFH

8. Dry stack gas volumetric flow rate at standard conditions, cfh.

$$Q_{s_{std}} = 17.65\ Q_s \frac{P_s}{T_s} (1-B_{ws}) = \text{SCFM} \times 60 = \text{SCFH}$$

$$Q_{std} = 17.65 \times 18{,}906\ \frac{28.86}{657} \times (1-.228) = 11{,}316 \times 60 = 678{,}960$$

9. Concentration in g/scf

$$C'_s = 0.001 \text{ g/mg} \frac{M_n}{V_{m_{std}}} = 0.001 \times \frac{156.22}{50.332} = .0033$$

10. Particulate mass emission rate, lbs/hr.

$$\text{pmr} = \frac{C_s \times Q_{s_{std}}}{454} = \frac{.0033 \times 678{,}960}{454} = 4.9 \text{ lb/hr}$$

11. Isokinetic variation

$$I = \frac{100\ T_s \left[0.002669\ V_{1_c} + \frac{V_m}{T_m} Y\ P_{bar} + \frac{\Delta H}{13.6}\right]}{60\ \ominus\ V_s\ P_s\ A_n} =$$

$$I = \frac{100\ (657)\ [0.002669(316.1) + \frac{53.831}{547}\ (1.0)\ (28.85 + \frac{1.73}{13.6})]}{60 \times 72 \times 26.72 \times 28.86 \times .000707} = 103.1\%$$

Commonwealth of Pennsylvania
Environmental Resources
August 9, 1990

Subject: Source Test Review

To: Data File
TPC Paving and Supply (Tresco Paving Corporation)
Salem Township, Westmoreland County

From: Richard St. Louis, Chief
Source Testing Unit
Division of Technical Services and Monitoring
Bureau of Air Quality Control

Through: Chief, Source Testing and Monitoring Section

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The following results were extracted from the test report:

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cc: Richard Murray, Greensburg District Office
File - 65-303-015
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RSL:dlg

COMPREHENSIVE SAFETY COMPLIANCE, INC.

295 William Pitt Way Pittsburgh, PA 15238
Telephone 412/826-5480

Safety Health Legal Environmental

TRESCO paving
65-303-475

July 12, 1990

Mr. Rick St. Louis
P.A. D.E.R.
Bureau of Air Quality Control
Executive House
South 2nd & Chestnut St. (Room 108)
P. O. Box 2357
Harrisburg, PA 17120

Dear Mr. St. Louis:

Enclosed is the test report for TPC Paving and Supply asphalt plant located in Delmont, PA. If you have any questions, please do not hesitate to contact me.

Sincerely,

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Division Manager
Source Testing

RLC/jab

Enclosure

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PARTICULATE EMISSION TESTING
ASPHALT PLANT BAGHOUSE
T.P.C. PAVING AND SUPPLY
DELMONT, PA

Report to:

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P. O. Box 14004
Pittsburgh, PA 15239

Report by:

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Comprehensive Safety Compliance, Inc.
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APPENDIX

1.0 INTRODUCTION

On May 31, 1990, particulate emission testing and opacity observations were performed on the Asphalt Plant Baghouse at T.P.C. Paving and Supply Company's plant in Delmont, PA.

The test program was authorized by Mr. Sonny Tresco of T.P.C. Paving and Supply Company. Testing was performed by Mr. Richard Campbell, Mr. Darren Midberry and a visible emission reading by Mr. Kevin Kennedy of Comprehensive Safety Compliance, Inc. (CSC). Testing was observed by Mr. Dick Murray of the Pennsylvania Department of Environmental Resources Air Pollution Control Bureau.

2.0 SUMMARY OF RESULTS

Table No. 1 below is a summary of Particulate Emission Data and Opacity Data from tests on the Asphalt Plant Baghouse.

Table No. 2 is a summary of flue gas parameters.

TABLE NO. 1

Particulate Emissions and Opacity Data

Test Data 1990	Test No.	Test Location	Particulate Emission Data: Conc.[a] Gr/dscf	Particulate Emission Data: Emission Rate[b] lb/hr.	Particulate Emission Data: Allowable lb/hr	Opacity Data[c]: Min. %	Opacity Data[c]: Max. %	Opacity Data[c]: Highest 6 min. Avg. %
5/31	TP-1	Baghouse Outlet	0.0033	4.9	11.3	5	5	5
5/31	TP-2	Baghouse Outlet	0.0036	5.5	11.3	0	10	5
5/31	TP-3	Baghouse Outlet	0.0033	5.3	11.3	0	10	6

(a) Grains per dry standard cubic foot
(b) Pounds per hour
(c) Opacity data from EPA Method 9 observations

TABLE NO. 2

Summary of Flue Gas Parameters

Test Date 1990	Test No.	Test Location	Percent Moisture	Stack Temp. °F	Percent		Flow Rates	
					CO_2 [a]	O_2 [b]	ACFM[c]	DSCFM[d]
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a percent carbon dioxide by volume
b percent oxygen by volume
c actual cubic feet per minute
d dry standard cubic feet per minute

3.0 PROCESS AND TEST PROGRAM DESCRIPTION

The process begins with the loading of different sized aggregate from stockpiles, usually into four "cold" bins as shown in Figure No. 1. From these cold bins calibrated vibratory feeders control the amounts of each aggregate falling onto a conveyor that leads, either directly or by means of a bucket elevator, to the inlet of the dryer. The function of the dryer is to remove surface moisture and heat the aggregate in order to be coated with asphalt cement in the pugmill.

The dryer is an inclined rotary drum, about 9 feet in diameter and 28 feet long, in which the aggregate is dried and heated by an oil burner. The dryer is designed with "flights" on the inside that tumble the aggregate and increase exposure to the hot gases. The burner is located at the aggregate discharge or low end of the dryer; therefore, the combustion gases flow counter current to aggregate flow.

The effluent gases from the dryer are directed to a primary cyclone and a fabric filter secondary collector. The collector is an Astec baghouse with 8 compartments and 384 polyester bags. The dry collected material is either stored to be partially metered back into the weigh hopper or transported directly to the hot elevator.

From the discharge end of the dryer the heated aggregate is transported by the "hot elevator" to a set of vibrating screens located over the hot bins in the batching tower. These screens sort the aggregate according to size and drop it into the appropriate hot bin. Over size material and material from overfilled bins is discharged via a reject chute. It is from these hot bins that each size aggregate is weighed in the weigh hopper according to mix specifications and dropped into the pugmill. Additional mineral filler, when necessary, is added onto the hot elevator or onto the weight hopper. The aggregate is then mixed dry for a few seconds before a fixed percentage of asphalt cement is pumped in from heated storage. Mixing then lasts an additional thirty to forty seconds after which the completed batch of asphalt is dropped into waiting trucks. Process data for each test is provided in Table No. 3.

Test Program Description

Testing was conducted on the Particulate Emissions from the Asphalt Plant Baghouse.

The sampling location is shown in Figure No. 2 Sample duration was 72 minutes for all three tests.

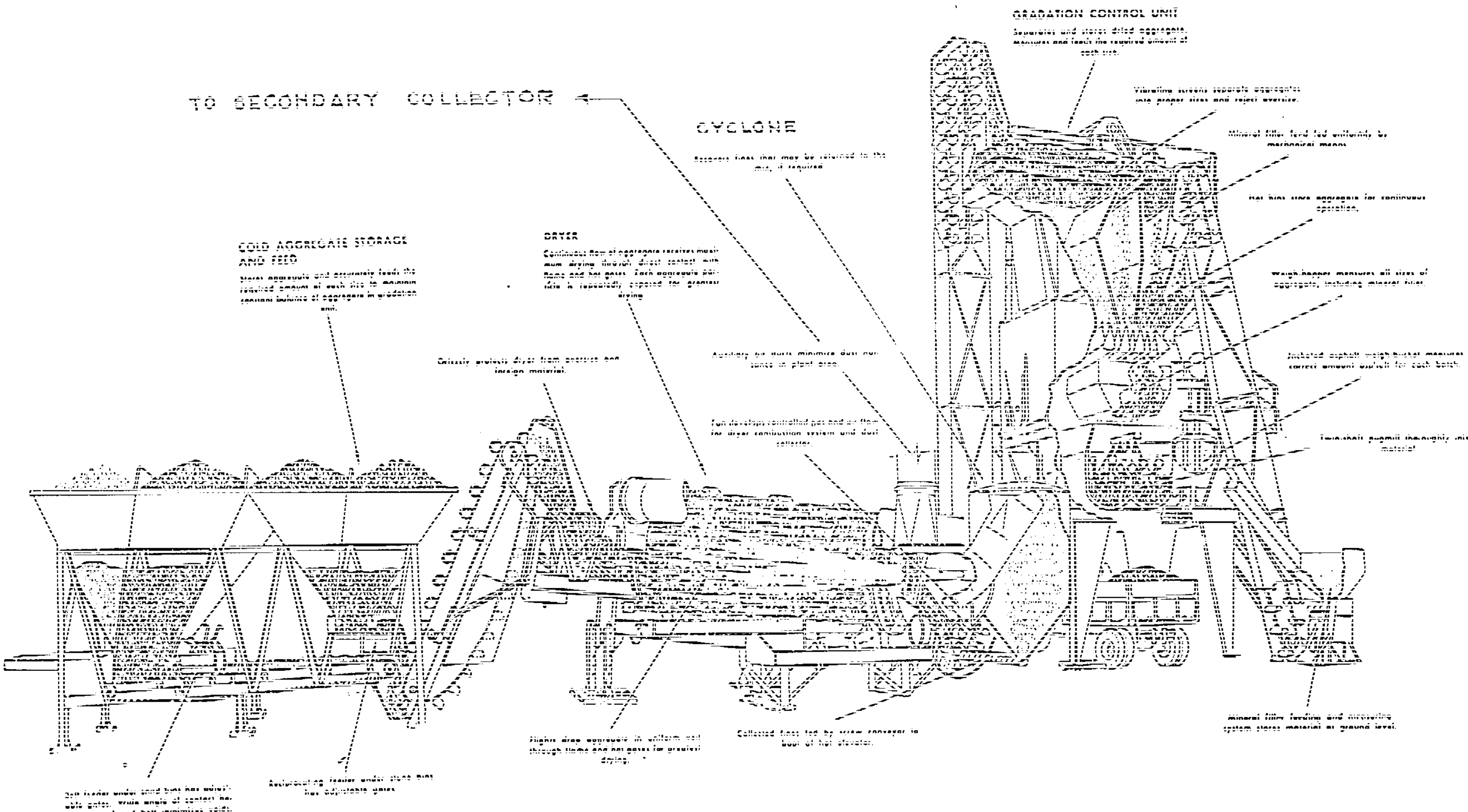
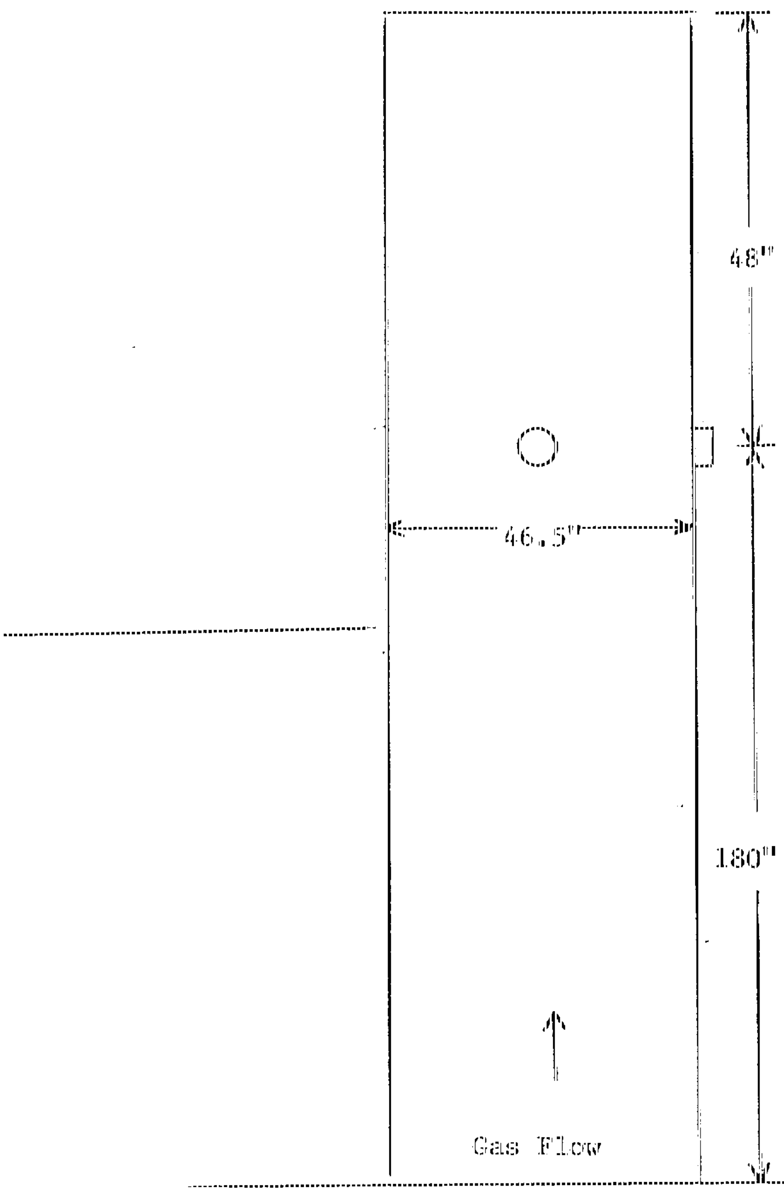

TO SECONDARY COLLECTOR
CYCLONE
Recovers fines that may be returned to the mix, if required.
GRADATION CONTROL UNIT
Separates and stores dried aggregate, measures and feeds the required amount of each size.
Vibrating screens separate aggregates into proper sizes and reject oversize.
Mineral filler feed fed uniformly by mechanical means.
Hot bins store aggregate for continuous operation.
Weigh-hopper measures all sizes of aggregate, including mineral filler.
Jacketed asphalt weigh-bucket measures correct amount asphalt for each batch.
Twin-shaft pugmill thoroughly mixes material.
COLD AGGREGATE STORAGE AND FEED
Stores aggregate and accurately feeds the required amount of each size to maintain constant balance of aggregate in gradation unit.
DRYER
Continuous flow of aggregate receives maximum drying through direct contact with flame and hot gases. Each aggregate particle is repeatedly exposed for greatest drying.
Grizzly protects dryer from oversize and foreign material.
Auxiliary air ducts minimize dust nuisance in plant area.
Fan develops controlled gas and air flow for dryer combustion system and dust collector.
Belt feeder under sand bins has adjustable gates. Wide angle of contact between sand and belt minimizes voids.
Reciprocating feeder under stone bins has adjustable gates.
Flights drop aggregate in uniform veil through flame and hot gases for greatest drying.
Collected fines fed by screw conveyor to boot of hot elevator.
Mineral filler feeding and measuring system stores material at ground level.

