AP-42 Section 11.6
Reference 63
Report Sect. 4
Reference 76

LONE STAR INDUSTRIES, INC.
CAPE GIRARDEAU ALTERNATE FUELS C

2524 S. Sprigg Street, Cape Girardeau, MO 63701
314 335-8878 FAX: 314 335-1119
P.O. Box 968, Cape Girardeau, MO 63702-0968

April 21, 1993

Mr. Tom Lapp
MRI
401 Harrison Oaks Blvd.
Suite 350
Cary, NC 27513

Dear Mr. Lapp:

Please find enclosed a copy of the Certification of Compliance testing that Lone Star was required to do under the requirements of the BIF regulations. Prior to this required testing, Lone Star also did background testing to measure certain emissions. Mercury was one of the metals for which testing was conducted. The background testing is identified as "Phase I" throughout this report. This testing was conducted while the kiln was burning conventional fuels. "Phase II" testing was conducted when hazardous waste fuel was being fired in the kiln.

If you need additional information concerning QA/QC procedures, lab analysis, etc., I can supply that information. The entire report is nine volumes in length, and I did not think that you would be interested in the entire report. However, if you need additional data as related to the mercury testing, please let me know.

Sincerely,

Norris Johnson

Norris Johnson
Facility Manager

cc: Harry Philip

APCC AIR POLLUTION CHARACTERIZATION AND CONTROL, LTD.

CERTIFICATION OF COMPLIANCE STACK EMISSION TEST PROGRAM AT LONESTAR INDUSTRIES, INC. CAPE GIRARDEAU, MISSOURI APRIL & JUNE 1992

BIF CERTIFICATION OF COMPLIANCE LETTER & FORMS

Revised January 1993

BIF COC TEST REPORT

& APPENDIX A

APPENDIX A

VOLUME 1

60 Industrial Park Road West, Tolland, CT 06084 (203) 87

LONE STAR INDUSTRIES, INC.
CAPE GIRARDEAU ALTERNATE FUELS COMPANY

2524 S. Sprigg Street, Cape Girardeau, MO 63701
314 335-8878 FAX: 314 335-1119
P.O. Box 968, Cape Girardeau, MO 63702-0968

September 24, 1992

Mr. John Smith
U. S. EPA RCRA Branch
726 Minnesota Avenue
Kansas City, KS 66101

RE: EPA I.D. NO. MO 981127319

Dear Mr. Smith,

Please find enclosed the Certificate of Compliance as required for Boilers and Industrial Furnaces burning hazardous waste under the BIF regulations in 40 CFR Part 266. This certification was revised in September and should replace that document date August 17, 1992.

Some revisions to Sections 3.5.2, Phase 2 have been made in order to detail the testing process.

After reviewing analyses of raw mix and waste derived liquid fuel (WDLF) it was ascertained that the digestion method used for sample preparation of these materials was inadequate. Those metals in raw mix and WDLF taken under Tier III guidelines were reanalyzed using the ASTM sample preparation technique, and these analyses for those metals were used in this COC. The QA/QC documentation for the analysis is found in Appendix C, staring with page 1000A.

Also, under this revision, Mercury was considered under Tier IA guidelines, and the appropriate changes to the Precompliance Certification have been made to reflect this change.

Please contact me if further questions or clarification is required.

Sincerely,

Norris Johnson

Norris Johnson
Facility Manager

LONE STAR INDUSTRIES, INC.
CAPE GIRARDEAU ALTERNATE FUELS COMPANY

2524 S. Sprigg Street, Cape Girardeau, MO 63701
314 335-8878 FAX: 314 335-1119
P.O. Box 968, Cape Girardeau, MO 63702-0968

August 17, 1992

Mr. Joe Galbraith
U.S. EPA RCRA Branch
726 Minnesota Avenue
Kansas City, KS 66101

Dear Mr. Galbraith,

Please find enclosed the Certificate of Compliance as required for Boiler and Industrial Furnaces burning hazardous waste under the BIF regulations in 40 CFR part 266.

The document is complete as far as we can ascertain. It should be noted that the CO limit was established after the certification testing upon your verbal approval on August 10, 1992. The CO limit discussion contained herein should be used for the backup for the limitation established for CO.

Much of the laboratory data was very late in arriving. Although, it was checked for accuracy, the shortness of time between receiving all the laboratory data and filing of this document might be a source of error upon closer examination of all the data. If any errors exist we will contact your office immediately.

If you need to communicate with me, I can be reached at address and telephone number listed above.

Sincerely,

Norris Johnson

Norris Johnson
Facility Manager

cc: Wane Roberts
Jim Burris

COMPLIANCE CERTIFICATION FORM 1 (CC-1)

GENERAL FACILITY AND TESTING INFORMATION

[ ]Initial Certification [ ]Revised Certification [ ]Recertification

1. EPA facility ID Number:	MO 981127319
2. Facility Name:	LONE STAR ALTERNATE FUELS CO.
Contact Person:	NORRIS JOHNSON
Telephone Number:	(314) 335-8878
Facility Address:	2524 SOUTH SPRIGG STREET CAPE GIRARDEAU, MO 63701
3. Type of boiler/industrial furnace.	INDUSTRIAL FURNACE (CEMENT KILN)
4. Person responsible for conducting compliance test: (Attach statement of qualifications)	JOHN POWELL
Telephone Number:	(203) 871-8557
Company Name:	APCC
Address:	60 INDUSTRIAL PARK ROAD WEST TOLLAND, CT 06084
5. Date(s) of compliance test:	JUNE 25-26, 1992
6. Person responsible for QA/QC:	JOHN SCHNEIDER
Title:	SENIOR PROJECT ENGINEER
Telephone Number:	(203) 871-8557
Attach a statement certifying that procedures prescribed in QA/QC plan submitted with Compliance Test Notification Form 3 (CTN-3) have been followed, or a description of any changes and an explanation of why changes were necessary.	

I certify under penalty of law that this information was prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information and supporting documentation. Copies of all emissions tests, dispersion modeling results, and other information used to determine conformance with the requirements of §266.103(c) are available at the facility, and can be obtained from the facility contact person listed above. Based on my inquiry of the person or persons who manages the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I also acknowledge that the operating conditions established in this certification pursuant to §266.103(c)(4)(iv) are enforceable limits at which the facility can legally operate during interim status until (1) a revised certification of compliance is submitted or (2) an operating permit is issued.

Signature: [signature] Date: 9/28/92

Title: Vice President, Cement Operations

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COMPLIANCE CERTIFICATION FORM 2 (CC-2)

DEVIATIONS FROM SUBMITTED NOTIFICATION OF COMPLIANCE TEST

1. Were there any changes in the unit configuration prior to or during testing that would alter any of the information submitted on Form CTN-2 of the unit's Notification of Compliance Test? ___ Yes _X_ No

   If yes, describe these changes and why they were necessary and attach an amended Form CTN-2 describing the unit as actually tested. (Attach additional sheets if necessary).

2. Were there any changes in the planned test conditions prior to or during testing that alter any of the information submitted on Form CTN-3 of the unit's Notification of Compliance Test? _X_ Yes ___ No

   If yes, describe these changes and why they were necessary and attach amended Form CTN-3 describing test conditions. (Attach additional sheets if necessary.)

   In the initial protocol for testing it was planned to test the kiln while firing 100% hazardous waste fuel and coal, with no tires being used as fuel. However, upon completion of testing using tires, waste fuel, and coal as fuels, it was determined this testing was not needed.

COMPLIANCE CERTIFICATION FORM 3 (CC-3)
SUMMARY OF COMPLIANCE TEST EMISSIONS

Complete a separate form for each test condition (if more than 1) under each mode of operation for each unit.

1. Use the same identification codes as on Form CTN-3 for the following:

   Unit # 1 ; Mode (letter) A ; Test Condition (1, 2 or N/A)[a] 1

   Brief Description of Mode and Test Condition: Minimum burning zone condition

2. Purpose of Test (e.g., Demonstrate compliance with PM, metals, HCl, and Cl_2 emission limits when firing sludges at maximum feed rate and flue gas flow):
   Demonstrates compliance with HCL/CL2, PM and POHC DRE for state while firing hazardous waste feed at maximum rate.

3. Attach a complete copy of QA/QC results for each test.

4. Test Results:	Run No. 1	Run No. 2	Run No. 3	Avg[b]	Allowable Emission Rate[c]	OK[d]
Date (month/day/yr)	6-25-92	6-25-92	6-25-92			
Time Run Started (hr:min)	8:30	17:45	21:45			
Total Run Time (mins)	180	180	210			
Sootblow Time (mins)[e]			N/A			
CO (ppmv @ 7% O_2)						
Run Avg	See CO	Limit				
Highest 60-min rolling avg	Paper					
HC (ppmv @ 7% O_2)						
Run avg	See CO	Limit				
Highest 60-min rolling avg	Paper					
PM emissions (gr/dscf)	0.026	0.024	0.023	0.0243	0.032	
HCl emissions (g/hr)	3577	4077	6615	4756	501991.2	
Cl_2 emissions (g/hr)	23.4	47.1	70.1	46.9	28684.8	
Antimony (g/hr)	Not Measured this condition					
Arsenic (g/hr)	"	"	"	"	"	
Barium (g/hr)	"	"	"	"	"	
Beryllium (g/hr)	"	"	"	"	"	
Cadmium (g/hr)	"	"	"	"	"	
Chromium (g/hr)	"	"	"	"	"	
Lead (g/hr)	"	"	"	"	"	
Mercury (g/hr)	"	"	"	"	"	
Silver (g/hr)	"	"	"	"	"	
Thallium (g/hr)	"	"	"	"	"	

[a] If facility conducted tests at only one set of test conditions for the stated mode, enter N/A. If two sets of test conditions were run for the mode, fill out a separate form for each set of test conditions, identifying the test condition (1 or 2) as on Form CTN-3.

[b] If soot blowing or other daily activity that increases the PM emission rate was incorporated into the testing, calculate average using equation provided in instructions.

[c] Allowable levels are the same as indicated on Form PC-4.

[d] Check if each non-sootblowing run and average are less than or equal to allowable.

[e] Indicate sootblowing time or time of other activity that was incorporated into the testing.

COMPLIANCE CERTIFICATION FORM 3 (CC-3)
SUMMARY OF COMPLIANCE TEST EMISSIONS

Complete a separate form for each test condition (if more than 1) under each mode of operation for each unit.

1. Use the same identification codes as on Form CTN-3 for the following:

   Unit # 1; Mode (letter) A; Test Condition (1, 2 or N/A)[a] 2

   Brief Description of Mode and Test Condition: Maximum Burning Zone Temperature

2. Purpose of Test (e.g., Demonstrate compliance with PM, metals, HCl, and Cl_2 emission limits when firing sludges at maximum feed rate and flue gas flow):

   Comply with metal emissions, maximum APCD temperatures, maximum hazardous waste feed rate, maximum production

3. Attach a complete copy of QA/QC results for each test.

4. Test Results:	Run No. 1	Run No. 2	Run No. 3	Avg[b]	Allowable Emission Rate[c]	OK[d]
Date (month/day/yr)	6-26-92	6-26-92	6-26-92			
Time Run Started (hr:min)	13:45	17:45	21:45			
Total Run Time (mins)	180	180	180			
Sootblow Time (mins)[e]			N/A			
CO (ppmv @ 7% O_2)						
Run Avg	See CO	limit				
Highest 60-min rolling avg	Paper					
HC (ppmv @ 7% O_2)						
Run avg	See CO	Limit				
Highest 60-min rolling avg	Paper					
PM emissions (gr/dscf)	Not measured	condition 2				
HCl emissions (g/hr)	"	"	"	"		
Cl_2 emissions (g/hr)	"	"	"	"		
Antimony (g/hr)	Tier I				21513.94	
Arsenic (g/hr)	0.64	1.03	0.97	0.88	164.97	
Barium (g/hr)	Tier I				3585657.4	
Beryllium (g/hr)	0.02	0.02	0.07	0.037	301.20	
Cadmium (g/hr)	0.82	7.19	0.02	2.68	401.59	
Chromium (g/hr)	5.47	0.02	0.02	1.84	71713147.41	
Lead (g/hr)	6.34	5.64	12.94	8.31	6454.18	
Mercury (g/hr)	18.11	16.42	58.14	30.89	21513.94	
Silver (g/hr)	Tier I				215139.44	
Thallium (g/hr)	Tier I				35856.57	

[a] If facility conducted tests at only one set of test conditions for the stated mode, enter N/A. If two sets of test conditions were run for the mode, fill out a separate form for each set of test conditions, identifying the test condition (1 or 2) as on Form CTN-3.

[b] If soot blowing or other daily activity that increases the PM emission rate was incorporated into the testing, calculate average using equation provided in instructions.

[c] Allowable levels are the same as indicated on Form PC-4.

[d] Check if each non-sootblowing run and average are less than or equal to allowable.

[e] Indicate sootblowing time or time of other activity that was incorporated into the testing.

COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification codes as on Forms CC-3 and CTN-3.

1. Unit #: 1 ; Mode: A ; Test Condition (1, 2, or N/A): 1 ;

Run No.: 3 ; Test Date: 6-25-92

2. Run Start Time (hr:min): 8:30 ; Run End Time (hr:min): 12:30

If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: ______

3. Operating Conditions:

	Run Avg	60-min Avg[a]
Max. Production Rate (specify units)	245.4	256.2
Max. PM Control Device Inlet Temp.(°F)[b]	Not measured condition 1	
Max. Combustion Chamber Temp. (°F)[b]	"	"
APCS Operating Parameters (List applicable parameters, see §266.103(c)(1)(ix-xiii))	Run Avg	60-min Avg[c]
Not measured condition 1		

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[d]

Stream No.[e]	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	WDLF	WDSF	RAW MIX	COAL
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	Pump HW	Nonpump HW	RM	Fuel
Mass Feed Rate (g/hr)	9.28E+06	3.90E+05	2.13E+08	1.08E+07
Thermal Feed Rate (Btu/hr)	2.3E+08	3.06E+06	0	2.65E+08
Ash Feed Rate (g/hr)[f]	N/A	N/A	N/A	N/A
Chlorine and Chloride (g/hr)	447,068.2	453.6	95,754.96	11,793.6
Antimony (g/hr)	Not measured condition 1			
Arsenic (g/hr)				
Barium (g/hr)				
Beryllium (g/hr)				
Cadmium (g/hr)				
Chromium (g/hr)				
Lead (g/hr)				
Mercury(g/hr)				
Silver (g/hr)				
Thallium (g/hr)				

[a]Indicate highest or lowest 60-minute rolling average as appropriate.
[b]Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c]Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d]Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e]Copy form and add additional pages if more than four streams were fed during test.
[f]Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification codes as on Forms CC-3 and CTN-3.

1. Unit #: 1 ; Mode: A ; Test Condition (1, 2, or N/A): 1 ;
   Run No.: 3 ; Test Date: 6-25-92
2. Run Start Time (hr:min): 8:30 ; Run End Time (hr:min): 12:30
   If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: ____________

3. Operating Conditions:

	Run Avg	60-min Avg[a]
Max. Production Rate (specify units)	245.4	256.2
Max. PM Control Device Inlet Temp.(°F)[b]	Not measured	Condition 1
Max. Combustion Chamber Temp. (°F)[b]	"	"
APCS Operating Parameters (List applicable parameters, see §266.103(c)(1)(ix-xiii))	**Run Avg**	**60-min Avg[c]**
	Not measured	Condition 1

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[d]

Stream No.[e]	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	Tires			
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	Fuel			
Mass Feed Rate (g/hr)	1.36E+6			
Thermal Feed Rate (Btu/hr)	4.27E+7			
Ash Feed Rate (g/hr)[f]	N/A			
Chlorine and Chloride (g/hr)	1496.88			
Antimony (g/hr)	Not measured condition 1			
Arsenic (g/hr)	↓			
Barium (g/hr)				
Beryllium (g/hr)				
Cadmium (g/hr)				
Chromium (g/hr)				
Lead (g/hr)				
Mercury (g/hr)				
Silver (g/hr)				
Thallium (g/hr)				

[a] Indicate highest or lowest 60-minute rolling average as appropriate.
[b] Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c] Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d] Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e] Copy form and add additional pages if more than four streams were fed during test.
[f] Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

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COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification codes as on Forms CC-3 and CTN-3.

1. Unit #: 1; Mode: A; Test Condition (1, 2, or N/A): 1;
   Run No.: 4; Test Date: 6-25-92
2. Run Start Time (hr:min): 17:45; Run End Time (hr:min): 20:45
   If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: ______
3. Operating Conditions:

	Run Avg	60-min Avg[a]
Max. Production Rate (specify units)	248.1	255.92
Max. PM Control Device Inlet Temp.(°F)[b]	Not measured	condition 1
Max. Combustion Chamber Temp. (°F)[b]	"	"
APCS Operating Parameters (List applicable parameters, see §266.103(c)(1)(ix-xiii))	Run Avg	60-min Avg[c]
	Not measured	condition 1

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[d]

Stream No.[e]	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	WDLF	WDSF	RAW MIX	COAL
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	Pump HW	NonpumpHW	R.M.	Fuel
Mass Feed Rate (g/hr)	9.09E+06	4.53E+05	2.20E+08	1.10E+07
Thermal Feed Rate (Btu/hr)	2.23E+08	4.75E+06	0	2.65E+08
Ash Feed Rate (g/hr)[f]	N/A	N/A	N/A	N/A
Chlorine and Chloride (g/hr)	422185.48	907.2	107773.36	9843.12
Antimony (g/hr)	Not	measured	condition	1
Arsenic (g/hr)				
Barium (g/hr)				
Beryllium (g/hr)				
Cadmium (g/hr)				
Chromium (g/hr)				
Lead (g/hr)				
Mercury(g/hr)				
Silver (g/hr)				
Thallium (g/hr)				

[a]Indicate highest or lowest 60-minute rolling average as appropriate.
[b]Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c]Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d]Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e]Copy form and add additional pages if more than four streams were fed during test.
[f]Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification codes as on Forms CC-3 and CTN-3.

1. Unit #: 1; Mode: A; Test Condition (1, 2, or N/A): 1;
   Run No.: 4; Test Date: 6-25-92
2. Run Start Time (hr:min): 17:45; Run End Time (hr:min): 20:45
   If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: ______
3. Operating Conditions:

	Run Avg	60-min Avg[a]
Max. Production Rate (specify units)	248.1	255.92
Max. PM Control Device Inlet Temp.(°F)[b]	Not Measured	Condition 1
Max. Combustion Chamber Temp. (°F)[b]	"	"

APCS Operating Parameters (List applicable parameters; see §266.103(c)(1)(ix-xiii))	Run Avg	60-min Avg[c]
	Not Measured	Condition 1

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[d]

Stream No.[e]	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	Tires			
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	Fuel			
Mass Feed Rate (g/hr)	1.36E+6			
Thermal Feed Rate (Btu/hr)	4.51E+7			
Ash Feed Rate (g/hr)[f]	N/A			
Chlorine and Chloride (g/hr)	1360.8			
Antimony (g/hr)	Not Measured Condition 1			
Arsenic (g/hr)				
Barium (g/hr)				
Beryllium (g/hr)				
Cadmium (g/hr)				
Chromium (g/hr)				
Lead (g/hr)				
Mercury (g/hr)				
Silver (g/hr)				
Thallium (g/hr)				

[a] Indicate highest or lowest 60-minute rolling average as appropriate.
[b] Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c] Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d] Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e] Copy form and add additional pages if more than four streams were fed during test.
[f] Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification codes as on Forms CC-3 and CTN-3.

1. Unit #: 1 ; Mode: A ; Test Condition (1, 2, or N/A): 1 ;
Run No.: 5 ; Test Date: 6-25-92

2. Run Start Time (hr:min): 21:45 ; Run End Time (hr:min): 1:05
If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: ____

3. Operating Conditions:

	Run Avg	60-min Avg[a]
Max. Production Rate (specify units)	247.4	255.9
Max. PM Control Device Inlet Temp.(°F)[b]	Not measured	Condition 1
Max. Combustion Chamber Temp. (°F)[b]	"	"
APCS Operating Parameters (List applicable parameters, see §266.103(c)(1)(ix-xiii))	Run Avg	60-min Avg[c]
	Not measured	Condition 1

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[d]

Stream No.[e]	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	WDLF	WDSF	RAW MIX	COAL
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	Pump HW	Nonpump HW	R.M.	Fuel
Mass Feed Rate (g/hr)	9.11E+06	4.12E+05	2.19E+08	1.06E+07
Thermal Feed Rate (Btu/hr)	2.41E+08	5.84E+05	0	2.52E+08
Ash Feed Rate (g/hr)[f]	N/A	N/A	N/A	N/A
Chlorine and Chloride (g/hr)	416813.04	997.92	111494.88	8436.96
Antimony (g/hr)	Not	measured	condition	1
Arsenic (g/hr)	↓	↓	↓	↓
Barium (g/hr)				
Beryllium (g/hr)				
Cadmium (g/hr)				
Chromium (g/hr)				
Lead (g/hr)				
Mercury (g/hr)				
Silver (g/hr)				
Thallium (g/hr)				

[a] Indicate highest or lowest 60-minute rolling average as appropriate.
[b] Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c] Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d] Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e] Copy form and add additional pages if more than four streams were fed during test.
[f] Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification codes as on Forms CC-3 and CTN-3.

1. Unit #: 1; Mode: A; Test Condition (1, 2, or N/A): 1;
Run No.: 5; Test Date: 6-25-92

2. Run Start Time (hr:min): 21:45; Run End Time (hr:min): 1:05
If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: __________

3. Operating Conditions:

	Run Avg	60-min Avg[a]
Max. Production Rate (specify units)	247.4	255.9
Max. PM Control Device Inlet Temp.(°F)[b]	Not Measured	Condition 1
Max. Combustion Chamber Temp. (°F)[b]	"	"
APCS Operating Parameters (List applicable parameters; see §266.103(c)(1)(ix-xiii))	**Run Avg**	**60-min Avg[c]**
	Not Measured	Condition 1

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[d]

Stream No.[e]	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	Tires			
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	Fuel			
Mass Feed Rate (g/hr)	1.36E+6			
Thermal Feed Rate (Btu/hr)	4.21E+7			
Ash Feed Rate (g/hr)[f]	N/A			
Chlorine and Chloride (g/hr)	1905.12			
Antimony (g/hr)	Not Measured Condition 1			
Arsenic (g/hr)	↓			
Barium (g/hr)	↓			
Beryllium (g/hr)	↓			
Cadmium (g/hr)	↓			
Chromium (g/hr)	↓			
Lead (g/hr)	↓			
Mercury (g/hr)	↓			
Silver (g/hr)	↓			
Thallium (g/hr)	↓			

[a] Indicate highest or lowest 60-minute rolling average as appropriate.
[b] Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c] Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d] Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e] Copy form and add additional pages if more than four streams were fed during test.
[f] Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

COMPLIANCE CERTIFICATION FORM 5 (CC-5)
SUMMARY OF OPERATING AND FEED RATE LIMITS FOR A SPECIFIC MODE

1. Unit #: 1 ; Mode: A-1; Run Nos.: 3-5 ; Test Date: 6-25-92

2. Operating Condition Limits[a]

Max. PM Control Device Inlet Temp. (°F)[b,c] *	* Not determined
Max. Combustion Chamber Temp. (°F)[b] *	* Not determined
APCS Operating Conditions (list applicable parameters, see § 266.103(c)(1)(ix-xiii)):	
Low pressure drop Main APCD	-6" WC manufacturors design
Low pressure drop Bypass APCD	-2.95" WC
Max. Production Rate (specify units)	256 TPH
Max. Total HW Feed Rate (g/hr)	9328919
Max. Total Pumpable HW Feed Rate (g/hr)[b]	9328919
Max. Total Chlorine and Chloride Feed Rate (g/hr)	553044.24
Max. Total Ash Feed Rate (g/hr)[d]	N/A

3. Maximum Metals Feed Rates

	Total Feed Streams[a]	Total HW Feed Streams[b]	Total Pumpable HW Feed Streams
Antimony (g/hr) *	Not determined	this	condition
Arsenic (g/hr) *	"	"	"
Barium (g/hr) *	"	"	"
Beryllium (g/hr) *	"	"	"
Cadmium (g/hr) *	"	"	"
Chromium (g/hr) *	"	"	"
Lead (g/hr) *	"	"	"
Mercury (g/hr) *	"	"	"
Silver (g/hr) *	"	"	"
Thallium (g/hr) *	"	"	"

4. CO, HC, and PM Limits

CO (ppmv @ 7% O_2)[f,h]	1169.7 See CO limit discussion
HC (ppmv as propane @ 7% O_2)[c,g,h]	20.0 " " " "
PM (gr/dscf @ 7% O_2)[i]	0.032 " " " "

[a] Asterisk any parameter not determined under the primary test conditions.
[b] Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c] If applicable, attach documentation that the increased cancer risk to the MEI from emissions of dioxins and furans is not greater than 1 in 100,000.
[d] Not required for cement and light-weight aggregate kilns.
[e] Not required for furnaces monitoring metals concentrations in collected PM.
[f] If under Tier I, CO limit is 100 ppmv. If under Tier II, limit is the average over all runs of the HHA CO level for each run.
[g] If under Tier I, HC limit is not applicable. If under Tier II, limit is 20 ppmv.
[h] If a furnace cannot meet the Tier II 20 ppmv HC limit because of organic matter in raw material feedstocks, the interim HC and CO limits are the baseline limits proposed in the Part B permit application or the limits established by the Director as a condition of a time extension for certification of compliance.
[i] 0.08 gr/dscf or existing permit, whichever is more stringent.

COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification codes as on Forms CC-3 and CTN-3.

1. Unit #: 1 ; Mode: A ; Test Condition (1, 2, or N/A): 2 ;
   Run No.: 7 ; Test Date: 6-26-92
2. Run Start Time (hr:min): 13:45 ; Run End Time (hr:min): 16:45
   If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: ______

3. Operating Conditions:

	Run Avg	60-min Avg[a]
Max. Production Rate (specify units)	251.1 TPH	256.2 TPH
Max. PM Control Device Inlet Temp.(°F)[b]	310°F 428°F	365°F 434°F
Max. Combustion Chamber Temp. (°F)[b]	1669.3	1688
APCS Operating Parameters (List applicable parameters, see §266.103(c)(1)(ix-xiii))	Run Avg	60-min Avg[c]
Pressure Drop Main APCD*/Bypass APCD	6"wc 3.08"wc	6" wc 2.96"wc
*Manufacturers specifications		

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[d]

Stream No.[e]	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	WDLF	WDSF	RAW MIX	COAL
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	Pump HW	Nonpump HW	R. M.	Fuel
Mass Feed Rate (g/hr)	9.27E+06	1.24E+05	2.28E+08	1.11E+07
Thermal Feed Rate (Btu/hr)	2.3E+08	1.9E+06	0	2.74E+08
Ash Feed Rate (g/hr)[f]	N/A	N/A	N/A	N/A
Chlorine and Chloride (g/hr)	4.21E+08	226.8	118,343	121.57
Antimony (g/hr)	Tier IA			
Arsenic (g/hr)	1854.52	1.02	173.98	60.70
Barium (g/hr)	Tier IA			
Beryllium (g/hr)	22.25	0.02	117.73	3.68
Cadmium (g/hr)	2679.75	0.16	799.32	2.63
Chromium (g/hr)	6500.48	25.28	4258.48	184.49
Lead (g/hr)	5517.14	8.12	2024.49	70.02
Mercury (g/hr)	Tier IA			
Silver (g/hr)	Tier IA			
Thallium (g/hr)	Tier IA			

[a] Indicate highest or lowest 60-minute rolling average as appropriate.
[b] Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c] Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d] Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e] Copy form and add additional pages if more than four streams were fed during test.
[f] Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification codes as on Forms CC-3 and CTN-3.

1. Unit #: 1; Mode: A; Test Condition (1, 2, or N/A): 2;
   Run No.: 7; Test Date: 6-26-92
2. Run Start Time (hr:min): 13:45; Run End Time (hr:min): ;6:45
   If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: ______

3. Operating Conditions:

	Run Avg	60-min Avg
Max. Production Rate (specify units)	251.1 TPH	256.2 TPH
Max. PM Control Device Inlet Temp.(°F)[a]	310°F 428°F	365°F 434°F
Max. Combustion Chamber Temp. (°F)[a]	1669.4	1688
APCS Operating Parameters (List applicable parameters, see §266.103(c)(1)(ix-xiii))	Run Avg	60-min Avg[c]
Pressure drop main APCD*/Bypass APCD	6"wc 3.08"wc	6"wc 2.96"wc
*used manufacturers specifications		

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[e]

Stream No.[d]	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	TIRES			
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	FUEL			
Mass Feed Rate (g/hr)	1.36E+06			
Thermal Feed Rate (Btu/hr)	4.42E+07			
Ash Feed Rate (g/hr)[f]	N/A			
Chlorine and Chloride (g/hr)	0.00			
Antimony (g/hr)	Tier IA			
Arsenic (g/hr)	1.31			
Barium (g/hr)	Tier IA			
Beryllium (g/hr)	0.07			
Cadmium (g/hr)	2.48			
Chromium (g/hr)	6.58			
Lead (g/hr)	14.71			
Mercury(g/hr)	Tier IA			
Silver (g/hr)	Tier IA			
Thallium (g/hr)	Tier IA			

[a] Indicate highest or lowest 60-minute rolling average as appropriate.
[b] Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c] Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d] Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e] Copy form and add additional pages if more than four streams were fed during test.
[f] Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification codes as on Forms CC-3 and CTN-3.

1. Unit #: 1 ; Mode: A ; Test Condition (1, 2, or N/A): 2 ;
   Run No.: 8 ; Test Date: 6-26-92
2. Run Start Time (hr:min): 17:45 ; Run End Time (hr:min): 20:45
   If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: ____

3. Operating Conditions:

	Run Avg	60-min Avg
Max. Production Rate (specify units)	250.7 TPH	255.6 TPH
Max. PM Control Device Inlet Temp.(°F)[a]	310°F 430°F	366°F 436°F
Max. Combustion Chamber Temp. (°F)[a]	1677°F	1699.6°F
APCS Operating Parameters (List applicable parameters, see §266.103(c)(1)(ix-xiii))[c]	Run Avg	60-min Avg
P MAIN APCD | BYPASS APCD	6"wc 3.05"wc	6"wc 2.99"wc

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[d]

Stream No.[e]	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	WDLF	WDSF	RAW MIX	COAL
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	Pump HW	Nonpump HW	R.M.	Fuel
Mass Feed Rate (g/hr)	9.43E+06	1.24E+05	2.28E+08	1.14E+07
Thermal Feed Rate (Btu/hr)	2.30E+08	1.52E+06	0	2.78E+09
Ash Feed Rate (g/hr)[f]	N/A	N/A	N/A	N/A
Chlorine and Chloride (g/hr)	365,011.92	181.44	132,133.60	11,285.26
Antimony (g/hr)	Tier IA			
Arsenic (g/hr)	1744.47	0.83	326.04	44.94
Barium (g/hr)	Tier IA			
Beryllium (g/hr)	22.82	0.03	138.62	6.60
Cadmium (g/hr)	2860.28	0.26	362.51	1.99
Chromium (g/hr)	6530.61	23.18	4651.18	178.62
Lead (g/hr)	6064.61	6.77	3328.78	63.60
Mercury (g/hr)	Tier IA			
Silver (g/hr)	Tier IA			
Thallium (g/hr)	Tier IA			

[a] Indicate highest or lowest 60-minute rolling average as appropriate.
[b] Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c] Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d] Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e] Copy form and add additional pages if more than four streams were fed during test.
[f] Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification codes as on Forms CC-3 and CTN-3.