Figure No. 1

TABEL NO. 3

Process Production

DATE 1990	TEST NO	PRODUCTION RATE TONS/HR	TYPE MIX
5/31	TP-1	102.4	Top
5/31	TP-2	103.9	Top
5/31	TP-3	102.8	Top



Traverse Point Location

Traverse Point No.	Percent of Diameter
1	2.1
2	6.7
3	11.8
4	17.7
5	25.0
6	35.6
7	64.4
8	75.0
9	82.3
10	88.2
11	93.3
12	97.9

Two sample ports 90^{o} apart
12 points per port
24 total sample points

Figure No. 2
Baghouse Outlet
Sampling Location

Method 5 Sampling Procedures

After selecting the sampling site and the minimum number of traverse points, the stack pressure, temperature, moisture and range of velocity head were measured according to the procedures described in the Federal Register*.

Approximately 200 grams of silica gel was weighed in a sealed impinger prior to each test. Glass fiber filters** (4 inch diameter) desiccated for at least 24 hours, dried at 105°C for 2 hours and weighed to the nearest 0.1mg. on an analytical balance. One hundred ml of distilled water was placed in each of the first two impingers; the third impinger was initially empty; and the impinger containing the silica gel was placed next in series. The sampling train was leak-checked at the sampling site prior to each test run by plugging the inlet to the nozzle and pulling 15-inch Hg vacuum, at the conclusion of the test by plugging the inlet to the nozzle and pulling a vacuum equal to the highest vacuum reached during the test run. A more detailed description of the sampling and analytical procedures is provided in Appendix B.

A. FORMULAS AND CALCULATIONS

NOMENCLATURE AND DIMENSIONS

A_s = cross-sectional area of stack, ft^2

A_n = area of sampling nozzle, ft^2

B_{ws} = proportional by volume of water vapor in the gas stream, dimensionless

C_p = pitot tube coefficient, diamensionless = .84

C_s = concentration of particulate matter in stack gas, gr/scf,dry basis

%CO = percent of carbon monoxide by volume, dry basis

$\%CO^2$ = percent of carbon dioxide by volume, dry basis

H = average pressure drop across the orifice meter, inches of H_2O

I = percent of isokinetic sampling

M_d = dry molecular weight, lb/lb-mole

M_n = total amount of particulate matter collected, mg.

M_s = molecular weight of stack gas (wet basis), lb/lb-mole

$\%N_2$ = percent of nitrogen by volume, dry basis

$\%O_2$ = percent of oxygen by volume, dry basis

p = velocity head of stack gas, inches of H_2O

P_{bar} = barometric pressure, inches of Hg

P_s = absolute stack gas pressure, inches of Hg

pmr = particulate matter emission rate, lbs/hr

Q_s = volumetric flow rate, wet basis, standard conditions

$Q_{s\,std}$ = volumetric flow rate, dry basis, standard

T_m = average temperature of dry gas meter, R

T_s = average temperature of stack gas, R

V_{lc} = total volume of liquid collected in impingers and silica gel, ml.

V_m = volume of sample through the dry gas meter at meter conditions, ft^3

$V_{m_{std}}$ = volume of gas sample through the dry gas meter at standard conditions, ft^3

V_s = stack gas velocity at stack conditions, fps

$V_{w_{std}}$ = volume of water in the gas sample at standard conditions, ft^3

θ = total sampling time, minutes

Note: Standard conditions = 70 F and 29.92 inches of Hg.

Example Calculations for Particulate Emissions

Test No. TP-1

1. Volume of dry gas sampled corrected to standard conditions. Note: V_m must be corrected for leakage if any leakage rates exceed L_a.)

$$V_{m_{std}} = 17.65 \times V_m \times Y \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] =$$

$$V_{m_{std}} = 17.65 \times 53.831 \times 1.0 \left[\frac{28.85 + \frac{1.73}{13.6}}{547}\right] = 50.332$$

2. Volume of water vapor at standard conditions, ft^3.

$$V_{w_{std}} = 0.04707 V_{lc} =$$

$$V_{w_{std}} = 0.04707 \times 316.1 = 14.88$$

3. Moisture content in stack gas.

$$B_{ws} = \frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{m_{std}} + V_{wc_{std}} + V_{wsg_{std}}} = B_{ws} = \frac{14.88}{50.332 + 14.88} = .228$$

4. Dry molecular weight of stack gas.

$$M_d = 0.440\ (\%\ CO_2) + 0.320\ (\%O_2) + 0.280\ (\%\ N_2 + \%\ CO) =$$

$$M_d = 0.440\ (4.3) + 0.32\ (14.7) + 0.280\ (81) = 29.28$$

5. Molecular weight of stack gas

$$M_s = M_d\ (1-B_{ws}) + 18\ B_{ws} =$$

$$M_s = 29.28\ (1-.228) + 18(.228) = 26.71$$

6. Stack velocity at stack conditions, fps

$$V_s = 85.49\ C_p \quad \sqrt{\Delta p}\ \text{avg.} \quad \sqrt{\frac{T_s}{P_s\ M_s}} =$$

$$V_s = 85.49 \times .84 \times (.403) \times \sqrt{\frac{657}{28.86 \times 26.71}} = 26.72$$

7. Stack gas volumetric flow rate at stack conditions, cfh

$$Q_s = 3600 \times V_s \times A_s$$

$$Q_s = 60 \times 26.72 \times 11.793 = 18,906 \text{ ACFM}$$

1,134,360 ACFH

8. Dry stack gas volumetric flow rate at standard conditions, cfh.

$$Q_{s_{std}} = 17.65\ Q_s\ \frac{P_s}{T_s}\ (1-B_{ws}) = \text{SCFM} \times 60 = \text{SCFH}$$

$$Q_{std} = 17.65 \times 18,906\ \frac{28.86}{657} \times (1-.228) = 11,316 \times 60 = 678,960$$

9. Concentration in g/scf

$$C'_s = 0.001\ \text{g/mg}\ \frac{M_n}{V_{m_{std}}} = 0.001 \times \frac{166.22}{50.332} = .0033$$

10. Particulate mass emission rate, lbs/hr.

$$\text{pmr} = \frac{C_s \times Q_{s_{std}}}{454} = \frac{.0033 \times 678,960}{454} = 4.9\ \text{lb/hr}$$

11. Isokinetic variation

$$I = \frac{100\ T_s \left[0.002669\ V_{1_c} + \frac{V_m}{T_m}\ Y \left(P_{bar} + \frac{\Delta H}{13.6}\right)\right]}{60\ \theta\ V_s\ P_s\ A_n} =$$

$$I = \frac{100\ (657)\ [0.002669(316.1) + \frac{53.831}{547}\ (1.0)\ (28.85 + \frac{1.73}{13.6})]}{60 \times 72 \times 26.72 \times 28.86 \times .000707} = 103.1\%$$

Example Calculations for Particulate Emissions

Test No. TP-2

1. Volume of dry gas sampled corrected to standard conditions. Note: V_m must be corrected for leakage if any leakage rates exceed L_a.)

$$V_{m_{std}} = 17.65 \times V_m \times Y \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] =$$

$$V_{m_{std}} = 17.65 \times 55.271 \times 1.0 \left[\frac{28.0 + \frac{1.9}{13.6}}{555} \right] = 49.462$$

2. Volume of water vapor at standard conditions, ft^3.

$$V_{w_{std}} = 0.04707 V_{l_c} =$$

$$V_{w_{std}} = 0.04707 \times 298.4 = 14.04$$

3. Moisture content in stack gas.

$$B_{ws} = \frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{m_{std}} + V_{wc_{std}} + V_{wsg_{std}}} = B_{ws} = \frac{14.04}{49.462 + 14.04} = .221$$

4. Dry molecular weight of stack gas.

$$M_d = 0.440\ (\%\ CO_2) + 0.320\ (\%O_2) + 0.280\ (\%\ N_2 + \%\ CO) =$$

$$M_d = 0.440\ (4.7) + 0.32\ (16.5) + 0.280\ (78.8) = 29.41$$

5. Molecular weight of stack gas

$$M_s = M_c\ (1-B_{ws}) + 18\ B_{ws} =$$

$$M_s = 29.41\ (1-.221) + 18(.221) = 26.89$$

6. Stack velocity at stack conditions, fps

$$V_s = 85.49\ C_p \quad \sqrt{\Delta p} \quad \text{avg.} \sqrt{\frac{T_s}{P_s\ M_s}} =$$

$$V_s = 85.49 \times .84 \times (.420) \times \sqrt{\frac{660}{28.01 \times 26.89}} = 28.23$$

7. Stack gas volumetric flow rate at stack conditions, cfh

$$Q_s = 3600 \times V_s \times A_s$$

$$Q_s = 60 \times 28.23 \times 11.793 = 19,975 \text{ ACFM}$$

1,198,500 ACFH

8. Dry stack gas volumetric flow rate at standard conditions, cfh.

$$Q_{s_{std}} = 17.65\ Q_s \frac{P_s}{T_s} (1-B_{ws}) = \text{SCFM} \times 60 = \text{SCFH}$$

$$Q_{std} = 17.65 \times 19,975 \frac{28.01}{660} \times (1-.221) = 11,656 \times 60 = 699,360$$

9. Concentration in g/scf

$$C'_s = 0.001 \text{ g/mg} \frac{M_n}{V_{m_{std}}} = 0.001 \times \frac{178.92}{49.462} = .0036$$

10. Particulate mass emission rate, lbs/hr.

$$\text{pmr} = \frac{C_s \times Q_{s_{std}}}{454} = \frac{.0036 \times 699,360}{454} = 5.54 \text{ lb/hr}$$

11. Isokinetic variation

$$I = \frac{100\ T_s \left[0.002669\ V_{1c} + \frac{V_m}{T_m} Y \left(P_{bar} + \frac{\Delta H}{13.6}\right)\right]}{60\ \theta\ V_s\ P_s\ A_n} =$$

$$I = \frac{100\ (660)\ \left[0.002669(298.4) + \frac{55.271}{555} \times (1.0)\ \left(28 + \frac{1.9}{13.6}\right)\right]}{60 \times 72 \times 28.23 \times 28.01 \times .000707} = 98.3\%$$

Example Calculations for Particulate Emissions

Test No. TP-3

1. Volume of dry gas sampled corrected to standard conditions. Note: V_m must be corrected for leakage if any leakage rates exceed L_a.)

$$V_{m_{std}} = 17.65 \times V_m \times Y \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] =$$

$$V_{m_{std}} = 17.65 \times 58.439 \times 1.0 \left[\frac{28.0 + \frac{2.04}{13.6}}{563}\right] = 51.572$$

2. Volume of water vapor at standard conditions, ft^3.

$$V_{w_{std}} = 0.04707 V_{1_c} =$$

$$V_{w_{std}} = 0.04707 \times 300.7 = 14.15$$

3. Moisture content in stack gas.

$$B_{ws} = \frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{m_{std}} + V_{wc_{std}} + V_{wsg_{std}}} = B_{ws} = \frac{14.15}{51.572 + 14.15} = .215$$

4. Dry molecular weight of stack gas.

$$M_d = 0.440\ (\%\ CO_2) + 0.320\ (\%O_2) + 0.280\ (\%\ N_2 + \%\ CO) =$$

$$M_d = 0.440\ (5.2) + 0.320\ (14.2) + 0.280\ (80.6) = 29.4$$

5. Molecular weight of stack gas

$$M_s = M_d\ (1-B_{ws}) + 18\ B_{ws} =$$

$$M_s = 29.4\ (1-.215) + 18(.215) = 26.95$$

6. Stack velocity at stack conditions, fps

$$V_s = 85.49\ C_p \sqrt{\Delta p}\ \text{avg.} \sqrt{\frac{T_s}{P_s\ M_s}} =$$

$$V_s = 85.49 \times .84 \times (.440) \times \sqrt{\frac{665}{28.01 \times 26.95}} = 29.66$$

7. Stack gas volumetric flow rate at stack conditions, cfh

$$Q_s = 3600 \times V_s \times A_s$$

$$Q_s = 60 \times 29.66 \times 11.793 = 20,987 \text{ ACFM}$$

1,259,220 ACFH

8. Dry stack gas volumetric flow rate at standard conditions, cfh.

$$Q_{s_{std}} = 17.65\ Q_s \frac{P_s}{T_s} (1 - B_{ws}) = \text{SCFM} \times 60 = \text{SCFH}$$

$$Q_{std} = 17.65 \times 20,987\ \frac{28.01}{665} \times (1 - .215) = 12,248 \times 60 = 734,880$$

9. Concentration in g/scf

$$C'_s = 0.001 \text{ g/mg} \frac{M_n}{V_{m_{std}}} = 0.001 \times \frac{172.79}{51.572} = .0033$$

10. Particulate mass emission rate, lbs/hr.

$$\text{pmr} = \frac{C_s \times Q_{s_{std}}}{454} = \frac{.0033 \times 734,880}{454} = 5.34 \text{ lb/hr}$$

11. Isokinetic variation

$$I = \frac{100\ T_s \left[0.002669\ V_{1_c} + \frac{V_m}{T_m} Y \left(P_{bar} + \frac{\Delta H}{13.6} \right) \right]}{60\ \theta\ V_s\ P_s\ A_n} =$$

$$I = \frac{100\ (665)\ [0.002669(300.7) + \frac{58.439}{563} \times (1.0)\ (28 + \frac{2.04}{13.6})]}{60 \times 72 \times 29.66 \times 28.01 \times .000707} = 97.6\%$$

Formula,

$A = 0.76E^{0.42}$, where:
A = Allowable emissions in pounds per hour
E = Emission index = F x W pounds per hour
E = Process factor in pounds per unit, and
W = Production or charging rate in units per hour
F = 6 lbs/ton
W = Tons/hr

Test No.1

A = 0.76 (6 x 102.4) 0.42 = 11.27 lbs/hr

Test No. 2 .76

A = .076 (6 x 103.9) 0.42 - 11.34 lbs/hr

Test No. 3

A = 0.76 (6 x 102.8) 0.42 11.29 lbs/hr

B. SAMPLING METHODOLOGY & EQUIPMENT CALIBRATION

EPA METHOD 1

SAMPLE AND VELOCITY TRAVERSES AFOR STATIONARY SOURCES

SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES
EPA METHOD 1

The following method was used in this test program. Sampling procedures follow those described in EPA Method 1 of the Federal Register*.

SELECTION OF THE MEASUREMENT SITE

The velocity measurement were taken at 3.9 stack (or duct) diameters downstream and 1.03 diameters upstream from any flow disturbances.

CHOOSING THE NUMBER OF TRAVERSE POINTS (non-Cyclonic flow)

Particulate Traverse Sampling

At least twelve (12) traverse points were sampled for circular (or rectangular) stack diameters greater than .61 meters. At least eight (8) traverse points will be sampled for circular stacks and nine (9) points for rectangular stacks for equivalent diameters for .30 to .61 meters. For other stack diameters, Figure 1-1 was be referred to.

Non-Particulate Traverse Sampling

The above procedure were used except that Figure 1-2 is substituted for Figure 1-1.

CROSS SECTIONAL TRAVERSE POINT LOCATIONS

The traverse points were located on two (2) perpendicular diameters. For particulate traverse samples, one of the above diameters was positioned in the plane containing the greatest concentration variation.

Circular Stacks

EPA Method 1, Figure 1-3 and Table 1-2 were referred to.

Rectangular Stacks

Using Figure 1-4 and Table 1-1 a rectangular grid, sectioned into as many equal areas as there are traverse points, was constructed. A sample was taken at the center of each elemental area in the grid.

No traverse points were located within 2.5 centimeters of the stack wall for stack diameters greater than .61 meters. For stack diameters equal to or less than .61 meters, no traverse points were located within 1.3 centimeters. For both of the above cases, where the sample nozzle inside diameter is greater than the adjusted distances, the larger distance was used.

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*Federal Register, CFR 40, Part 60, July 1, 1989

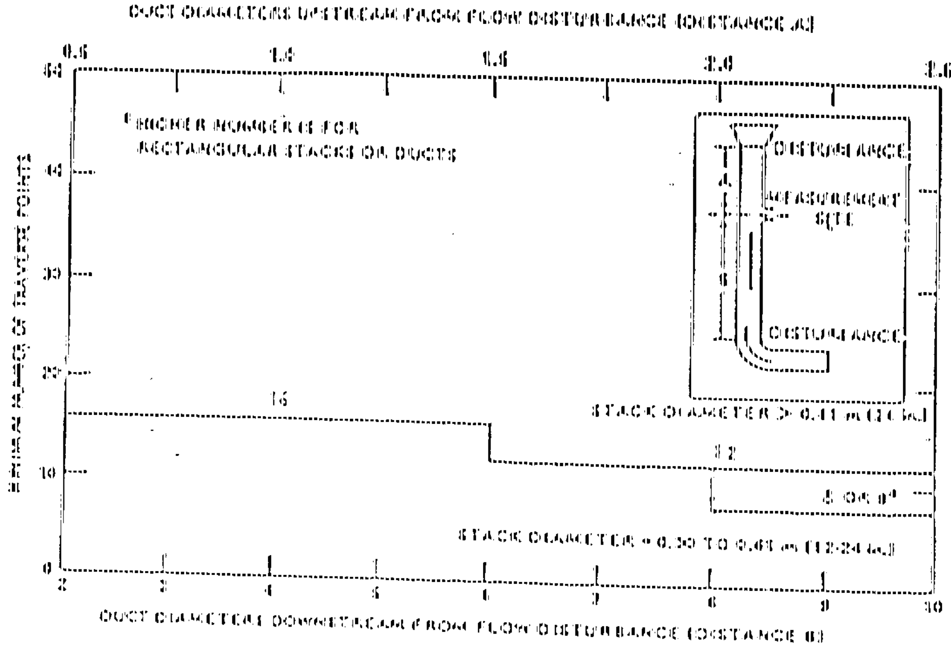


Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

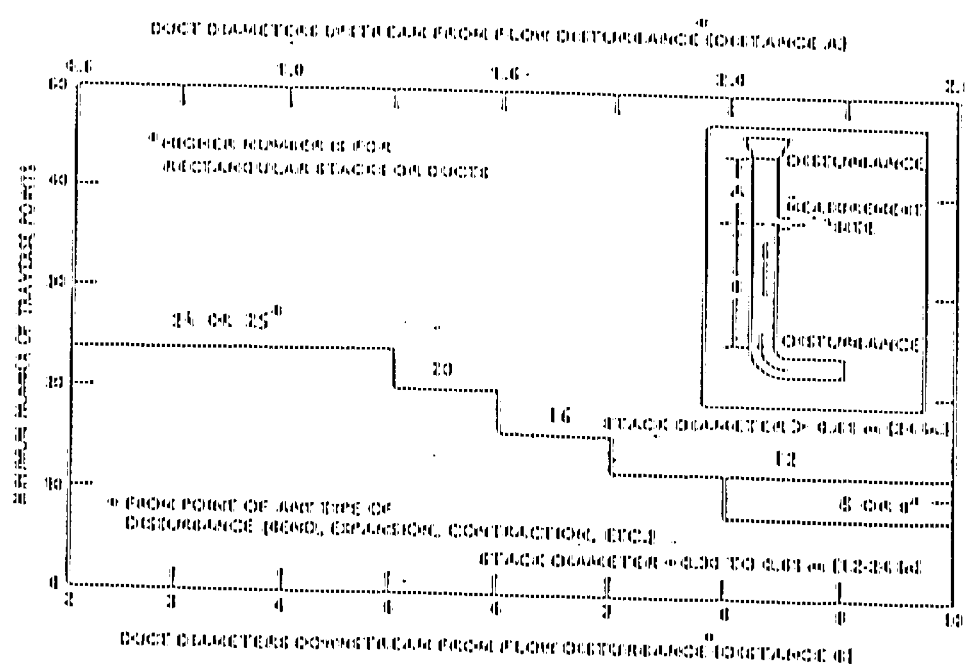


Figure 1-1. Minimum number of traverse points for particulate traverses.

TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

Traverse point	Distance, % diameter
1	4.4
2	14.6
3	29.6
4	70.4
5	85.4
6	95.6

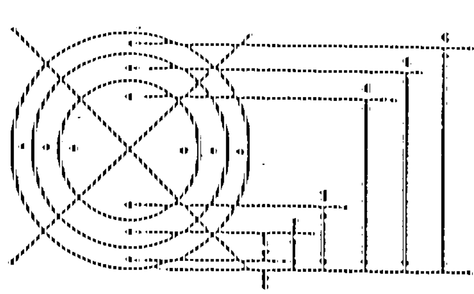


Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

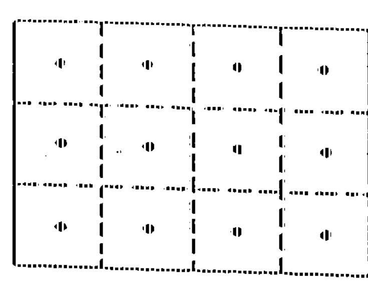


Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

Verification of the Absence of Cyclonic Flow through Stacks

For any stack where there existed a possibility of cyclonic flow, a test for the presence of cyclonic flow was performed using a manometer and Type S pitot tube.

The manometer was leveled and zeroed before the pitot tube was connected to the probe and positioned at each traverse point. The pitot tube was rotated (if necessary) until a null reading was obtained. All rotation angles were assigned absolute values. When no rotation was necessary, a value of 0 degrees was assigned. The values were summed, and the resultant angle called alpha ( ). Twenty (20 degrees was the limit of acceptability of the measurement locations for the average value of alpha with a Standard Deviation of ten (10) degrees or less.

A minimum of 24 traverse points for circular ducts and 42 points for rectangular ducts were used in the determination of gas flow angles. When the absence of cyclonic gas flow was verified, these same points were used to obtain velocity measurements.

EPA METHOD 2

DETERMINE OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE
EPA METHOD 2

The average velocity in a stack (or duct) was determined from the gas' density and average velocity head with a Type S pitot tube and stack gas flow was quantified.

SAMPLING APPARATUS

The apparatus consisted of the following equipment:

Pitot Tube - Type S pitot tube that meet all geometry standards was used to monitor stack gas velocity.

Draft Gauge - An inclined manometer made by Dwyer with readability of 0.01 inches H_2O in the 0-1 inch range was used.

Temperature Gauge - Included a thermocouple and digital readout capable of measuring temperatures to within 1.5% of the minimum stack temperatures.

Barometer - A barometer capable of measuring atmospheric pressure to within 2.5 mm Hg.

Gas Density Determination Equipment - Fyrite analyzer.

SAMPLING PROCEDURE

The apparatus was set up as illustrated in Figure 1.

The pretest leak-check was conducted for both the impact and static openings of the Pitot tube.

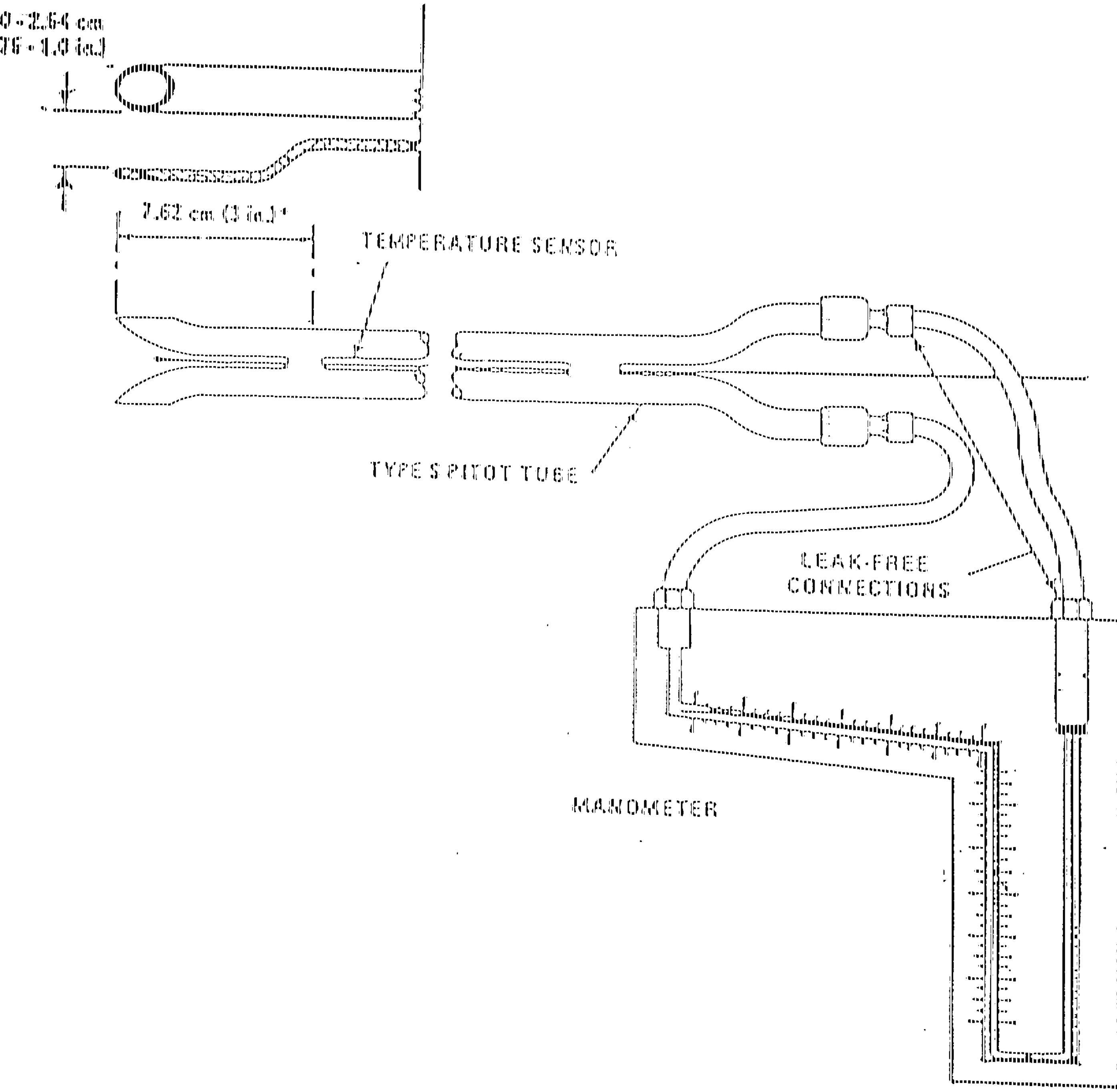
After adjusting the manometer level and zero, the velocity head and temperature were measured for each traverse point and recorded on the data sheet.