1. Unit #: 1 ; Mode: A ; Test Condition (1, 2, or N/A): 2 ;
   Run No.: 8 ; Test Date: 6-26-92
2. Run Start Time (hr:min): 17:45 ; Run End Time (hr:min): 20:45
   If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: ______

3. Operating Conditions:

	Run Avg	60-min Avg[a]
Max. Production Rate (specify units)	250.7 TPH	255.6 TPH
Max. PM Control Device Inlet Temp.(°F)[b]	310°F 430°F	366°F 436°F
Max. Combustion Chamber Temp. (°F)[b]	1677°F	1699.6°F
APCS Operating Parameters (List applicable parameters, see §266.103(c)(1)(ix-xiii))	Run Avg	60-min Avg
P MAIN APCD | BYPASS APCD	6"wc 3.05"wc	6"wc 2.99"wc

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[d]

Stream No.[e]	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	TIRES			
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	FUEL			
Mass Feed Rate (g/hr)	1.36E+06			
Thermal Feed Rate (Btu/hr)	4.31E+07			
Ash Feed Rate (g/hr)[f]	N/A			
Chlorine and Chloride (g/hr)	2585.52			
Antimony (g/hr)	Tier IA			
Arsenic (g/hr)	4.98			
Barium (g/hr)	Tier IA			
Beryllium (g/hr)	0.11			
Cadmium (g/hr)	22.61			
Chromium (g/hr)	77.36			
Lead (g/hr)	42.49			
Mercury (g/hr)	Tier IA			
Silver (g/hr)	Tier IA			
Thallium (g/hr)	Tier IA			

[a]Indicate highest or lowest 60-minute rolling average as appropriate.
[b]Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c]Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d]Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e]Copy form and add additional pages if more than four streams were fed during test.
[f]Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

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COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification codes as on Forms CC-3 and CTN-3.

1. Unit #: 1; Mode: A; Test Condition (1, 2, or N/A): 2;
Run No.: 9; Test Date: 6-26-92
2. Run Start Time (hr:min): 21:30; Run End Time (hr:min): 00:30
If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: ______

3. Operating Conditions:

	Run Avg	60-min Avg
Max. Production Rate (specify units)	251 TPH	256 TPH
Max. PM Control Device Inlet Temp.(°F)[a]	309°F 433°F	367°F 438°F
Max. Combustion Chamber Temp. (°F)[a]	1666.1	1685.8
APCS Operating Parameters (List applicable parameters, see 266.103(c)(1)(ix-xiii))	Run Avg	60-min Avg
Pressure drop main APCD*/Bypass APCD	6"wc 2.97"wc	6"wc 2.89wc

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[e]

Stream No.	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	WDLF	WDSF	RAW MIX	COAL
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	Pump HW	Nonpump HW	R.M.	Fuel
Mass Feed Rate (g/hr)	9.43E+06	1.81E+05	2.28E+08	1.08E+07
Thermal Feed Rate (Btu/hr)	2.37E+08	2.1E+06	0	2.66E+08
Ash Feed Rate (g/hr)[f]	N/A	N/A	N/A	N/A
Chlorine and Chloride (g/hr)	477731.52	498.96	118434.96	11,793.6
Antimony (g/hr)	Tier IA			
Arsenic (g/hr)	1584.47	2.75	171.91	34.29
Barium (g/hr)	Tier IA			
Beryllium (g/hr)	24.43	0.05	122.21	2.73
Cadmium (g/hr)	2831.25	0.45	303.24	2.60
Chromium (g/hr)	6380.80	50.05	3853.18	219.31
Lead (g/hr)	6157.42	10.97	2621.99	42.57
Mercury (g/hr)	Tier IA			
Silver (g/hr)	Tier IA			
Thallium (g/hr)	Tier IA			

[a]Indicate highest or lowest 60-minute rolling average as appropriate.
[b]Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c]Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d]Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e]Copy form and add additional pages if more than four streams were fed during test.
[f]Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

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COMPLIANCE CERTIFICATION FORM 4 (CC-4)
SUMMARY OF COMPLIANCE TEST OPERATING CONDITIONS

Complete a separate form for each run of a specified test condition, use same identification code as on Forms CC-3 and CTN-3.

1. Unit #: 1; Mode: A; Test Condition (1, 2, or N/A): 2;

   Run No.: 9; Test Date: 6-26-92

2. Run Start Time (hr:min): 21:30; Run End Time (hr:min): 00:30

   If there were any interruptions in sampling, discuss cause, duration, and impact on sampling: ______________________

3. Operating Conditions:

	Run Avg	60-min Avg[a]
Max. Production Rate (specify units)	251 TPH	256 TPH
Max. PM Control Device Inlet Temp. (°F)[b]	309°F 433°F	[illegible]7°F 438°F
Max. Combustion Chamber Temp. (°F)[b]	1666.1	1685.8
APCS Operating Parameters (list applicable parameters, see §266.103(c)(1)(ix-xiii))	Run Avg	60-min Avg[c]
Pressure drop main APCD*/Bypass APCD	6"wc 2.97"wc	6"wc 2.89wc

4. Description of All Fuel, Raw Material, and Waste Feed Streams:[d]

Stream No.[e]	1	2	3	4
Stream Type (e.g., coal, shale, sludge, liquid solvents, etc.)	TIRES			
Category (e.g., Fuel, Raw Material, Pumpable HW, Nonpumpable HW)	FUEL			
Mass Feed Rate (g/hr)	1.36E+06			
Thermal Feed Rate (Btu/hr)	4.23E+07			
Ash Feed Rate (g/hr)[f]	N/A			
Chlorine and Chloride (g/hr)	3,674.16			
Antimony (g/hr)	Tier IA			
Arsenic (g/hr)	1.46			
Barium (g/hr)	Tier IA			
Beryllium (g/hr)	0.13			
Cadmium (g/hr)	47.81			
Chromium (g/hr)	135.93			
Lead (g/hr)	35.14			
Mercury (g/hr)	Tier IA			
Silver (g/hr)	Tier IA			
Thallium (g/hr)	Tier IA			

[a] Indicate highest or lowest 60-minute rolling average as appropriate.
[b] Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c] Indicate highest 60-minute rolling averages for maximum flue gas flow rate and, if chosen, maximum suspended solids content of scrubber water where applicable. Indicate lowest 60-minute averages for all other APCS parameters.
[d] Owners/operators of furnaces monitoring metals concentrations in collected PM are not required to determine metals feed rates in nonhazardous waste feed streams.
[e] Copy form and add additional pages if more than four streams were fed during test.
[f] Owners/operators of cement and light-weight aggregate kilns are not required to determine ash feed rates of feed streams.

COMPLIANCE CERTIFICATION FORM 5 (CC-5)
SUMMARY OF OPERATING AND FEED RATE LIMITS FOR A SPECIFIC MODE

1. Unit #: 1 ; Mode: A-2 ; Run Nos.: 7-9 ; Test Date: 7-26-92

2. Operating Condition Limits[a]

Max. PM Control Device Inlet Temp. (°F)[a]	366°F and 436°F
Max. Combustion Chamber Temp. (°F)[a]	1691°F
APCS Operating Conditions (list applicable parameters, see § 266.103(c)(1)(ix-xiii)):	*Not determined this test condition
Max. Production Rate (specify units)	256 TPH
Max. Total HW Feed Rate (g/hr)	9571322.88
Max. Total Pumpable HW Feed Rate (g/hr)[b]	9571322.88
Max. Total Chlorine and Chloride Feed Rate (g/hr)	Not determined this condition
Max. Total Ash Feed Rate (g/hr)[d]	N/A

3. Maximum Metals Feed Rates

	Total Feed Streams[e]	Total HW Feed Streams[e]	Total Pumpable HW Feed Streams
Antimony (g/hr)	Tier IA		
Arsenic (g/hr)	2002.63	1729.35	1727.82
Barium (g/hr)	Tier IA		
Beryllium (g/hr)	153.93	23.20	23.17
Cadmium (g/hr)	3305.81	2790.71	2717.09
Chromium (g/hr)	11029.72	6503.47	5993.49
Lead (g/hr)	8669.84	5921.67	5812.01
Mercury (g/hr)	Tier IA		
Silver (g/hr)	Tier IA		
Thallium (g/hr)	Tier IA		

4. CO, HC, and PM Limits

CO (ppmv @ 7% O_2)[f,h]	1169.7 See CO limit discussion
HC (ppmv as propane @ 7% O_2)[c,g,h]	20.0 See CO limit discussion
PM (gr/dscf @ 7% O_2)[i]	0.032 See CO limit discussion

[a] Asterisk any parameter not determined under the primary test conditions.
[b] Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[c] If applicable, attach documentation that the increased cancer risk to the MEI from emissions of dioxins and furans is not greater than 1 in 100,000.
[d] Not required for cement and light-weight aggregate kilns.
[e] Not required for furnaces monitoring metals concentrations in collected PM.
[f] If under Tier I, CO limit is 100 ppmv. If under Tier II, limit is the average over all runs of the HHA CO level for each run.
[g] If under Tier I, HC limit is not applicable. If under Tier II, limit is 20 ppmv.
[h] If a furnace cannot meet the Tier II 20 ppmv HC limit because of organic matter in raw material feedstocks, the interim HC and CO limits are the baseline limits proposed in the Part B permit application or the limits established by the Director as a condition of a time extension for certification of compliance.
[i] 0.08 gr/dscf or existing permit, whichever is more stringent.

COMPLIANCE TEST NOTIFICATION FORM 1 (CTN-1)

GENERAL FACILITY AND PLANNED TESTING INFORMATION

[x]Initial Certification [ ]Revised Certification [ ]Recertification

1. EPA facility ID Number:		MO 981127319
2. Facility Name:		LONE STAR ALTERNATE FUELS CO.
Contact Person:		NORRIS JOHNSON
Telephone Number:		(314) 335-8878
Facility Address:		2524 South Sprigg Street
		Cape Girardeau, Missouri 63701
3. List all hazardous waste combustors at facility by type (boiler, industrial furnace, incinerator); if more than 3 units, list additional units at bottom of page.	#1:	Industrial Furnace (Cement Kiln)
	#2:	
	#3:	
4. Person responsible for conducting compliance test: (Attach statement of qualifications)		JOHN POWELL
Telephone Number:		(203) 871-8557
Company Name:		APCC
Address:		60 Industrial Park Road West
		Tolland, CT 06084
5. Planned date(s) of compliance test:		June 22-26

Signature: Norris Johnson Date: 8-15-92

Title: Manager Alternate Fuel Co, Lone Star Ind, Inc

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COMPLIANCE TEST NOTIFICATION FORM 2 (CTN-2):

UNIT DESCRIPTION Unit # ___ (see Form CTN-1, Block 3)

Complete a separate form for each unit. Attach additional sheets if necessary.

1. Type and Size of Boiler or Industrial Furnace (e.g., 100 million Btu/hr natural gas-fired boiler with four front-wall burners, 100 ton/hr wet process cement kiln): 160 Ton/hr Precalciner Cement Kiln

2. Attach (a) scaled plot plan showing entire facility and location of this unit and (b) schematic drawing showing combustor; fuel, feedstock, and waste feed systems; air pollution control devices; continuous emission monitoring systems; and stack. Drawing should clearly indicate location and design capacities (kg/hr) of all feed systems, and location of all continuously monitored parameter sampling points.

3. Description of air pollution control devices (e.g., 3-field ESP with design PM emissions of 0.03 gr/dscf): Fabric Filter Baghouse with reverse air cleaning

   Is APCD (Shared with other device(s)) or Unique (circle correct answer); if shared, will other device(s) be in use during the test? [Yes] No

4. List of installed continuous emission monitors:

   x Carbon Monoxide; x Oxygen; x Hydrocarbons;

   Description of hydrocarbon monitor:

   x Heated system; minimum CEM system temperature (°C): 148°C

   __ Unheated system; minimum CEM system temperature (°C): ______

   If not using a heated system, explain why and briefly describe sample gas conditioning system: ______

5. Description of Stack:

   Shared with other device(s) or Unique (circle correct answer); if shared, will other device(s) be in use during the test? x Yes ___ No

6. Other information useful to understanding unit design or operation (Note: if it is expected that a conflict between parameters will arise, such that more than one test condition under a given mode is needed in order to determine a parameter, indicate the parameter and the reason for conflict): Kiln APCD is shared with the mill used to grind raw material

COMPLIANCE TEST NOTIFICATION FORM 2 (CTN-2):

UNIT DESCRIPTION Unit # ____ (see Form CTN-1, Block 3)

Complete a separate form for each unit. Attach additional sheets if necessary.

1. Type and Size of Boiler or Industrial Furnace (e.g., 100 million Btu/hr natural gas-fired boiler with four front-wall burners, 100 ton/hr wet process cement kiln): 160 Ton/hr Precalciner Cement Kiln

2. Attach (a) scaled plot plan showing entire facility and location of this unit and (b) schematic drawing showing combustor; fuel, feedstock, and waste feed systems; air pollution control devices; continuous emission monitoring systems; and stack. Drawing should clearly indicate location and design capacities (kg/hr) of all feed systems, and location of all continuously monitored parameter sampling points.

3. Description of air pollution control devices (e.g., 3-field ESP with design PM emissions of 0.03 gr/dscf): Fabric Filter Baghouse with reverse air cleaning

   Is APCD (Shared with other device(s)) or Unique (circle correct answer); if shared, will other device(s) be in use during the test? [Yes] No

4. List of installed continuous emission monitors:

   x Carbon Monoxide; x Oxygen; X Hydrocarbons;

   Description of hydrocarbon monitor:

   x Heated system; minimum CEM system temperature (°C): 148°C

   __ Unheated system; minimum CEM system temperature (°C): ______

   If not using a heated system, explain why and briefly describe sample gas conditioning system: ______

5. Description of Stack:

   Shared with other device(s) or Unique (circle correct answer); if shared, will other device(s) be in use during the test? X Yes ___ No

6. Other information useful to understanding unit design or operation (Note: if it is expected that a conflict between parameters will arise, such that more than one test condition under a given mode is needed in order to determine a parameter, indicate the parameter and the reason for conflict): Kiln APCD is shared with the mill used to grind raw material

COMPLIANCE TEST NOTIFICATION FORM 3 (CTN-3)
DESCRIPTION OF PLANNED TESTING

Complete a separate form for each test condition (if more than 1) under each mode of operation for each unit.

1. Unit # 1 ; Mode (letter) A ; Test Condition (1, 2, or N/A)[a] 1

   Brief Description of Mode and Test Condition: Minimum burning zone temperature

2. Purpose of Test (e.g., to demonstrate compliance with PM, metals, HCl, and Cl_2 emission limits when firing sludges at maximum feed rate and flue gas flow):

   Carbon dioxide limit, particulate matter, HCl and Cl2 emission limits

3. Attach a complete copy of QA/QC Plan and test protocol.

4. Planned Operating Conditions:

Max. Production Rate (specify units)	255 TPH
Max. PM Control Device Inlet Temp. (°F)[b]	435°F
Max. Combustion Chamber Temp. (°F)	2800°F
APCS Operating Conditions (list applicable parameters, see § 266.103(c)(1)(ix-xiii):	Fiber Filter baghouse with
	minimum OP-manufactures
	design

5. Fuel, Raw Material, and Waste Description:	Description of Each Feed Stream[c]			
Type (e.g. liquid, sludge, drummed solids, coal, shale)		Liq. Waste	Coal	Tires
Category (e.g., Fuel, Raw Materials, Pumpable HW, Nonpumpable HW)	Raw Mat	Pumpable	Fuel	Fuel
Typical Heating Value (Btu/lb)	-	11,000	11,000	13,500
How Fed (e.g., atomized, lanced, gravity fed)	Airslide	Lanced	Feeder	Gravity
Normal feed material (N) or spike (S)	N	S	N	N
Total Feed Rate (g/hr)[d]	2.27 X 10^8	9 X 10^6	1.09 X 10^7	2.18 X 10^6
Ash Feed Rate (g/hr)[e]	N/A	N/A	N/A	
Chlorine and Chloride (g/hr)	4082.3	444566	5550.7	4298
Antimony (g/hr)	1360.7	8981	130.63	4.35
Arsenic (g/hr)	340.2	1520	10.89	4.35
Barium (g/hr)	5805.9	89811	685.83	108.9
Beryllium (g/hr)	680.4	20.94	5.99	1.74
Cadmium (g/hr)	3401.9	3570	87.09	13.06
Chromium (g/hr)	4735.9	9878	217.72	19.16
Lead (g/hr)	2268	6286.8	195.95	141.52
Mercury (g/hr)	11.34	13.27	0.54	1.09
Silver (g/hr)	226.8	4490.5	8.71	1.31
Thallium (g/hr)	2268	8981.13	413.68	1.09

[a]If facility will conduct tests at only one set of test conditions for the stated mode, enter N/A. If two sets of conditions will be run for the mode, fill out a separate form for each set of test conditions. Identify each test condition as 1 or 2.
[b]Owners/operators of dry PM control devices that operate at an inlet temperature between 450°F and 750°F must document that emissions of dioxins and furans will not result in an increased MEI cancer risk of greater than 1 in 100,000.
[c]Copy form and add additional pages if firing more than four streams during test.
[d]Rates must not exceed those certified on Form PC-5.
[e]Not applicable for cement kilns and light-weight aggregate kilns.

COMPLIANCE TEST NOTIFICATION FORM 3 (CTN-3)
DESCRIPTION OF PLANNED TESTING

Complete a separate form for each test condition (if more than 1) under each mode of operation for each unit.

1. Unit # 1 ; Mode (letter) A ; Test Condition (1, 2, or N/A)[a] 2

   Brief Description of Mode and Test Condition: Maximum burning zone temperature

2. Purpose of Test (e.g., to demonstrate compliance with PM, metals, HCl, and Cl_2 emission limits when firing sludges at maximum feed rate and flue gas flow):

   Metal emissions, Hexavalent chromium

3. Attach a complete copy of QA/QC Plan and test protocol.

4. Planned Operating Conditions:

Max. Production Rate (specify units)	255 TPH
Max. PM Control Device Inlet Temp. (°F)[b]	435°F
Max. Combustion Chamber Temp. (°F)	2800°F
APCS Operating Conditions (list applicable parameters, see § 266.103(c)(1)(ix-xiii)):	Fiber filter baghouse
	with minimum DP-
	manufactures design

5. Fuel, Raw Material, and Waste Description:	Description of Each Feed Stream[c]			
Type (e.g., liquid, sludge, drummed solids, coal, shale)	Kiln Feed	Liq. Waste	Coal	Tires
Category (e.g., Fuel, Raw Materials, Pumpable HW, Nonpumpable HW)	Raw Materia	Pumpable HW	Fuel	Fuel
Typical Heating Value (Btu/lb)	-	11,000	11,000	13,500
How Fed (e.g., atomized, lanced, gravity fed)	Airslide	Lanced	Feeder	Gravity
Normal feed material (N) or spike (S)	N	S	N	N
Total Feed Rate (g/hr)[d]	2.27×10^5	9×10^6	1.09×10^7	2.18×10^6
Ash Feed Rate (g/hr)[e]	N/A	N/A	N/A	
Chlorine and Chloride (g/hr)	4082.3	444566	5550.7	4298
Antimony (g/hr)	1360.7	8981	130.63	4.35
Arsenic (g/hr)	340.2	1520	10.89	4.35
Barium (g/hr)	5805.9	89811	685.83	108.9
Beryllium (g/hr)	680.4	2[illegible].94	5.99	1.74
Cadmium (g/hr)	3401.9	3570	87.09	13.06
Chromium (g/hr)	4535.9	9878	217.72	19.16
Lead (g/hr)	2268	6286.8	195.95	141.52
Mercury (g/hr)	11.34	13.27	0.54	1.09
Silver (g/hr)	226.8	4490.5	8.71	1.31
Thallium (g/hr)	2268	8981.13	413.68	1.09

[a] If facility will conduct tests at only one set of test conditions for the stated mode, enter N/A. If two sets of conditions will be run for the mode, fill out a separate form for each set of test conditions. Identify each test condition as 1 or 2.

[b] Owners/operators of dry PM control devices that operate at an inlet temperature between 450°F and 750°F must document that emissions of dioxins and furans will not result in an increased MEI cancer risk of greater than 1 in 100,000.

[c] Copy form and add additional pages if firing more than four streams during test.

[d] Rates must not exceed those certified on Form PC-5.

[e] Not applicable for cement kilns and light-weight aggregate kilns.

COMPLIANCE TEST NOTIFICATION FORM 4 (CTN-4)

DOCUMENTATION OF PLANNED VERSUS ALLOWABLE FEED RATE LIMITS

Complete a separate form for each mode of operation for each unit.

Unit #: 1 Mode (letter): A Constituent	Planned Feed Rate[a]			Allowable Feed Rates[b]		
	Total Feed Streams	Total Hazardous Waste Feed Streams[c]	Total Pumpable Hazardous Waste Feed Streams	Total Feed Streams	Total Hazardous Waste Feed Streams	Total Pumpable Hazardous Waste Feed Streams
Ash (g/hr)[d]	N/A			N/A		
Chlorine and Chloride (g/hr)	455458.97			455458.97		
Antimony (g/hr)	N/A	N/A	N/A	10472.74	8981.13	8981.13
Arsenic (g/hr)	1878	1526	1526	1878.07	1526.79	1526.79
Barium (g/hr)	N/A	N/A	N/A	96303.30	89811.29	89811.29
Beryllium (g/hr)	713	26.9	26.9	713.32	26.94	26.94
Cadmium (g/hr)	7081	3592	3592	7081.68	3592.45	3592.45
Chromium (g/hr)	15444	9879	9879	15444.00	9879.24	9879.24
Lead (g/hr)	87588	6286	6286	875.88	6286.68	6286.68
Mercury (g/hr)	27.3	15.2	15.2	27.35	15.27	15.27
Silver (g/hr)	N/A	N/A	N/A	4726.26	4490.56	4490.56
Thallium (g/hr)	N/A	N/A	N/A	11662.77	8981.13	8981.13

[a] Sum of applicable feed streams from all Form CTN-3's.
[b] From Form PC-5.
[c] Not applicable if complying with Tier I or adjusted Tier I metals feed rate screening limits.
[d] Not applicable for cement kilns and light-weight aggregate kilns.

QUALITY ASSURANCE CERTIFICATION

The attached Certification of Compliance Test Report was prepared in accordance to APCC QA/QC procedures as outlined in Section 6.0 of the attached report. As part of the addendum to this report, section 6.8 was added to included a narrative discussion concerning the QA/QC results and a table indicating where the laboratory QA/QC data can be found in the Appendix. To the best of my knowledge all previously missing data has been recieved and is complete in this report.

John Schneider
Senior Project Engineer

John Schneider

Quality Assurance Manager

ALTERNATE MEASUREMENT TECHNIQUES FOR MEASURING HYDROCARBONS UNDER INTERIM STATUS

Under 266.103 of the BIF regulations, an owner that is required to comply with the hydrocarbon controls may use a conditioned gas monitoring system in conformance with the specifications provided in appendix IX, provided that the certification of compliance is submitted without a time extension.

The HC monitoring device used at Lone Star has needed to be cleaned on a regular basis in order to keep this instrument operational. If these problems persist it may be necessary to correct the present hot probe system to a conditional gas system. Every effort will be made to retain the presently used hot probe unconditioned system, however, we can see potential problems that may make this system inoperable unless a conditioned gas system is utilized.

BURNING ZONE MEASUREMENT

The fourth stage inlet temperature was chosen as the point to measure the burning zone temperature. This point was chosen because it represents the point nearest the burning zone temperature where a continuous measurement can be measured. Conditions at locations closer to the burning zone are too sever to measure temperature on a continuous basis.

The fourth stage temperature does respond to changes in the burning zone. During the compliance testing the burning zone temperature was measured by a hand held optical pyrometer and this measurement was compared to the temperature at the fourth stage. The pyrometer used for this measurement was an old instrument and was not in calibration. The calibration is being accomplished at the present time. However, the trend to note is when the fourth stage temperature is high, the burning zone temperature is elevated, and when the fourth stage temperature is low, the temperature in the burning zone is lower. The results are found in the table below:

BURNING ZONE TEMPERATURES
VS 4TH STAGE TEMPERATURES

	Minimum Conditions	Maximum Conditions
Fourth Stage	1629	1691
Burning Zone	1928	2068

During the minimum conditions, the Burning Zone Temperature (BZT) was measured every five minutes and the fourth stage temperatures were monitored on a rolling hourly average basis. The 1629 represents the average of the maximum rolling averages for each test conducted, while 1928 represents the average of the five minute BZT temperatures. During the maximum conditions BZT temperatures were only measured every 15 minutes. This was done for safety reasons. Since the measurement was taken in an opening very near the kiln by a hand held pyrometer, and since the opening through which the pyrometer read the BZT was continually clogged with dust, temperatures could only be obtained every 15 minutes. However, the trend is still apparent, when the fourth stage temperature is raised, the BZT temperature is higher.

Again, is should be pointed out that BZT temperatures are much higher than indicated by the pyrometer. The dusty conditions of the kiln and the calibration of the pyrometer account for the lower temperatures.

BURNING ZONE TEMPERATURES

DATE: 6/25/92 THURSDAY - MINIMUM 4TH STAGE TEMPERATURE

TIME	TEMP	TIME	TEMP	TIME	TEMP
8:50 A.M.		6:00 P.M.	2060	10:15 P.M.	2095
8:55 A.M.		6:05 P.M.	2000	10:20 P.M.	2080
9:00 A.M.		6:10 P.M.	2025	10:25 P.M.	2090
9:05 A.M.		6:15 P.M.	2040	10:30 P.M.	2025
9:10 A.M.		6:20 P.M.	2040	10:35 P.M.	2040
9:15 A.M.	1725	6:25 P.M.	2040	10:40 P.M.	1995
9:20 A.M.	1750	6:30 P.M.	2035	10:45 P.M.	1990
9:25 A.M.	1760	6:35 P.M.	2020	10:50 P.M.	1985
9:30 A.M.	1740	6:40 P.M.	2010	10:55 P.M.	2040
9:35 A.M.	1740	6:45 P.M.	2020	11:00 P.M.	2040
9:40 A.M.	1725	6:50 P.M.	1995	11:05 P.M.	2025
9:45 A.M.	1675	6:55 P.M.	1970	11:10 P.M.	2050
9:50 A.M.	1725	7:00 P.M.	1950	11:15 P.M.	
R AVG	1730.00	R AVG	2015.77	R AVG	2037.92

4TH STAGE TEMP OF 1622.26

4TH STAGE TEMP OF 1624.19

4TH STAGE TEMP OF 1642.15

DATE: 6/26/92 FRIDAY - MAXIMUM 4TH STAGE TEMPERATURE

TIME	TEMP	TIME	TEMP	TIME	TEMP
1:55 P.M.		6:15 P.M.	2020	10:00 P.M.	2030
2:00 P.M.	1990	6:20 P.M.		10:05 P.M.	
2:05 P.M.		6:25 P.M.		10:10 P.M.	
2:10 P.M.		6:30 P.M.	2085	10:15 P.M.	2000
2:15 P.M.	2000	6:35 P.M.		10:20 P.M.	
2:20 P.M.		6:40 P.M.		10:25 P.M.	
2:25 P.M.		6:45 P.M.	2100	10:30 P.M.	2050
2:30 P.M.	2020	6:50 P.M.		10:35 P.M.	
2:35 P.M.		6:55 P.M.		10:40 P.M.	
2:40 P.M.		7:00 P.M.	2140	10:45 P.M.	2130
2:45 P.M.	2050	7:05 P.M.		10:50 P.M.	
2:50 P.M.		7:10 P.M.		10:55 P.M.	
2:55 P.M.		7:15 P.M.	2180	11:00 P.M.	2190
3:00 P.M.	2030	7:20 P.M.		11:05 P.M.	
R AVG	2018.00	R AVG	2105.00	R AVG	2080.00

4TH STAGE TEMP OF 1699.6

4TH STAGE TEMP OF 1685.84

4TH STAGE TEMP OF 1688.15

PRODUCTION OF NORMAL PRODUCT

Under BIF guidelines, the BIF unit must produce a product within specification for the product normally produced. The unit at Lone Star Cape Girardeau is a cement kiln and produces clinker as its normal product. During the compliance testing, clinker was produced in the kiln system in an acceptable manner to produce cement, and the total production was used to produce portland and/or masonry cement.

Under normal conditions clinker is considered of quality to produce portland cement if the Free Lime (FL) is less than 1.8% and the C3S content is above 40%. Also, contents of other constituent of the clinker are controlled more broadly as shown below:

Constituent	Range of Acceptable Values
K_2O	0-1.1%
SO_3	0.2-2.7%
Silica Ratio (SR)	2.6-3.4
Al_2O_3/Fe_2O_3	2.5-1.3

Clinker outside any of these criteria may also be used to produce portland cement, but is blended with higher quality clinker.

Clinker used to produce masonry cement is generally the same make up as that used to produce portland cement, except that the free lime content can be higher in that clinker used to produce masonry cement.

The laboratory control sheets for clinker during the stack testing is enclosed. The clinker quality during the compliance testing fell within the guidelines listed above, and all the clinker produced during this time period was used to produce product.

CLINKER B

DATE 6-25-92

TIME	x FL	Al_2O_3	Fe_2O_3	x SO_3	x K_2O	x C_3S	x SR	LSF	POSITION	REF.	MG
~~7700~~ 8:00	.97 .41	4.67	2.84	.86	.54	49.14	3.02	88.25	6 [illegible] 6 Bay		4.43
10:00	.73 1.3	4.67	2.84	1.53	.90	44.52	3.01	87.36	6 Bay		4.14
12:00 [redacted]	RAW								9½ Bay		
1200 NOON											
14:00 1530 –	.45								5½ Bay		
16:00	.41 .37	4.59	2.91	.95	.41	54.10	2.98	90.33	5½ Bay		4.31
18:00 PM	.30								5½		
20:00	.32 .36	4.38	2.67	1.05	.55	60.36	3.13	92.78	5½		3.98
22:00	.42 .32								5½		
24:00	.38 .36 .44	4.96	2.68	1.00	.50	47.15	3.03	87.62	6½		3.95
2:00	.29								10 Silo		
4:00	.34 .36	4.64	2.72	1.11	.65	52.51	3.05	89.83	6½		3.89
6:00*	.42 .41					55.27			6½		

DESIRED: Al_2O_3 4.3%
Fe_2O_3 3.1%
C_3S 57.0%

	1st	2nd	3rd
SO_3 Kiln Coal			
SO_2 RSP Coal	3.26	2.87	3.12

CLINKER B

DATE 6-26-02

TIME	% FL	Al_2O_3	Fe_2O_3	% SO_3	% K_2O	% C_3S	% SR	LSF	POSITION	REF	MG
8:00	.41 .72	4.63	2.70	1.20	.54	56.74	3.01	91.75	6 Bay		4.05
10:00	1.31 .65					46.72			6 Bay		
12:00 ~~AM~~ 12:00 N	.37 .41	4.53	3.02	.96	.47	48.41	3.03	87.94	5 Bay		4.16
14:00	.46 .65	4.57	2.79	1.10	.55	54.0	3.04	90.41	5 Bay		4.08
16:00	.45 .50	4.64	2.76	1.19	.54	51.02	3.04	89.36	5 Bay		4.00
18:00 PM	.39 .36	4.71	2.86	1.06	.48	48.43	3.00	88.17	5		4.01
20:00	.32 .28	4.79	2.89	.81	.53	46.01	2.99	86.94	5 1/2		4.03
22:00	.34 .32								5 1/2		
24:00	.30 .26	4.70	2.82	1.04	.53	44.44	3.08	86.50	5 1/2		3.99
2:00	.32 .38								5		
4:00	.58	4.76	3.09	.62	.57	48.72	2.91	87.82			3.96
6:00			Feed off			4:58 am					

DESIRED: Al_2O_3 4.3%, Fe_2O_3 3.1%, C_3S 52.0%

	1st	2nd	3rd
SO3 Kiln Coal	down	—	—
SO2 RSP Coal	3.35	3.58	3.60

FUGITIVE EMISSSIONS SYSTEMS

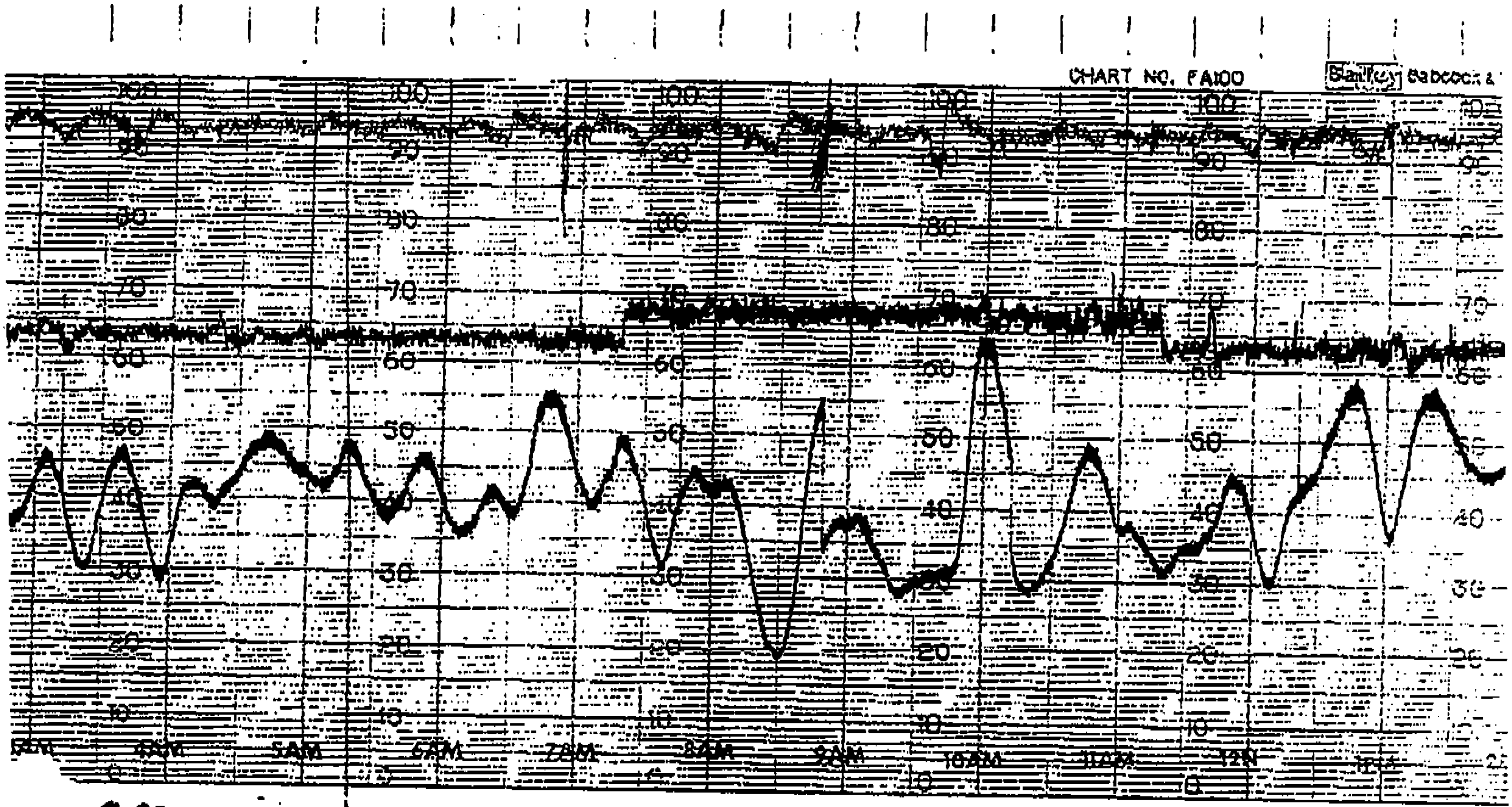
During interim status, BIF's must comply with the requirements in 266.103 (h) to control fugitive emissions from the combustion zone. Measurements are presented below showing that the kiln at the Lone Star Cape Girardeau plant maintains a pressure less than atmospheric when containerized waste are fed into the kiln system.