In addition, the static pressure in the stack was measured and the atmospheric pressure recorded.

The stack gas dry-molecular weight was determined using EPA Method 3.

The moisture content was obtained using either EPA Method 4 or EPA Method 5.

The cross sectional area of the stack (or duct) at the sampling location was measured and recorded.



EPA Method 2

Flow Measurement System

EPA METHOD 3

GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN, EXCESS AIR & DRY

GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN, EXCESS AIR AND DRY MOLECULAR WEIGHT

EPA METHOD 3

The following method was used in this test program. Sampling procedures followed those described in EPA Method 3 of the Federal Register*.

SAMPLING APPARATUS

The gas analysis sampling train used in these tests at the exit stack meet the design specifications established by the Federal EPA and was assembled by Comprehensive Safety Compliance, Inc. (CSC) personnel.

The apparatus consisted of the following:

INTEGRATE SAMPLING: APPARATUS

PROBE - A stainless steel probe equipped with an in-stack or out-stack glass wool filter to remove particulate matter.

PUMP - A leak-free, diaphragm-type pump to transport sample gas to the flexible bag.

CONDENSER - A water-cooled condenser to remove excess moisture.

VALVE - A needle valve to adjust the sample flow rate.

SURGE TANK - A surge tank installed between the pump and rate meter to eliminate the pulsation effect of the diaphragm pump on the rate meter.

RATE METER - A rotameter capable of measuring flow rates to within $\pm$ 2% of a flow range of 500 to 1000 cubic centimeters per minute.

ORSAT ANALYZER - This combustible gas analyzer was used to determine dry molecular weight (DMW) for O_2, CO_2 and CO.

*Federal Register, CFR 40, Part 60, July 1, 1989

INTEGRATED SAMPLING

The sample train was set up as shown in Figure No. 1.

For single point sampling the sample point location was at the center of the cross-section or at least 1 meter away from the stack wall. The analyzer leak test was performed, and the flexible bag as well as the sample train was also leak tested.

For multi-point sampling at least eight traverse points were sampled in circular stacks with diameters less than .61 meters (9 points for rectangular stacks of .61 meter equivalent diameter). At least twelve points were sampled for all other cases.

Traverse point location was performed; with respect to EPA Method 1. All points were traversed and sampled for an equal length of time.

After positioning the probe and purging the sample line, the sample bag was connected to the train.

The sample was taken at a constant rate. The run was simultaneous will the lasted the total duration of the pollutant emission rate determination.

One flue gas sample was taken for each pollutant emission rate determination. Within eight hours the samples were analyzed for % CO_2 and O_2. The % N_2 and CO were determined and the dry molecular weight was calculated.

SAMPLE ANALYSIS

After a sample was drawn into a combustible gas analyzer, it was immediately analyzed for percent CO_2 and O_2. The percentage of the gas that is N_2 and Co was determined by subtracting the sum of the percents CO_2 and O_2 from 100 percent.

During sample analysis for a given gas, consecutive passes through the analyzer absorbing solutions were made until two consecutive readings were obtained. All values were averaged and recorded to the nearest 0.1%.

The analyzer was leak-tested before and after the analyses was performed.

CO_2 ANALYSIS

The results of three analyses differ by no more than:

a) .3% volume when the CO_2 was greater than 4% of the total gas volume.

b) .2% volume when CO_2 was less than or equal to 4% of the total gas volume.

O_2 ANALYSIS

The analytical procedure was repeated until the results of three analyses differ by no more than:

a) .3% volume when O_2 was less than or equal to 15% of total gas volume.

b) .2% by volume when O_2 was greater than or equal to 15% of total gas volume.

CO AND N_2 ANALYSIS

For percent CO and N_2, the analytical procedure was repeated until three analyses differ by no more than .3%.

DETERMINATION OF THE DRY MOLECULAR WEIGHT

The DMW of each sample was determined using the following formula:

$$DMW = 0.440\ (\%\ CO_2) + .322\ (\%\ O_2) + .280\ (\%\ N_2 + \%\ CO)$$

EMISSION RATE CORRECTION FACTOR OR EXCESS AIR DETERMINATION

An EPA approved combustible gas analyzer was used to determine the excess air content in the stack emissions.

For single point and grab samples, the values obtained for % O_2, CO and N_2 were substituted in the following equation to determine the % excess air:

$$\%\ EA = \frac{\%\ O_2 - .5\%\ CO}{.264\%\ N_2 - (\%\ O_2 - .5\%\ CO)} \times 100\%$$

The fuel factor, F, calculated as follows:

$$F = \frac{20.9 - \%O_2}{\%CO_2}$$

*20.9 = The percent of O_2 by volume in ambient air.

SAMPLING PROCEDURE

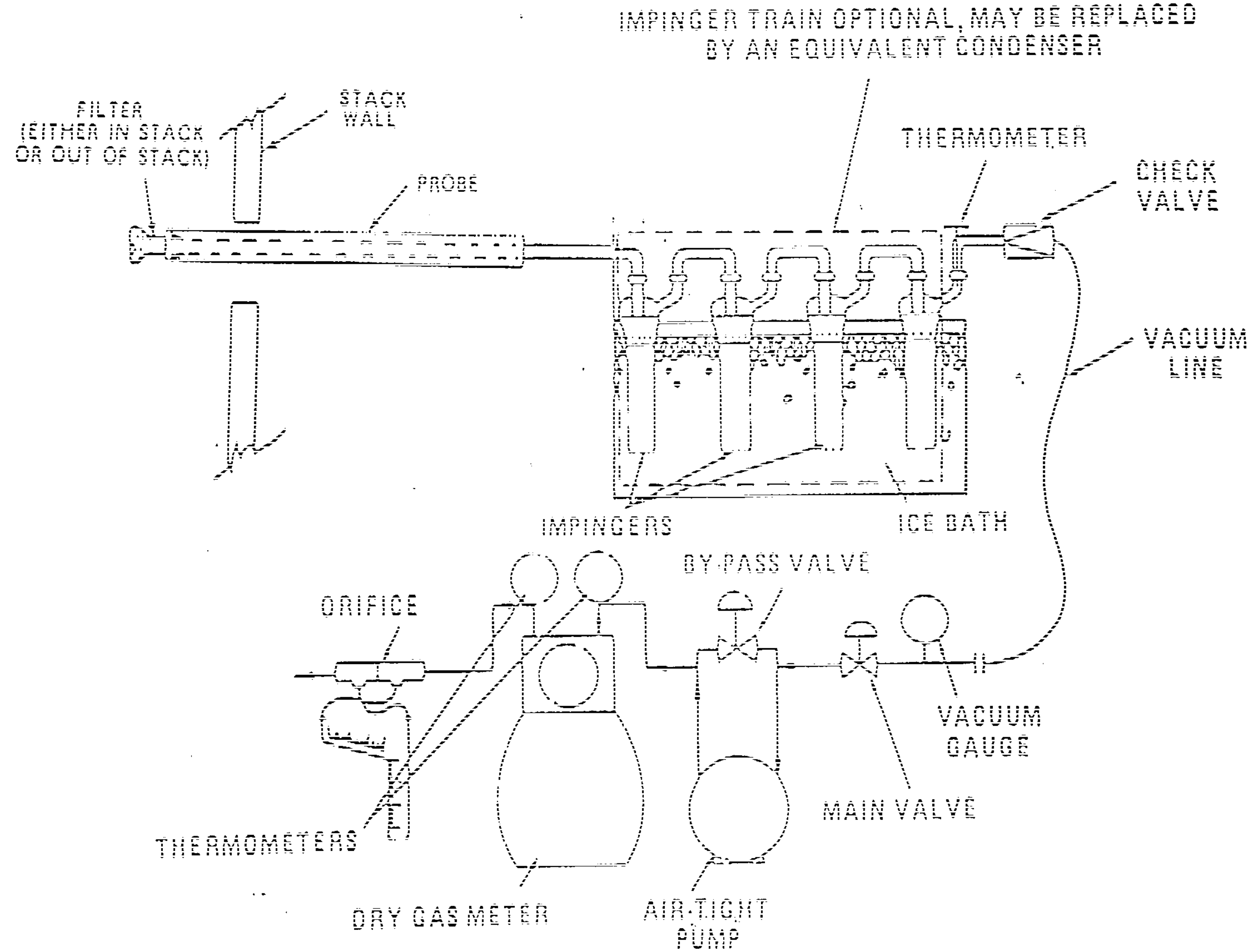
After selecting the sampling site and the minimum number of traverse points, the stack pressure and temperature was measured according to the procedures described in the Federal Register*.

Approximately 200 grams of silica gel were weighed in a sealed impinger prior to each test. One-hundred ml of distilled water was placed in each of the first two impingers; the third impinger was initially empty; and the impinger containing the silica gel was placed next in series. The train was set up with the probe as shown in Figure A-1. The sampling train was leak-checked at the sampling site prior to each test run by plugging the inlet to the nozzle and pulling a 15 inch Hg vacuum, and at the conclusion of the test by plugging the inlet to the nozzle and pulling a vacuum equal to the highest vacuum reached during the test run.

Crushed ice was placed around the impingers to keep the temperature of the gases leaving the last impinger at 68 F or less.

During sampling, stack gas and sampling train data were recorded at each sampling point and when significant changes in stack flow conditions occur. All sampling data were recorded on the Field Data Sheet.

*Federal Register, CFR 40, Part 60, July 1, 1989



Moisture sampling train-reference method.

SAMPLE RECOVERY PROCEDURE

The sampling train was moved carefully from the test site to the cleanup area. Sample fractions were recovered as follows:

1. The volume of water from the first three impingers was measured and recorded on the Recovery Data Sheet.

2. The silica gel from the fourth impinger was weighed and the gain recorded on the Sample Recovery Data Sheet with other pertinent data.

EPA METHOD 5

DETERMINATION OF PARTICULATE EMISSIONS

DETERMINATION OF PARTICULATE EMISSIONS
EPA METHOD 5

The following method was used in this test program. Sampling procedures followed those described in Method 5 of the Federal Register*.

SAMPLING APPARATUS

The particulate sampling train used in these tests at the exit stack met design specifications established by the Federal EPA and was assembled by Comprehensive Safety Compliance, Inc. (CSC) personnel. It consisted of:

Nozzle - Stainless steel (316) with sharp, tapered leading edge and accurately measured round opening.

Probe - Glass lined with a heating system capable of maintaining a minimum gas temperature of 250 F at the exit end during sampling.

Filter Holder - Pyrex glass with heating system capable of maintaining a filter temperature of approximately 250 F.

Draft Gauge - An inclined manometer made by Dwyer with readability of 0.01 inches H_2O in the 0-1 inch range was used.

Impingers - Four impingers connected in series with glass ball joints. The first, third and fourth impingers were of the Greensburg-Smith design, modified by replacing the tip with a 1/2 inch I.D. glass tube extending to 1/2 inch from the bottom of the flask.

Metering System - Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5 , calibrated dry gas meter, and related equipment, to maintain an isokinetic sampling rate and to determine sample volume. The dry gas meter is made by Rockwell and the fiber vane pump is made by Gast.

Barometer - Aneroid type to measure atmospheric pressures to ±0.1 inch Hg.

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*Federal Register, CFR 40, Part 60, July 1, 1989

SAMPLING PROCEDURE

After selecting the sampling site and the minimum number of traverse points, the sack pressure, temperature, moisture and range of velocity head were measured according to the procedures described in the Federal Register*.

Approximately 200 grams of silica gel was weighed in a sealed impinger prior to each test. Glass fiber filters** (4 inch diameter) were desiccated for at least 24 hours, dried at 105 C for 2 hours and weighed to the nearest 0.1 mg on an analytical balance. One hundred ml of distilled water was placed in each of the first two impingers; the third impinger was initially empty; and the impinger containing the silica gel was placed next in series. The train was set up with the probe as shown in Figure A-1. The sampling train was leak-checked at the sampling site prior to each test run by plugging the inlet to the nozzle and pulling 15 inch Hg vacuum, and at the conclusion of the test by plugging the inlet to the nozzle and pulling a vacuum equal to the highest vacuum reached during the test run.

The pitot tube and line were leak-checked at the test site prior to an following the initial velocity traverse. The check was made by blowing into the impact opening of the pitot tube* until 3 or more inches of water were recorded on the manometer and then capping the impact opening and holding it for 15 seconds to assure it was leak free. The static pressure side of the pitot tube was leak checked using the same procedure, except suction was used to obtain the 3 inch H_2O manometer reading. Crushed ice was placed around the impingers to keep the temperature of the gases leaving the last impinger at 68 F or less.

During sampling, stack gas and sampling train data were recorded at each sampling point and when significant changes in stack flow conditions occurred. Isokinetic sampling rates were set throughout the sampling period with the said of a nomograph or calculator. All sampling were recorded on the Particulate Field Data Sheet.

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* Federal Register, CFR 40, Part 60, July 1, 1989
**934 AH type

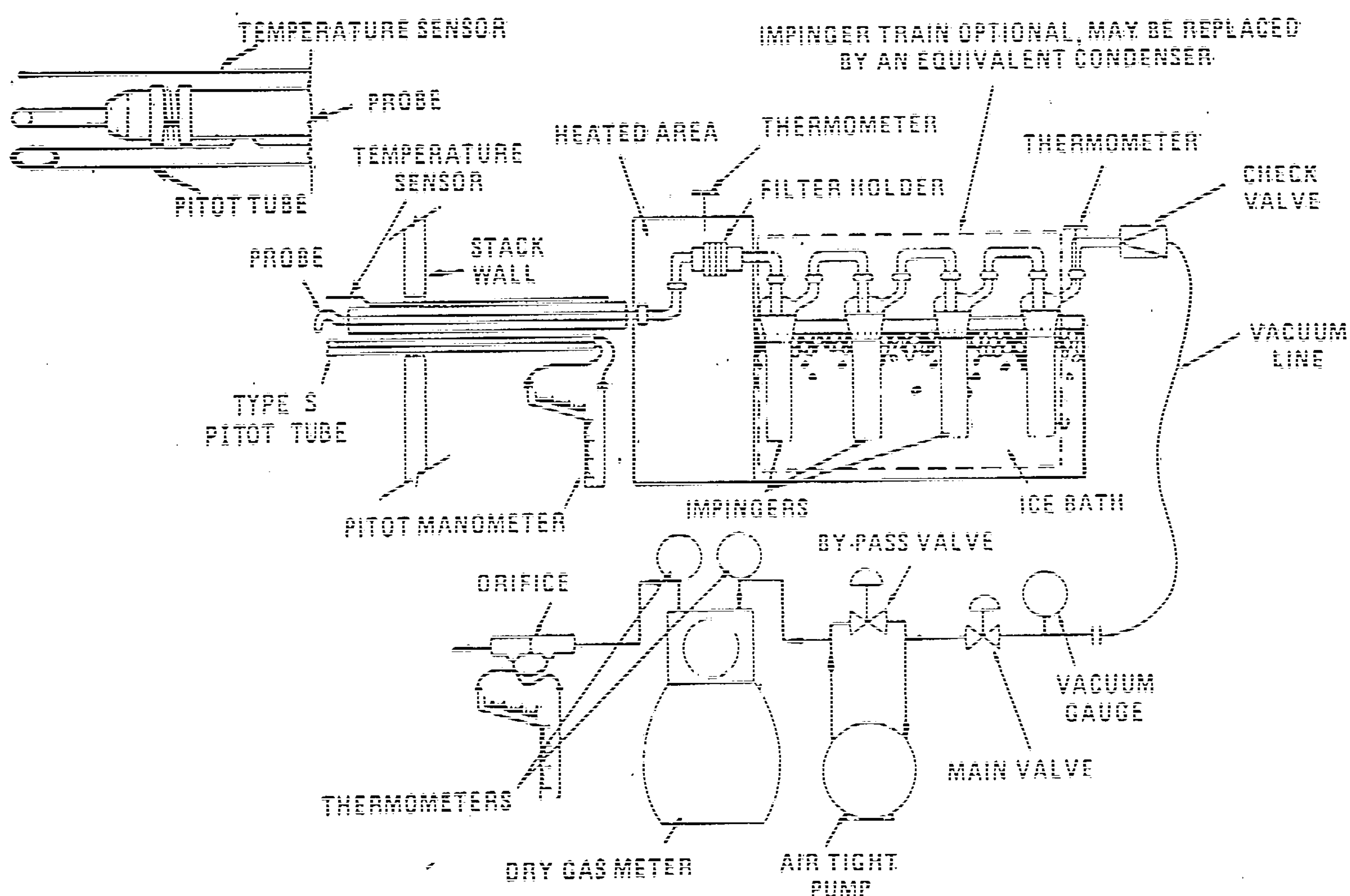


Figure 1. Schematic of Method 5 sampling train.

SAMPLE RECOVERY PROCEDURE

The sampling train was moved carefully from the test site to the cleanup area. Samples of the acetone and distilled water used in the sample recovery were taken for use as blanks. The volume of water from the first three impingers was measured. Sample fractions were recovered as follows:

Container No. 1 - The filter was removed from its holder and placed in a petri dish and sealed.

Container No. 2 - Loose particulate and H_2O washings from all sample-exposure surface prior to the filter were placed in a sample container, sealed and labelled. Particulate was removed from the probe with the aid of a brush and H_2O rinsing. The liquid level was marked after the container was sealed.

Container No. 3 - Loose particulate and acetone washings from all sample-exposure surface prior to the filter were placed in sample container, sealed and labeled. Particulate was removed from the probe with the aid of a brush and acetone rinsing. The liquid level was marked after the container was sealed.

Container No. 4 - A minimum of 200 ml of acetone was taken for the blank analysis. The blank was obtained and treated in a similar manner as the acetone washing.

Container No. 5 - Distilled water in the impinger section of the sampling train was measured and placed in a sample container. The impingers and connecting glassware were rinsed with distilled H_2O and this rinse was added to the container for shipment to the laboratory.

Container No. 6 - The impinger section of the sampling train of the connecting glassware was rinsed with acetone and this rinse was put in a container for shipment to the laboratory.

Container No. 7 - A minimum of 200 ml of distilled water was taken for the blank analysis. The blank was obtained and treated in a similar manner as the water rinse.

The silica gel from the fourth impinger was weighed and the gain recorded on the Sample Recovery Data Sheet with other pertinent data.

ANALYTICAL PROCEDURES

The following procedures were used and follow the methods described in the DER Source Testing Manual*.

Container No. 1 - The filter and any loosed particulate matter from this sample container were placed into a tared glass weighing dish, baked at 105 C for 2 hours, desiccated for 24 hours to a constant weight and weighed to the nearest 0.1 mg.

Container No. 2 - The H_2O washings were transferred to a tared beaker and evaporated to dryness at 105 C temperature and pressure, desiccated for 24 hours to a constant weight, and weighed to the nearest 0.1 mg.

Container No. 3 - the acetone washings were transferred to a tared beaker and evaporated to dryness at ambient temperature and pressure, desiccated for 24 hours to a constant weight, and weighed to the nearest 0.1 mg.

Container No. 4 - The acetone blank was transferred to a tared breaker and evaporated to dryness at ambient temperature and pressure. The blank was then desiccated for 24 hours to a constant weight and weighed to the nearest 0.1 mg.

Container No. 5 - The contents of this container were filtered through 0.8-.22 micron tared filters to remove insoluble particulate. The filters and filtrates in tared breakers were evaporated to dryness at 105 C, then desiccated to a constant weight and weighed on an analytical balance to the nearest 0.1 mg.

Container No. 6 - The acetone was transferred to a tared beaker and evaporated to dryness at ambient temperature and pressure. The sample was then desiccated for 24 hours to a constant weight and weighed to the nearest 0.1 mg.

Container No. 7 - The distilled water blank was transferred to a tared beaker and evaporated to dryness at 105 C. The blank was desiccated to a constant weight and weighed on analytical balance to the nearest 0.1 mg.

The term "constant weight" means a difference of no more than 0.5 mg or 1% of total weight less tare weight, whichever is greater between two consecutive readings, with no less than 6 hours of desiccation between weighings.

PITOT TUBE INSPECTION DATA SHEET

Pitot Tube Identification Number: 1 #   Date: 2/22/90

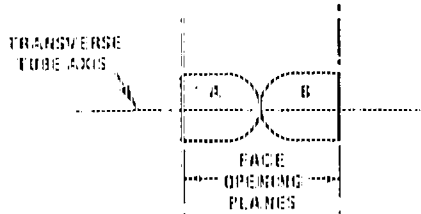
1. What is the external diameter of the tubing in inches? 3/8"

2. Are the face opening planes perpendicular to the transverse axis as in Figure A (end view)? yes

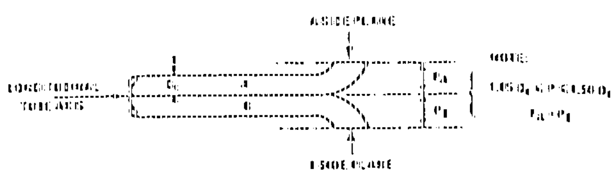
3. Are the face opening planes parallel to the longitudinal axis as in Figure B (top view)? yes

4. Are both legs of equal length and center lines coincident, when viewed from both sides as in Figure (C)? yes

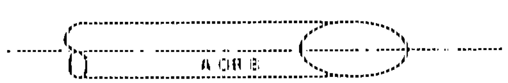
5. Does the tube meet all the geometric specifications to be assigned a .84 coefficient? yes



(a)



(b)



(c)

CALIBRATED BY: ______________________

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 3/5/90 Meter box number 999

Barometric pressure, P_b = 29.5 in. Hg Calibrated by [illegible signature]

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter Inlet (t_{d_i}), °F	Temperature: Dry gas meter Outlet (t_{d_o}), °F	Temperature: Dry gas meter Avg[a] (t_d), °F	Time (Θ), min	Y_i	$\Delta H@_i$ in. H_2O
0.5	5	5.19	76	107	87	97	12.35	1.0	1.8
1.0	5	5.22	76	129	94	109	8.58	1.0	1.8
1.5	10	10.41	76	131	87	109	14.30	1.0	1.7
2.0	10	10.45	76	134	88	111	12.40	1.0	1.7
3.0	10	10.52	76	134	88	111	10.25	1.0	1.8
4.0	10	10.33	76	110	80	95	8.36	1.0	1.8
							Avg	1.0	1.8

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H@_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460) \Theta}{V_w} \right]^2$
0.5	0.0368	(5) 29.5 (557) 5.19 (29.5+.0368)(536)	.0317 x 0.5 [(76+460) 12.6]² 29.5 (97+460) [5]
1.0	0.0737	(5) 29.5 (109+460) 5.22 (29.5 + .0737) 536	.0317 x 1.0 [(76+460) 9.0]² 29.5 (109+460) [5]
1.5	0.110	(10) 29.5 (569) 10.41 (29.5 + .110) 536	.0317 x 1.5 [(76+460) 14.3]² 1.7 29.5 (109+460) [10]
2.0	0.147	(10) 29.5 (571) 10.45 (29.5 + .147) 536	.0317 x 2.0 [(76+460) 12.7]² 1.7 29.5 (111+460) [10]
3.0	0.221	(10) 29.5 (571) 10.52 (29.5 +.221) 536	.0317 x 3.0 [(76+460) 10.4]² 29.5 (111+460) [10]
4.0	0.294	(10) 29.5 (555) 571 10.33 (29.5 + .294) 536	.0317 x 4.0 [(76+460) 8.6]² 29.5 (95+460) [10]

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

POSTTEST DRY GAS METER CALIBRATION DATA FORM

Test numbers ________ Date 6/6/90 Meter box number 444 Plant ________

Barometric pressure, P_b = 29.5 in. Hg Dry gas meter number ________ Pretest Y 1.0

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average (t_d),[a] °F	Time (Θ), min	Vacuum setting, in. Hg	Y_i	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
1.0	10	5.24	76	108	84	92	9:00	1.8	1.0	(5)29.5(92+460) / 5.24(29.5+.0737) [illegible]
2.0	10	10.47	76	102	87	95	12:45	1.7	1.0	(10) 29.5 (555) / 10.47 29.5+.147 536
3.0	10	10.50	76	105	89	96	10:30	1.8	1.0	(10) 29.5 (556) / 10.50 [illegible] 536
									Y = 1.0	

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y $\pm$0.05Y

P_b = Barometric pressure, in. Hg.

Θ = Time of calibration run, min.

NOZZLE CALIBRATION DATA FORM

Date 5/30/90 Calibrated by R. Campbell

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
#4	.360	.360	.360	0.0	.360

where:

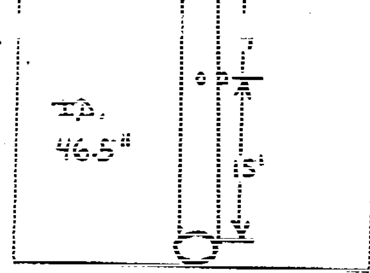
[a] $D_{1,2,3,}$ = three different nozzles diameters, mm (in.); each diameter must be within (0.025 mm) 0.001 in.