The kiln at the Lone Star Cape Girardeau plant operates under a negative-pressure. Containerized waste are fed into the front part of the kiln by an air cannon. The containers are injected 50 feet into the burning zone of the kiln. When these wastes are fed into the kiln it has been demonstrated that the system does not generate pressures greater than atmospheric when the containers burst.

The demonstration is based on the pressure at the front of the kiln called the "Hood Pressure". By a system of fans, the pressure at the kiln hood is maintained at a desired set point. The set point chosen to operate the kiln is between -0.10 and -0.20" wc for this particular system. The line near the 60% mark on the enclosed chart paper represents the hood pressure (HP) on a 0-100% scale. The actual range for the HP is -1.0" we for 0% and 100% represents +.25" wc. The chart indicated that the HP normally is controlled in the 63% range. This would indicate an actual HP of approximately -0.2" wc.

On July 28, 1992, containerized waste was injected into the kiln with an air cannon between the hours of 6:00 a.m. and 10:00 p.m. at a rate of one bucket per minute. Each bucket contained 25 pounds of waste. The chart indicates that the HP remained very near the set point before containerized waste was fed to the kiln and after the waste was fed to the kiln. At no time did the HP approach atmospheric pressure (indicated by 80% on the chart). Containerized waste have no significant effect on the pressure inside the kiln.

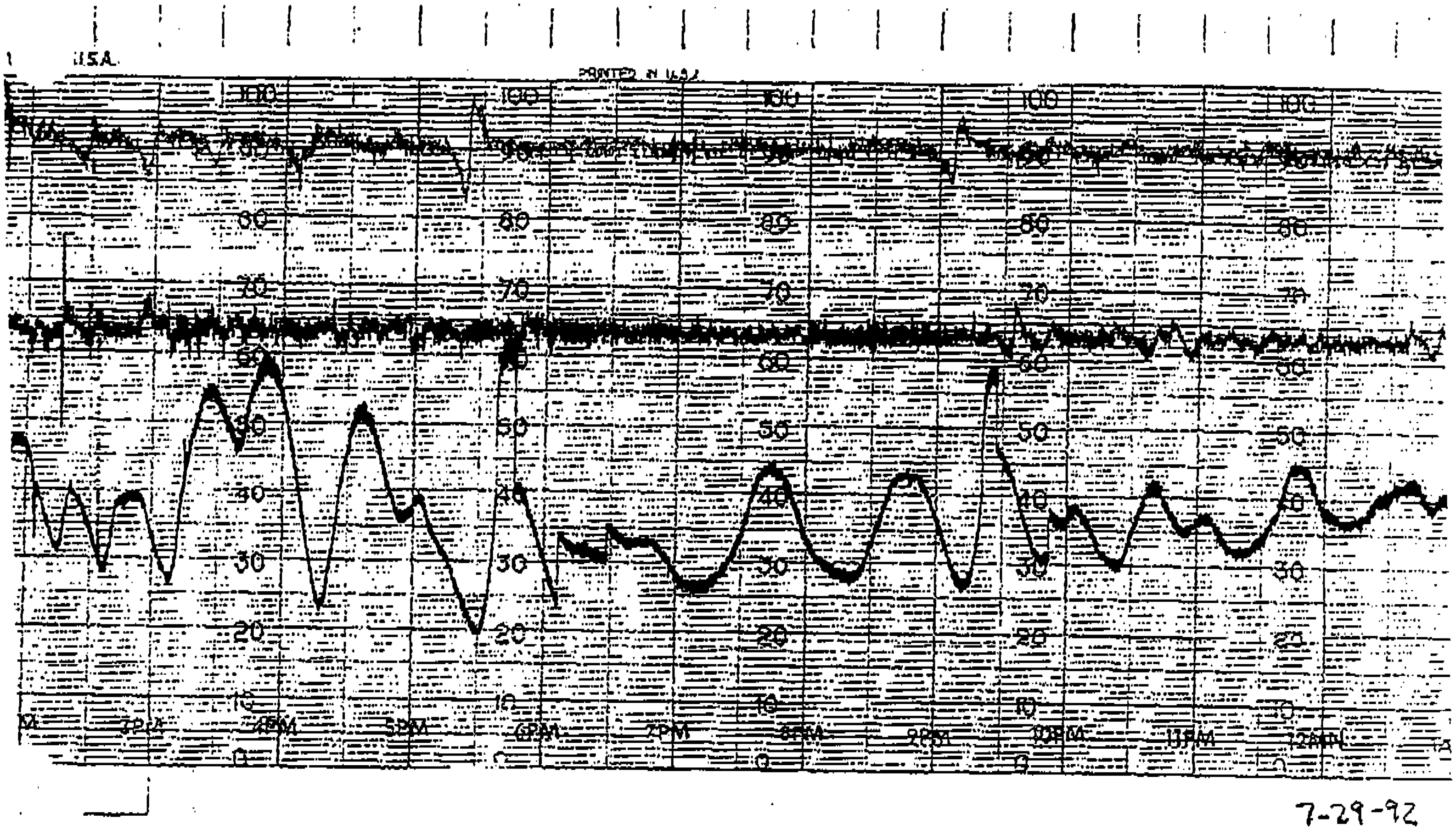
If process conditions occur that cause the HP to approach 0"wc (atmospheric) an alarm is activated and the injection of waste is discontinued until the system stabilizes.



8-92

0% = -1.0 "wc

100% = +0.25 "wc


U.S.A.
PRINTED IN U.S.A.
100
80
70
60
50
40
30
20
10
0
3PM
4PM
5PM
6PM
7PM
8PM
9PM
10PM
11PM
12AM

7-29-92

3.0 QUALIFICATIONS AND EXPERIENCE

Air Pollution Characterization and Control, Ltd. (APCC) was incorporated in the State of Connecticut in May 1988 to provide specialty professional environmental services to aid industry and government in their quest to keep abreast of regulatory issues, to maintain compliance with government regulations, to assist in industrial process evaluations, to aid in the definition of air pollution problems and establish control strategies for those problems. APCC is expertly qualified to assist its clients in the following areas at extremely cost effective rates:

- AIR TOXICS EVALUATION AND CONTROL
- AIR POLLUTION CONTROL TECHNOLOGY
- CONTINUOUS EMISSION MONITORING
- INDOOR AIR QUALITY EVALUATION
- HAZARDOUS WASTE INCINERATION
- TRIAL BURNS
- PART B PREPARATION
- SARA TITLE III
- SOURCE EMISSION MEASUREMENTS
- FUGITIVE EMISSION EVALUATION
- ENVIRONMENTAL AUDITS
- EMISSION INVENTORIES
- AEROMETRIC MONITORING
- DISPERSION MODELING
- ENVIRONMENTAL PERMITTING
- ODOR ASSESSMENT
- MUNICIPAL WASTE INCINERATION
- RISK ASSESSMENT

3.1 Summary of Capabilities

APCC consists of a team of scientists and engineers, complemented by a network of other consulting engineers and scientists, dedicated to defining and solving environmental problems. Although a relatively new firm, APCC has amassed a significant amount of project experience in the past three years, which is supplemented by over 50 man-years of experience in the field of air pollution measurements and control by the expertly qualified staff. During this period, the staff has established contacts with numerous environmental professionals, including many at the U.S. EPA as well as many state and local regulatory agencies. Principal consultants which are drawn from a network to make up a project team are professional engineers registered in numerous states with over 15 years experience in the field of air pollution. Projects are managed by skilled professionals who give proper attention to planning, technical direction and quality assurance for the project team. These project teams are made complete by a group of field technicians to assist in the performance of field projects on a nationwide basis.

APCC project teams consist of engineers, scientists and technicians, each with a clear area of responsibility and experience working together as an efficient team. These teams are supported by a network of state-of-the-art measurement equipment, computer facilities and laboratory facilities capable of virtually any chemical analytical technique. In addition, APCC can provide on-site analytical services for many wet chemical as well as gas chromatographic analyses.

Atmospheric contamination from toxic air pollutants is of primary industrial, regulatory and public concern. APCC specializes in providing timely, cost effective air pollution measurement and control technology services followed up by thorough and interpretive reports with high quality, usable results. This valuable strategy for solving air pollution problems begins with basic problem identification with follow through to complete permitting and compliance. A "Whole Process Orientation" towards these problems looks at a specific problem as a function of the whole, thereby allowing objective points of view in the definition and solution of the problem to include the entire process or facility rather than a narrow focus on only an apparent problem. This approach helps to avoid short-sighted "solutions" to problems that could cause further problems in the future or in other segments of the facility or process as well as to provide cost effective, defensible solutions.

Upon the inception of any project, APCC routinely visits the site to perform a plant survey to develop a "hands-on" feel of the situation and to collect the information required to formulate a comprehensive project plan. In the case of a project for compliance determination, this information is used to prepare protocols for submission to regulatory agencies for approval prior to performance. In performing measurements, APCC utilizes EPA, ASTM, ASME, NIOSH and other approved protocols to determine emissions and ambient levels of toxic substances as well as criteria and priority pollutants, including Dioxins and Furans, POHC, VOC, PIC, Heavy Metals, HCl, NO_x, SO_2, CO, TRS and particulate. In the absence of applicable approved methodology, APCC has integrated published sampling and analytical methods and developed new methods to provide clients with accurate and reliable engineering data.

In addition to a full range of air pollution measurement services, APCC can provide expert services to evaluate the degree of air pollution control required to meet emission and ambient air standards for numerous pollutants. Engineers review potentially available control technologies or combinations thereof to afford the required emission reduction. Practical systems are then scrutinized in great detail to determine technical, operational and economic compatibility with the defined problem utilizing BACT, RACT and LAER analyses. Working closely with the client, APCC develops preliminary design specifications, solicits vendor bids, prepares air permit applications, supervises installation and performs performance and compliance emission testing. APCC engineers and scientists will provide expert testimony before state and federal regulatory agencies as well as public hearings in defense of the specified system.

APCC is expertly qualified to design, fabricate, install and calibrate ambient and aerometric monitoring networks to comply with Prevention of Significant Deterioration (PSD) requirements. Upon the installation of a system, APCC provides operational training to clients personnel to ensure ease of operation and maintenance.

Design and installation of permanent Continuous Emission Monitoring Systems is a service provided by APCC. These systems can be designed, specified, installed and made operational, certified, maintained and audited by APCC personnel.

Air permitting services provided by APCC require the resolution of complex state and local regulatory issues, streamlined to meet individual project requirements. APCC will interact with federal, state and local regulatory agencies to determine the applicability of regulations, establish a rapport with agency personnel and negotiate permit conditions.

In conjunction with the aforementioned services, APCC performs emission inventories and environmental audits to cost effectively determine environmental liability. These inventories and audits consist of in-plant surveys to determine the use and fate of toxic and other regulated substances. Mass balances are then performed and calculated emissions compared to regulations to determine possible problem areas. Further study is then performed, including measurements, to determine compliance with federal, state and local regulations.

In addition to a dedicated staff of professionals, APCC is aided by a complete assortment of brand new state-of-the-art equipment to perform engineering measurements. Over the past two years, APCC has invested over $250,000 in air pollution measurement equipment and computerization to provide our clients with the best data possible upon which to formulate solutions to their problems. The APCC Environmental Monitoring Laboratory (EML), a mobile instrument laboratory housed in a 24 foot climate controlled custom built trailer, is designed to provide a cost effective solution for continuous emission monitoring of CO, NO_x, SO_2, O_2, CO_2 and total hydrocarbons; for on-site on-line gas chromotography (dual column/dual detector) and on-site wet chemical analyses of samples. This unit is ideal for CEMS Relative Accuracy Testing, Reference Method Testing during in-plant CEMS down-time in order in avoid process interruptions, hazardous waste trial burns, performance testing of air pollution control equipment and measurements requiring immediate analyses of samples in order to avoid sample degredation or implement process modifications. An additional advantage allows the performance of emission measurements and sample recovery under almost any weather and plant conditions and in any season.

In summary, APCC is qualified and ready to assist your organization with problems related to air pollution characterization and control. Section 2 of this Statement of Qualifications and Experience relates specific project experience of APCC since its inception as well as experience gained by its principals over the past 10 years. Section 3 presents resumes of key APCC personnel and those of the consulting engineers and scientists available to the project team.

3.2 Case Studies of Experience

Since its inception in May 1988, APCC has performed a number of projects for a diverse group of clientele. Since all work is performed on a strictly confidential basis, actual client names cannot be utilized in a document of this type. Actual references can be provided upon request. The first group of project experience relates to work directly performed by APCC, while the second group past reflects experience of its principals.

3.2.1 APCC EXPERIENCE

WASTE FUEL COMBUSTOR

APCC performed a trial burn program for a client firing hazardous waste fuels in an expanded aggregate kiln under the proposed EPA Industrial Furnace Regulations. The project involved air and hazardous waste permitting, process operational parameter measurements for permit verification, Trial Burn Protocol preparation (requiring over three years of negotiations with the state regulatory agency), preparation of the facility for the trial burn program including trouble shooting and "tune ups" of the air pollution control and continuous emission monitoring systems as well as performance of the actual trial burn including measurements of PCDD/PCDF, POHC, particulate, metals, acid gases and complete continuous emission monitoring. CEMS Performance Specification Testing was also performed. Consultation was provided in the preparation of a health risk assessment related to plant emissions subsequent to the trial burn.

Results of the Trial Burn program indicated acceptable emissions for all measured parameters with the exception of particulate. A BACT analysis was then performed to determine the most practical form of emission control for the source. APCC then assisted the client in soliciting bids, selecting a vendor to install the new air pollution control equipment (a fabric filter followed by a series of wet venturi scrubbers) and reviewing the engineering design of the system. A Supplemental Trial Burn Protocol was then negotiated. Following completion of the new air pollution control system, performance and shakedown testing of the new system was performed followed by the Supplemental Trial Burn. The Trial Burn Report was recently submitted and permit issuance is expected soon.

SECONDARY ALUMINUM ALLOYING

APCC was retained by a Midwest specialty aluminum refiner following the denial by the state EPA of an application to renew a Permit to Operate a melting furnace. A test program previously performed by a local firm had demonstrated noncompliance with state emission limitations for particulate, but the report failed to bring this fact to the owner's attention and was unknowingly submitted to the state EPA as part of the application package. Along with the rejection of the permit application, the state EPA demanded the installation of hard air pollution control technology (estimated cost in excess $500,000) prior to consideration of further applications. APCC's task at that point was to

APCC AIR POLLUTION CHARACTERIZATION AND CONTROL, LTD.

CERTIFICATION OF COMPLIANCE TEST FOR THE BURNING OF WASTE DERIVED FUELS AT LONE STAR INDUSTRIES, INC CAPE GIRARDEAU, MISSOURI

PREPARED FOR:
US EPA REGION VII
and
MISSOURI DNR

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APCC Project 92007

EPA Facility ID No. MOD 981127319

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1.0 INTRODUCTION

Air Pollution Characterization and Control, Ltd. (APCC), of Tolland Connecticut, under contract to the Lone Star Industries, Inc., was contracted to perform a Certification of Compliance (COC) emission measurement program to demonstrate the acceptability of rotary cement kiln incineration of Waste Derived Liquid and Solid Fuels (WLDF/WDSF) for energy recovery purposes at the Lone Star facility in Cape Girardeau, Missouri.

This Certification of Compliance test program was required to be performed by Code of Federal Regulations, Title 40, Part 266 STANDARD FOR THE MANAGEMENT OF SPECIFIC HAZARDOUS WASTE AND SPECIFIC TYPES OF HAZARDOUS WASTE MANAGEMENT FACILITIES (commonly known as Boiler and Industrial Furnace Regulations or 'BIF') and Section 266.103, Interim Status Standards For Burners, promulgated February 21, 1991. In addition, this test program demonstrated the acceptability of the Lone Star kiln to destroy WDLF, WDSF and tires for compliance with Missouri Department of Natural Resources requirements. The State of Missouri also requires an emission test program under 10 CSR 25 of the Missouri Administrative Code. This report intermixes the requirements of both agencies.

John H. Powell, Principal of APCC and program manager, has personally managed hazardous waste trial burn programs at cement / expanded aggregate manufacturing facilities since 1984. Robert J. Zychal, Manager of Engineering for APCC, is the Project Engineer and Field Crew Chief for this project. Edward P. Nowak was responsible for all analytical phases and Yakov Zusmanovich for data reduction. John E. Schneider performed QA/QC review for the project. Other APCC personnel included Don Smith, James Severson, Adam Ploszaj, Peter Day and Earl Most.

Norris Johnson, Manager of Lone Star AAF was responsible for the overall program. Kiln operations were supervised by Harry Phillip of Lone Star. All process input / output sampling for mass balance was performed under the supervision of Steve Sebaugh of Lone Star. Waste fuel feed and spiking was supervised by Paul Knowlson of CP Recycling, the waste fuel supplier.

Lone Star also contracted the Services of Schreiber, Yonley & Grana to provide oversight QA/QC of the program and to ensure adherance to the protocol. Doug Elley of MO DNR was on-site throughout the test program. Wane Roberts, Khalid Aljunadi and Mike Tharpe of DNR were also on-site for portions of the program. No US EPA personnel were on-site during the program.

1.1 TECHNICAL APPROACH

This COC was performed during April and June 1992. The COC program was conducted in two Phases; firing coal only (Phase 1 - April) and firing coal/WDF/tires (Phase 2 - June). Phase II was further divided into two distinct operating conditions as discussed below. Table 1-1 summarizes the testing sequence as presented in this report.

TABLE 1-1
TEST SEQUENCE
CERTIFICATION OF COMPLIANCE TEST
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
JUNE, 1992

PHASE 1

TEST NO.	DATE	DESCRIPTION
1	4/12/92	Trip & Field Blanks for VOST and Blank Train for PM/HCl/Cl
2	4/13/92	PM/HCl/Cl, VOST, CEM
3	4/13/92	PM/HCl/Cl, VOST, CEM
4	4/13/92	PM/HCl/Cl, VOST, CEM
5	4/13/92	Blank Train for Metals
6	4/14/92	Metals, CEM
7	4/14/92	Metals, CEM
8	4/14/92	Metals, CEM

PHASE 2

TEST NO.	DATE	DESCRIPTION
1	6/22/92	Trip & Field Blanks for VOST and Blank Train for PM/HCl/Cl
2	6/25/92	Discarded Test Run
3	6/25/92	PM/HCl/Cl, VOST, CEM
4	6/25/92	PM/HCl/Cl, VOST, CEM
5	6/25/92	PM/HCl/Cl, VOST, CEM
6	6/24/92	Train Blanks for Cr+6 and Metals
7	6/26/92	Cr+6, Metals and CEM
8	6/26/92	Cr+6, Metals and CEM
9	6/26/92	Cr+6, Metals and CEM

Phase 1

Phase 1 was the background determination of kiln emissions while firing coal only. This Phase was performed concurrent with a Tire Trial Burn during April, 1992. Items tested for in triplicate were:

- POHC
- Heavy Metals Emissions (As, Be, Cd, Cr, Ag, Ba, Hg, Pb, Sb, Tl & Zn)
- CEM @ Exhaust Stack
  - Carbon Monoxide Emissions (CO)
  - Total Hydrocarbon (THC) Emissions
  - Stack Gas Oxygen (O_2)
- Particulate Matter (PM)
- Chloride (HCl), Chlorine (Cl_2)

Testing also included mass balance determinations for metals and chlorides. Hexavalent chrome emissions were not monitored during this period.

Phase 2

Phase 2 was performed while the kiln was firing a combination of WDF and tires for 100% kiln fuel replacement. Coal was fired in the pre-calciner only.

This Phase was divided into two operating conditions. The first condition determined the destruction and removal efficiency (DRE) of the kiln for surrogate POHCs while operating under the **MINIMUM PRACTICAL TEMPERATURE CONDITIONS.** During this period triplicate measurements of the following parameters were performed.

- POHC / DRE
- CEM @ Exhaust Stack
  - Carbon Monoxide Emissions (CO)
  - Total Hydrocarbon (THC) Emissions
  - Stack Gas Oxygen (O_2)
- CEM @ Bypass Duct
  - Carbon Monoxide Emissions (CO)
  - Total Hydrocarbon (THC) Emissions
  - Bypass Oxygen (O_2)
- Particulate Matter (PM)
- Chloride (HCl), Chlorine (Cl_2)

The following operating parameters were either minimized or maximized (as appropriate) for the required 1-hour rolling average by the plant operators for determination of operational limits as follows:

- Minimum combustion chamber temperature
- Maximum pumpable waste derived fuel feed rate
- Maximum total waste derived fuel feed rate

- Maximum chlorine feed
- Maximum production rate
- Maximum ID fan amps

The DRE of the POHCs and the maximum CO and THC in the exhaust gases were measured and reported as part of this COC.

The second operating condition of this Phase was to determine the emissions of the following parameters and System Removal Efficiencies (SRE) for metals while the kiln is at **MAXIMUM PRACTICAL TEMPERATURE.** During this phase triplicate measurements of the following parameters were performed:

- Metals Emissions & SRE (Pb, As, Cr, Be, Cd, Hg and Zn)
- Hexavalent Chromium Emissions (Cr^{+6})
- Total Hydrocarbon (THC) emissions
- Carbon Monoxide Emissions
- Oxygen Emissions

The following operating parameters were either minimized or maximized (as appropriate) for the required 1-hour rolling average by the plant operators for this portion of the COC:

- Maximum combustion chamber temperature
- Maximum APCD temperatures (both main and bypass)
- Maximum pumpable waste derived fuel feed rate
- Maximum total waste derived fuel feed ratio
- Maximum metals feed rate (Pb, As, Cr, Be, Cd and Hg)
- Maximum total chlorine feed rate
- Maximum ID fan amps

<u>Phase 3</u>

Phase 3 was planned to be a repeat of Phase II while firing 100% WDF in the kiln (no tires) and coal in the precalciner only. The same sampling and operational conditions of Phase II were planned for this test. Upon completion of Phase 2, which was considered a worse case than Phase 3, however, it was determined by Lone Star that there was no need for Phase 3, as all required data was obtained during Phase 2.

It should be noted that a Tier 2 CO emission limitation in the bypass duct was not demonstrated during either Phase 1 or Phase 2. The bypass CEMS was not yet installed during Phase 1 to observe CO emissions under 100% coal fire. During Phase 2 (@ 100% WDF w/ tires in the back end) CO emissions were within the Tier 1 range (i.e. <100 ppm @ 7% O_2). Subsequent to Phase 2 testing, however, significant concentrations of CO have been observed when firing **less waste fuel** and a greater amount of coal. Measured emissions concentrations of THC are always insignificant (< 1 ppm actual) under all operating conditions.

Due to this situation, Lone Star, with the approval of Joe Galbraith of EPA Region VII, conducted a number of additional different tests under varying operating conditions during the months of July and August to establish a Tier 2 CO emission limitation. These conditions were each approximately 6 hours each in duration and were as follows:

- 100% coal in kiln / coal in precalciner
- 100% coal in kiln / tires at back end & coal in precalciner
- 50% WDF & 50% coal in kiln / coal in precalciner
- 50% WDF & 50% coal in kiln / tires at back end & coal in precalciner
- 100% WDF in kiln / coal in precalciner
- 100% WDF in kiln / tires at back end & coal in precalciner

The results of this testing are presented under separate cover and were used to determine a CO Limitation for WDF cutoff.

A material mass balance on the kiln was performed during both Phases for chlorides as per Part 266.103 (c) (1) Limits on operating conditions. In addition, a metals mass balance was performed during each phase to determine maximum metals input and validate PCC Engineering Judgements. Listed below are the material input and output sample locations.

INPUTS

- Coal feed belts (2)
- Water for the Conditioning Tower
- Raw material feed to kiln
- Tire feed
- WDLF feed
- WDSF feed
- Metals Spike
- Spent kiln brick (planned for, not available during COC)

OUTPUTS

- Clinker cooler conveyer
- Kiln / Preheater dust
- Bypass baghouse hopper
- Stack/Kiln outlet (Emissions)

Sampling was not performed for dioxins and furans (PCDD/PCDF). The BIF regulation exempts facilities from the requirements for PCDD/PCDF testing if the following regulations are met: 266.104, Standards to Control Organic Emissions and 266.112, Regulation of Residues. CO concentrations at the bypass did not exceed 100 ppm corrected to 7 % oxygen during the actual test program. Although CO did exceed 100 ppm under subsequent operational conditions (firing **less WDF** and more coal, the concentration of total hydrocarbons was always less then 20 ppm (as propane) corrected to 7% O_2. With the inlet to the air pollution control system maintained below 450°F, no PCDD/PCDF testing was required for the COC.

Section 2 of this report presents all test results and a discussion thereof. Section 3 presents a summary of the portland cement process, the air pollution control system, the kiln safety systems and COC process operations. A full description of all sampling and analytical methods employed is presented in Section 4. Section 5 describes the Scope of the Sampling Program on a Site Specific Basis and specifies the test schedule. Section 6 of this plan presents the APCC Quality Assurance Plan for this program. Data summaries, raw field and laboratory data, process operational data, sampling train figures and calibrations are presented in the Appendix of this Report. See Table of Contents for exact document locations.

2.0 RESULTS AND DISCUSSION

The Certification of Compliance test program was performed over 2 distinct one-week periods. Phase 1 testing was performed while the kiln fired only coal in April 1992. Phase 2 was performed while the kiln was firing 100% WDF, with tires in the back end and coal in the precalciner in June 1992.

During Phase 1, the kiln was operated under normal steady state operating conditions. During Phase 2, two distinct abnormal operating conditions were run in an attempt to set minimum and maximum kiln operating limits. This typically meant running the kiln under near upset conditions while still producing saleable product. In an attempt to set minimum and maximum hourly rolling averages for operational parameters as required by BIF, it should be noted that it was necessary to manipulate the kiln to the edge of upset and/or shut-down conditions. Operation was then held at this point as long as possible to set the limitation by establishing a 1-hour rolling average, as required by Section 5.3.1 of "Technical Implementation Document for EPA's Boiler and Industrial Furnace Regulations" (EPA-530-R-92-011, March 1992).

The first condition determined the destruction and removal efficiency (DRE) of the kiln for surrogate POHCs while operating under the **MINIMUM PRACTICAL TEMPERATURE CONDITIONS.** During this period triplicate measurements were performed of the following parameters:

- POHC / DRE
- CEM @ Exhaust Stack
  - Carbon Monoxide Emissions (CO)
  - Total Hydrocarbon (THC) Emissions
  - Stack Gas Oxygen (O_2)
- CEM @ Bypass Duct
  - Carbon Monoxide Emissions (CO)
  - Total Hydrocarbon (THC) Emissions
  - Bypass Oxygen (O_2)
- Particulate Matter (PM)
- Chloride (HCl) and Chlorine (Cl_2) Emissions

The following operating parameters were either minimized or maximized (as appropriate) for the required 1-hour rolling average by the plant operators for determination of operational limits as follows:

- Maximum CO concentration
- Minimum combustion chamber temperature
- Maximum pumpable waste derived fuel feed rate
- Maximum total waste derived fuel feed rate
- Maximum chlorine feed
- Maximum production rate
- Maximum ID fan amps

The second operating condition of this Phase was to determine the emissions of the following parameters and System Removal Efficiencies (SRE) for metals while the kiln is at **MAXIMUM PRACTICAL TEMPERATURE.** During this phase triplicate measurements of the following parameters were performed:

- Metals Emissions & SRE (Pb, As, Cr, Be, Cd, Hg and Zn)
- Hexavalent Chromium Emissions & SRE (Cr^{+6})
- Total Hydrocarbon (THC) emissions
- Carbon Monoxide Emissions
- Oxygen Emissions

The following operating parameters were either minimized or maximized (as appropriate) for the required 1-hour rolling average by the plant operators for this portion of the COC:

- Maximum combustion chamber temperature
- Maximum APCD temperatures (both main and bypass)
- Maximum pumpable waste derived fuel feed rate
- Maximum total waste derived fuel feed ratio
- Maximum metals feed rate (Pb; As, Cr, Be, Cd and Hg)
- Maximum total chlorine feed rate
- Maximum ID fan amps

A material mass balance of the kiln was performed during both Phases for chloride and chlorine in accordance with Part 266.103 (c) (1) Limits on operating conditions. In addition, a metals mass balance was performed during each phase to determine maximum metals input and validate PCC Engineering Judgements. Listed below are the material input and output sample locations.

INPUTS

- Coal feed pipes (2)
- Water for the Conditioning Tower
- Raw material feed to kiln
- Tire feed
- WDLF feed
- WDSF feed
- Metals Spike
- Spent kiln brick (planned for, not available during COC)

OUTPUTS

- Clinker cooler conveyer
- Kiln / Preheater dust
- Bypass baghouse hopper
- Stack/Kiln outlet

2.1 Phase 1

Phase 1 testing was performed on 13 and 14 April 1992 during steady state coal fired kiln operation. Three tests were performed for POHC, particulate and HCl/Cl_2 on 13 April (Tests 2, 3 & 4), and heavy metals on 14 April (Tests 6, 7 & 8). Test #1 was a "Blank Train" performed for QA/QC purposes, as was Test #5. Blank train data are presented in Section 6 of this report. The kiln was operated under normal conditions for these tests, as presented in Section 3.

2.1.1 Particulate, Chloride and Chlorine Emission Measurements

A summary of particulate, chloride (HCl) and chlorine emission measurements from 13 April is presented in Table 2-1. Data presented include: test times, process conditions, stack conditions, sample conditions and measured emissions.

Particulate emissions as measured were less than 0.03 gr/dscf @ 7% O_2 and within limitations set by US EPA (NSPS) and MO DNR, which are stricter than the 0.08 gr/dscf @ 7% O_2 set by the BIF regulation. Opacity, as determined by EPA Method 9 was less than 10% throughout the tests.