[b] ΔD = maximum difference between any two diameters, mm (in.), $\Delta D \leq$ (0.10 mm) 0.004 in.

[c] D_{avg} = average of D_1, D_2, and D_3.

C. FIELD DATA SHEETS

LOCATION [illegible]
OPERATOR Rick Jampell
DATE 5/31/90
RUN NO. TP-1
SAMPLE BOX NO.
METER BOX NO.
METER ΔH@
C FACTOR 10.5
PITOT TUBE COEFFICIENT, C_p .84



SCHEMATIC OF STACK CROSS SECTION
Location
Stack dimen: 46.5" I.D.

AMBIENT TEMPERATURE
BAROMETRIC PRES. 28.6
ASSUMED MOISTURE, %
PROBE LENGTH, (ft) 4.5'
NOZZLE IDENTIFICATION NO. #4
AVERAGE CALIBRATED NOZZLE DIAMETER, (in.) .360
PROBE HEATER SETTING 250°F
LEAK RATE, (cfm) 0.0 at 7"Hg
PROBE LINER MATERIAL Glass
STATIC PRESSURE, (in. Hg) +.2
FILTER NO. 1000 11

TRAVERSE POINT NUMBER	TIME	SAMPLING TIME (θ), min.	VACUUM (in. Hg)	STACK TEMPERATURE (T_S) (°F)	VELOCITY HEAD (ΔP_S), (in. H_2O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H_2O)	GAS SAMPLE VOLUME (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (°F)	GAS SAMPLE TEMPERATURE AT DRY GAS METER OUTLET (°F)	FILTER HOLDER TEMPERATURE, (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, (°F)
	7:25	0					564.520				
A-1		3	2.0	110	.10	1.1	566.590	77	69	251	48
2		6	2.0	170	.15	1.6	568.640	88	69	259	49
3		9	2.0	172	.15	1.6	570.790	90	71	260	50
4		12	3.0	175	.20	2.1	573.210	95	72	267	54
5		15	3.0	185	.20	2.1	575.650	95	72	268	54
6		18	3.0	182	.20	2.1	578.160	96	71	269	54
7		21	3.0	186	.17	1.8	580.320	95	72	264	56
8		24	3.0	189	.17	1.8	582.580	96	73	264	57
9		27	3.0	187	.15	1.6	584.695	96	73	263	57
10		30	3.0	192	.15	1.6	586.940	97	74	263	58
11		33	3.0	200	.16	1.7	589.080	98	75	266	54
12		36/5	3.0	201	.15	1.6	591.189	99	76	267	56
B-1	8:07	57/39	3.0	200	.12	1.2	593.010	104	80	266	50
2		42	3.0	198	.15	1.6	595.210	106	81	267	47
3		45	3.0	207	.15	1.6	597.470	106	79	269	47
4		48	3.0	209	.15	1.6	599.590	106	78	270	46
5		51	3.0	219	.17	1.8	601.900	106	76	271	46
6		54	3.0	220	.17	1.8	604.190	106	75	272	46
TOTAL								Avg.	Avg.		
AVERAGE				197	.403		53.831	Avg. 94	87		

C-031

IMPINGER WATER
Final 504 ml
Init. 200 ml
Cond. 304 ml

DESICCANT
Final 255.5 gms
Init. 245.4 gms
Gain 10.1 gms

ORSAT ANALYSES

Time				
CO_2	4.0	4.0	5.0	4.3
O_2	15.5	16.0	14.0	14.3
CO				

LOCATION [illegible]
OPERATOR Kirk Campbell
DATE 5/31/90
RUN NO. TP-1 cont.
SAMPLE BOX NO. 1
METER BOX NO. 444
METER ΔH@
C FACTOR
PITOT TUBE COEFFICIENT, C_p .84

SCHEMATIC OF STACK CROSS SECTION
Location
Stack dimen.

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
ASSUMED MOISTURE, %
PROBE LENGTH, (ft)
NOZZLE IDENTIFICATION NO.
AVERAGE CALIBRATED NOZZLE DIAMETER, (in.) .360
PROBE HEATER SETTING
LEAK RATE, (cfm) 0.0 at 7.0"Hg
PROBE LINER MATERIAL
STATIC PRESSURE, (in. Hg)
FILTER NO.

TRAVERSE POINT NUMBER	TIME	SAMPLING TIME (θ), min.	VACUUM (in. Hg)	STACK TEMPERATURE (T_S) (°F)	VELOCITY HEAD (ΔP_S), (in. H_2O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H_2O)	GAS SAMPLE VOLUME (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (°F)	GAS SAMPLE TEMPERATURE AT DRY GAS METER OUTLET (°F)	FILTER HOLDER TEMPERATURE, (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, (°F)
B-7		57	3.0	214	.17	1.8	606.610	108	73	274	44
8		60	3.0	225	.15	1.6	608.810	107	72	273	45
9		63	3.0	223	.20	2.1	611.270	108	73	274	45
10		66	3.5	220	.20	2.4	613.790	108	73	274	45
11		69	3.5	215	.17	1.8	616.100	107	75	272	45
12	8:45	72	4.0	221	.17	1.8	618.351	108	77	274	47
TOTAL				197	.403			Avg.	Avg.		
AVERAGE						1.73	53.831	Avg.	91		

IMPINGER WATER
Final 504 ml
Init. 200 ml
Cond. 304 ml

DESICCANT
Final ______ gms
Init. ______ gms
Gain ______ gms

ORSAT ANALYSES

Time			
CO_2			
O_2			
CO			

LOCATION [illegible]

OPERATOR [illegible] Campbell

DATE 5/31/90

RUN NO. TP-2

SAMPLE BOX NO. 2

METER BOX NO. 444

METER ΔH@

C FACTOR 10.5

PITOT TUBE COEFFICIENT, C_p .84

SCHEMATIC OF STACK CROSS SECTION

Location

Stack dimen.

AMBIENT TEMPERATURE

BAROMETRIC PRESSURE 28.

ASSUMED MOISTURE, %

PROBE LENGTH, (ft) 4.5'

NOZZLE IDENTIFICATION NO. #4

AVERAGE CALIBRATED NOZZLE DIAMETER, (in.) .360

PROBE HEATER SETTING 250

LEAK RATE, (cfm) 0.02 @ 6.0"

PROBE LINER MATERIAL Glass

STATIC PRESSURE, (in. Hg) + .12

FILTER NO. 10 0007

TRAVERSE POINT NUMBER	TIME	SAMPLING TIME (θ), min.	VACUUM (in. Hg)	STACK TEMPERATURE (T_S) (°F)	VELOCITY HEAD (ΔP_S), (in. H_2O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H_2O)	GAS SAMPLE VOLUME (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER: INLET (°F)	GAS SAMPLE TEMPERATURE AT DRY GAS METER: OUTLET (°F)	FILTER HOLDER TEMPERATURE, (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, (°F)
	4:35	0					618.984				
A-1		3	3.0	198	.17	1.8	621.210	73	73	245	31
2		6	3.0	208	.15	1.6	623.400	108	76	246	32
3		9	3.0	212	.15	1.6	625.530	108	77	252	30
4		12	3.0	207	.18	1.9	627.790	109	79	256	31
5		15	3.0	206	.18	1.9	630.110	110	79	266	31
6		18	3.0	201	.17	1.8	632.390	108	81	268	32
7		21	3.0	205	.18	1.9	634.750	109	81	270	32
8		24	3.0	201	.18	1.9	637.030	110	79	272	32
9		27	3.0	200	.18	1.9	639.400	111	80	272	36
10		30	3.5	197	.20	2.1	641.840	114	77	271	40
11		33	4.0	198	.18	1.9	644.170	112	73	270	45
12	10:11	36/5	4.0	198	.18	1.9	646.500	112	73	271	45
B-1	10:16	5T/39	3.0	178	.15	1.6	648.610	99	80	274	53
2		42	3.0	197	.17	1.8	650.890	109	82	272	53
3		45	3.0	198	.20	2.1	653.320	113	82	274	50
4		48	3.0	199	.20	2.1	655.780	114	82	273	48
5		51	3.0	194	.20	2.1	658.260	113	84	272	43
6		54	3.0	198	.17	1.8	660.480	112	83	273	43
TOTAL								Avg.	Avg.		
AVERAGE				20[illegible]	.420		55.27	Avg. 95			

C-011

IMPINGER WATER
Final 418 ml
Init. 200 ml
Cond. 218 ml

DESICCANT
Final 248.7 gms
Init. 222.3 gms
Gain 26.4 gms

ORSAT ANALYSES

Time				
CO_2	5.0	5.0	4.0	4.7
O_2	16.0	16.5	17.0	16.5
CO				

LOCATION Baghouse Outlet
OPERATOR Rick Campbell
DATE 5/31/90
RUN NO. TP-2 Cont.
SAMPLE BOX NO. 2
METER BOX NO. 444
METER ΔH@
Y FACTOR 1.05
PITOT TUBE COEFFICIENT, C_p .84

SCHEMATIC OF STACK CROSS SECTION
Location
Stack dimen.

ROME ... RESS
ASSUMED MOISTURE, %
PROBE LENGTH, (ft)
NOZZLE IDENTIFICATION NO.
AVERAGE CALIBRATED NOZZLE DIAMETER, (in.) .360
PROBE HEATER SETTING
LEAK RATE, (cfm) 0.02 6.0 ".
PROBE LINER MATERIAL
STATIC PRESSURE, (in. Hg)
FILTER NO. 10 0007

TRAVERSE POINT NUMBER	TIME	SAMPLING TIME (θ), min.	VACUUM (in. Hg)	STACK TEMPERATURE (T_s) (°F)	VELOCITY HEAD (ΔP_s), (in. H_2O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H_2O)	GAS SAMPLE VOLUME (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (°F)	GAS SAMPLE TEMPERATURE AT DRY GAS METER OUTLET (°F)	FILTER HOLDER TEMPERATURE, (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, (°F)
B-7		57	3.5	196	.17	1.8	663.720	113	83	274	46
8		60	3.5	197	.19	1.9	665.020	112	84	273	46
9		63	3.5	203	.18	1.9	667.330	113	86	273	46
10		66	3.5	202	.18	1.9	669.680	114	85	273	48
11		69	3.5	204	.18	1.9	671.990	113	84	276	48
12	10:52	72	3.5	205	.17	1.8	674.255	113	83	271	48
TOTAL								Avg.	Avg.		
AVERAGE				[illegible]	.420	1.87	55.211	Avg. 95			

IMPINGER WATER
Final 418 ml
Init. 200 ml
Cond. 218 ml

DESICCANT
Final ____ gms
Init. ____ gms
Gain ____ gms

ORSAT ANALYSES

Time			
CO_2			
O_2			
CO			

LOCATION [illegible]
OPERATOR [illegible]
DATE 5/31/90
RUN NO. TP-3
SAMPLE BOX NO. #1
METER BOX NO. 444
METER ΔHg
C FACTOR 10.5
PITOT TUBE COEFFICIENT, C_p .84

SCHEMATIC OF STACK CROSS SECTION
Location
Stack dimen.

[illegible] PRESS 28
ASSUMED MOISTURE, %
PROBE LENGTH, (in)
NOZZLE IDENTIFICATION NO. #4
AVERAGE CALIBRATED NOZZLE DIAMETER, (in) .360
PROBE HEATER SETTING 250 °F
LEAK RATE, (cfm)
PROBE LINER MATERIAL
STATIC PRESSURE, (in. Hg) + .12
FILTER NO. 100017

TRAVERSE POINT NUMBER	TIME	SAMPLING TIME (θ), min.	VACUUM (in. Hg)	STACK TEMPERATURE (T_S) (°F)	VELOCITY HEAD (ΔP_S), (in. H_2O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H_2O)	GAS SAMPLE VOLUME (ft³)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (°F)	OUTLET (°F)	FILTER HOLDER TEMPERATURE, (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, (°F)
	11:40	0					674.546				
A-1		3	3.0	198	.20	2.1	676.880	79	88	245	44
2		6	3.0	195	.20	2.1	679.150	117	91	247	44
3		9	3.0	194	.20	2.1	681.630	119	90	249	44
4		12	3.0	199	.18	1.9	683.900	120	91	250	46
5		15	3.0	209	.18	1.9	686.240	119	86	261	44
6		18	3.0	210	.21	2.2	688.760	120	90	264	40
7		21	3.0	210	.21	2.2	691.280	121	84	269	44
8		24	3.0	217	.20	2.1	693.720	119	86	270	44
9		27	3.0	215	.20	2.1	696.190	119	85	271	46
10		30	3.0	214	.20	2.1	698.640	119	83	272	44
11		33	3.0	212	.18	1.9	701.010	120	83	270	47
12	12:16	36/s	3.0	204	.20	2.1	703.465	117	82	271	48
B-1	12:21	ST/39	3.0	202	.18	1.9	705.770	104	86	270	48
2		42	3.0	207	.18	1.9	707.710	115	88	268	49
3		45	4.0	207	.20	2.1	710.200	117	88	271	49
4		48	4.0	208	.20	2.1	712.640	118	89	268	50
5		51	4.0	207	.20	2.1	715.150	122	89	270	52
6		54	4.0	209	.20	2.1	717.640	123	87	267	52
TOTAL								Avg.	Avg.		
AVERAGE				206	.440		58.459	Avg. 103			

C - 004

IMPINGER WATER
Final 494 ml
Init. 200 ml
Cond. 294 ml

DESICCANT
Final 232.1 gms
Init. 215.4 gms
Gain 16.7 gms

ORSAT ANALYSES

Time				
CO_2	5.0	5.0	5.5	5.2
O_2	14.0	14.0	14.5	14.2
CO				

OOAT [illegible]
OPERATOR Rick Crandall
DATE 5/31/90
RUN NO. TP-3
SAMPLE BOX NO. #1
METER BOX NO. 444
METER ΔH@
C FACTOR 10.5
PITOT TUBE COEFFICIENT, C_p .84

SCHEMATIC OF STACK CROSS SECTION
Location
Stack dimen.