Chloride emissions as HCl averaged 406 g/hr, less than 0.1% of the limitation set by the Lone Star Precompliance Certification (PCC) of 502,000 g/hr. Chlorine emissions averaged 157 g/hr, less than 0.5% of the PCC limitation of 28,700 g/hr.

Data summaries including all calculation inputs and outputs are presented in Appendix A, field data in B-1 and laboratory data in C-1. All tests were acceptable with leak rates less than 0.02 cfm and isokinesis at 100% $\pm$ 10%.

2.1.2 Chloride Mass Balance

A summary of the chloride mass balance performed during Phase 1 is presented in Table 2-2. Data summaries are presented in Appendix A, field data in B-2 and laboratory data in C-2.

Closure of the balance on a mass input / output basis was good at 100$\pm$5%. Total measured chloride input to the system was consistent, averaging approximately 220 lbs/hr for the tests performed in Phase 1. Most Cl^- input is attributable to the raw feed.

2.1.3 Heavy Metals Emissions

A summary of heavy metals emissions (Tests 6, 7 & 8; 5 was blank train) is presented in Table 2-3. Please note that no metals spiking was performed during Phase 1. Emissions of heavy metals were well within the limitations set by the PCC. All metals emissions were less than 10% of the PCC limitations, with most measured emissions below 1% of the allowable No hexavalent chromium testing was performed during Phase 1. Data summaries are presented in Appendix A, field data in B-3 and laboratory data in C-3.

TABLE 2-1
PARTICULATE/ CHLORINE/ HCl DATA SUMMARY
BIF COC TEST PROGRAM - PHASE 1
LONE STAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NO.	2 CL	3 CL	4 CL
DATE:	4/13/92	4/13/92	4/13/92
TIME :	9:24 - 11:31	13:08 - 15:13	16:55 - 19:00
PROCESS CONDITIONS			
Raw Feedrate (lbs/hr)	507400	505000	507400
Kiln Coal Feedrate (lbs/hr)	16800	16800	16800
Pre-Cal Coal Feedrate (lbs/hr)	24200	23800	23600
SAMPLE CONDITIONS			
Volume at STD Conditions (dscf)	67.2	65.0	65.1
Particulate Catch (mg)	74.2	81.5	64.6
Chlorine Catch (mg)	0.7	0.4	0.9
HCl Catch (mg)	6.1	3.6	1.5
Isokinesis (%)	102.6	99.2	100.6
STACK CONDITIONS			
Stack Temperature (°F)	240	238	239
Moisture (%)	12.7	14.8	13.9
Actual Gas Flowrate (acfm)	397564	406747	399357
Corrected Gas Flowrate (dscfm)	260724	261101	257569
EMISSIONS			
Particulate Concentration (gr/dscf)	0.017	0.019	0.015
Particulate Concentration (gr/dscf @ 7% O2)	0.022	0.025	0.021
Particulate Emission Rate (lbs/hr)	38.06	43.26	33.80
Chlorine Emission Rate (g/hr)	163	95	213
Chlorine Emission Rate (g/sec)	0.045	0.026	0.059
HCL Emission Rate (g/hr)	1416	863	354
HCL Emission Rate (g/sec)	0.393	0.240	0.098

TABLE 2-2
CHLORIDE MASS BALANCE
BIF COC TEST PROGRAM/PHASE 1
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST #2	MASS FLOW lbs/hr	% Chloride	Chloride Flow lbs/hr
FEEDS:			
Raw Feed	507400	0.035	177.6
Raw Feed (H2O)	14000		
Coal-Kiln	16800	0.11	18.5
Coal-Precalciner	24200	0.09	21.8
Quench Water	63959	0.0056	3.6
TOTAL:	626359		221.4
OUTPUTS:			
Clinker	324000	0.0063	20.4
Kiln Dust	50800	0.47	238.8
Bypass Dust	1960	0.99	19.4
Calcination CO2	177590		
Stack Gas (H20)	108752		3.0
TOTAL:	663102		281.6
% CLOSURE	105.87		127.17

TEST #3	MASS FLOW lbs/hr	% Chloride	Chloride Flow lbs/hr
FEEDS:			
Raw Feed	505000	0.035	176.8
Raw Feed (H2O)	14000		
Coal-Kiln	16800	0.11	18.5
Coal-Precalciner	23800	0.09	21.4
Quench Water	65458	0.0058	3.8
TOTAL:	625058		220.4
OUTPUTS:			
Clinker	322000	0.005	15.1
Kiln Dust	50600	0.27	136.6
Bypass Dust	1960	3.00	58.8
Calcination CO2	176750		
Stack Gas (H20)	108752		1.8
TOTAL:	660062		212.4
% CLOSURE	105.60		96.35

TEST #4	MASS FLOW lbs/hr	% Chloride	Chloride Flow lbs/hr
FEEDS:			
Raw Feed	507400	0.034	172.5
Raw Feed (H2O)	14000		
Coal-Kiln	16800	0.11	18.5
Coal-Precalciner	23600	0.09	21.2
Quench Water	66957	0.0054	3.6
TOTAL:	628757		215.9
OUTPUTS:			
Clinker	324000	0.0063	20.4
Kiln Dust	50800	0.26	132.1
Bypass Dust	1960	1.6	31.4
Calcination CO2	177590		
Stack Gas (H20)	108752		0.8
TOTAL:	663102		184.6
% CLOSURE	105.46		85.54

TABLE 2-3
SUMMARY OF METALS EMISSIONS
BIF COC TEST PROGRAM - PHASE 1
LONE STAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NO.		6 ME	7 ME	8 ME
DATE:		4/14/92	4/14/92	4/14/92
TIME :		11:28 - 14:10	16:10 - 18:35	20:30 - 22:44
PROCESS CONDITIONS				
Raw Feedrate (lbs/hr)		517200	514800	514800
Kiln Coal Feedrate (lbs/hr)		17000	16600	16200
Pre-Cal Coal Feedrate (lbs/hr)		24000	23800	24400
SAMPLE CONDITIONS				
Volume at STD Conditions (dscf)		67.17	68.08	67.90
Isokinesis (%)		102.87	102.31	101.44
STACK CONDITIONS				
Stack Temperature (°F)		238	237	235
Moisture (%)		14.09	13.92	13.13
Actual Gas Flowrate (acfm)		403942	411704	410029
Corrected Gas Flowrate (dscfm)		260019	265017	266550
METALS EMISSIONS				
Antimony	(ug/Nm3)	0.273	0.467	0.343
	(g/hr)	0.121	0.210	0.155
Arsenic	(ug/Nm3)	1.740	2.339	1.997
	(g/hr)	0.769	1.053	0.905
Barium	(ug/Nm3)	30.912	34.437	159.661
	(g/hr)	13.658	15.508	72.314
Beryllium	(ug/Nm3)	0.168	0.062	0.099
	(g/hr)	0.074	0.028	0.045
Cadmium	(ug/Nm3)	0.357	0.410	0.307
	(g/hr)	0.158	0.185	0.139
Chromium	(ug/Nm3)	16.245	15.818	36.613
	(g/hr)	7.177	7.123	16.583
Lead	(ug/Nm3)	12.880	13.277	11.337
	(g/hr)	5.691	5.979	5.135
Silver	(ug/Nm3)	0.100	0.104	0.120
	(g/hr)	0.044	0.047	0.054
Thallium	(ug/Nm3)	1.178	0.773	0.754
	(g/hr)	0.520	0.348	0.342
Zinc	(ug/Nm3)	43.424	32.362	95.173
	(g/hr)	19.186	14.573	43.106
Mercury	(ug/Nm3)	4.274	2.899	2.897
	(g/hr)	1.888	1.306	1.312

2.1.4 Metals Mass Balance

A summary of the metals mass balance and System Removal Efficiencies (SRE) is presented in Table 2-4. Please note that no metals spiking was performed. As can be seen, the majority of metals input results from the raw feed material, which can vary greatly. Closure of the mass portion (actual product) of the balance was good at 100±5%, but closure of the metals balance was erratic, at best.

Metals analyses were performed on what were ultimately very small samples of massive process streams. Although grab samples were drawn at 15 minute intervals and composited over an entire test period, questionable results still occurred. An analytical variance of 1 ppm when multiplied by a massive flow rate (raw feed) of 500,000 lbs/hr, can result in a mass rate difference of 227 g/hr, which can be a significant factor in a mass balance such as this.

System Removal Efficiencies (SRE) were determined using the total metal input and the stack gas exhaust rate for each metal species. Although no metals spiking was performed during this phase, SRE were typically greater than 99% for all metals except mercury, which was determined at 97%. Data summaries are presented in Appendix A, field data in B-2 and laboratory data in C-4.

2.1.5 POHC Emissions

No POHC spiking was performed during this phase of the test program, as no WDF was fired. Emissions of the surrogate POHC used in Phase 2 were, however, monitored for comparison with emissions while firing spiked waste fuels. Measured emissions of these compounds were in the same range as the emissions measured while firing spiked WDF, which were all measured at or near the lower detection of the sampling and analytical method. Emissions of all POHC were less than 0.6 g/hr.

A summary of measured POHC emissions is presented in Table 2-5. Emissions of surrogate POHC were below analytical detection limits as well as insignificant. Other organic emissions included typical products of incomplete combustion. Data summaries are presented in Appendix A, field data in B-4 and laboratory data in C-5.

2.1.6 Continuous Emission Monitoring of CO, THC and O_2

A summary of CEM data for CO, THC and O_2 is presented in Table 2-6. CEM was performed at the exhuast stack only (not in bypass duct) during Phase 1. CO emissions concentrations, corrected to 7% O_2, ranged from approximately 1000 to 1500 ppm for the 6 tests performed, while THC emissions concentrations ranged from 75 to 125 ppm (dry) corrected to 7% O_2, as propane. No THC data was recorded during Tests 3, 4 and 5 due to instrument problems.

These data are not totally representative of combustion conditions in the kiln, but primarily represent conditions in the pre-calciner, where coal is fired at oxygen conditions and incomplete calcination takes place. Data summaries are presented in Appendix A and field data in B-5.

TABLE 2-4A
MASS BALLANCE METALS DATA
BIF COC TEST PROGRAM-PHASE 1
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST #6	MASS FLOW	Antimony (Sb)	FLOW	Arsenic (As)	FLOW	Barium (Ba)	FLOW	Beryllium (Be)	FLOW	Cadmium (Cd)	FLOW
FEEDS	lbs/hr	MG/KG	g/hr	MG/KG	g/hr	MG/KG	g/hr	MG/KG	g/hr	MG/KG	g/hr
RAW FEED	517200	0.458	107.542	1.220	286.467	19.400	4555.291	0.080	18.785	0.606	142.294
RAW FEED (H20)	14000										
COAL KILN	17000	<0.277	2.138	2.070	15.976	23.300	179.829	0.603	4.654	1.930	14.898
COAL PRECAL	24000	<0.353	3.846	3.450	37.591	46.700	508.843	0.508	5.535	2.790	30.400
QUENCH H2O*	65958	<0.005	0.150	< 0.002	0.060	0.090	2.695	< 0.0005	0.015	< 0.001	0.030
TOTAL:	638158		113.68		340.09		5246.66		28.99		187.62
CLINKER	330000	<0.442	66.220	1.950	292.149	51.300	7685.766	0.468	70.116	1.400	209.748
KILN DUST	61800	<0.381	8.490	2.190	51.503	23.300	547.951	0.159	3.730	0.658	15.474
BYPASS DUST	1960	<0.388	0.345	1.600	1.424	40.300	35.881	0.388	0.345	2.120	1.886
CALCINATION CO2	181020										
STACK GAS (H2O)	102746		0.121		0.769		13.658		0.743		0.158
TOTAL:	667526		75.18		345.84		8283.24		74.94		227.27
%CLOSURE	104.60		66.13		101.69		157.88		258.53		121.13
SRE%			99.894		99.774		99.740		97.436		99.918
TEST #7											
FEEDS											
RAW FEED	514800	0.410	95.825	1.340	313.184	19.500	4557.524	0.104	24.307	0.632	147.711
RAW FEED (H2O)	14000										
COAL KILN	18600	< 0.327	2.464	1.020	7.687	15.300	115.307	0.321	2.419	1.620	12.209
COAL PRECAL	23800	< 0.398	4.279	4.290	46.354	46.200	499.200	0.460	4.970	2.610	28.202
QUENCH H2O*	60457	< 0.005	0.151	0.003	0.091	0.087	2.625	< 0.0005	0.015	< 0.001	0.030
TOTAL:	635657		102.72		367.32		5174.66		31.71		188.15
CLINKER	328000	< 0.275	40.951	2.580	384.193	49.400	7356.253	0.467	69.542	1.350	201.031
KILN DUST	51400	< 0.335	7.817	1.690	39.437	23.400	546.053	0.168	3.920	0.619	14.445
BYPASS DUST	1960	< 0.305	0.271	1.790	1.593	40.400	35.950	0.396	0.352	2.810	2.500
CALCINATION CO2	180180										
STACK GAS (H2O)	103458		0.210		1.053		15.508		0.028		0.185
TOTAL:	684998		49.25		426.26		7953.76		73.84		218.16
%CLOSURE	104.62		47.95		116.05		153.71		232.86		115.95
SRE%			99.795		99.713		99.700		99.912		99.902
TEST #8											
FEEDS											
RAW FEED	514800	< 0.371	86.710	1.210	282.800	18.400	4300.433	0.126	29.449	0.476	111.250
RAW FEED (H2O)	14000										
COAL KILN	16200	< 0.335	2.464	2.740	20.152	22.900	168.425	0.817	6.009	1.870	13.753
COAL PRECAL	24400	< 0.398	4.387	3.820	42.316	48.100	532.833	0.736	8.153	2.660	29.466
QUENCH H2O*	66457	< 0.005	0.151	0.004	0.121	0.094	2.836	< 0.0005	0.015	< 0.001	0.030
TOTAL:	635857		93.71		345.39		5004.53		43.63		154.50
CLINKER	326000	< 0.298	44.376	1.730	257.618	48.800	7266.906	0.524	78.030	1.400	208.477
KILN DUST	51400	< 0.454	10.594	1.310	30.570	21.200	494.715	0.245	5.717	0.516	12.041
BYPASS DUST	1960	< 0.364	0.324	1.860	1.655	37.700	33.547	0.480	0.427	2.720	2.420
CALCINATION CO2	180100										
STACK GAS (H2O)	98151		0.155		0.905		72.314		0.045		0.139
TOTAL:	659691		55.45		290.75		7867.48		84.22		223.08
%CLOSURE	103.75		59.17		84.18		157.21		193.05		144.39
SRE %			99.834		99.738		98.555		99.897		99.910

* RESULTS REPORTED IN MG/L

TABLE 2-4B
MASS BALLANCE METALS DATA
BIF COC TEST PROGRAM-PHASE 1
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

	MASS FLOW lbs/hr	Chromium (Cr) MG/KG	FLOW g/hr	Lead (Pb) MG/KG	FLOW g/hr	Silver (Ag) MG/KG	FLOW g/hr	Thallium (Tl) MG/KG	FLOW g/hr	Zinc (Zn) MG/KG	FLOW g/hr	Mercury (Hg) MG/KG	FLOW g/hr
TEST #6													
FEEDS													
RAW FEED	517200	5.540	1300.841	10.500	2465.492	< 0.066	15.497	0.756	177.515	12.600	2958.591	0.260	61.050
RAW FEED (H20)	14000												
COAL KILN	17000	9.650	74.479	9.030	69.694	0.105	0.810	< 0.111	0.857	37.800	291.740	0.167	1.289
COAL PRECAL	24000	8.340	90.873	11.200	122.035	< 0.071	0.774	< 0.141	1.538	51.200	557.875	0.230	2.506
QUENCH H2O*	65958	< 0.005	0.150	0.049	1.467	< 0.001	0.030	< 0.002	0.060	< 0.001	0.030	< 0.001	0.030
TOTAL:	638158		1466.34		2658.69		17.11		179.97		3808.24		64.88
CLINKER	330000	45.700	6846.774	12.300	1842.786	< 0.088	13.184	0.177	26.518	23.700	3550.734	< 0.090	13.484
KILN DUST	51800	7.010	164.856	21.300	500.916	0.116	2.728	45.400	1087.681	12.300	289.262	0.415	9.760
BYPASS DUST	1860	19.400	17.263	87.900	60.420	0.465	0.414	0.372	0.331	21.200	18.865	0.100	0.089
CALCINATION CO	181020												
STACK GAS (H2O	102746		7.177		5.691		0.044		0.520		19.186		1.888
TOTAL:	667526		7038.07		2409.81		16.37		1095.05		3878.05		25.22
%CLOSURE	104.60		479.84		90.64		95.67		608.47		101.83		38.88
SRE %			99.511		99.786		99.742		99.711		99.496		97.089
TEST #7													
FEEDS													
RAW FEED	514800	5.900	1378.943	30.300	7081.692	< 0.075	17.529	1.200	280.463	13.100	3061.722	0.228	53.288
RAW FEED (H2O)	14000												
COAL KILN	16600	9.800	73.028	4.540	34.215	0.131	0.987	< 0.131	0.987	43.800	330.094	0.127	0.957
COAL PRECAL	23800	7.520	81.255	13.700	148.031	< 0.079	0.854	< 0.158	1.707	51.500	556.466	0.121	1.307
QUENCH H2O*	66457	< 0.005	0.151	0.022	0.664	< 0.001	0.030	< 0.002	0.060	0.001	0.030	0.005	0.151
TOTAL:	635657		1533.38		7264.60		19.40		283.22		3948.31		55.70
CLINKER	328000	50.300	7490.274	14.000	2084.768	< 0.055	8.190	< 0.110	16.380	18.700	2784.654	< 0.086	12.806
KILN DUST	51400	7.760	181.084	24.300	567.055	0.107	2.497	46.500	1085.105	18.800	438.709	0.335	7.817
BYPASS DUST	1960	18.100	16.106	109.000	96.993	0.646	0.575	0.457	0.407	24.700	21.979	< 0.078	0.069
CALCINATION CO	180180												
STACK GAS (H2O	103458		7.123		5.979		0.047		0.348		14.573		1.308
TOTAL:	664998		7694.59		2754.79		11.31		1102.24		3259.92		22.00
%CLOSURE	104.62		501.81		37.92		58.29		389.18		82.56		39.49
SRE %			99.535		99.918		99.759		99.877		99.631		97.656
TEST #8													
FEEDS													
RAW FEED	514800	5.870	1371.932	14.700	3435.672	40.100	9372.140	2.210	516.519	9.200	2150.217	0.473	110.549
RAW FEED (H2O)	14000												
COAL KILN	16200	9.190	67.591	8.250	60.677	0.080	0.588	< 0.134	0.986	52.900	389.069	0.119	0.875
COAL PRECAL	24400	8.250	91.390	1.240	13.736	< 0.079	0.875	< 0.158	1.750	55.003	609.268	0.136	1.507
QUENCH H2O*	66457	< 0.005	0.151	< 0.004	0.121	< 0.001	0.030	< 0.002	0.060	0.002	0.060	0.0004	0.012
TOTAL:	635857		1531.06		3510.21		9373.63		519.32		3148.61		112.94
CLINKER	328000	48.100	7162.667	15.700	2337.918	0.077	11.466	< 0.119	17.721	23.600	3514.323	< 0.083	12.360
KILN DUST	51400	6.960	162.416	21.500	501.715	0.118	2.754	58.900	1374.467	25.500	595.058	0.275	6.417
BYPASS DUST	1960	16.200	16.195	105.000	93.433	0.837	0.745	0.582	0.518	28.400	25.271	< 0.079	0.070
CALCINATION CO	180180												
STACK GAS (H2O	98151		16.583		5.135		0.054		0.342		43.106		1.312
TOTAL:	659691		7357.66		2938.20		15.02		1393.05		4177.76		20.16
%CLOSURE	103.75		480.57		83.70		0.16		268.25		132.69		17.85
SRE %			98.917		99.854		99.999		99.934		98.631		98.838

* RESULTS REPORTED IN MG/L

TABLE 2-5
POHC EMISSION SUMMARY
BIF COC TEST PROGRAM - PHASE 1
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
13-Apr-92

	Perchloroethylene	Trichlorotrifluoromethane	1,1,2 Trichloroethane	1,1,1 Trichloroethane
TEST #2 9:25 - 12:48	<0.571	<0.571	<0.571	<0.571
TEST #3 13:08 - 16:20	<0.596	<0.596	<0.596	<0.596
TEST #4 16:55 - 20:06	<0.583	<0.583	<0.583	<0.583

TABLE 2-6
APCC CEM DATA SUMMARY
BACKGROUND TEST/PHASE 1
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Apr-92

TEST NO. DATE	TIME From	TIME To	CO (ppm)	THC (ppm)	OXYGEN (%)	CO2 (%)	CO @ 7% O2 (ppm)	THC @ 7% O2 (ppm)
Test #2 4/13/92	9:25	12:48	849	-	10.3	17.7	1113	-
Test #3 4/13/92	13:08	16:20	759	-	10.2	17.5	986	-
Test #4 4/13/92	16:55	20:06	746	-	10.5	17.7	997	-
Test #6 4/14/92	11:28	14:05	1182	76.1	10.2	17.8	1535	99
Test #7 4/14/92	16:11	18:35	1016	56.2	10.6	17.5	1371	76
Test #8 4/14/92	20:33	22:48	1038	64.1	10.6	17.2	1401	87

2.2 Phase 2

Phase 2 testing was performed on 25 and 26 June 1992. Three tests were performed for POHC, particulate and HCl/Cl_2 (Tests 3, 4 & 5) on 25 June, and heavy metals (Tests 7, 8 & 9) on 26 June. The blank trains for this series of tests were Tests 1 & 6. Test 2 was voided due to a thunder storm which forced personnel from the stack. The kiln was operated under near upset conditions while still producing saleable product as discussed above in order to set operational limitations.

2.2.1 Particulate, Chloride and Chlorine Emission Measurements

A summary of particulate, chloride (HCl) and chlorine emission measurements from 25 June is presented in Table 2-7. Data presented include: test times, process conditions, stack conditions, sample conditions and measured emissions.

Particulate emissions as measured were less than 0.03 gr/dscf @ 7% O_2 and within limitations set by US EPA (NSPS) and MO DNR, which are stricter than the 0.08 gr/dscf @ 7% O_2 set by the BIF regulation. Emissions were almost identical to those measured during the backgroung test in Phase 1. This result was expected, as the majority of particulate emissions result from the raw mill and preheater tower, and not the kiln.

Chloride emissions as HCl averaged 4760 g/hr, higher than the background test but still less than 1% of the limitation set by the Lone Star Precompliance Certification of 502,000 g/hr. Chlorine emissions averaged 47 g/hr, less than 0.1% of the PCC limitation of 28,700 g/hr.

Data summaries including all calculation inputs and outputs are presented in Appendix A, field data in B-1 and laboratory data in C-1. All tests were acceptable with leak rates less than 0.02 cfm and isokinesis at 100% ± 10%.

2.2.2 Chloride Mass Balance

A summary of the chloride mass balance performed during Phase 2 is presented in Table 2-8A and 2-8B. Data summaries are presented in Appendix A, field data in B-2 and laboratory data in C-2.

Closure of the balance on a mass input / output basis was good at 100±5%. Total chloride into the system was consistent, ranging from 1200 to 1350 lbs/hr for the 6 tests performed in Phase 2.

2.2.3 Heavy Metals Emissions

A summary of heavy metals emissions and System Removal Efficiencies (SRE) is presented in Table 2-9. Emissions of heavy metals were all within the limitations set by the PCC. Data summaries are presented in Appendix A, field data in B-3 and laboratory data in C-3.

TABLE 2-7
PARTICULATE/CHLORINE/HCl DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NO.	3-CL	4-CL	5-CL
DATE:	6/25/92	6/25/92	6/25/92
TIME :	8:38-10:46	17:50-19:56	22:02-00:10
PROCESS CONDITIONS			
Raw Feedrate (lbs/hr)	469200	484800	482000
Coal Feedrate (lbs/hr)	23680	24160	23280
WDLF Feedrate (lbs/hr)	20448	20016	20064
WDSF Feedrate (lbs/hr)	859	998	907
Tires (lbs/hr)	3000	3000	3000
SAMPLE CONDITIONS			
Volume at STD Conditions (dscf)	67.3	68.6	68.7
Particulate Catch (mg)	82.5	77.3	74.1
Chlorine Catch (mg)	0.1	0.2	0.3
HCl Catch (mg)	15.3	17.3	28.3
Isokinesis (%)	103.3	104.6	105.5
STACK CONDITIONS			
Stack Temperature (°F)	246	246	242
Moisture (%)	14.8	14.6	14.6
Actual Gas Flowrate (acfm)	422041	433547	427157
Corrected Gas Flowrate (dscfm)	262015	269655	267690
EMISSIONS			
Particulate Concentration (gr/dscf)	0.02	0.02	0.02
Particulate Concentration (gr/dscf @ 7% O2)	0.026	0.024	0.023
Particulate Emission Rate (lbs/hr)	42.48	40.13	38.15
Chlorine Emission Rate (g/hr)	23.38	47.14	70.12
Chlorine Emission Rate (g/sec)	0.006	0.013	0.019
HCL Emission Rate (g/hr)	3577	4077	6615
HCL Emission Rate (g/sec)	0.994	1.133	1.837

TABLE 2-8A
CHLORIDE MASS BALANCE
BIF COC TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

TEST #3	MASS FLOW	% Chloride	Chloride Flow
FEEDS:	lbs/hr		lbs/hr
Raw Feed	469200	0.045	211.1
Raw Feed (H2O)	14000		
Coal	23680	0.11	26.0
Quench Water	67460	0.0031	2.1
Tires	3000	0.11	3.3
WDSF	859	0.12	1.0
WDLF	20448	4.82	985.6
Spike Material			
TOTAL:	598647		1229.2
OUTPUTS:			
Clinker	298854	0.200	597.7
Kiln Dust	46920	0.31	145.5
Bypass Dust	6000	7.4	444.0
Calcination CO2	164220		
Stack Gas (H20)	108752		7.7
TOTAL:	624746		1194.8
% CLOSURE	104.36		97.20
TEST #4			
FEEDS:			
Raw Feed	484800	0.049	237.6
Raw Feed (H2O)	14000		
Coal	24160	0.09	21.7
Quench Water	67460	0.0033	2.2
Tires	3000	0.10	3.0
WDSF	998	0.20	2.0
WDLF	20016	4.65	930.7
Spike Material			
TOTAL:	614434		1197.3
OUTPUTS:			
Clinker	308790	0.093	287.2
Kiln Dust	48480	0.29	140.6
Bypass Dust	6000	10.0	600.0
Calcination CO2	169680		
Stack Gas (H20)	110411		8.8
TOTAL:	643361		1036.5
% CLOSURE	104.71		86.57
TEST #5			
FEEDS:			
Raw Feed	482000	0.051	245.8
Raw Feed (H2O)	14000		
Coal	23280	0.08	18.6
Quench Water	67460	0.0035	2.4
Tires	3000	0.14	4.2
WDSF	907	0.24	2.2
WDLF	20064	4.58	918.9
Spike Material			
TOTAL:	610711		1192.1
OUTPUTS:			
Clinker	307006	0.140	429.8
Kiln Dust	48200	0.30	144.6
Bypass Dust	6000	9.3	558.0
Calcination CO2	168700		
Stack Gas (H20)	109606		14.2
TOTAL:	639512		1146.6
% CLOSURE	104.72		96.18

TABLE 2-8B
CHLORIDE MASS BALANCE
BIF COC TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

	MASS FLOW lbs/hr	% Chloride	Chloride Flow lbs/hr
TEST #7			
FEEDS:			
Raw Feed	501600	0.052	260.8
Raw Feed (H2O)	14000		
Coal	24480	0.11	26.9
Quench Water	67460	0.0032	2.2
Tires	3000	0.12	3.6
WDSF	273	0.17	0.5
WDLF	20424	4.55	929.3
Spike Material	21		
TOTAL:	631258		1223.3
OUTPUTS:			
Clinker	319490	0.110	351.4
Kiln Dust	50160	0.33	165.5
Bypass Dust	6000	14.0	840.0
Calcination CO2	175560		
Stack Gas (H20)	106567		
TOTAL:	657777		1357.0
% CLOSURE	104.20		110.93
TEST #8			
FEEDS:			
Raw Feed	502200	0.058	291.3
Raw Feed (H2O)	14000		
Coal	25060	0.10	25.1
Quench Water	67460	0.0039	2.6
Tires	3000	0.19	5.7
WDSF	273	0.14	0.4
WDLF	20770	4.50	934.7
Spike Material	22		
TOTAL:	632785		1259.7
OUTPUTS:			
Clinker	319873	0.047	150.3
Kiln Dust	50220	0.29	145.6
Bypass Dust	6000	18.0	1080.0
Calcination CO2	175770		
Stack Gas (H20)	106002		9.0
TOTAL:	657865		1385.0
% CLOSURE	103.96		109.95
TEST #9			
FEEDS:			
Raw Feed	502200	0.052	261.1
Raw Feed (H2O)	14000		
Coal	23680	0.11	26.0
Quench Water	67460	0.0036	2.4
Tires	3000	0.27	8.1
WDSF	398	0.28	1.1
WDLF	20774	5.07	1053.2
Spike Material	22		
TOTAL:	631534		1352.1
OUTPUTS:			
Clinker	319873	0.050	159.9
Kiln Dust	50220	0.27	135.6
Bypass Dust	6000	17.0	1020.0
Calcination CO2	175770		
Stack Gas (H20)	103374		
TOTAL:	655237		1315.5
% CLOSURE	103.75		97.30

TABLE 2–9
SUMMARY OF METALS EMISSIONS
CERTIFICATION OF COMPLIANCE TEST/PHASE2
LONE STAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NO. DATE: TIME:	7–ME 6/26/92 13:51–16:01	8–ME 6/26/92 18:08–20:20	9–ME 6/26/92 21:54–00:03
PROCESS CONDITIONS			
Raw Feedrate (lbs/hr)	501600	502200	502200
~~Raw~~ Feedrate (lbs/hr)	24480	25060	23680
WDLF Feedrate (lbs/hr)	20424	20770	20774
WDSF Feedrate (lbs/hr)	273	273	398
Tires (lbs/hr)	3000	3000	3000
SAMPLE CONDITIONS			
Volume at STD Conditions (dscf)	58.39	61.04	61.06
Isokinesis (%)	102.32	103.55	106.22
STACK CONDITIONS			
Stack Temperature (F)	310	310	310
Moisture (%)	16.21	15.62	15.61
Actual Gas Flowrate (acfm)	417,600	428,400	417,700
Corrected Gas Flowrate (dscfm)	234,600	242,300	236,300
METALS EMISSIONS			
Arsenic (ug/Nm3)	1.597	2.493	2.417
(g/hr)	0.640	1.030	0.970
SRE (%)	99.97	99.97	99.96
Beryllium (ug/Nm3)	0.060	0.058	0.168
(g/hr)	0.020	0.020	0.070
SRE (%)	99.57	99.63	99.58
Cadmium (ug/Nm3)	2.068	17.477	0.057
(g/hr)	0.820	7.200	0.020
SRE (%)	99.98	99.97	99.97
Chromium (ug/Nm3)	13.722	0.058	0.058
(g/hr)	5.470	0.020	0.020
SRE (%)	99.95	99.95	99.94
Lead (ug/Nm3)	15.917	13.705	32.223
(g/hr)	6.340	5.640	12.940
SRE (%)	99.92	99.93	99.93
Zinc (ug/Nm3)	32.426	0.058	22.334
(g/hr)	12.920	0.020	8.970
SRE (%)	99.94	99.96	99.94
Mercury (ug/Nm3)	45.441	39.877	144.799
(g/hr)	18.110	16.420	58.140
SRE (%)	84.26	86.28	86.50
Chrome 6+ (ug/Nm3)	0.409	0.408	0.405
(g/hr)	0.160	0.170	0.160

Although metals inputs to the system were significantly greater in Phase 2, emissions were typically in the same order of magnitude as in Phase 1. Please note that metals spiking was performed during these tests in order to maximize metals input. Emissions of heavy metals were well within the limitations set by the PCC. All metals emissions were less than 10% of the PCC limitations, with most measured emissions below 1% of the allowable. Hexavalent chromium testing was performed during Phase 2.

2.2.4 Metals Mass Balance

A summary of the metals mass balance performed and System Removal Efficiencies (SRE) is presented in Table 2-10A&B. Please note that metals spiking was performed, and as can be seen, the majority of metals input now results from the WDF. Closure of the mass portion (actual product) of the balance was good at 100%±5%, but closure of the metals balance was erratic, at best.

Changes in input mass rates of metals require the kiln system to reach equilibrium before those changes are accurately reflected in the output. This is most likely reason for lack of closure in the metals portion of the mass balance equation.

System Removal Efficiencies (SRE) were determined using the total metal input and the stack gas exhaust rate for each metal species. SRE were typically greater than 99% for all metals except mercury, which was determined at 84% to 86%. Data summaries are presented in Appendix A, field data in B-2 and laboratory data in C-4.

2.2.5 POHC Emissions

POHC spiking was performed during this phase of the test program in the WDLF fired. Surrogate POHC were perchloroethylene, trichlorofluoromethane, 1,2 trichloroethane and 1,1,1 trichloroethane. A summary of DRE measurements is presented in Table 2-11. DRE was greater than 99.99% for all four surrogates used.

Laboratory detecion of POHC was acceptable for all tests with the exception of Test 4 for perchloroethylene, where none was detected in the spiked fuel sample. As all other surrogates were present, it is hypothesized that a laboratory interference or error is responsible for this anomaly. Subsequent analysis of the split sample retained on site resulted in the low, but measureable level presented.

The determination of acceptable DRE for the four compounds indicates the acceptability of the Lone Star kiln to fire any and all compounds permitted with DRE at least 99.99%.

Emissions of surrogate POHC were similar to those measured during Phase 1 (at lower detection limits of the method) and were insignificant. Other organic emissions included typical products of incomplete combustion. Data summaries are presented in Appendix A-11, field data in B-4 and laboratory data in C-5.

TABLE 2–10A
MASS BALANCE METALS DATA
CERTIFICATION OF COMPLIANCE TEST/PHASE 2
LONESTAR INDUSTRIES, INC.

CAPE GIRARDEAU, MISSOURI

TEST #7 FEEDS	MASS FLOW lbs/hr	Silver (Ag) mg/kg	Flow g/hr	Arsenic (As) mg/kg	Flow g/hr	Barium (Ba) mg/kg	Flow g/hr	Beryllium (Be) mg/kg	Flow g/hr	Cadmium (Cd) mg/kg	Flow g/hr
RAW FEED	501600	0.665	151.44	0.754	173.98	14.100	3210.94	0.517	117.73	3.510	799.32
RAW FEED (H2O)	14000										
COAL PRECAL	24480	0.489	5.43	5.460	60.68	60.700	674.61	0.331	3.66	0.237	2.63
QUENCHH2O	67460	0.007	0.21	0.005	0.15	0.104	3.19	0.004	0.12	0.001	0.03
TIRES	3000	0.460	0.63	0.959	1.31	13.200	17.98	0.053	0.07	1.820	2.48
WDSF	273	6.190	0.77	8.260	1.02	309.000	38.30	0.196	0.02	1.280	0.16
WOLF	20424	3.670	34.03	200.000	1854.50	912.000	8456.52	2.400	22.25	289.000	2679.75
SPIKE	21										
TOTAL	631276		192.51		2091.65		12401.54		143.89		3484.37
CLINKER	319490	0.540	78.33	15.500	2248.25	56.400	8180.73	0.830	120.39	3.270	474.31
KILN DUST	50160	0.364	8.29	2.220	50.56	14.700	334.76	0.210	4.78	3.640	82.89
BYPASS DUST	6000	2.520	6.86	18.100	49.30	55.300	150.64	0.528	1.44	346.000	942.50
CALCINE CO2	175560										
STACK GAS H2O	106567		0.00		0.64		0.00		0.02		0.82
TOTAL	657777		93.48		2348.75		8665.13		126.63		1500.52
% CLOSURE	104.20		48.56		112.29		69.88		88.01		43.06
SRE %					99.97				99.57		99.96

TEST #8 FEEDS	MASS FLOW lbs/hr	Silver (Ag) mg/kg	Flow g/hr	Arsenic (As) mg/kg	Flow g/hr	Barium (Ba) mg/kg	Flow g/hr	Beryllium (Be) mg/kg	Flow g/hr	Cadmium (Cd) mg/kg	Flow g/hr
RAW FEED	502200	0.411	93.73	1.430	326.04	12.400	2827.19	0.608	138.62	1.590	362.52
RAW FEED (H2O)	14000										
COAL PRECAL	25060	0.546	6.21	3.950	44.94	51.500	585.93	0.580	6.60	0.175	1.99
QUENCHH2O	67460	0.007	0.21	0.001	0.02	0.100	3.06	0.004	0.12	0.001	0.03
TIRES	3000	0.685	0.93	3.660	4.98	20.200	27.51	0.081	0.11	16.600	22.61
WDSF	273	0.503	0.06	6.660	0.83	368.000	45.61	0.237	0.03	2.060	0.26
WOLF	20770	3.940	37.15	185.000	1744.47	826.000	7788.83	2.420	22.82	280.000	2640.28
SPIKE	22										220.00
TOTAL	632765		138.30		2121.28		11278.13		168.30		3247.69
CLINKER	319873	0.444	64.48	16.500	2396.17	60.200	8742.38	0.771	111.97	4.480	650.60
KILN DUST	50220	0.475	10.83	2.480	56.54	15.300	348.84	0.219	4.99	5.030	114.68
BYPASS DUST	6000	4.270	11.63	16.800	45.76	80.800	220.10	0.449	1.22	501.000	1364.72
CALCINE CO2	175770										
STACK GAS H2O	103374		0.00		1.03		0.00		0.02		7.20
TOTAL	655237		86.94		2499.51		9311.32		118.20		2137.20
% CLOSURE	103.55		62.86		117.83		82.56		70.23		65.81
SRE %					99.97				99.63		99.97

TEST #9 FEEDS	MASS FLOW lbs/hr	Silver (Ag) mg/kg	Flow g/hr	Arsenic (As) mg/kg	Flow g/hr	Barium (Ba) mg/kg	Flow g/hr	Beryllium (Be) mg/kg	Flow g/hr	Cadmium (Cd) mg/kg	Flow g/hr
RAW FEED	502200	0.408	93.02	0.754	171.91	11.400	2599.19	0.536	122.21	1.330	303.24
RAW FEED (H2O)	14000										
COAL PRECAL	23680	0.535	5.75	3.190	34.29	70.800	761.15	0.254	2.73	0.242	2.60
QUENCHH2O	67460	0.007	0.21	0.002	0.06	0.109	3.34	0.002	0.06	0.001	0.03
TIRES	3000	0.684	0.93	1.070	1.46	6.430	8.76	0.099	0.13	35.100	47.81
WDSF	398	0.495	0.09	15.200	2.75	356.000	64.33	0.269	0.05	2.470	0.45
WOLF	20774	3.130	29.52	168.000	1584.47	490.210	4623.36	2.590	24.43	277.000	2612.50
SPIKE	22										216.75
TOTAL	631534		129.53		1794.95		8060.12		149.61		3185.37
CLINKER	319873	0.440	63.90	17.900	2599.48	63.900	9279.71	0.894	129.83	4.090	593.96
KILN DUST	50220	0.559	12.75	3.120	71.14	16.700	380.78	0.296	6.75	4.320	98.50
BYPASS DUST	6000	4.230	11.52	17.800	48.49	02.200	223.91	0.551	1.50	467.000	1272.11
CALCINE CO2	175770										
STACK GAS H2O	103374		0.00		0.97		0.00		0.07		0.02
TOTAL	655237		88.17		2720.07		9884.38		138.15		1964.58
% CLOSURE	103.75		68.07		151.54		122.63		92.34		61.68
SRE %					99.90				99.58		99.97

TABLE 2-10B
MASS BALANCE METALS DATA
CERTIFICATION OF COMPLIANCE TEST/PHASE 2
LONESTAR INDUSTRIES, INC.

CAPE GIRARDEAU, MISSOURI

TEST #7	MASS FLOW lbs/hr	Chromium (Cr) mg/kg	Flow g/hr	Mercury (Hg) mg/kg	Flow g/hr	Lead (Pb) mg/kg	Flow g/hr	Antimony (Sb) mg/kg	Flow g/hr	Thallium (Tl) mg/kg	Flow g/hr	Zinc (Zn) mg/kg	Flow g/hr
FEEDS													
RAW FEED	501600	18.700	4258.46	0.414	94.28	8.690	2024.49	0.295	67.18	4.760	1083.96	20.300	4622.85
RAW FEED (H2O)	14000												
COAL PRECAL	24480	16.600	184.49	0.205	2.28	6.300	70.02	0.383	4.26	0.727	8.08	53.400	593.48
QUENCHH2O	67480	0.150	4.60	0.004	0.12	0.008	0.25	0.005	0.15	0.002	0.06	0.066	2.02
TIRES	3000	4.630	6.58	0.094	0.13	10.800	14.71	7.900	10.76	0.105	0.14	5564.000	7605.41
WDSF	273	204.000	25.28	9.710	1.20	65.500	8.12	2.430	0.30	0.270	0.03	637.000	78.95
WDLF	20424	612.000	5674.77	1.840	17.06	595.000	5517.14	19.050	176.64	0.109	1.01	951.000	8818.14
SPIKE	21		825.71										
TOTAL	831278		10979.91		115.07		7634.71		259.29		1093.31		21720.85
CLINKER	319490	39.700	5758.42	0.086	12.76	23.800	3452.15	0.389	56.42	0.179	25.96	92.800	13460.50
KILN DUST	50160	8.550	194.71	0.524	14.21	19.400	441.79	0.274	6.24	49.200	1120.41	26.300	598.92
BYPASS DUST	6000	32.200	87.71	0.093	0.25	685.000	1865.94	0.767	2.09	1.690	4.60	113.000	307.81
CALCINE CO2	175560												
STACK GAS H2O	106587		5.47		18.11		6.34		0.00		0.00		12.92
TOTAL	657777		6046.31		45.34		5766.22		64.75		1150.98		14380.15
% CLOSURE	104.20		55.07		39.40		75.53		24.97		105.28		66.20
SRE %			99.95		84.26		99.92						99.94

TEST #8	MASS FLOW lbs/hr	Chromium (Cr) mg/kg	Flow g/hr	Mercury (Hg) mg/kg	Flow g/hr	Lead (Pb) mg/kg	Flow g/hr	Antimony (Sb) mg/kg	Flow g/hr	Thallium (Tl) mg/kg	Flow g/hr	Zinc (Zn) mg/kg	Flow g/hr
FEEDS													
RAW FEED	502200	20.400	4651.18	0.510	116.28	14.600	3328.76	0.281	64.07	3.940	898.32	20.900	4765.17
RAW FEED (H2O)	14000												
COAL PRECAL	25080	15.700	178.62	0.076	0.89	5.590	63.60	0.302	3.44	0.671	7.63	46.100	524.49
QUENCHH2O	67460	0.283	8.67	0.004	0.12	0.009	0.28	0.005	0.15	0.002	0.05	0.062	1.90
TIRES	3000	56.800	77.36	0.096	0.13	31.200	42.49	6.530	8.89	0.162	0.22	16200.000	22064.40
WDSF	273	187.000	23.18	9.840	1.22	54.600	6.77	1.750	0.22	0.525	0.07	658.000	81.55
WDLF	20770	605.000	5704.90	1.420	13.39	611.000	5761.47	11.650	109.85	0.123	1.16	441.000	4158.44
SPIKE	22		825.71				303.14						
TOTAL	632765		11469.61		132.03		9506.53		186.62		907.46		31595.96
CLINKER	319873	33.000	4792.34	0.083	12.05	14.900	2163.81	0.368	53.44	0.147	21.35	84.800	12314.85
KILN DUST	50220	10.400	237.12	0.798	18.19	20.700	471.96	0.294	6.70	56.500	1288.19	29.900	681.72
BYPASS DUST	6000	38.500	104.87	0.094	0.26	1060.000	2887.44	0.588	1.60	2.260	6.16	128.000	348.67
CALCINE CO2	175770												
STACK GAS H2O	103374		0.02		16.42		5.64		0.00		0.00		0.02
TOTAL	655237		5134.35		46.92		5528.85		61.75		1315.70		13345.26
% CLOSURE	103.55		44.76		35.54		58.16		33.09		144.99		42.24
SRE %			99.95		86.26		99.93						99.96

TEST #9	MASS FLOW lbs/hr	Chromium (Cr) mg/kg	Flow g/hr	Mercury (Hg) mg/kg	Flow g/hr	Lead (Pb) mg/kg	Flow g/hr	Antimony (Sb) mg/kg	Flow g/hr	Thallium (Tl) mg/kg	Flow g/hr	Zinc (Zn) mg/kg	Flow g/hr
FEEDS													
RAW FEED	502200	18.900	3853.18	0.495	112.66	11.500	2621.99	0.350	79.80	4.440	1012.31	20.700	4719.58
RAW FEED (H2O)	14000												
COAL PRECAL	23680	20.400	219.31	0.135	1.45	3.960	42.57	0.303	3.26	0.416	4.49	65.200	700.95
QUENCHH2O	67460	0.012	0.37	0.004	0.12	0.006	0.18	0.005	0.15	0.002	0.06	0.080	2.45
TIRES	3000	99.800	135.93	0.085	0.12	25.800	35.14	1.240	1.69	0.179	0.24	8650.000	11781.30
WDSF	398	277.000	50.05	11.500	2.08	60.700	10.97	3.410	0.62	0.774	0.14	806.000	145.64
WDLF	20774	589.000	5555.09	1.860	17.54	621.000	5856.80	10.810	101.95	0.155	1.46	297.000	2801.12
SPIKE	22		825.71				300.52						
TOTAL	631534		10639.64		134.17		8868.27		187.47		1018.72		20151.03
CLINKER	319873	32.200	4676.16	0.078	11.33	30.200	4385.71	0.754	109.50	0.149	21.64	86.400	12547.21
KILN DUST	50220	6.190	141.13	0.825	18.81	33.400	761.52	0.399	9.10	88.800	2024.63	29.300	668.04
BYPASS DUST	6000	32.900	89.62	0.154	0.42	1000.000	2724.00	2.550	6.95	5.230	14.25	126.000	343.22
CALCINE CO2	175770												
STACK GAS H2O	103374		0.02		58.14		12.94		0.00		0.00		8.97
TOTAL	655237		4906.93		88.70		7884.17		125.54		2060.51		13567.44
% CLOSURE	103.75		46.12		66.11		88.90		66.97		202.27		67.33
SRE %			99.95		86.50		99.93						99.94

TABLE 2-11
DRE SUMMARY DATA
BIF COC TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

TEST #3	MASS FLOW	Perchloroethylene	: Flow	Trichlorotrifluoromethane	: Flow	1,1,2 Trichloroethane	: Flow	1,1,1 Trichloroethane	: Flow
6/25/92	g/hr	ug/g	g/hr	ug/g	g/hr	ug/g	g/hr	ug/g	g/hr
WDLF	9275213	28833	267432	1350	12526	4232	39252	15294	141855
WDSF	389733	5.881	2	0.125	0	1.987	1	4.545	2
Tires	1362000								
Coal	10750720								
TOTAL INPUT	21777666	28839	267435	1351	12526		39253	15299	141857
STACK GAS	49373408		0.591		0.591		0.591		0.591
% DRE			100.000		99.995		99.998		100.000
TEST #4									
6/25/92									
WDLF	9079258	7190	65280	1403.368	12742	5489	49836	13406	121713
WDSF	452874	0.125	0	0.125	0	0.125	0	7.462	3
Tires	1362000								
Coal	10968640								
TOTAL INPUT	21862772	7190	65280	1403	12742		49836	13413	121717
STACK GAS	50126594		0.626		0.626		0.626		0.626
% DRE			99.999		99.995		99.999		99.999
TEST #5									
6/25/92									
WDLF	9101030	15570	141706	1597	14539	4722	42979	9029	82169
WDSF	411506	0.125	0	20.574	8	0.125	0	143.449	59
Tires	1362000								
Coal	10569120								
TOTAL INPUT	21443656	15570	141706	1618	14547		42979	9172	82228
STACK GAS	49761124		0.602		0.602		0.602		0.602
% DRE			100.000		99.996		99.999		99.999

2.2.6 Continuous Emission Monitoring of CO, THC and O_2

During Phase 2, CEM data was collected by APCC from the exhaust stack (as in Phase 1), and also by the Lonestar CEMS installed in the bypass duct. A summary of APCCs CEM data for CO, THC and O_2 is presented in Table 2-12. Emissions of CO from the main exhaust stack were significantly higher than in Phase 1 while THC emissions were approximately 50% lower. This combination of data could indicate different calcination conditions in the precalciner. These data are not representative of combustion conditions in the kiln, but primarily represent conditions in the pre-calciner, where coal is fired at low oxygen conditions and incomplete calcination takes place. Data summaries are presented in Appendix A, with field data in B-5.

A summary of Lone Star's CEM for CO, THC and O_2 is presented in Table 2-13. CO emission concentrations were typically less than 100 ppm, with the exception of Test 3 which was 113 ppm (corrected to 7% O_2). THC concentrations were less than 0.3 ppm (corrected to 7% O_2) throughout all tests. Data summaries are presented in Appendix A, field data in B-6.

It should be noted that, although attempted, a Tier 2 CO emission limitation in the bypass duct was not demonstrated during Phase 1 or Phase 2. The bypass CEMS was not yet installed during Phase 1 to observe CO emissions under 100% coal fire. During Phase 2 (@ 100% WDF w/ tires in the back end) CO emissions were typically within the Tier 1 range (i.e. <100 ppm @ 7% O_2). Subsequent to Phase 2 testing, however, significant concentrations of CO have been observed when firing **less waste fuel** and a greater amount of coal. Measured emissions concentrations of THC are always insignificant (< 1 ppm actual) under all operating conditions.

Due to this situation, Lone Star, with the approval of Joe Galbraith of EPA Region VII, ran under a number of different operating conditions during the months of July and August to establish a Tier 2 CO emission limitation. Field data for these tests are presented in Appendix B-7.

TABLE 2-12
APCC (STACK) CEM DATA SUMMARY
BIF COC TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

TEST# DATE	TIME From	TIME To	CO (ppm)	CO2 (%)	O2 (%)	NOx (ppm)	SO2 (ppm)	THC (ppm)	CO Corr. (ppm)	THC Corr. (ppm dry)	CO Corr. Rolling Avg	THC Corr. Rolling Avg
Test #3 6/25/92	8:33	12:03	2223	16.8	10.7	110	67	24	2947	38	3147	38
Test #4 6/25/92	17:48	20:48	1156.8	16.9	11.1	216	99	22	1611	36	1783	35
Test #5 6/25/92-6/26/92	21:48	1:03	1144.7	16.9	10.8	221	91	20	1559	33	1599	33
Test #7 6/26/92	13:49	16:49	2242	18.7	9.7	208	152	40	2704	57	2983	60
Test #8 6/26/92	17:49	20:49	1917	19.1	9.4	274	190	39	2258	55	2329	56
Test #9 6/26/92-6/27/92	21:34	0:34	2196	18.9	10.1	259	187	38	3136	67	3075	66

TABLE 2-13
LONESTAR BYPASS DUCT CEMS DATA
BIF COC TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST# DATE	TIME From	TIME To	O2 (%)	CO (ppm)	CO Corr. (ppm)	THC (ppm)	THC Corr. (ppm)	CO Corr. Rolling Avg	THC Corr. Rolling Avg
6/25/92									
TEST 3	08:33	11:33	18.6	20	113	0	0	99	0
TEST 4	17:48	20:48	17.2	19	73	0	0	62	0
TEST 5	21:48	00:48	17.3	23	89	0	0	91	0
6/26/92									
TEST 7	13:49	16:49	17.3	4	16	0	0	23	0
TEST 8	18:04	20:34	16.8	3	4	0	0	12	0
TEST 9	21:49	00:19	17.7	7	32	0	0	34	0

3.0 PROCESS AND OPERATIONS

Lone Star Industries produces portland cement with a dry preheater, precalciner kiln process. The kiln system was designed by Allis-Chalmers. The kiln is 14'6" diameter and 235' long as shown in Figure 3-1. The kiln is designed for 9" thick refractory throughout and is mounted on a slope for precalcined raw material to enter the top and be conveyed towards the burners at the front end. Energy is provided at three locations in the kiln process; kiln front end, material shelf and precalciner.

The precalciner provides 45% of the total system energy, the tires at the material shelf 15%, and the front end of the kiln 40%. At the front end, pulverized coal is injected to provide heat to transform the raw material to clinker at a temperature of 3500° F (2700° F material temp.). Clinker production is on average 3500-3800 tons/day. Feed rate of raw material mix on an hourly basis varies from 225 to 270 tph, averaging about 250 tph. The kiln rotates 3.5 RPM maximum, and with normal production the kiln turns at 2.7 RPM. Draft air is drawn through the kiln and the preheater tower by a 4000 horsepower I.D. preheater fan. An additional 4000 horsepower I.D. fan located after the raw mill draws hot exhaust gases through the mill to dry raw material. A separate ID fan draws off approximately 10% to 30% of the kiln exhaust gas through the bypass baghouse. This stack discharges into the main stack. Particulate matter is removed from the raw mill exhaust stream by a fabric filter dust collector (main baghouse) before venting to the atmosphere.

3.1 PORTLAND CEMENT PROCESS

Raw materials (limestone, silica, alumina, iron oxide and flyash) are mined, crushed, stockpiled and reclaimed to mill feed bins for storage. The raw materials are conveyed to a roller mill for size reduction and drying. The roller mill is used to grind the product to a 72% passing 200 mesh size (74 microns). The material is dryed by hot gases drawn from the kiln and the preheater system through the roller mill by the I.D fan. All ground raw material as well as kiln exhaust emissions are conveyed by air to a glass bag dust collector preceded by multiple cyclones to remove particulate from the gas stream while simultaneously collecting raw material for blending. The conditioned raw material is discharged from the dust collector and cyclones into blending silos to be conveyed by a 292 foot elevator to the first stage of the 4 stage preheater / precalciner as needed. Exhaust gases from the main baghouse are vented to the atmosphere 210 feet above grade.

The preheater uses the kiln and precalciner exhaust gases to heat the raw material to 1500°F before entering the precalciner. Pulverized coal is fired in the precalciner to heat the material to 1750-1900°F. Where the material enters the kiln, the gas temperatures exceed 2100°F and product temperature averages 1600°F. Approximately 85% of the raw feed is calcined before it enters the kiln. The precalciner is fired with a maximum of 14 tph of coal. The heated raw material is then conveyed to one final cyclone for separation from the process gas before entering the rotary kiln. The rotary kiln heats the raw material to incipient melting where the portland cement products are formed near a temperature of 2700 °F (material). A typical temperature profile of the kiln is presented in Figure 3-2.

FIGURE 3 - 1
PROCESS SCHEMATIC
LONE STAR CEMENT PLANT
CAPE GIRARDEAU, MISSOURI

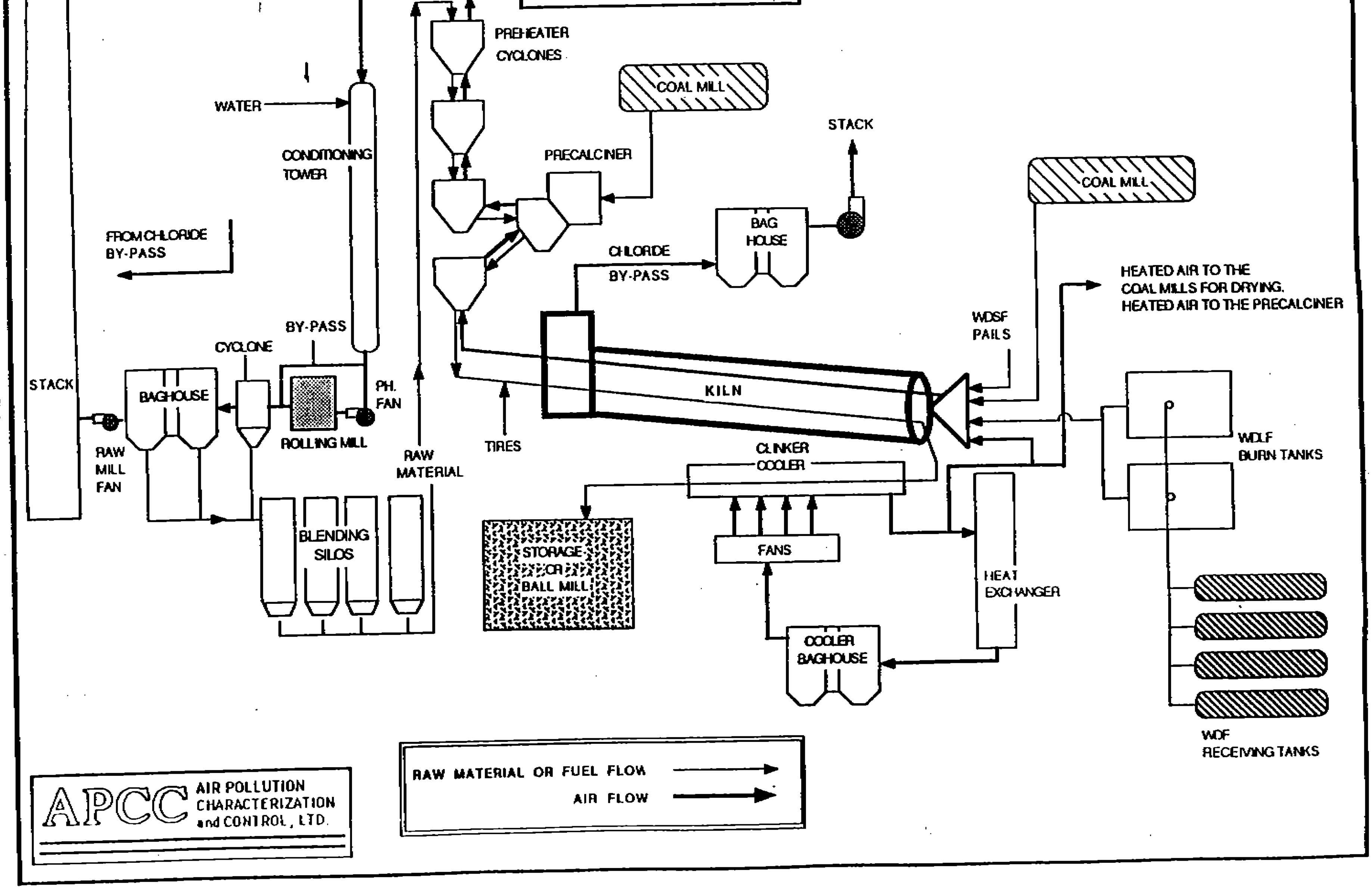
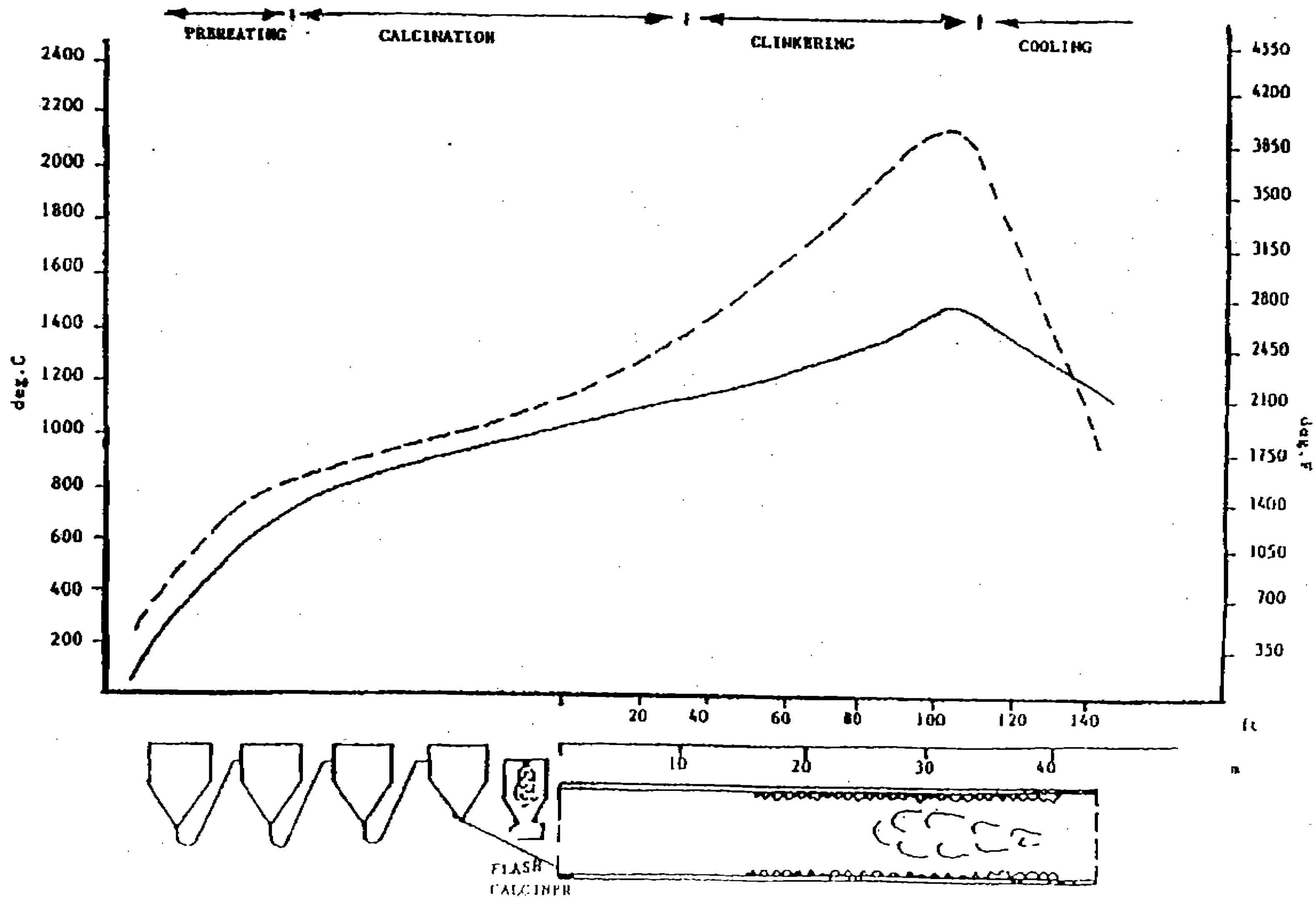


FIGURE 3-2
PRECALCINER KILN
MATERIAL & GAS TEMPERATURE PROFILE



Only tires and pulverized coal are used to provide heat to the preheater system. Heat to the kiln is supplied by firing pulverized coal, and/or a combination of WDLF & WDSF. Coal is injected counter current to the product flow through burners at the front (product discharge) end of the kiln. Coal is gravimetrically fed to a coal mill where it is pulverized and fired through a single gun burner system. A second burner for firing WDLF is installed concentric to the coal burner. This burner uses high pressure air atomization to inject WDLF directly into the flame. The burner is rated at 44 gallons per minute. WDSF, contained in 3.5 gallon pails, is fired into the kiln by means of an air cannon mounted on the kiln hood. Tires are introduced to the back end of the kiln at the material shelf, as described in Section 3.2.

While the bulk of kiln gaseous emissions exit the kiln through the precalciner and 4-stage preheater, the majority of the chloride emissions exit the kiln bypass through a bypass duct at the back of the kiln. The chloride bypass (typically 10% to 30% of the total gas flow) kiln exhaust is cooled to approximately 400°F with ambient air and water injection for sensible cooling. The dust is collected by a baghouse described in Section 3.3. The exhaust gases are then vented to the main exhaust stack.

The portland cement product (clinker) is discharged from the front (hot) end of the kiln to the clinker cooler for cooling (to approximately 175 °F). Ambient air is drawn into the clinker cooler at a rate of 247,000 scfm. The heated air is drawn to the kiln for combustion air and for drying coal in the coal mills and raw material in the roller mill. Clinker is conveyed either to storage silos or to the finish mill feed bins. All exhaust from the kiln, precalciner, preheater, and roller mill are vented to atmosphere through the main baghouse and a single stack 210 feet above grade. Bypass exhaust also connects to the same stack.