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
ASSUMED MOISTURE, %
PROBE LENGTH, (ft)
NOZZLE IDENTIFICATION NO.
AVERAGE CALIBRATED NOZZLE DIAMETER, (in.) .360
PROBE HEATER SETTING
LEAK RATE, (cfm) 0.001 @ 11"
PROBE LINER MATERIAL
STATIC PRESSURE, (in. Hg)
FILTER NO.

TRAVERSE POINT NUMBER	TIME	SAMPLING TIME (θ), min.	VACUUM (in. Hg)	STACK TEMPERATURE (T_s) (°F)	VELOCITY HEAD (ΔP_s), (in. H_2O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H_2O)	GAS SAMPLE VOLUME (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (°F)	GAS SAMPLE TEMPERATURE AT DRY GAS METER OUTLET (°F)	FILTER HOLDER TEMPERATURE, (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, (°F)
3-7		57	3.5	203	.18	1.9	719.880	123	88	271	54
8		60	4.0	205	.18	1.9	722.220	124	84	270	54
9		63	4.0	201	.18	1.9	724.590	125	90	268	54
10		66	4.0	197	.20	2.1	727.340	125	90	268	54
11		69	4.0	197	.20	2.1	729.590	126	91	270	56
12	12:57	72	4.0	198	.20	2.1	732.985	126	91	270	56
TOTAL				205				Avg.	Avg.		
AVERAGE					.440	2.04	58.[illegible]	Avg. 103			

IMPINGER WATER
Final ________ ml
Init. ________ ml
Cond. ________ ml

DESICCANT
Final ________ gms
Init. ________ gms
Gain ________ gms

ORSAT ANALYSES

Time			
CO_2			
O_2			
CO			

Visible Emission Observation Form

Field	Entry
SOURCE NAME	Tresco Paving
ADDRESS	
CITY	Delmont
STATE	PA
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Asphalt Plant
OPERATING MODE	Normal
CONTROL EQUIPMENT	Baghouse
OPERATING MODE	Normal
DESCRIBE EMISSION POINT	START Exit Stack STOP Exit Stack
HEIGHT ABOVE GROUND LEVEL	START 30' STOP
HEIGHT RELATIVE TO OBSERVER	START STOP
DISTANCE FROM OBSERVER	START 150' STOP
DIRECTION FROM OBSERVER	START NW STOP
DESCRIBE EMISSIONS	START STOP
EMISSION COLOR	START White STOP
PLUME TYPE	CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT	NO ☐ YES ☑
IF WATER DROPLET PLUME	ATTACHED ☐ DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	START Beginning STOP
DESCRIBE BACKGROUND	START [illegible] sky STOP
BACKGROUND COLOR	START Blue STOP
SKY CONDITIONS	START STOP
WIND SPEED	Calm START 0-2 STOP
WIND DIRECTION	START STOP
AMBIENT TEMP.	START [illegible]° STOP
WET BULB TEMP.	
RH, percent	

OBSERVATION DATE	START TIME	STOP TIME
5/3/90	7:25	

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	5	5	5	5	31	5	5	5	5
2	5	5	5	5	32	5	5	5	5
3	5	5	5	5	33	5	5	5	5
4	5	5	5	5	34	5	5	5	5
5	5	5	5	5	35	5	5	5	5
6	5	5	5	5	36	5	5	5	5
7	5	5	5	5	37	5	5	5	5
8	5	5	5	5	38	5	5	5	5
9	5	5	5	5	39	5	5	5	5
10	5	5	5	5	40	5	5	5	5
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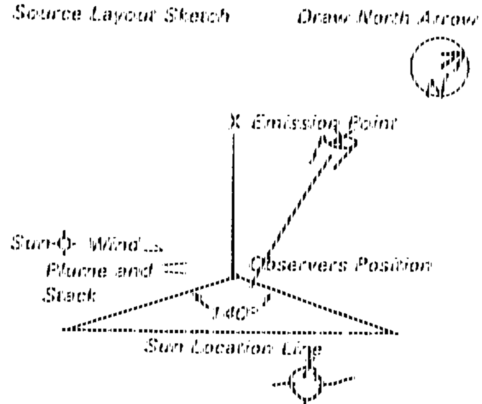
12	5	5	5	5	42	5	5	5	5
13	5	5	5	5	43	5	5	5	5
14	5	5	5	5	44	5	5	5	5
15	5	5	5	5	45	5	5	5	5
16	5	5	5	5	46	5	5	5	5
17	5	5	5	5	47	5	5	5	5
18	5	5	5	5	48	5	5	5	5
19	5	5	5	5	49	5	5	5	5
20	5	5	5	5	50	5	5	5	5
21	5	5	5	5	51	5	5	5	5
22	5	5	5	5	52	5	5	5	5
23	5	5	5	5	53	5	5	5	5
24	5	5	5	5	54	5	5	5	5
25	5	5	5	5	55	5	5	5	5
26	5	5	5	5	56	5	5	5	5
27	5	5	5	5	57	5	5	5	5
28	5	5	5	5	58	5	5	5	5
29	5	5	5	5	59	5	5	5	5
30	5	5	5	5	60	5	5	5	5

Source Layout Sketch

Draw North Arrow



Field	Entry
AVERAGE OPACITY FOR HIGHEST PERIOD	
NUMBER OF READINGS ABOVE % WERE	
RANGE OF OPACITY READINGS	MINIMUM MAXIMUM
OBSERVER'S NAME (PRINT)	Kevin Kennedy
OBSERVER'S SIGNATURE	[signature]
DATE	5/3/90
ORGANIZATION	CSE Inc.
CERTIFIED BY	ETA
DATE	March 1990
VERIFIED BY	
DATE	
COMMENTS	TEST NOL
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS SIGNATURE	
TITLE	
DATE	

Visible Emission Observation Form

SOURCE NAME: Tresco Paving

ADDRESS:

CITY: Delmont | STATE: PA | ZIP:

PHONE: | SOURCE ID NUMBER:

PROCESS EQUIPMENT: Asphalt Plant | OPERATING MODE: Normal

CONTROL EQUIPMENT: Baghouse | OPERATING MODE: Normal

DESCRIBE EMISSION POINT
START: Exit stack STOP: exit stack

HEIGHT ABOVE GROUND LEVEL
START: 30' STOP

HEIGHT RELATIVE TO OBSERVER
START STOP

DISTANCE FROM OBSERVER
START: 150 STOP

DIRECTION FROM OBSERVER
START: NW STOP

DESCRIBE EMISSIONS
START STOP

EMISSION COLOR
START: White STOP

PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☐ YES ☑

IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED
START: Beginning STOP

DESCRIBE BACKGROUND
START: Sky STOP

BACKGROUND COLOR
START: Blue STOP

SKY CONDITIONS
START STOP

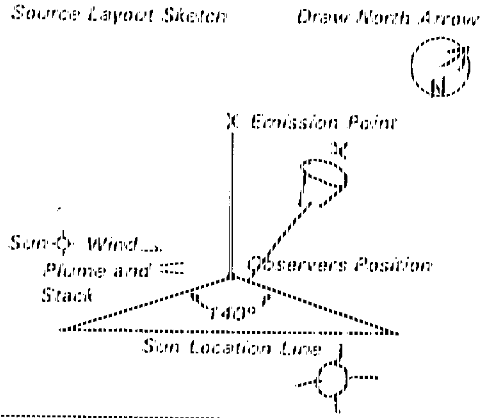
WIND SPEED
START: 0-2 calm STOP

WIND DIRECTION
START STOP

AMBIENT TEMP.
START: 40° STOP

WET BULB TEMP. | RH, percent

Source Layout Sketch Draw North Arrow



COMMENTS: TEST NO 1

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SIGNATURE

TITLE | DATE

OBSERVATION DATE: 5/31/90 | START TIME: 7:25 | STOP TIME: 8:30

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	5	5	5	5	31				
2	5	5	5	5	32				
3	5	5	5	5	33				
4	5	5	5	5	34				
5	5	5	5	5	35				
6	5	5	5	5	36				
7	5	5	5	5	37				
8	5	5	5	5	38				
9	5	5	5	5	39				
10	5	5	5	5	40				
11	5	5	5	5	41				
12	5	5	5	5	42				
13					43				
14					44				
15					45				
16					46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

AVERAGE OPACITY FOR HIGHEST PERIOD | NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS
MINIMUM MAXIMUM

OBSERVER'S NAME (PRINT): Keith Kennedy

OBSERVER'S SIGNATURE: [signature] | DATE: 5/31/90

ORGANIZATION: CSC Inc.

CERTIFIED BY: ETA | DATE: March 1990

VERIFIED BY | DATE

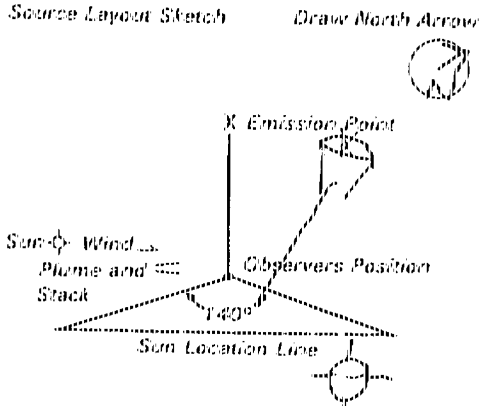
Visible Emission Observation Form

Field	Entry
SOURCE NAME	Tresco Paving
ADDRESS	
CITY	Delmont
STATE	PA
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Asphalt Plant
OPERATING MODE	Normal
CONTROL EQUIPMENT	Baghouse
OPERATING MODE	Normal
DESCRIBE EMISSION POINT	START Ext Stack STOP Ext stack
HEIGHT ABOVE GROUND LEVEL	START 30 STOP
HEIGHT RELATIVE TO OBSERVER	START STOP
DISTANCE FROM OBSERVER	START 150 STOP
DIRECTION FROM OBSERVER	START NW STOP
DESCRIBE EMISSIONS	START White STOP
EMISSION COLOR	START White STOP
PLUME TYPE	CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT	NO ☐ YES ☑
IF WATER DROPLET PLUME	ATTACHED ☐ DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	START Beginning of Plume STOP
DESCRIBE BACKGROUND	START Sky STOP
BACKGROUND COLOR	START Blue STOP
SKY CONDITIONS	START STOP
WIND SPEED	START 0–2 calm STOP
WIND DIRECTION	START STOP
AMBIENT TEMP.	START 52° STOP
WET BULB TEMP.	
RH, percent	

OBSERVATION DATE: 5/31/90 START TIME: 9:35 STOP TIME:

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	5	5	5	5	31	0	5	5	5
2	5	5	5	5	32	5	5	10	10
3	5	5	5	5	33	5	5	5	5
4	5	5	0	0	34	0	5	5	0
5	0	0	0	0	35	0	5	5	5
6	0	0	0	0	36	5	5	5	5
7	5	5	5	5	37	0	5	5	5
8	5	5	5	5	38	5	5	5	5
9	5	5	5	5	39	5	5	5	5
10	5	5	5	5	40	5	5	5	5
11	5	5	5	5	41	5	5	5	5
12	0	0	0	0	42	0	0	0	0
13	0	5	5	0	43	5	5	5	5
14	0	5	5	5	44	0	5	5	5
15	5	5	5	5	45	5	5	5	5
16	5	5	5	5	46	5	5	5	5
17	5	5	5	5	47	5	5	5	5
18	5	5	5	5	48	5	5	5	5
19	5	5	5	5	49	5	5	5	5
20	5	5	5	5	50	5	5	5	5
21	5	5	5	5	51	5	5	5	5
22	5	5	5	5	52	5	5	5	5
23	5	5	5	5	53	5	5	5	5
24	5	5	0	0	54	5	5	5	5
25	5	0	0	0	55	5	5	5	5
26	0	0	0	0	56	5	5	5	5
27	0	0	0	0	57	5	5	5	5
28	0	0	0	0	58	5	5	5	5
29	5	0	0	0	59	5	5	5	5
30	0	0	0	5	60	5	5	5	5

Source Layout Sketch   Draw North Arrow



AVERAGE OPACITY FOR HIGHEST PERIOD:

NUMBER OF READINGS ABOVE % WERE:

RANGE OF OPACITY READINGS MINIMUM MAXIMUM

OBSERVER'S NAME (PRINT): Kevin Kennedy

OBSERVER'S SIGNATURE: Kevin Kennedy DATE 5/31/90

ORGANIZATION: CSC Inc.