3.2 FUEL BURNING

No. 2 fuel oil is used to preheat the kiln during start-up. The maximum coal firing rate to the kiln is 10 tph and 14 tph for precalciner. Shredded tires are fired at the material shelf of the 4-stage preheater at the entrance to the kiln. The rated production capacity of the kiln is approximately 3500 to 3800 tons per day.

Heat is supplied to the rotary kiln by firing pulverized coal, tires, WDLF and WDSF. Coal and WDLF are injected counter current to the product flow through burners at the front (product discharge) end of the kiln. WDSF is injected into the burn zone at the front end of the kiln via an air cannon. Coal is feed to a coal mill where it is dried, pulverized and stored in bins. The coal is gravimetrically drawn from the bin and fired through a single gun burner system rated at approximately 10 tph. The coal mill is rated at 15 tph. The fan which draws drying air through the mill is rated at at 22,000 acfm at 600°F and -4 in.w.c. The clinkering zone extends into the kiln approximately 1/3 the length of the kiln. A typical coal analysis is presented in Table 3-1.

Heat to the precalciner is provided by firing pulverized coal supplied by a second coal mill. This coal mill is rated at 20 tph and the fan is rated at 36,000 acfm at

600°F and -4 in.w.c. No WDLF or WDSF is fired in the precalciner. Tires fired at the material shelf also supply heat to the precalciner.

WDLF and WDSF consist of organic substances and mixtures immediately useful as fuel, or which are blended into a useful fuel. Typical generic types of organic substances which may be present at some level are shown in Table 3-2. The Table 3-2 list is descriptive and not considered limiting. The substances contained in WDLF and WDSF are typically those used each day in industry, commerce and around the home. They are found in products such as paints, varnishes, lacquers, thinners, cleaners, detergent formulations, spot removers, nail polish remover, lighter fluid and gasoline.

TABLE 3-1
TYPICAL COAL ANALYSIS

HHV	11000 Btu/lb	Dry basis
Sulfur	2-3%	Dry basis
Ash	18-24%	As received
% Chloride	565 ppm	As received
Antimony	0.20 ppm	As received
Arsenic	6.0 ppm	As received
Barium	0.37 ppm	As received
Cadmium	5.0 ppm	As received
Chromium	1.40 ppm	As received
Lead	20.0 ppm	As received
Mercury	0.05 ppm	As received
Silver	5.00 ppm	As received
Thallium	0.50 ppm	As received

TABLE 3-2
TYPICAL ORGANIC SUBSTANCES PRESENT IN WDLF & WDSF

Alcohols	Degreasers
Glycols	Chlorinated Organic Liquids
Polyols	Polymers, Copolymers,
Glycol Ethers	Oligomers and Resin Fragments
Ketones	Esters
Aldehydes	Vegetable Oils & Derivatives
Aldehydes	Oxides & Epoxides
Acrylics	Ethers
Hydrocarbons	Petroleum Oils & Derivatives

Approximately 900, 3.5 gallon plastic pails filled with solid waste filter material, sludges and non-pumpable/unsuspended waste (WDSF) can be fired in the kiln on a daily basis. The pails are injected approximately 60 feet into the front of the kiln by air cannon which is set at 40 to 70 psi., depending upon the container weight which can vary between 20-35 lbs. Along with the firing of WDLF, these pails are fired into the burn zone at an approximate rate of one every 90 seconds. Pails are not fired daily, but only as supply becomes available at the facility.

A second burner for firing WDLF is installed within the coal burner pipe. This burner uses high pressure air atomization to inject WDLF directly into the kiln. The burner is rated at 44 gallons per minute, which is the anticipated burn rate for 100% replacement of coal.

Lone Star does not use as WDLF or WDSF any substances or mixtures subject to Federal PCB regulations pursuant to 40 CFR Part 761. The contents of WDLF streams vary greatly on a daily basis. Burn specification analyses for WDLF and WDSF streams are shown in Table 3-3. No. 2 fuel oil is used to preheat the kiln during start-up. The maximum coal firing rate to the kiln is 10 tph and 14 tph for precalciner. When firing WDLF at 44 gpm, no coal is fired in the kiln. The rated production capacity of the kiln is approximately 3500 to 3800 tons per day.

Shredded tires are supplied to the feed end of the kiln at the material shelf as a supplement to coal firing in the preheater. The tires are delivered to the kiln via a bucket elevator and belt conveyor. The shredded tires are conveyed directly into a chute equipped with two hydraulically controlled gates. The action of the feed gates determines the feed rate into the kiln. The maximum burn rate (approximate) for tires is 2.0 tph. A typical tire analysis is presented in Table 3-4.

TABLE 3-3
WDLF & WDSF
ANNUAL AVERAGE PCC
BURN SPECIFICATIONS
LONE STAR INDUSTRIES
CAPE GIRARDEAU, MISSOURI

COMPOUND	Maximum Limit	COC Specifications	BIF Tier Control
Total Chlorides	5.0 %	5.0%	
Antimony	50 ppm	NA	I
Arsenic	175 ppm	175 ppm	III
Beryllium	3 ppm	3 ppm	III
Cadmium	400 ppm	400 ppm	III
Chromium III	900 ppm	900 ppm	III
Chromium VI	100 ppm	100 ppm	III
Total Chromium	1000 ppm	1000 ppm	III
Barium	10,000 ppm	NA	I
Lead	700 ppm	700 ppm	III
Mercury	1.7 ppm	1.7 ppm	III
Silver	50 ppm	NA	I
Thallium	50 ppm	NA	I
Sulfur (yearly avg.)	2.7 %		
Heating Value	> 5000 Btu/lb	NA	III

TABLE 3-4
TYPICAL TIRE ANALYSIS

HHV	13,000 Btu/lb
Carbon	75.81 %
Nitrogen	7.67 %
Hydrogen	6.95 %
Sulfur	1.47 %
Oxygen	1.05 %
Moisture	0.00 %
Arsenic	< 2 ppm
Cadmium	6 ppm
Calcium	0.379 %
Chlorine	0.191 %
Chromium	0.0087 %
Fluorine	10 ppm
Iron	2.90 %
Lead	65 ppm
Mercury	<0.5 ppm
Phosphorus	0.02 %
Zinc	1.59 %

3.3 AIR POLLUTION CONTROL SYSTEM

Kiln emissions are collected with a modified Buell Model 56-RM-12 fabric filter main baghouse designed to collect raw material from the roller mill and dust generated from the kiln / preheater system. Immediately before the baghouse are four cyclones which remove most of the large particles (raw material). The baghouse is a 32 module reverse air cleaning device. This emission control system normally cleans 325,000 acfm of gases at an inlet temperature that is controlled to not exceed 350°F (roller mill by-pass condition). Under normal conditions (roller mill on-line) the inlet temperature is approximately 250° F. Kiln emissions dust is mixed in with the raw material from the rolling mill and stored in the storage silos.

The reverse air cleaning system utilizes a programmable controller unit (scheduled time periods) to control cleaning duration and sequence. Also, during cleaning cycles, acoustic horns are utilized to assist in cleaning. The reverse air fan is designed to run continuously; compartments are isolated via inlet dampers, and reverse air valves are opened to clean modules. Two modules at a time are isolated and cleaned simultaneously.

There are 56 fabric bags per module for a total of 1792 bags. The total area of cloth is 173,632 ft^2 with an air to cloth ratio of 2.01:1. The normal differential pressure drop across the baghouse is 10 in. w.c. The minimum pressure drop recommended by the manufacturer 7 in. w.c. Typically one section of the baghouse is isolated for bag replacement, an on-going process of plant maintenance.

Baghouse collection efficiency is estimated to be 99.9%. The basis for the estimation is as follows: According to stack testing done by Lone Star as well as other contractors, a typical particulate emission is 34 pounds per hour, with the MO DNR Permit Limit of 63 lbs/hr. The normal feed rate to the baghouse is 260 tph. If the cyclones immediately before the baghouse are 85% efficient, the baghouse would therefore receive 39 tph of material. The efficiency would therefore be:

$$\text{Efficiency} = \frac{[(39 \times 2000)-34]}{(39 \times 2000)} \times 100 \quad = 99.9+\%$$

Currently the only time any dust in the system is wasted (i.e. not recycled) is when the chloride bypass system is operating. This system is designed to draw off a maximum of 30% of the kiln exit gases to prevent chloride salt accumulation in the preheater section. The maximum volume drawn off is approximately 8,000 scfm. The rate of the bypass is dependent on the amount of chloride and alkali in the system. The system is designed on the theory that all chloride salts are gaseous at kiln temperatures and therefore rise to the top of the kiln. A slipstream, therefore, drawn off the top of the kiln will remove most of the undesirable salts present. A minimum of 10% of the kiln exhaust gas is bypassed during the firing of WDF.

The kiln exit temperature of the gases is above 2000° F. This dust and chloride salt laden air stream is cooled with induced ambient air and water to approximately 400°F and passed through a fabric filter baghouse to control dust in the air stream. The bypass baghouse contains 6 modules with 120 bags per module and is cleaned by reverse air. The dust collected in this baghouse is wasted (i.e. not used as product). Under normal conditions, approximately 1-3 tph of dust is collected by the baghouse. Exhaust gases from the baghouse are vented to the main kiln stack.

Draft is provided by an induced draft preheater fan rated at 430,000 acfm, while secondary combustion air is supplied by eight forced draft clinker cooler fans rated at a total of 368,000 acfm. The secondary combustion air is preheated by the clinker cooler at the front of the kiln.

3.4 KILN SAFETY SYSTEM

A Foxboro doppler flow meter is installed to control, continuously monitor, and record the WDLF firing rate. In addition, a computer is installed and programmed to energize interlocks to automatically stop the flow of WDLF to the burner if one of the following parameters are exceeded:

- Limits on CO
- THC >20 ppm corrected hourlu rolling average
- Total feed rate of WDF and WDLF
- Kiln rotation
- Maximum production rate
- Maximum or minimum combustion zone temperature (as indicated by 4th stage preheater thermocouple)
- Maximum flue gas temperature entering the main baghouse
- Main baghouse minimum ΔP

In addition, an alarm and light signals the WDSF operator to cease manually injecting pails when limits are approached.

Kiln operators, along with the kiln microprocessor based control system programmed to initiate operator alarms, are continually monitoring and logging key operating parameters and are conscious of changing readings or unusual conditions which can be indications of potential problems. The control system warns of problems before they become critical, to allow time for corrective action. Copies of the log sheets are presented in the Appendix of this report.

3.5 COC PROCESS OPERATIONS

The CŌC was performed in two phases; coal only and coal/WDF/tires. Phase 1 was performed in April 1992, while Phase 2 was performed in June.

3.5.1 Phase 1

Phase 1 was performed in conjunction with a Tire Trial Burn Program in April, and serves as background comparison when the only fuel to the kiln was coal. The kiln was operated under normal conditions during this period. A summary of average kiln conditions is presented in Table 3-5A.

Kiln feed averaged between 252 and 257 tph for the 6 tests performed during Phase 1. 8.1 to 8.5 tph coal was fired in the kiln with an additional 11.9 to 12.1 in the preheater (RSP). Combustion zone temperatures as indicated by the fourth stage of the preheater (as a surrogate, as there is no practical was to monitor actual combustion zone temperatures on a continuous basis) ranged from 1678°F to 1695°F.

3.5.2 Phase 2

During Phase 2, two distinct abnormal operating conditions were run in an attempt to set minimum and maximum kiln operating limits. This typically meant running the kiln under near upset conditions while still producing saleable product. In an attempt to set minimum and maximum hourly rolling averages for operational parameters as required by BIF, it should be noted that it was necessary to manipulate the kiln to the edge of upset and/or shut-down conditions. Operation was then held at this point as long as possible to set the limitation by establishing a 1-hour rolling average, as required by Section 5.3.1 of "Technical Implementation Document for EPA's Boiler and Industrial Furnace Regulations" (EPA-530-R-92-011, March 1992).

Phase 2 was performed in June 1992 under two distinct kiln operating conditions of maximum and minimum combustion chamber temperatures as discussed in Section 1.1, (1) minimum burning zone temperature conditions and (2) maximum burning zone temperature conditions. Three tests were performed for particulate, POHC, HCl, Cl_2, THC, and CO while the kiln was firing approximately 44 gpm (352 lbs/min) of combined WDLF and WDSF in the front end of the kiln as an energy replacement for kiln coal, and approximately 1.5 tph of shredded tires at the material shelf at the back end of the kiln as supplemental heat to the precalciner.

These tests were performed at minimum combustion chamber conditions, as represented by the temperature of the fouth stage of the preheater, representing 100% energy replacement of the kiln coal. The WDSF was preweighed in 3.5 gallon plastic pails and "shot " into the burning zone of the kiln with an air cannon. Each bucket contained API separator sludge and weighed 25 pounds. An effort was made to procure and blend a waste fuel simulating as closely as possible worst case conditions for chlorides and Btu content. This WDF contained a minimum of 5000 Btu/pound and a maximum of 5% chloride. The rate of firing of the two waste derived fuels was set to maximize the **total hazardous fuel feed stream,** as required by the BIF regulation, at approximately 44 gal/min. This limit is based on a MO DNR limitation of 20,000,000 gal/year. WDLF was injected by a lance placed in the coal burner pipe, while WDSF was placed in 3.5 gallon buckets preweighed at 25 pounds each and fired into the burning zone of the kiln via an air cannon.

Pails were not continually fired during the entire period of each test. When the shooting of pails was ceased in order to maintain kiln operations, the WDLF rate was adjusted to increase the **total hazardous fuel feed stream** to 44 gal/min. In a similar manner, when pails were injected, the WDLF feedrate was decreased to bring the **total hazardous fuel feed stream** to 44 gal/min. The minimum burning zone conditions were maintained as was practicable to set the minimum 60-minute rolling average temperature limit as indicated by the temperature of the fourth stage of the preheater. WDLF was spiked with surrogate POHC to demonstrate destruction under minimum combustion chamber temperatures. No spiking of WDSF in pails was performed.

A summary of Phase 2 / Minimum Combustion Temperature kiln operations is presented in Table 3-5B. Tests 3, 4 and 5 represent this condition. In addition, the following represent the **total hazardous fuel feed stream (THFFS)** to the kiln on 25 June:

Test#	WDLF (gpm)	WDSF (gpm)	THFFS (gpm)
3	42.6	1.8	44.4
4	41.7	2.1	43.8
5	41.8	1.9	43.7

As can be determined, the sum of these two rates is approximately 44 gal/min. The average of these numbers was used to determine the total hazardous feed rate to the kiln. However, the maximum pumpable feed rate was determined by the highest hourly rolling average of liquid fuel when buckets were not utilized as fuel.

Kiln feed averaged 241 tph for the three tests performed under this operating condition, with an average fourth stage preheater temperature of 1652°F. Specific trends for these operations can be seen in Figures 3-3, 3-4 and 3-5. These figures represent operations during attempts to establish minimum and maximum kiln operating limits. This typically meant running the kiln under near upset conditions while still producing saleable product. In an attempt to maintain minimum operating temperatures during each test run, it was necessary to decrease kiln feed following the establishment of the 60-minute rolling average maximum to prevent total upset conditions. Due to these requirements, it was impossible to maintain "steady state" operations throughout each test period, as would be done for a normal (non-BIF) test program).

For Phase 2 maximum burning zone temperature conditions, triplicate tests for metals, Cr^{+6}, THC, and CO were performed. To condition the kiln system, maximum metals were spiked for a period of twelve hours before the start of the first test to ensure that the kiln system approached equilibrium with regards to metals before testing. In addition, analyses of kiln inputs and outputs were performed hourly to determine equilibrium for each metal. A graphic presentation of equilibrium (not to be confused with "steady state", where equilibrium is defined as "the condition where a change in inputs causes an equivalent change in outputs") demonstrations for each metal is presented in Appendix D.

In addition, Region VII BIF coordinator, Joe Galbraith, met with Lone Star and APCC in December 1991 following review of the COC Test Protocol and at that time required twelve hours of preconditioning at maximum metals feedrates prior to metals testing. The same fuels that were utilized under minimum combustion conditions were also used under this condition. WDLF and WDSF fuels rates were adjusted in the same manner as described above. Maximum combustion chamber temperatures were achieved by increasing the coal fired to the kiln precalciner. Under this condition the feed enters the kiln in a more prepared state and the temperature in the burning zone of the kiln increases. This is because the actual clinkering inside the kiln is somewhat exothermic, while calcination is an endothermic process.

A summary of Phase 2 / Maximum Combustion Temperature kiln operations is presented in Table 3-5B. Tests 6, 7 and 8 represent this condition. In addition, the following represent the **total hazardous fuel feed stream (THFFS)** to the kiln on 26 June:

Test#	WDLF (gpm)	WDSF (gpm)	THFFS (gpm)
7	42.6	0.6	43.1
8	43.3	0.6	43.8
9	43.3	0.8	44.1

As can be determined, the sum of these two rates is approximately 44 gal/min. The average of these numbers was used to determine the total hazardous feed rate to the kiln. However, the maximum pumpable feed rate was determined by the highest hourly rolling average of liquid fuel when buckets were not utilized as fuel.

These tests were performed at maximum combustion chamber temperature, as represented by the temperature of the fouth stage of the preheater, representing 100% energy replacement of the kiln coal. The WDSF was preweighed in 3.5 gallon plastic pails and "shot " into the burning zone of the kiln with an air cannon. Each bucket contained API separator sludge and weighed 25 pounds. An effort was made to procure and blend a waste fuel simulating as closely as possible worst case conditions for chlorides and Btu content. This WDF contained a minimum of 5000 Btu/pound and a maximum of 5% chloride. The rate of firing of the two waste derived fuels was set to maximize the **total hazardous fuel feed stream**, as required by the BIF regulation, at approximately 44 gal/min.

As in the minimum temperature scenario, pails were not continually fired during the entire period of each test. When the shooting of pails was ceased in order to maintain kiln operations, the WDLF rate was adjusted to increase the **total hazardous fuel feed stream** to 44 gal/min. In a similar manner, when pails were injected, the WDLF feedrate was decreased to bring the **total hazardous fuel feed stream** to 44 gal/min. WDLF was spiked with metals and additional metals fed in solid form through the coal pipe to demonstrate SRE under maximum combustion chamber temperatures. No spiking of WDSF in pails was performed.

Kiln feed averaged 251 tph for the three tests performed under this maximum temperature operating condition, with an average fourth stage preheater temperature of 1669°F. Specific trends for these operations can be seen in Figures 3-6, 3-7 and 3-8. Also included in these figures is the WDLF feedrate in gph. These figures represent operations during attempts to establish maximum kiln operating limits for metals feedrates, kiln feed and combustion zone temperature. This typically meant running the kiln under near upset conditions while still producing saleable product. As can be seen, from an operational point of view, it is easier to maintain maximum operating

TABLE 3-5A
PROCESS DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST/PHASE 1
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Apr-92

TEST # TIME	Main Baghouse		FEED END	4TH STAGE	KILN	STACK	Kiln I.D. Fan			KILN	RSP
	Δ PRESS	TEMP	O2	TEMP	FEED	OPACITY	TEMP	PRESS	SPEED	COAL	COAL
UNITS	IN. WC	°F	%	°F	TPH	%	°F	IN. WC	RPM	TPH	TPH
4/13/92											
TEST 2 9:25-12:48	12.2	204	4.3	1678	253.7	12.4	389	37.5	822.3	8.4	12.1
TEST 3 13:08-16:20	12.1	210	4.2	1683	252.5	14.4	388	37.5	823.3	8.4	11.9
TEST 4 16:55-20:06	11.6	208	4.4	1693	253.7	12.7	390	37.6	824.0	8.4	11.8
4/14/92											
TEST 6 11:28-14:05	11.5	200	4.1	1695	258.6	12.1	389	38.3	826.0	8.5	12.0
TEST 7 16:11-18:35	11.8	200	3.6	1684	257.4	12.3	387	38.1	823.0	8.3	11.9
TEST 8 20:33-22:48	11.4	198	3.3	1694	257.4	11.8	390	38.4	829.5	8.1	12.2

TABLE 3-5B
PROCESS DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

TEST #	Main Baghouse		Bypass Baghouse		FEED END	4TH STAGE	KILN	STACK	Kiln I.D. Fan			WDLF	WDSF	TIRES
TIME	Δ PRESS	TEMP	Δ PRESS	TEMP	O2	TEMP	FEED	OPACITY	TEMP	PRESS	SPEED	FLOW	FLOW	FEED
UNITS	IN. WC	°F	IN. WC	°F	%	°F	TPH	%	°F	IN. WC	RPM	GPM	TPH	TPH
6/25/92														
TEST 3 8:33-11:33	11.6	224.8	3.5	417	3.1	1644	240	8.8	367	38.9	862	42.6	1.79	1.5
TEST 4 17:48-20:48	11.4	223.7	3.4	411	3.8	1651	242	8.6	367	37.9	866	41.7	2.08	1.5
TEST 5 21:48-00:48	11.5	220.3	3.3	410	3.6	1662	241	8.2	356	38.2	866	41.8	1.89	1.5
6/26/92														
TEST 7 13:49-16:49	10.5	292.0	3.0	431	4.5	1673	251	9.8	386	38.6	873	42.6	0.57	1.5
TEST 8 18:04-20:34	10.3	305.9	3.0	433	6.9	1665	251	9.0	388	37.6	867	43.3	0.57	1.5
TEST 9 21:49-00:19	10.3	308.5	3.0	428	6.4	1669	251	9.0	389	38.4	869	43.3	0.83	1.5

FIGURE 3-3 KILN OPERATION TRENDS - 6/25/92 TEST 3 - (8:33 - 11:33)

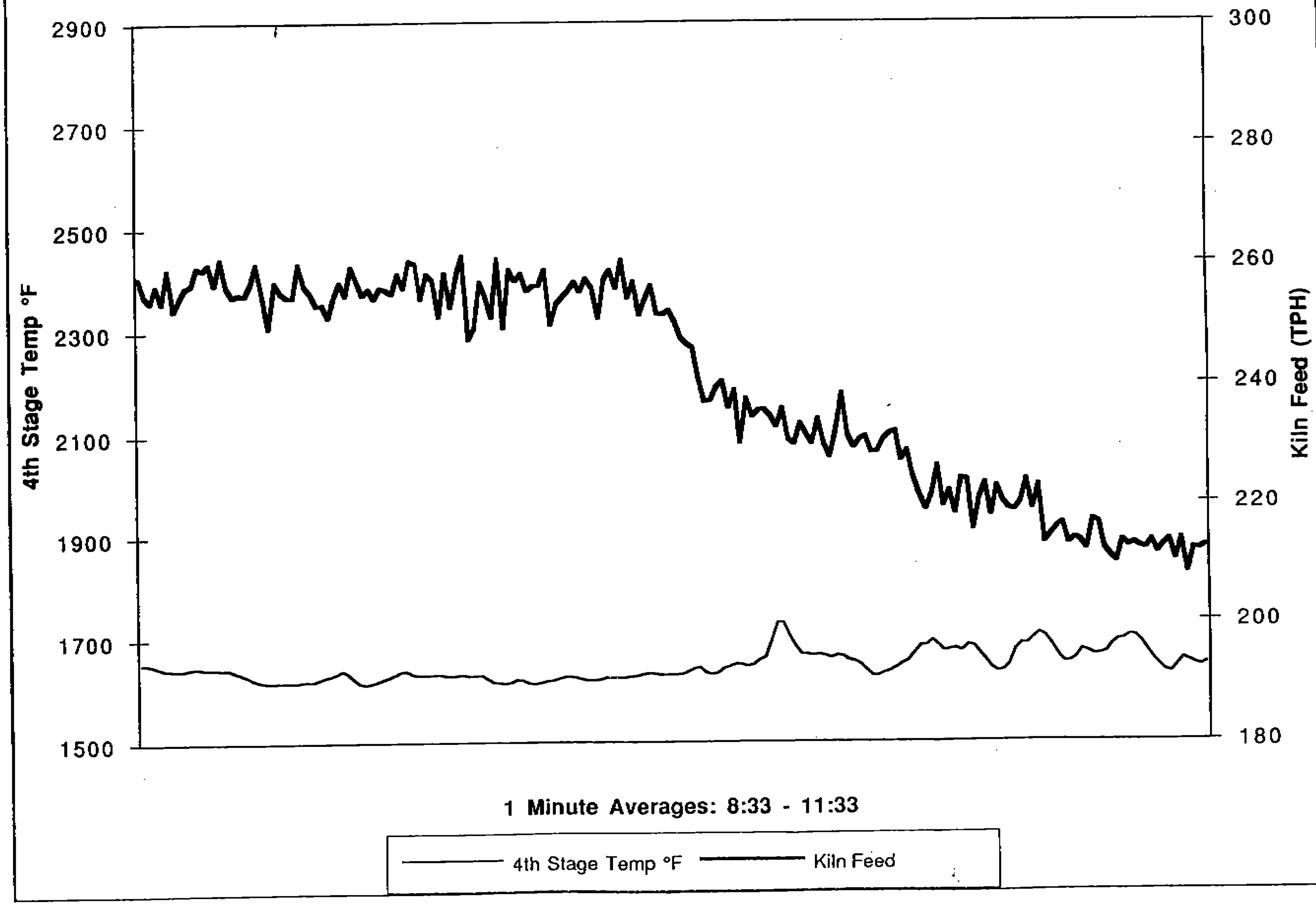


FIGURE 3-4 KILN OPERATION TRENDS - 6/25/92 TEST 4 - (17:48 - 20:48)

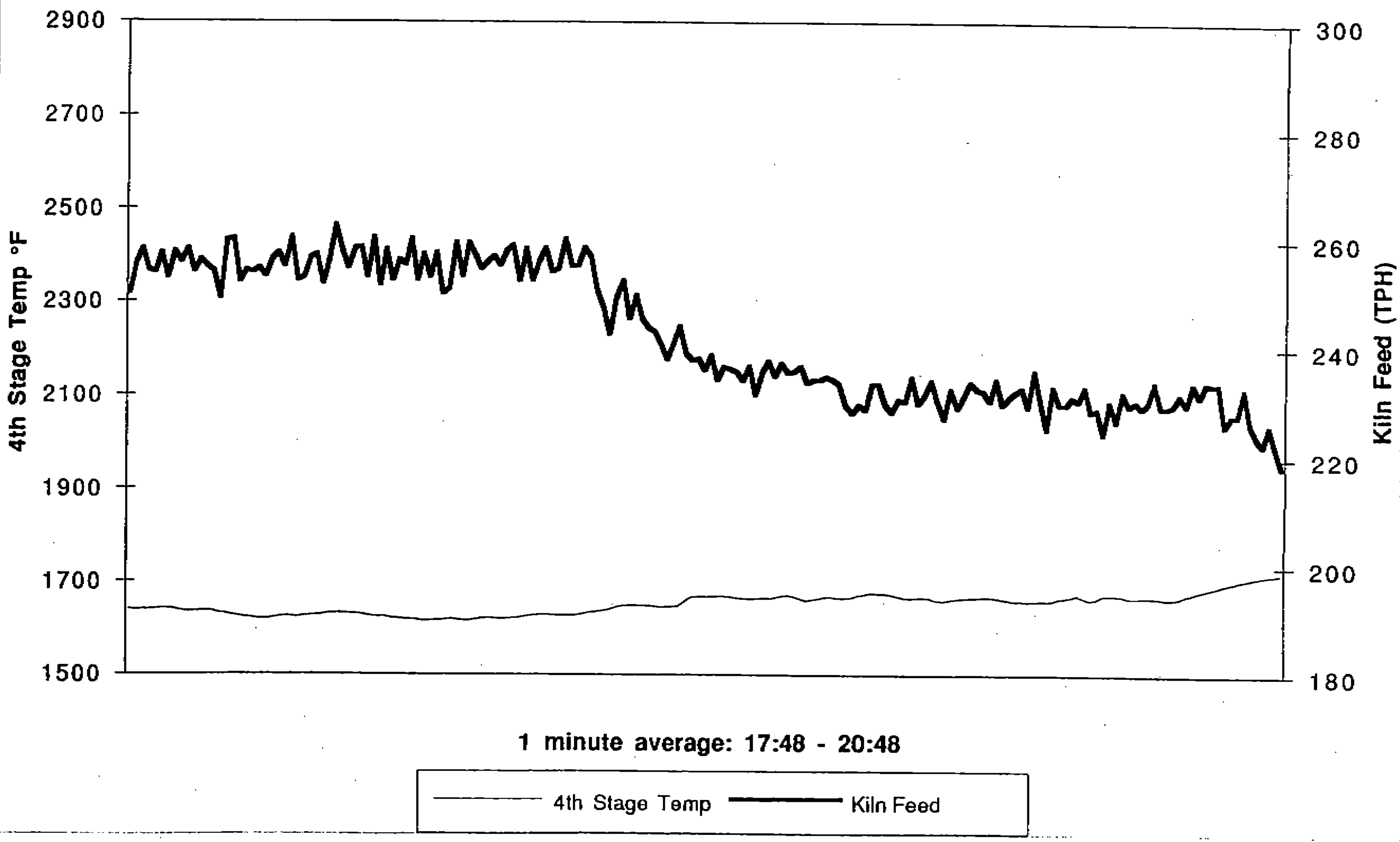


FIGURE 3-5 KILN OPERATION TRENDS - 6/25/92 TEST 5 - (21:48 - 00:48)

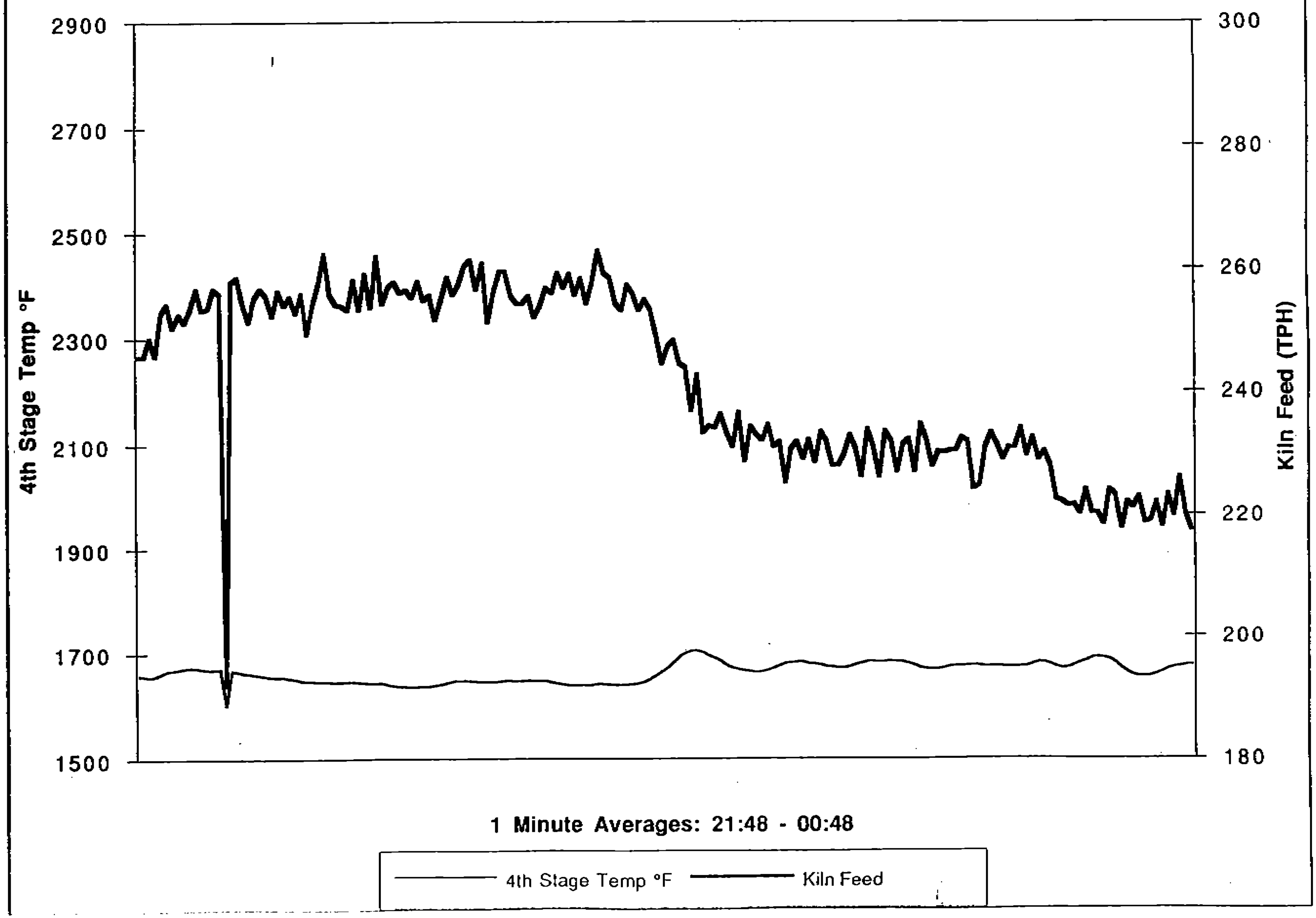


FIGURE 3-6 KILN OPERATION TRENDS - 6/26/92 TEST 7 - (13:49 - 16:49)

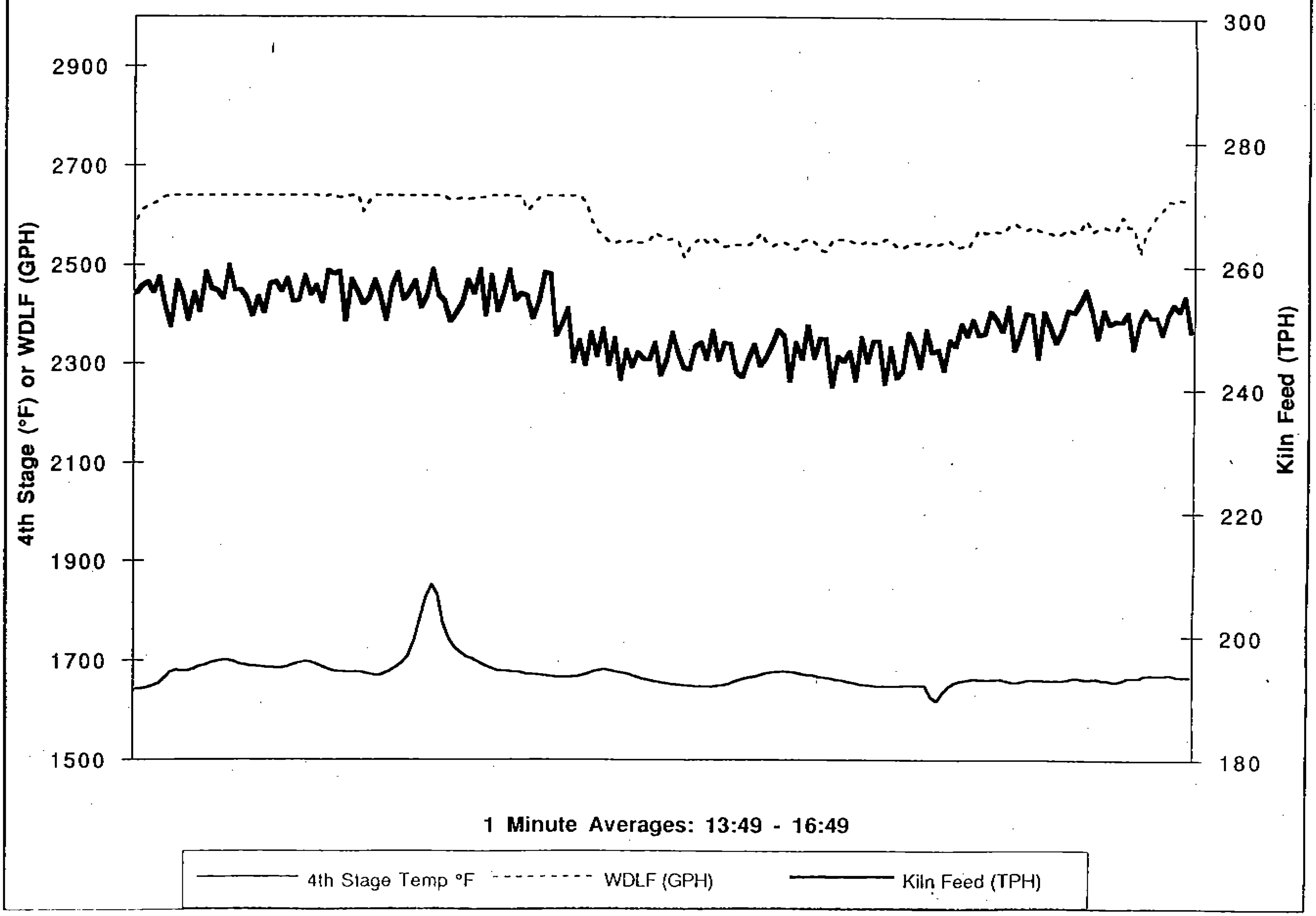


FIGURE 3-7 KILN OPERATION DATA - 6/26/92 TEST 8 - (18:04 - 20:34)

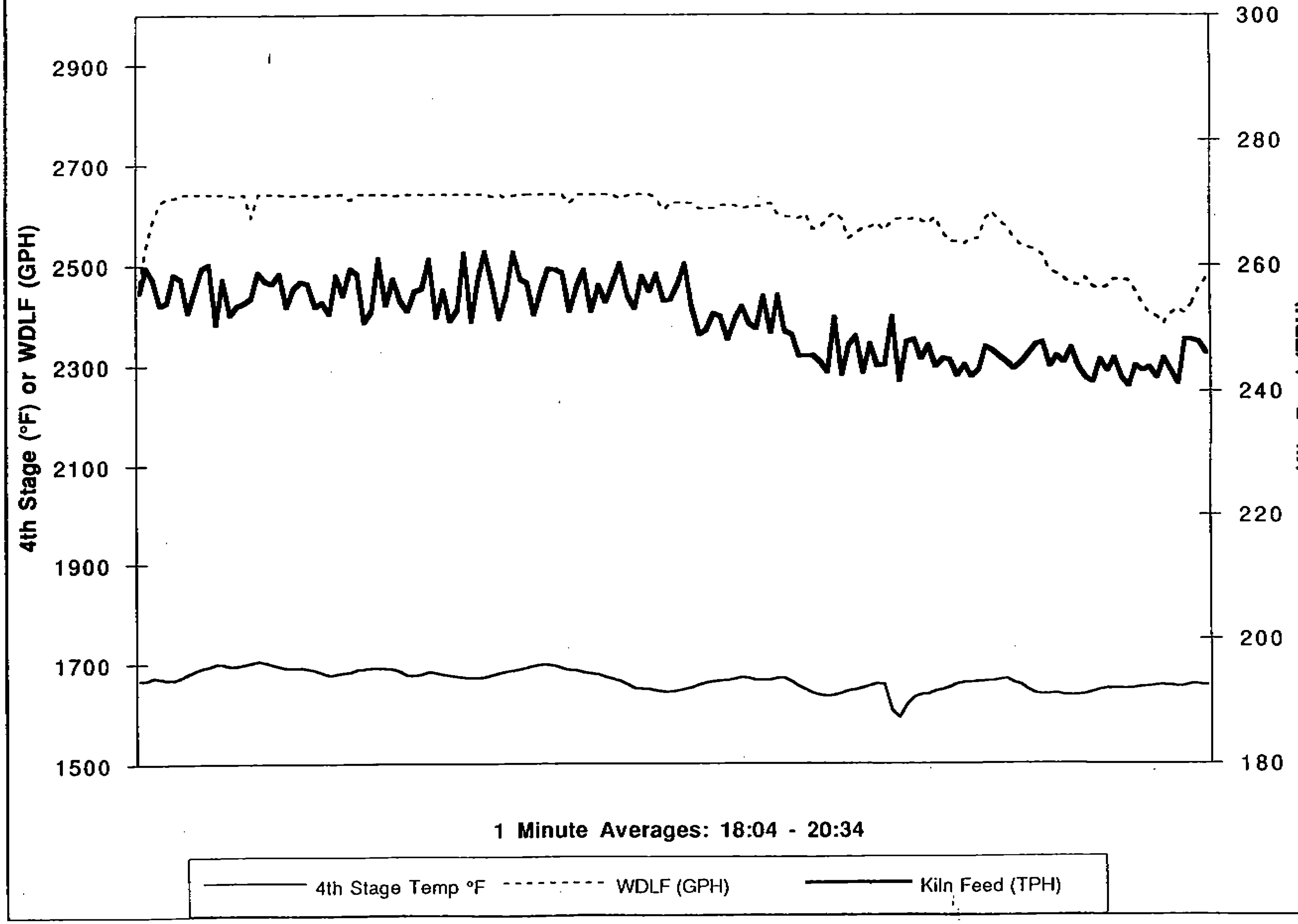
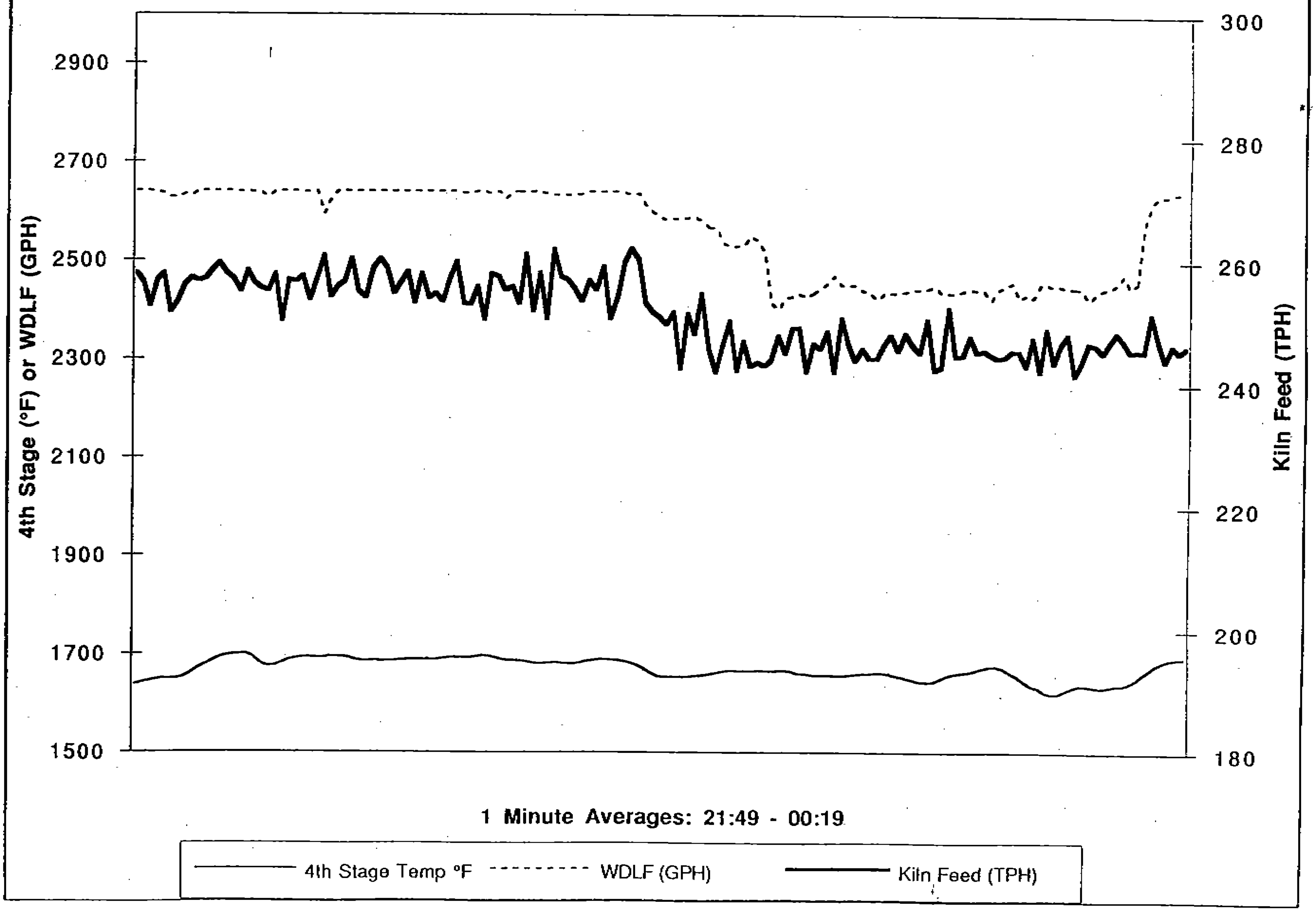


FIGURE 3-8 KILN OPERATION DATA - 6/26/92 TEST 9 - (21:49 - 00:19)



temperatures during each test run, without altering kiln feed following the establishment of the 60-minute rolling average . Due to these factors, it was possible to maintain more "steady state" operations throughout each test period.

3.6 METALS SPIKING

The Lone Star Cape Girardeau plant sampled for six metals under the BIF Tier III Criteria. These metals are Arsenic, Beryllium, Cadmium, Chromium III & VI, Lead, and Mercury. The maximum metals concentrations in the waste fuel as described in the Precompliance Certification are as follows:

Arsenic	170 PPM
Beryllium	3 PPM
Cadmium	400 PPM
Chromium (III)	900 PPM
Chromium (VI)	100 PPM
Lead	700 PPM
Mercury	1.7 PPM

Prior to the start of each phase of testing, the kiln was allowed to reach equilibrium while burning spiked fuels. Lone Star determine equilibrium by spiking the waste fuel with metals and taking half-hourly dust samples from the kiln. The samples was analyzed for the surrogate metals. When the plot of the lbs/hr inputs flattened, then equilibrium was reached. These data are presented in Appendix D.

With the exception of Cr^{+6}, these metals were introduced into the pumpable hazardous waste feed stream and, therefore, represent the most conservative approach to obtain the maximum level of metals allowed in all feed streams. However, it was not possible to obtain the maximum level of all metals as a hazardous feed stream, and therefore it was necessary to spike some of the metal to achieve maximum metal feed rates. Cr^{+6} was spiked as a powder through the kiln coal injection system.

During the metal testing for BIF compliance the pumpable hazardous feed stream was sampled at 15 minute intervals, composited, and analyzed for metals for each test period. Prior to the start of the test, 80,000 gallons (2 tanks) were adjusted for the maximum metals concentrations.

Prior to and during each test the feed stream was adjusted for total metals input by spiking. The method of spiking was to add the metals in fine powered form to the coal system that blows coal in the front of the kiln. The metals were added through a rotary feeder directly into the pulverized coal transport pipe. The powdered metal was blown into the kiln directly into the flame. This represents a conservative approach since the metals in powered form entering the flame volatilize very rapidly. All Cr^{+6} were added like this.

The compounds used for spiking metal were:

Beryllium sulfate
Cadmium oxide
Potassium dichromate (Cr^{+6})

Lead oxide
Mercuric chloride
Chromium III oxide

The use of pumpable hazardous stream with maximum metal concentration and metal spiking began 12 hours before the stack test for metal removal efficiency. This was to ensure that the kiln system achieved equilibrium conditions with respect to metals. Samples of inputs and outputs were taken every 30 minutes during this period to establish when equilibrium was reached. Metal removal efficiency was determined while burning coal (precalciner), hazardous waste and tires.

Since the Lone Star Cape Girardeau plant also proposed to burn solid hazardous waste by injecting the pails into the burning zone of the kiln, pails were also injected into the kiln burning zone via an air cannon during the entire test. The injection was done during the same time interval as the metal spiking occured. No spiked metal was introduced into these solid streams. The metals introduced by the solid stream were accounted for in the total metal input to the kiln system. The pails were injected into the kiln approximately 70-90 feet from the material discharge end of the kiln. The gas temperature at this point in the kiln is in excess of 3000° F. The material temperature is above 2300° F.

To ensure maximum volatilization of metals during this compliance testing maximum combustion zone temperature and maximum flue gas temperature entering the PM control device were achieved. The burning zone control for maximum temperature was the 4th stage gas inlet temperature which represents the position nearest the burning zone where temperature can be reliably measured. Temperature entering the main and bypass fabric filter APCD was monitored on a continual basis and maximized during this testing.

3.7 POHC SPIKING

The COC test meets the requirements of the State of Missouri Department of Air Management. This department required Lone Star to conduct performance testing within 60 days of achieving maximum hazardous fuel kiln rate and in no case later than 180 days after the initial burn date of April 28, 1992. The testing was to demonstrate the following destruction and removal efficiencies:

Lead	98%
Mercury	33%
Beryllium	99%
VOC -	99.99%

To determine compliance with the organic emission limits, testing was performed with the kiln operating at minimum burning zone temperature conditions. To ensure this condition, the temperature was monitored at the 4th stage preheater inlet. This is the position nearest the burning zone where temperature can reliability be measured. This is the most conservative approach to prove thermal destruction of POHC.

To demonstrate 99.99% destruction of volatile organic compounds, principal organic hazardous constituents (POHC) were spiked in the liquid pumpable hazardous waste streams. The emissions of POHC were sampled in the stack in order to calculate the destruction and removal efficiency (DRE). Perchloroethylene (C_2Cl_4) and 1,1,1 trichloroethane ($C_2H_3Cl_3$) and 1,1,2 trichloroethane ($C_2H_3Cl_3$) were used as surrogate POHC for this program.

To ensure that sufficient POHC was introduced to the kiln, each POHC was planned to be burned at approximately 100 lbs/hr. This was assuming that the stack flow rate is 260,000 scfm and the POHC detection limit is 1 ng/l. Since this hazardous fuel stream was burned at approximately 44 gal/min during the testing, a blend tank containing approximately 1 % of each POHC was prepared prior to the test. This material was then burned for the duration of the DRE test for volatile organic compounds. The burning of the fuel containing the POHC began at least two hours prior to testing. This provided sufficient time to achieve equilibrium in the kiln.

The particular POHC were chosen to demonstrate the thermal destruction of cement kilns because:

1. According to the Thermal Stability Index and Heat of Combustion, these POHC's are difficult to destroy.

2. These compounds can be analyzed relatively free of interference, and therefore measured with precision.

3. These compounds are not known to be products of incomplete combustion from coal or hazardous waste. They are therefore indicators of performance independent of other compounds in the process.

3.8 PROCESS MASS BALANCE SAMPLING

A sample was drawn from the spiked WDLF mix tank after it had been circulated for a period of at least four hours and was well mixed. The sample was analyzed for POHC, metals, chlorine, total chloride and Burn Specifications prior to use. Samples of raw materials and product were taken during the COC emission tests at 15 minute intervals and composited for chlorides & metals analyses.

Raw Materials

- Coal feed belts (2)
- Water for the Conditioning Tower
- Raw material feed
- Tire feed
- WDLF feed
- WDSF feed
- Spent kiln brick (not available during COC)

Product

- Clinker cooler conveyer
- Kiln dust
- Bypass baghousehopper

4.0 SAMPLING AND ANALYTICAL METHODS

Air pollution emission measurements were performed during the COC at the single exhaust stack to determine emission concentrations and rates of particulate matter (PM), heavy metals (HM), chlorides (HCl), chlorine (Cl_2), Principal Organic Hazardous Constituents (POHC) and Hexavalent Chromium (Cr^{+6}). Carbon monoxide (CO), Total Hydrocarbons (THC) and oxygen (O_2) measurements were performed at the main stack (APCC CEMS) as well as the kiln bypass (Lone Star CEMS) to determine compliance with BIF regulations.

In addition to the air pollution measurements, product samples were drawn from the dust collector, kiln dust duct, and clinker cooler discharge conveyer. Raw feed samples were taken at the entrance to the kiln at the back end. WDLF samples were drawn from the feed loop pipe on the burner floor. Pails were opened prior to injection into the air cannon and samples drawn. Coal samples were taken from the coal transport pipes to the pre-calciner. Tires were sampled from the feed bin. Water samples were taken from the conditioning tower. Samples were analyzed for metals, chloride and chlorine content in order to perform a mass balance of the kiln system.

4.1 STACK EMISSION MEASUREMENTS

Emission measurements were performed to determine emission concentrations and rates of PM, heavy metals, Cr^{+6}, chloride, chlorine, POHC, THC, CO, O_2 and CO_2. Sampling was performed in accordance with EPA Reference Methods 1, 2, 3, 3A, 4, 5 (modified), 10, 25A and SW 846 0012, 0030, and 0050.

4.1.1 Particulate, HCl, and Chlorine Emission Measurements

Emissions of Particulate, Hydrogen Chloride (HCl) and Chlorine (Cl_2) were determined in accordance with EPA Methods 1-5 and SW 846 Method 0050 as published in the December 1990, Methods Manual For Compliance With The BIF Regulations. Sampling and analyses were performed in strict accordance with the method using a sampling train schematically similar to the one presented in Appendix E.

The glass nozzle is attached to a glass-lined probe which is heated to 248±25°F to prevent condensation. Pall quartz filter paper supported in a 4-1/2 inch Teflon filter holder is used as the collection media. The filter assembly is enclosed in a heated box to maintain temperatures of 248± 25°F to prevent condensation. A thermocouple is located inside the back half of the filter holder to monitor the gas stream temperature. An ice bath containing six impingers is attached to the back end of the filter via a flexible Teflon sample line.

The first impinger (optional) contains 50 ml of 0.1N sulfuric acid and is used as an additional moisture knockout. The second and third impingers each contain 100 ml of 0.1N sulfuric acid. The fourth and fifth impingers each contain 100 ml of 0.1N sodium hydroxide. The sixth contains 200 g indicating silica gel to remove any remaining moisture from the sampling train. Flexible tubing, vacuum gauge, needle valves, leakless vacuum pump, bypass valve, dry gas meter, calibration orifice and inclined manometer complete the sampling train. The stack velocity pressure is measured using an S-type pitot and inclined manometer. The stack temperature is monitored by a thermocouple connected to a potentiometer.

A nomograph is used to quickly determine the orifice pressure drop required for a pitot velocity pressure and stack temperature in order to maintain isokinetic sampling conditions. Sampling flow is adjusted by means of the bypass valve. Before and after each particulate test run, the sampling train is leak checked (acceptable at less than 0.02 cfm).

Sample recovery was performed in a relatively clean, environmentally controlled shelter constructed on the pre-heater tower. After the probe has been removed from the stack and allowed to cool, particulate matter is wiped from the exterior of the nozzle and the nozzle capped to prevent loss (or gain) of sample. The Teflon sample line is then removed from the filter holder and impinger train. The filter outlet is sealed with Para-film. The Teflon sample line is sealed at both ends. The impinger outlet vacuum line is then removed and the impinger train sealed. The impinger train is inspected and abnormal conditions noted before disassembly. Samples are recovered and placed in Teflon sealed glass containers as follows:

Container No. 1 - The 4-1/2 inch quartz filter is removed from its holder and placed in a petri dish, sealed, and labeled.

Container No. 2 - The probe, nozzle, and front half of the filter holder are brushed and rinsed three times with acetone. The wash is deposited in a 500 ml sample jar and labeled.

Container No. 3 - The volume of the first , second and third impinger solutions are measured and recorded. The solutions are then deposited in a 500 ml or 1000 ml glass sample jar. The impinger, Teflon line, and the back half of the filter holder are then rinsed three times DI water and the rinse added to the impinger solutions. The jar is sealed and labeled, and the liquid level marked.

Container No. 4 - The volume of the fourth and fifth impinger solutions are measured and recorded. The solutions are then deposited in a 500 ml glass sample jar. The impingers are then rinsed three times with DI water and the rinse added to the impinger solutions. The jar is sealed and labeled, and the liquid level marked.

Container No. 5 - The silica gel is replaced in its original container.

The samples will be transported to the laboratory and analyzed utilizing EPA Methods 5 and 9057 (ion chromatography) in accordance with the sampling method 0050.

Container No. 1- Desiccate and weigh to constant weight.

Container No. 2- Evaporate at ambient pressure and temperature. Desiccate and weigh to constant weight.

Container No. 3- Analyze chloride content by Ion Chromatography

Container No. 4- Analyze chlorine content by Ion Chromatography

Container No. 5 - Weigh silica gel to the nearest 0.5 g. The weight of the moisture entrapped in the silica gel, along with the weight of moisture which is condensed in the impingers, is used to calculate the moisture content of the flue gas.

Computer programs developed for the Macintosh computer and HP-41CX hand held calculator are used to calculate emission rates in grains per dry standard cubic foot, $\mu g/m^3$ and pounds per hour. The program also calculates percent moisture, molecular weight of the stack gas at stack conditions, and the percent isokinesis.

4.1.2 O_2, CO_2 and CO Manual Determination

An integrated gas sample is drawn from the main exhaust stack into a Tedlar bag at approximately 0.25 lpm simultaneously with each reference method test performed as described in Sections 3.1.1, and 3.1.3. These samples are drawn through a probe integral with the main sampling probe and analyzed on a dry basis in accordance with EPA Method 3A using combustion gas analyzers as described below in Section 4.1.6. Percent CO_2 and O_2, as well as ppm CO and the molecular weight of the gas stream, are determined from the analyses, which were used only as a QA check on the CEMS.

4.1.3 Heavy Metals Emission Measurement

Sampling was performed to determine emissions of heavy metals utilizing a modified EPA Method 5 sampling train and the SW Method 0012, "Methodology for the Determination of Metals Emissions in Exhaust Gases from Hazardous Waste Incineration and Similar Combustion Processes" as presented in 40 CFR 266.106, Appendix IX. Samples were analyzed for As, Be, Cd, Cr, Pb, & Hg.

<u>Sample Collection</u>

Sampling was performed isokinetically at traverse points as presented in Section 5. A typical sample volume 80 to 90 dscf in order to achieve minimum desired detection limits.

Metals sampling was performed using the modified EPA Method 5 collection train, described in the July 1, 1984 edition of the Federal Register as well as the method referenced above. It is shown schematically in Appendix E and consists of a quartz nozzle, probe, filter, a flexible Teflon umbilical line, seven impingers, vacuum pump, dry gas meter, and an orifice flow meter. The modification of this standard EPA

Method 5 train consists of placing a flexible Teflon sample line between the filter and the impingers. This modification makes the sampling equipment much less awkward. Complete sampling train calibrations are performed before and after every compliance test program.

A quartz nozzle is attached to a glass-lined probe which is heated to 248± 25°F to prevent condensation of moisture. Whatman glass fiber EPM 2000 filter paper supported in a 4-1/2 inch glass filter holder (Teflon frit) is used as the collection media. The filter assembly is enclosed in a heated box to maintain temperatures at 248± 25°F. A thermocouple is located inside the back half of the filter holder, to monitor the gas stream temperature and verify that it is kept at 248± 25°F. An ice bath containing seven impingers is attached to the back end of the filter via a flexible Teflon tube. The first impinger (optional) is left empty and is used as an additional moisture knockout in high moisture stack streams. The second and third impingers each contain 100 ml of 5% nitric acid/10% hydrogen peroxide solution. The fourth impinger is empty. The fifth and sixth each contain 100 ml 4% potassium permanganate / 10% sulfuric acid solution, and the seventh contains 200 g of indicating silica gel to remove any remaining moisture. Flexible tubing, vacuum gauge, needle valve, leakless vacuum pump, bypass valve, dry gas meter, calibrated orifice and inclined manometer complete the sampling train. The stack velocity pressure is measured using an S-type pitot tube and inclined manometer. The stack temperature is monitored by a thermocouple that is attached to the pitot and connected to a potentiometer. A check valve is not used in this sampling train.

A nomograph is used to quickly determine the orifice pressure drop required for any pitot velocity pressure and stack temperature in order to maintain isokinetic sampling conditions. Sampling flow is adjusted by means of the bypass valve. Before and after each test run the sampling train is leak checked (acceptable at less than 0.02 cfm). Test data is recorded on field data sheets as presented in the Appendix B.

<u>Sample Recovery</u>

Sample recovery was performed in a relatively clean, environmentally controlled shelter constructed on the pre-heater tower. After the probe has been removed from the stack and allowed to cool, particulate matter is wiped from the exterior of the nozzle and the nozzle capped with Parafilm to prevent loss (or gain) of sample. The Teflon sample line is then removed from the filter holder and impinger train. The filter outlet is sealed with Parafilm. The Teflon sample line is sealed at both ends. The impinger outlet vacuum line is then removed and the impinger train sealed. The impinger train is inspected and abnormal conditions noted before disassembly. Samples are recovered and placed in Teflon sealed glass containers as follows:

Container No. 1 The 4-1/2 inch glass fiber filter is removed from its holder and placed in a 1000 ml sample jar and labeled.The probe, nozzle, and front half of the filter holder are brushed and rinsed three times with nitric acid solution. The wash is deposited into the same container.

Container No. 2 — The volumes of the first three impingers are measured and recorded. The solutions are then deposited in a 1000 ml glass sample jar. The impingers, Teflon line, and the back half of the filter holder are then rinsed three times with nitric acid solution and the rinse added to the impinger solutions. The jar is sealed and labeled, and the liquid level marked.

Container No. 3 — The volume of the fourth impinger is determined and the contents emptied into a 500 ml sample jar. The impinger is then rinsed in triplicate with 100 ml nitric acid solution. The jar is sealed and labeled, and the liquid level marked.

Container No. 4 — The volume of the fifth and sixth impinger is determined and the contents emptied into a 500 ml sample jar. The impinger is then rinsed in triplicate with potassium permanganate solution and added to the container. Any remaining residue is then removed by rinsing with DI water and also deposited into the container. The jar is sealed and labeled, and the liquid level marked.

Container No. 5 — Any remaining residue in the fifth and sixth impingers is removed by rinsing with 8N HCl, and deposited in the container. The jar is sealed and labeled and the liquid level marked. This container is optional and only for cleaning any remaining residue after the DI rinse.

Container No. 6 — The silica gel is replaced in its original container.

Sample Analysis

Sample analyses were performed by Triangle Laboratories (TL), Inc. at Research Triangle Park, NC following SW Method 0012, "Methodology for the Determination of Metals Emissions in Exhaust Gases from Hazardous Waste Incineration and Similar Combustion Processes" guidelines by graphite furnace atomic absorption spectroscopy (GF-AAS), inductively coupled argon plasmography (ICAP), or cold vapor atomic absorption spectroscopy (CV-AAS). The technique with the lowest analytical detection limit was utilized for each metal.

Container No. 1 — The filter is divided into 0.5 g portions and digested by microwave or Par bomb method and combined with the acid digestion of probe rinse.

The nitric acid wash is acidified to a pH 2, reduced to dryness and digested as Container No.1. The sample is then combined with Container No.1 filtered and diluted. A 50 ml aliquot is taken and analyzed for Hg by CV-AAS. The remainder of sample is then analyzed for heavy metals by GF-AAS or ICAP.

Container No. 2	A 75 to 100 ml aliquot is taken and analyzed for Hg by CV AAS. The impinger solution is acidified with nitric acid to a pH 2, reduced to dryness and digested by conventional or microwave method. The sample is then analyzed for heavy metals by GF-AAS.
Container No. 3	The volume of this container is measured. The sample is then analyzed for Hg by CV-AAS.
Container No. 4	The volume of this container is measured. The sample is then analyzed for Hg by CV-AAS.
Container No. 5	The volume of this container is measured and diluted to 500 ml. The sample is then analyzed for Hg by CV AAS.
Container No. 6	The silica gel is weighed to the nearest 0.5 grams.

Blank filters and reagents taken prior to the test program and during the actual field test are analyzed in a manner identical to the actual samples in order to detect for background contamination.

4.1.4 Volatile POHC / DRE

Sampling was performed to determine the emission rate of Volatile POHC listed in Section 3.7 by utilizing the EPA Volatile Organic Sampling Train (VOST) procedure as outlined in EPA-SW 846 Method 0030, Destruction and Removal Efficiency (DRE) of volatile Principal Organic Hazardous Compounds (POHC). The slow VOST option was used. Four 40-minute samples comprise each test.

Sample Collection

A 20-liter (nominal) sample of effluent gas is drawn from the source at a flow rate of approximately 0.5 liters per minute for 40 minutes, using a heated (250±25°F) glass lined probe and a VOST sampling train. A schematic of the train is shown in Appendix E. The gas stream is cooled to <20°C by passage through a water cooled condenser and VOC are collected on a pair of sorbent resin traps. Liquid condensate is collected in an impinger placed between the two resin traps. The first resin trap (front trap) contains approximately 1.6 grams Tenax and the second trap (back trap) contains approximately one gram each of Tenax and petroleum based charcoal, 3:1 by volume. A total of four pairs of sorbent traps will be used to collect volatile POHCs from the effluent gas stream for each test. Three pairs of traps for each test run will be analyzed in tandem, with the fourth pair of traps analyzed separately. A total of four tests (16 cartridge pairs) will be performed. A velocity traverse will be performed in accordance with EPA Methods 1 and 2 during each test in order to determine exhaust volumetric flowrate and mass emission rates.