CERTIFIED BY: ETA DATE March 1990

VERIFIED BY: DATE

COMMENTS: TEST NO. 2

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

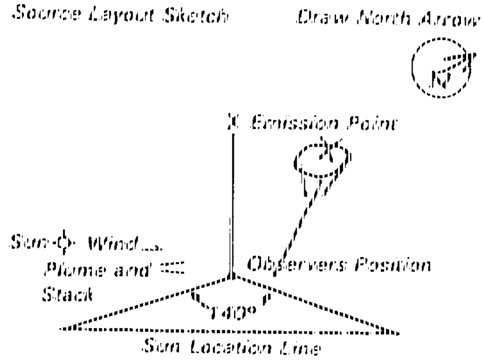
SIGNATURE

TITLE DATE

Visible Emission Observation Form

SOURCE NAME	Tresco Paving
ADDRESS	
CITY	Delmont
STATE	PA
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Asphalt Plant
OPERATING MODE	normal
CONTROL EQUIPMENT	Baghouse
OPERATING MODE	Normal
DESCRIBE EMISSION POINT	START Exit stack STOP
HEIGHT ABOVE GROUND LEVEL	START 30' STOP
HEIGHT RELATIVE TO OBSERVER	START STOP
DISTANCE FROM OBSERVER	START 150' STOP
DIRECTION FROM OBSERVER	START NW STOP
DESCRIBE EMISSIONS	START STOP
EMISSION COLOR	START White STOP
PLUME TYPE	CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT	NO ☐ YES ☒
IF WATER DROPLET PLUME	ATTACHED ☐ DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	START Beginning of Plume STOP
DESCRIBE BACKGROUND	START Sky STOP
BACKGROUND COLOR	START Blue STOP
SKY CONDITIONS	START STOP
WIND SPEED	START 0-2 calm STOP
WIND DIRECTION	START STOP
AMBIENT TEMP.	START 60 STOP
WET BULB TEMP.	
RH, percent	

Source Layout Sketch Draw North Arrow



COMMENTS: TEST NO. 2

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SIGNATURE

TITLE DATE

OBSERVATION DATE: 5/31/90 START TIME: 8:35 STOP TIME:

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	5	5	5	31				
2	5	5	5	5	32				
3	5	0	0	0	33				
4	5	0	0	5	34				
5	0	5	5	5	35				
6	5	5	5	5	36				
7	5	5	5	5	37				
8	0	0	0	0	38				
9	0	0	0	0	39				
10	5	5	5	5	40				
11	5	5	5	5	41				
12	5	5	5	5	42				
13					43				
14					44				
15					45				
16					46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

AVERAGE OPACITY FOR HIGHEST PERIOD

NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS MINIMUM MAXIMUM

OBSERVER'S NAME (PRINT): Kevin Kennedy

OBSERVER'S SIGNATURE: [signature] DATE: 5/31/90

ORGANIZATION: CSC Inc.

CERTIFIED BY: ETA DATE: March 1990

VERIFIED BY DATE

Visible Emission Observation Form

SOURCE NAME: TRESCO PAVING

ADDRESS:

CITY: Delmont | STATE: PA | ZIP:

PHONE: | SOURCE ID NUMBER:

PROCESS EQUIPMENT: Asphalt Plant | OPERATING MODE: Normal

CONTROL EQUIPMENT: Baghouse | OPERATING MODE: Normal

DESCRIBE EMISSION POINT
START STOP

HEIGHT ABOVE GROUND LEVEL: START 30 STOP | HEIGHT RELATIVE TO OBSERVER: START STOP

DISTANCE FROM OBSERVER: START 150' STOP | DIRECTION FROM OBSERVER: START STOP

DESCRIBE EMISSIONS
START STOP

EMISSION COLOR: START white STOP | PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☐ YES ☐ | IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED
START Stack exit STOP

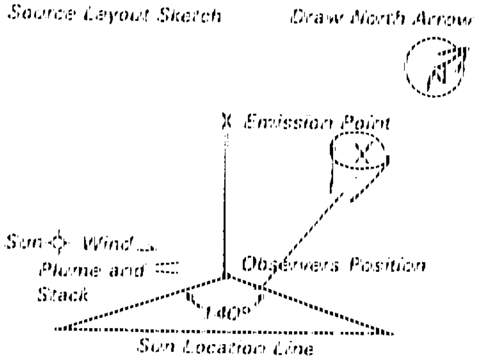
DESCRIBE BACKGROUND
START Sky STOP

BACKGROUND COLOR: START blue STOP | SKY CONDITIONS: START STOP

WIND SPEED: START 0-2 calm STOP | WIND DIRECTION: START STOP

AMBIENT TEMP: START 70° STOP | WET BULB TEMP. | RH, percent

Source Layout Sketch — Draw North Arrow



OBSERVATION DATE: 5/31/90 | START TIME: 11:40 | STOP TIME:

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
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2	5	5	5	5	32	5	5	5	5
3	5	5	0	5	33	5	5	5	5
4	5	5	5	5	34	5	5	5	5
5	0	5	5	10	35	5	5	5	5
6	10	5	5	5	36	5	5	5	5
7	10	10	5	5	37	5	5	5	5
8	5	5	5	5	38	5	5	5	5
9	10	5	5	5	39	5	5	5	5
10	5	5	5	5	40	5	5	5	5
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12	5	5	5	5	42	5	5	5	5
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16	5	5	5	5	46	5	5	5	5
17	5	5	5	5	47	5	5	5	5
18	5	5	5	5	48	5	5	5	5
19	5	5	5	5	49	5	5	5	5
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26	5	5	5	5	56	5	5	5	5
27	5	5	5	5	57	5	5	5	5
28	5	5	5	5	58	5	5	5	5
29	5	5	5	5	59	5	5	5	5
30	5	5	5	5	60	5	5	5	5

AVERAGE OPACITY FOR HIGHEST PERIOD | NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS: MINIMUM MAXIMUM

OBSERVER'S NAME (PRINT): Ken Kennedy

OBSERVER'S SIGNATURE: Ken Kennedy | DATE

ORGANIZATION: CSC Inc.

CERTIFIED BY: ETA | DATE: March 1990

VERIFIED BY | DATE

COMMENTS: TEST No. 3

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE
TITLE | DATE

Visible Emission Observation Form

SOURCE NAME: Tresco Paving

ADDRESS:

CITY: Delmont | STATE: PA | ZIP:

PHONE: | SOURCE ID NUMBER:

PROCESS EQUIPMENT: Asphalt Plant | OPERATING MODE: Normal

CONTROL EQUIPMENT: Baghouse | OPERATING MODE: Normal

DESCRIBE EMISSION POINT
START: Stack exit STOP

HEIGHT ABOVE GROUND LEVEL: START 30 STOP | HEIGHT RELATIVE TO OBSERVER: START STOP

DISTANCE FROM OBSERVER: START 150 STOP | DIRECTION FROM OBSERVER: START STOP

DESCRIBE EMISSIONS
START STOP

EMISSION COLOR: START White STOP | PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☐ YES ☑ | IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐

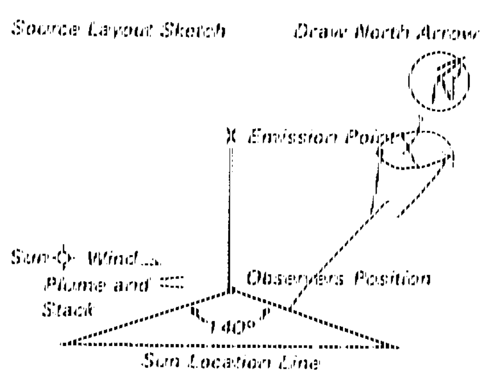
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED
START: Beginning of Plume

DESCRIBE BACKGROUND
START: Sky STOP

BACKGROUND COLOR: START Blue STOP | SKY CONDITIONS: START STOP

WIND SPEED: START 0-2 Calm STOP | WIND DIRECTION: START STOP

AMBIENT TEMP: START 70 STOP | WET BULB TEMP | RH, percent



COMMENTS: TEST NO. 3

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE
TITLE | DATE

OBSERVATION DATE: 5/31/90 | START TIME | STOP TIME

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	5	5	5	5	31				
2	5	5	5	5	32				
3	5	5	5	5	33				
4	5	5	5	5	34				
5	5	5	5	5	35				
6	5	5	5	5	36				
7	5	5	5	5	37				
8	5	5	5	5	38				
9	5	5	5	5	39				
10	5	5	5	5	40				
11	5	5	5	5	41				
12	5	5	5	5	42				
13					43				
14					44				
15					45				
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21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

AVERAGE OPACITY FOR HIGHEST PERIOD | NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS
MINIMUM MAXIMUM

OBSERVER'S NAME (PRINT): Kevin Kennedy

OBSERVER'S SIGNATURE: [signature] | DATE: 5/31/90

ORGANIZATION: CSC Inc.

CERTIFIED BY: ETA | DATE: March 1990

VERIFIED BY | DATE

D. PROCESS DATA

May 31, 1990

TEST TIME	MAX. TONS POSSIBLE	TONS PROVIDED	% OF MAX.
7:25-8:40AM	150	127.950	85.3
9:35-10:53AM	156	135.096	86.6
11:40-12:58PM	156	133.692	85.7
TOTALS 231 MINS. (3.85 HRS.)	462	396.738	85.9

*NOTE: THERE WAS NO BREAKS IN PRODUCTION DURING ANY OF THE TEST TIMES.

E. LABORATORY DATA

CSC Sample Log

Tresco Paving Co. 5/31/90

CSC Sample	Sample Type	Test No.
190	Impinger Water	TP-1
191	Impinger Water	TP-2
192	Impinger Water	TP-3
193	Probe Rinse Water	TP-1
194	Probe Rinse Water	TP-2
195	Probe Rinse Water	TP-3
196	Probe Rinse Acetone	TP-1
197	Probe Rinse Acetone	TP-2
198	Probe Rinse Acetone	TP-3
199	Backhalf Acetone	TP-1
200	Backhalf Acetone	TP-2
201	Backhalf Acetone	TP-3
202	Acetone Blank	
203	Acetone Blank	

ANALYTICAL DATA

Test No.	TP-1	TP-2	TP-3
Test Date	5/31/90	5/31/90	5/31/90
Filter No.	100011	100007	100017
Filter Tare, mg	629.8	636.2	621.1
Filter Final, mg	740.6	770.9	762.4
Filter Net, mg	110.8	134.7	141.3
Probe Acetone, mg	33.1	27.6	17.2
Probe Water	8.5	6.8	5.7
Impinger Insol., mg	10.72	4.82	4.39
Impinger Acetone, mg	3.1	5.0	4.2
Total particulate, mg	166.22	178.92	172.79

TOTAL SOLIDS ANALYSIS
COMPREHENSIVE SAFETY COMPLIANCE
295 WILLIAM PITT WAY
PITTSBURGH, PA 15238
PURCHASE ORDER #09395
SAMPLES RECEIVED: JUNE 5, 1990

CSC SAMPLE NUMBER	AQS LABORATORY NUMBER	SAMPLE TYPE	SAMPLE VOLUME ML	TOTAL SOLIDS MILLIGRAMS
196	54462	ACETONE	68	33.1
197	54463	ACETONE	72	27.6
198	54464	ACETONE	62	17.2
199	54465	ACETONE	56	3.1
200	54466	ACETONE	40	5.0
201	54467	ACETONE	34	4.2
202	54468	ACETONE	110	3.3
193	54459	WATER	96	8.5
194	54460	WATER	106	6.8
195	54461	WATER	116	5.7
203	54469	WATER	96	8.2

THE SAMPLES WERE WEIGHED ON A BALANCE CALIBRATED WITH WEIGHTS TRACEABLE TO THE NATIONAL BUREAU OF STANDARDS.
THE DATA HAS NOT BEEN CORRECTED FOR THE BLANK.

AIR QUALITY SERVICES, INC.

ANALYSIS OF SAMPLES FOR SOLUBLE-INSOLUBLE SOLIDS
COMPREHENSIVE SAFETY COMPLIANCE
295 WILLIAM PITT WAY
PITTSBURGH, PA 15238
PURCHASE ORDER #09395
SAMPLES RECEIVED: JUNE 5, 1990

CSC SAMPLE NUMBER	AQS LABORATORY NUMBER	SAMPLE VOLUME MILLILITERS	INSOLUBLE SOLIDS MILLIGRAMS	SOLUBLE SOLIDS MILLIGRAMS
190	54389	550	10.72	0.41
191	54390	510	4.82	8.60
192	54391	530	4.39	4.15

THE FILTERS WERE WEIGHED ON A MICRO BALANCE CALIBRATED WITH WEIGHTS TRACEABLE TO THE NATIONAL BUREAU OF STANDARDS.
THE DATA HAS NOT BEEN CORRECTED FOR A BLANK.

[signature]

AIR QUALITY SERVICES, INC.

F. V. E. CERTIFICATION

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Kevin Kennedy

met the specifications of Federal Reference Method 9 and qualified as a visible emissions evaluator. Maximum deviation on white and black smoke did not exceed 7.5% opacity and no single error exceeding 15% opacity was incurred during the certification test conducted by Eastern Technical Associates of Raleigh, North Carolina. This certificate is valid for six months from date of issue.

Thomas Hose
President

225654
Certificate Number

Vice President

Pittsburgh
Location

David Savage
Program Manager

March 21, 1990
Date of Issue