Sample Recovery

All sample cartridges were sealed with Swage-lok fittings and kept on ice until ready for analysis. Condensate was recovered and combined for each test series. Only a few ml were collected in four test runs combined since most of the moisture was adsorbed by the Tenax.

Sample Analysis

Sample analysis was performed by Triangle Laboratories (TL), Inc. at Research Triangle Park, NC. The contents of the paired sorbent cartridges are spiked with an internal standard and thermally desorbed for 10 minutes at 180°C with the carrier gas flow reversed so that the effluent flow from the analytical trap is directed into the GC/MS. The VOC are separated by temperature programmed gas chromatography and detected by low resolution mass spectrometry. The concentrations of VOC are calculated using the internal standard technique. Condensate samples are analyzed in a similar manner. Results are typically in the nanogram range. VOC concentrations were determined by analyzing the cartridges separately in the first sample and when not found in the range of suspected breakthrough, the remaining cartridges were analyzed in pairs.

4.1.5 Hexavalent Chromium

Sampling was performed to determine the emission rate of hexavalent chromium (Phase 2 only) by utilizing the EPA Method Cr^{+6} - Determination of Hexavalent Chromium Emissions From Stationary Sources. A sampling train schematically similar to the one presented in Appendix E was used.

Sample Collection

All portions of the Cr^{+6} sampling train that come in contact with the gas sample are either glass, quartz, Tygon or Teflon. The metering system used in this sampling train is identical to that specified by EPA Method 5 described above.

The probe nozzle is glass with a sharp, tapered leading edge. A Teflon union-T is connected behind the nozzle to provide the absorbing reagent / sample gas mix. A peristaltic pump is used to recirculate the absorbing reagent at a flow rate of at least 50 ml/min. Fittings, recirculating line, and sample line to the union-T are Teflon. 3/8" O.D. Teflon tubing is used to connect the union-T to the first Teflon impinger and recirculating pump. Three impingers are constructed of Teflon, with the fourth and fifth (silica gel) impingers made of glass. A schematic of this train is found in Appendix E.

Approximately 150 ml of 0.5N KOH reagent is placed in the first Teflon impinger. This is a variation from the 0.1N solution specified in the method necessary to maintain an alkaline solution while sampling acidic stack gases. The second and third impingers have approximately 75 ml of the same 0.5N KOH. The fourth impinger is left empty. The fifth impinger (glass) contains a preweighed 200g portion of indicating silica gel. Reagent blanks are retained for analyses. Flexible tubing, vacuum gauge, needle valves, leakless vacuum pump, bypass valve, dry gas meter, calibration orifice and inclined manometer complete the sampling train. The stack velocity pressure is measured using an S-type pitot and inclined manometer. The stack temperature is monitored by a thermocouple connected to a potentiometer.

A post-nitrogen purge of the impinger train is used as a safeguard against the conversion of hexavalent chromium to the trivalent oxidation state. The purge is effective in the removal of SO_2 from the impinger contents. The nitrogen is purged at an approximate rate of 10 lpm for 30 minutes.

A nomograph is used to quickly determine the orifice pressure drop required for a pitot velocity pressure and stack temperature in order to maintain isokinetic sampling conditions. Sampling flow is adjusted by means of the bypass valve. Before and after each test run, the sampling train is leak checked (acceptable at less than 0.02 CFM). At the end of the sampling run, the pH of the reagent in the first impinger is measured using a pH indicator strip. The pH of the solution must be greater than 8.5.

Sample recovery was performed in a relatively clean, environmentally controlled shelter constructed on the pre-heater tower. The probe assembly is allowed to cool prior to sample recovery. When the probe assembly can be safely handled, all external particulate matter near the tip of the nozzle is wiped off and the nozzle capped prior to transporting the sample train to the cleanup area. The impinger train is inspected and abnormal conditions noted before disassembly. Samples are recovered and placed in containers as follows:

Container No. 1 - Impingers 1 - 3 are disconnected and drained into a precleaned graduated cylinder. The volume of the liquid is measured to within 1 ml.

Container No. 2- Note the color of the silica gel to determine if it has been completely spent. Quantitatively transfer the silica gel from its impinger to the original container, and seal the container.

For determination of hexavalent chromium, the sample is filtered immediately following recovery to remove any insoluble matter. Nitrogen gas is used as a pressure assist to the filtration process (see figure in the Appendix). The entire sampling train is then cleaned by rinsing three times with 0.5N HNO_3 prior to reuse.

Sample Analysis

The Cr^{+6} content of the sample filtrate is determined by ion chromatography coupled with a post column reactor (IC/PCR). Sample analysis was performed by Research Triangle Institute (RTI), Inc at Research Triangle Park, NC.

4.1.6 Continuous Emission Monitoring of CO, THC, O_2, and CO_2

Continuous emission monitoring (CEM) was performed at the exhaust stack to determine concentrations and emission rates of CO and THC as well as diluent concentrations of O_2 and CO_2. Lone Star also monitored CO, THC and O_2

concentrations with their in-plant analyzers located at the kiln bypass. These data were used to set CO operational limits. An additional in-plant system monitors at the outlet of the preheater and at the exhaust stack.

All APCC CEM data was recorded using a Tracor/Westronics automatic digital data logger. The CEM system was housed in the APCC Environmental Monitoring Laboratory (EML) at the base of the exhaust stack.

Sample Conditioning System

An in-stack thimble filter serves to remove large particulate matter from the sample gas stream. The thimble filter is mounted on the front end of a heated (250°F±25°F) stainless steel sampling probe with a stainless steel nozzle facing away from the stack gas flow. The sample stream is then drawn through heated (300°F nominal) Teflon sample line to four modified Greenburg-Smith type impingers (with impingement stems broken off) immersed in an ice-bath to remove the moisture from the gas stream. The sample is then drawn through Teflon tubing by a leak-free Teflon double diaphragm pump to a stainless steel sample manifold with an atmospheric by-pass rotameter. The CO, O_2, and CO_2 analyzers draw sample gas from this manifold. The THC sample is drawn prior to the condensor.

Continuous Emission Monitoring Analyzers

Emission parameters to be continuously monitored by APCC are CO, THC, O_2 and CO_2. Oxygen and carbon dioxide concentrations will be monitored in accordance with EPA Method 3A, carbon monoxide concentrations will be monitored in accordance with EPA Method 10 and THC will be monitored in accordance with EPA Method 25A..

A TECO gas filter correlation nondispersive infrared gas analyzer was used to continuously monitor concentrations of CO in the exhaust stream. The analyzer operates on the measurement principle based on CO having a characteristic absorption spectra in the infrared range. It contains an infrared detector that uses the nondispersive single beam technique with alternate modulation of the sample and reference cells. Radiation absorbed by CO in the sample cell produces a capacitance change in the detector which is proportional to the CO concentration.

A RATFISCH Model RS55 Total Hydrocarbon Analyzer, which utilizes a flame ionization detector (FID) to measure, as carbon, hydrocarbons C_1 through C_{18}; was calibrated as propane. Approximately 5.0 lpm of sample gas is drawn from the stack through 50 feet of Teflon sample line heated to 350^{o} F (nominal). The sample gas is drawn through a heated filter and valving by a heated pump. The sample gas then enters the heated detector bench which contains the FID. Flame ionization is a process of continuously creating ions by flame, whereby, upon combustion, hydrocarbon molecules and carbon atoms are separated into positive ions and free electrons. The positive ions are attracted to the burner (-); the free electrons are attracted to the collector cylinder (+). An electron flow is established from the burner to the collector cylinder, proportional to the ionization created by the flame. The resulting current is detected and amplified by an electrometer/amplifier circuit. The output of the amplifier provides a signal to a recorder for real-time continuous monitoring.

A Westinghouse/Maihak OXIGOR O_2 analyzer was used to monitor concentrations of oxygen in the exhaust stream. This instrument utilizes the magnetic dumbbell sphere (paramagnetic) principle, which comparatively measures the magnetic susceptibility of a gas volume by the force acting upon a non-magnetic test body suspended in a disproportionate magnetic field. Output current is linearly proportional to the oxygen concentration.

A Westinghouse/Maihak FINOR CO_2 analyzer was used to monitor carbon dioxide emissions. This instrument operates on the principle of carbon dioxide having a known characteristic absorption spectra in the infrared range. Radiation absorbed by CO_2 in the sample cell produces a capacitance change in the detector which is proportional to the CO_2 concentration.

Data Acquisition and Handling

All CEM data was monitored by a Tracor/Westronics 3000 digital data logger which will record using its integral color printer. Trends will be monitored using the strip chart mode for CO, THC, O_2, CO_2 and stack temperature with averages printed digitally for 15-minute intervals and/or the test period. Emission data will be "viewed" by the data logger at 10-second intervals. This will enable real-time emission data to be available on-site.

Stratification Check

Prior to the CEM system coming on-line for the COC, a stratification check was performed at the sampling location. Twenty-four traverse points as described in Section 5.1 were sampled for CO and oxygen to detect the presence of stratification and to determine a point of average concentration for sampling. The plant CEM system was used as the point of reference. The CEM probe was then positioned at the point of average concentration for the remainder of the test program. Significant stratification was not detected.

CEM System Calibrations

Calibrations of the CEM system were performed at the beginning and end of each test using either EPA Protocol 1 and/or NBS Traceable calibration gases. Calibration gases (zero, mid range and span) were introduced to the CEM system through a 3-way heated valve located at the back of the sampling probe. Each analyzer was also multi-point calibrated prior to the trial burn to establish instrument linearity. A three point calibration of each analyzer (four point for THC), along with system leak and bias checks was performed at the beginning and end of each test day.

4.2 COMBUSTION EFFICIENCY

The combustion efficiency of the kiln cannot determined using the CO and CO_2 concentrations as used for a typical combustion source. The calcination of limestone and the clinkering process release a significant amount of CO_2 as well as CO that renders this calculation impractical.

4.3 RAW MATERIAL AND PRODUCT SAMPLES

Samples of raw materials (raw feed, WDLF, WDSF, tires, water, coal) and product (clinker baghouse and kiln dusts) were taken by plant personnel to evaluate levels and to attempt a metals, chloride and chlorine mass balance on the kiln. Samples were drawn on a grab sample basis at 15 minute intervals during each test and composited for all parameters except the WDLF. The WDLF sample was collected by a continuous drip methodology described below.

One glass sample jar was filled at each of the following sample locations as shown in Figure 5-2.

Raw Materials:

- Raw Material Feed
- Coal Feed Belts (2)
- Water for Conditioning Tower
- Shredded Tires
- WDLF Feed Pipe
- WDSF Pails
- Spent kiln brick (if available)

Product:

- Kiln Dust
- Clinker Cooler Conveyer
- By-pass Baghouse Hopper

WDLF samples were drawn using Method S-004. This method is designed for collecting integrated liquid samples from moving streams through a submerged fill pipe. The sample was kept on ice during sampling to reduce evaporation.

Analyses of composite samples of kiln raw materials and products drawn by Lone Star personnel were performed for the corresponding parameters by the methodologies indicated in Table 4-1. Additional analyses were performed on-site by ECL (metals and Btu).

A total of 12 composite samples plus audits of each type were analyzed. Triangle Labs performed metals analyses, Environmental Health Laboratories of Hartford, CT chlorides analyses, and Gould Engineering the chloride and Btu analyses on WDLF, WDSF and coal samples.

Bypass dust mass flowrate was quantified by measuring the weight collected dust in the silos at the beginning and end of each test day.

TABLE 4-1

MASS BALANCE METHODS OF ANALYSES
COMPLIANCE TEST PROGRAM
LONESTAR INDUSTRIES

Sample Matrix	Analytical Parameter	Preparation Method	Analytical Method
INPUT			
Raw Mix	Metals*	SW 3050	SW 6010/7000 series
	Chloride		ASTM C-114-19
WDSF	POHC		624
	Metals*	SW 3050	SW 6010/700 series
	Chloride		ASTM D-808-D512D
	Ultimate/BTU		ASTM D-240/3178/3179/482/129
	ASH		
WDLF	POHC		624
	Metals*	SW 3050	SW 6010/700 series
	Chloride		ASTM D-808-D512D
	Ultimate/BTU		ASTM D-240/3178/3179/482/129
	Viscosity, Ash		
Metals Spike	Metals*	SW 3050	SW 6010/700 series
Coal (Precalciner)	Metals*	SW 3050	SW 6010/700 series
	Chloride		ASTM D-4606
	Ultimate/BTU		ASTM D-2015/3178/3179/3174/4239
Coal (Kiln)	Metals*	SW 3050	SW 6010/700 series
	Chloride		ASTM D-4606
	Ultimate/BTU		ASTM D-2015/3178/3179/3174/4239
Tires	Metals*	SW 3050	SW 6010/700 series
	Chloride		ASTM D-4606
	Ultimate/BTU		ASTM D-2015/3178/3179/3174/4239
OUTPUT			
Clinker	Metals*	SW 3050	SW 6010/700 series
	Chloride		ASTM C-114-19
Kiln Dust	Metals*	SW 3050	SW 6010/700 series
	Chloride		ASTM C-114-19
Bypass Dust	Metals*	SW 3050	SW 6010/7000 series
	Chloride		ASTM C-114-19

SW 846/3050 - Acid Digestion of Sediments, Sludges and Soils
SW 846/6010 - Inductively Coupled Plasma Atomic Emissions
SW 846/7000 series - Atomic Absorption Methods
* As, Sb, Ba, Be, Cr, Cd, Ag, Pb, Tl, Zn and Hg

ASTM C-114-19 Total Chloride
Potentiometric Titration with Silver Nitrate

5.0 SCOPE OF THE SAMPLING PROGRAM BY SITE

The COC Sampling Matrix is shown in Table 5-1. Two phases of tests were performed to determine the acceptability of firing WDF. First, a background emissions determination test was performed while firing coal only in April 1992. A second phase was performed during the firing of 100% WDF and 1.5 tph of tires. Coal was fired in the pre-calciner during each phase. Sampling was performed at the exhaust stack to determine concentrations and emission rates of particulate matter (PM), chlorides (HCl), chlorine (Cl_2), Volatile POHC, Cr^{+6}, and heavy metals (HM). Additional measurements of carbon dioxide (CO_2), oxygen (O_2), carbon monoxide (CO) and total hydrocarbons (THC) were performed. Raw material and product samples were drawn for metals, total chloride and chlorine analyses during the COC.

5.1 STACK EMISSION SAMPLES

Emissions of PM, HCl, Cl_2, HM, POHC, Cr^{+6}, CO, THC, O_2 and CO_2 were determined at sampling ports, on two levels of the exhaust stack. The sampling ports are located 90° apart and 27 to 37 feet above the inlet breeching in the 11 foot ID stack. All isokinetic sampling was performed at the upper level. In accordance with EPA Method 1, 24 traverse points were sampled at each location to measure stack gas velocity, temperature and moisture content in order to determine volumetric flowrate. A schematic of these locations and traverse point locations is presented in Figure 5-1.

At the exhaust stack, emissions of particulate, chlorides, chlorine and Volatile POHC were determined concurrently. On separate test days, emissions of heavy metals and Cr^{+6} were determined (no Cr^{+6} measurements were performed during the coal only background test in Phase I). Continuous emission monitoring was performed concurrent with all tests on the stack, utilizing one of the lower level ports. Additional CEM was performed at the kiln bypass duct utilizing the Lone Star CEMS to set operating limits.

5.1.1 Particulate, Chloride, and Chlorine Emission Measurements

Particulate, Chloride (HCl) and Chlorine sampling was performed on the upper platform at 24 traverse points in the exhaust stack. Each point was sampled for 5 minutes for a total test time of 120 minutes. A total of 3 tests for PM, HCl and Cl_2 were performed during each phase of testing, for a total of 6 tests. Sampling and analytical methods are presented in Section 4.0.

5.1.2 CO, O_2 and CO_2 Integrated Measurements

Integrated gas samples were drawn through a probe integral with the sampling probe at 24 traverse points simultaneously with each test described in Section 4.0. Sampling and analyses were in accordance with EPA Methods 3 and 3A as described in Section 4.0 to determine concentrations of CO, O_2, CO_2 as a measure of CEMS QA/QC. Integrated samples were introduced into the APCC CEMS at the end of each test day.

Lead oxide
Mercuric chloride
Chromium III oxide

The use of pumpable hazardous stream with maximum metal concentration and metal spiking began 12 hours before the stack test for metal removal efficiency. This was to ensure that the kiln system achieved equilibrium conditions with respect to metals. Samples of inputs and outputs were taken every 30 minutes during this period to establish when equilibrium was reached. Metal removal efficiency was determined while burning coal (precalciner), hazardous waste and tires.

Since the Lone Star Cape Girardeau plant also proposed to burn solid hazardous waste by injecting the pails into the burning zone of the kiln, pails were also injected into the kiln burning zone via an air cannon during the entire test. The injection was done during the same time interval as the metal spiking occured. No spiked metal was introduced into these solid streams. The metals introduced by the solid stream were accounted for in the total metal input to the kiln system. The pails were injected into the kiln approximately 70-90 feet from the material discharge end of the kiln. The gas temperature at this point in the kiln is in excess of 3000° F. The material temperature is above 2300° F.

To ensure maximum volatilization of metals during this compliance testing maximum combustion zone temperature and maximum flue gas temperature entering the PM control device were achieved. The burning zone control for maximum temperature was the 4th stage gas inlet temperature which represents the position nearest the burning zone where temperature can be reliably measured. Temperature entering the main and bypass fabric filter APCD was monitored on a continual basis and maximized during this testing.

3.7 POHC SPIKING

The COC test meets the requirements of the State of Missouri Department of Air Management. This department required Lone Star to conduct performance testing within 60 days of achieving maximum hazardous fuel kiln rate and in no case later than 180 days after the initial burn date of April 28, 1992. The testing was to demonstrate the following destruction and removal efficiencies:

Lead	98%
Mercury	33%
Beryllium	99%
VOC -	99.99%

To determine compliance with the organic emission limits, testing was performed with the kiln operating at minimum burning zone temperature conditions. To ensure this condition, the temperature was monitored at the 4th stage preheater inlet. This is the position nearest the burning zone where temperature can reliability be measured. This is the most conservative approach to prove thermal destruction of POHC.

Lead oxide
Mercuric chloride
Chromium III oxide

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Mercuric chloride
Chromium III oxide

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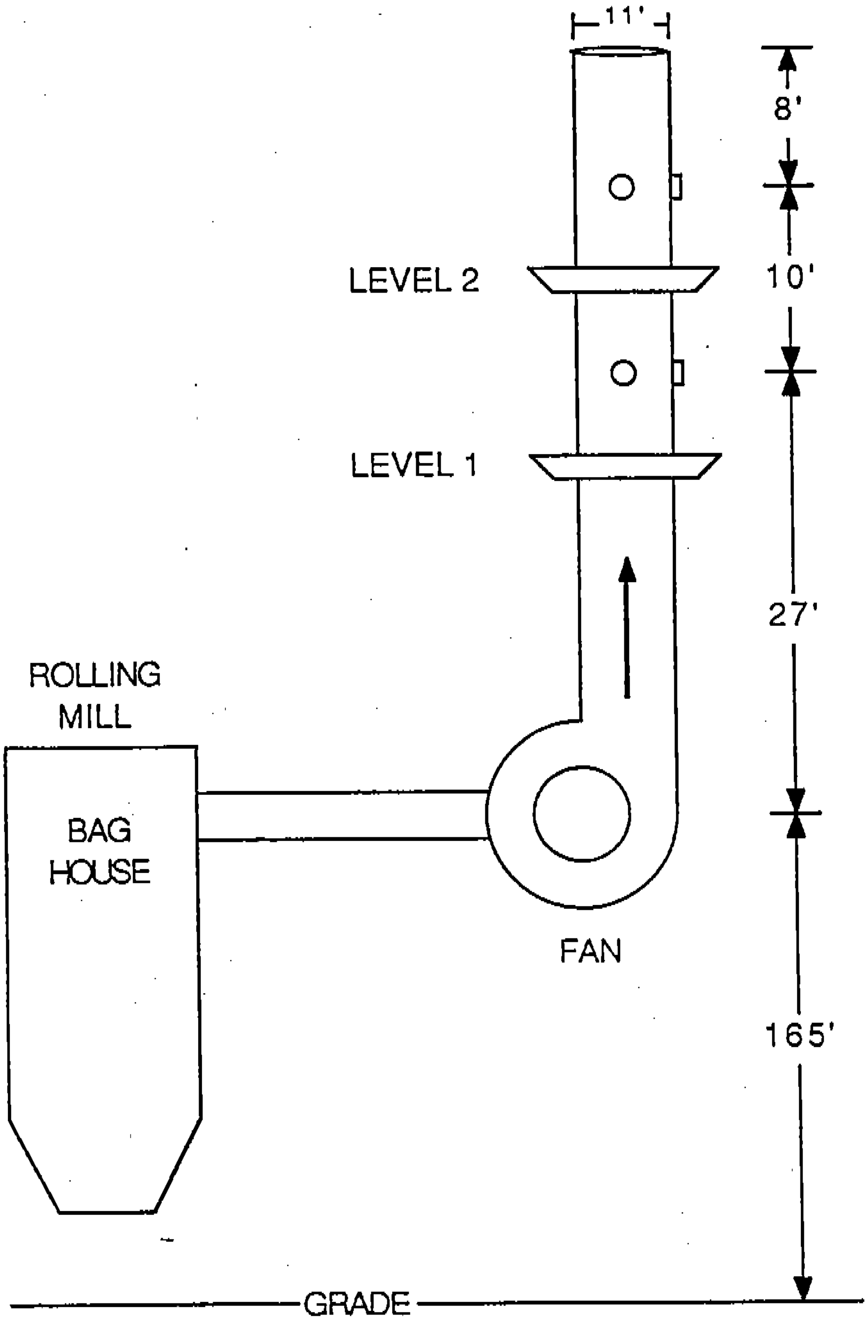
TABLE 5-1
SAMPLING MATRIX
COMPLIANCE TEST PROGRAM
LONE STAR INDUSRTRIES
CAPE GIRARDEAU, MISSOURI

SAMPLE LOCATION	SAMPLE MATRIX	TOTAL CHLORIDE CHLORINE	PM	Metals	POHC	Gas Flow	CO OXYGEN THC	VISCOSITY Btu/ASH SOLIDS	ULTIMATE Btu
Stack	Exhaust Gas	6	6	6 (a)	6	12	12		
Bypass Baghouse	Dust	12		6 (b)					
Kiln Dust	Dust	12		6 (b)					
Cooler Conveyor	Clinker	12		6 (b)					
Conditioning Tower	Water	12		6 (b)					
Raw Feed	Crush Rock	12		6 (b)					
Coal Mill-Precal.	Coal	12		6 (b)					12
WDLF Feed Line	WDLF	12		6 (b)	6			6	
WDSF Pails	WDSF	12		6 (b)	6				6
Metals Spike (c)	Spike	12		6 (c)					
Tire Feed	Tires	6		3 (b)				3	3

(a) Pb, As, Cr, Be, Cd, Hg, Zn, Cr+6
(b) Sb, Pb, As, Ba, Be, Cr, Cd, Hg, Ag, Tl, Zn, Cr+6
(c) Pb, As, Cr, Be, Cd, Hg, Cr+6

FIGURE 5 - 1
STACK TEST
SAMPLE LOCATIONS AND TRAVERSE POINTS
LONE STAR INDUSTRIES
CAPE GIRARDEAU, MISSOURI



LEVEL 1 & 2 TRAVERSE POINT PER PORT	
1	2.7"
2	8.8"
3	15.6"
4	23.4"
5	33.0"
6	45.0"
7	85.0"
8	99.0"
9	108.6"
10	116.4"
11	123.2"
12	129.2"

APCC AIR POLLUTION CHARACTERIZATION and CONTROL, LTD.

5.1.3 Heavy Metal Emission Measurements

Heavy metals sampling was performed on the upper level at 24 traverse points in the exhaust stack. Each point was sampled for 5 minutes for a total time of 120 minutes. A total of 3 tests were performed during each phase of testing, for a total of 6 tests. Sampling and analytical methods are presented in Section 4.0.

5.1.4 Volatile POHC Emission Measurements

POHC emission measurements utilizing the EPA Slow VOST procedure were performed on the lower level platform of the exhaust stack. Single point samples, 40 minutes in duration, were taken at a point approximately centered in the stack. Four VOST runs, each utilizing one pair of cartridges, were performed during each test. A total of four tests were performed during each phase of testing, for a total of 8 tests. One set of field and trip blank cartridges were taken during each phase. A velocity traverse was performed concurrently with each test performed in accordance with EPA Methods 1 and 2 to determine the exhaust volumetric flowrate.

5.1.5 Cr^{+6} Emission Measurement

Cr^{+6} sampling was performed on the upper level platform at 24 traverse points on the exhaust stack. Each point was sampled for 5 minutes for a total time of 120 minutes. A total of 3 tests were performed during the second phase of testing. Sampling and analytical methods are presented in Section 4.0.

5.1.6 Continuous Emission Monitoring

Continuous emission monitoring for CO, THC, O_2 and CO_2 was performed at the lower level of the exhaust stack during each emission test. Monitoring was performed concurrent with each manual emission test performed. Calibrations were performed at the beginning and end of each test. System leak checks and system bias checks were performed at the beginning and end of each test day.

5.2 RAW MATERIAL AND PRODUCT SAMPLES

Samples of raw material and product were drawn at 15 minute intervals during each test run and composited for the test period. A glass sample jar was filled with sample from each of the following locations:

INPUTS

- Coal feed belts
- Water for the Conditioning Tower
- Raw material feed belt
- WDLF feed pipe
- WDSF buckets
- Shredded tires
- Spent kiln brick (if available)

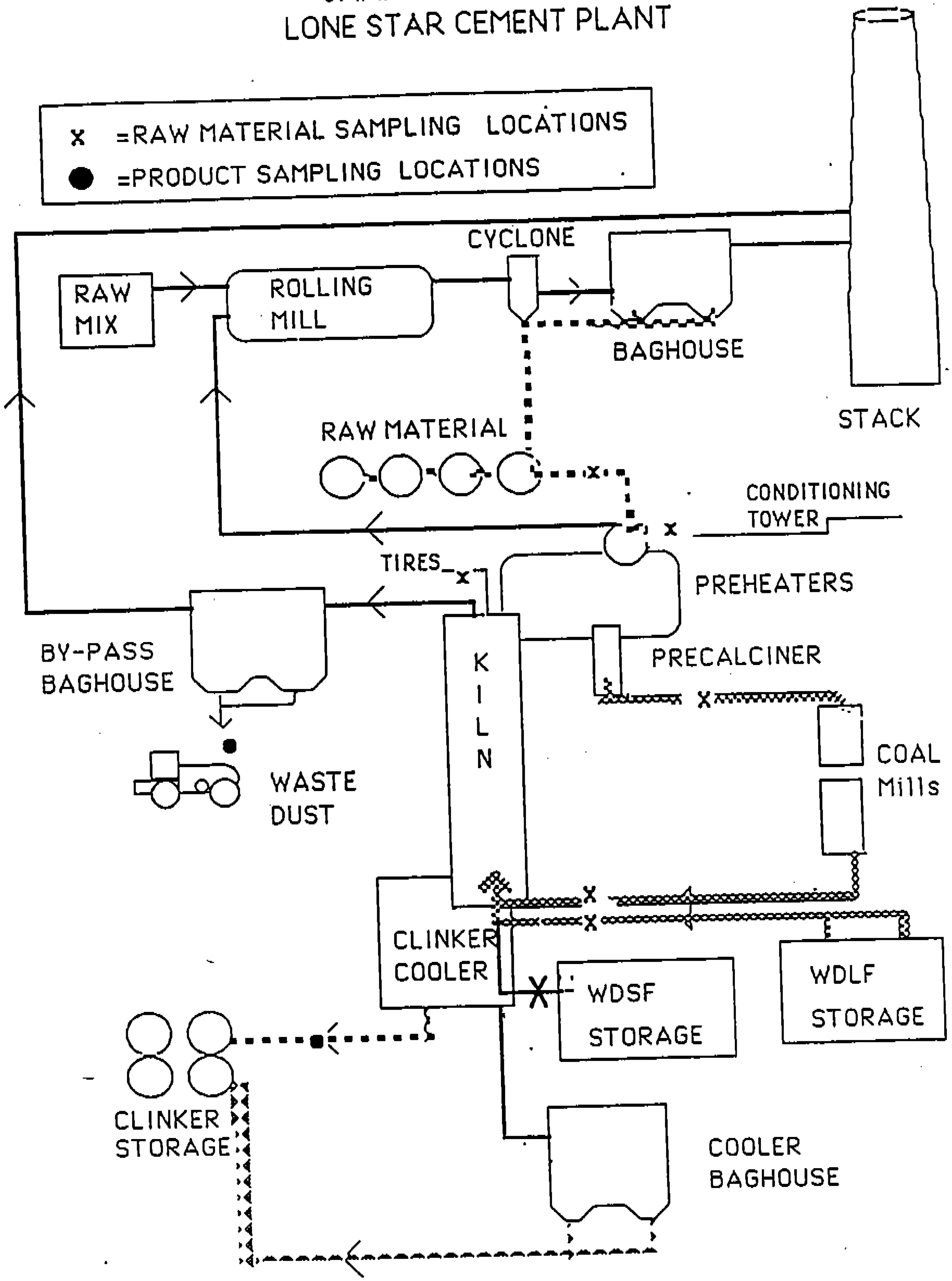
OUTPUTS

- Kiln Dust
- Clinker Cooler Conveyer
- By-pass Baghouse Hopper

Further details of this sampling are presented in Section 4.3. Sampling locations are presented in Figure 5-2. A total of 3 tests were performed for metals and a total of 3 tests were performed for chlorine and chloride mass balance during each phase, for a total of 12 chloride samples and 6 metals samples for each parameter. Analyses of composite samples of kiln raw materials and products drawn by Lone Star personnel were performed for the following constituents for the corresponding parameters.

Constituents	Parameters
Kiln Coal (Only if fired)	Chlorides/Chlorine Btu & Ultimate Metals
Pre-calciner Coal	Chlorides/Chlorine Btu & Ultimate Metals
Kiln Feed	Chlorides/Chlorine Metals
Kiln Dust	Chlorides/Chlorine Metals
Clinker	Chlorides/Chlorine Metals
Tires	Chlorides/Chlorine Btu Metals
WDLF	Chlorides/Chlorine Btu Metals
WDSF	Chlorides/Chlorine Btu Metals

FIGURE 5-2
SAMPLING LOCATIONS
LONE STAR CEMENT PLANT



5.3 TEST SCHEDULE

This COC was performed during the weeks of 13 April (Phase I) and 22 June (Phase II) 1992. Spiked (POHC, metals) WDLF at 5% chloride was fired for the particulate, chloride, chlorine and metals tests during Phase 2.

CERTIFICATION OF COMPLIANCE TEST SCHEDULE

Phase I
Kiln & Precalciner Firing Coal

April 13 Monday	Performed 3 background tests for PM, POHC, HCl, and Cl_2. CEM for CO_2, O_2, CO and THC.
April 14 Tuesday	Performed 3 background tests for HM. CEM for CO_2, O_2, CO and THC.

Phase II
Kiln Firing WDLF/WDSF/Tires
Pre-calciner Fire Coal

June 22 Monday	Mobilize on-site and performed preliminary tests.
June 25 Thursday	Performed 3 tests for PM, POHC, HCl and Cl_2. Mass balance for chlorides. CEM for CO_2, O_2, CO and THC.
June 26 Friday	Performed three tests for HM and Cr^{+6}. Mass balance for metals. CEM for CO_2, O_2, CO and THC.

6.0 QUALITY ASSURANCE PROGRAM

Quality Assurance (QA) and Quality Control (QC) guidelines required by Environmental Protection Agency to ensure the sampling program activities and analyses are performed in a manner as to achieve quality / accurate data. The QA/QC guideline summary presented in this section are detailed in the "Quality Assurance Handbook for Air Pollution Measurement Systems", Volume III (EPA-600/4-7-027b) and Test Methods for Evaluating Solid Waste, Volume 1A: Laboratory Manual Physical/Chemical Methods. Also detailed QA/QC procedures are found in each test method utilized in the test program.

6.1 PROJECT ORGANIZATION AND RESPONSIBILITY

The following individuals were responsible for implementation of the Quality Assurance Program as applied to the project. A schematic of the project organization chart can be seen in Figure 6-1.

- Program Manager
- Quality Assurance Manger
- Field Operation Manger
- Sampling and Analytical Manager
- Data Manager
- Laboratory Managers

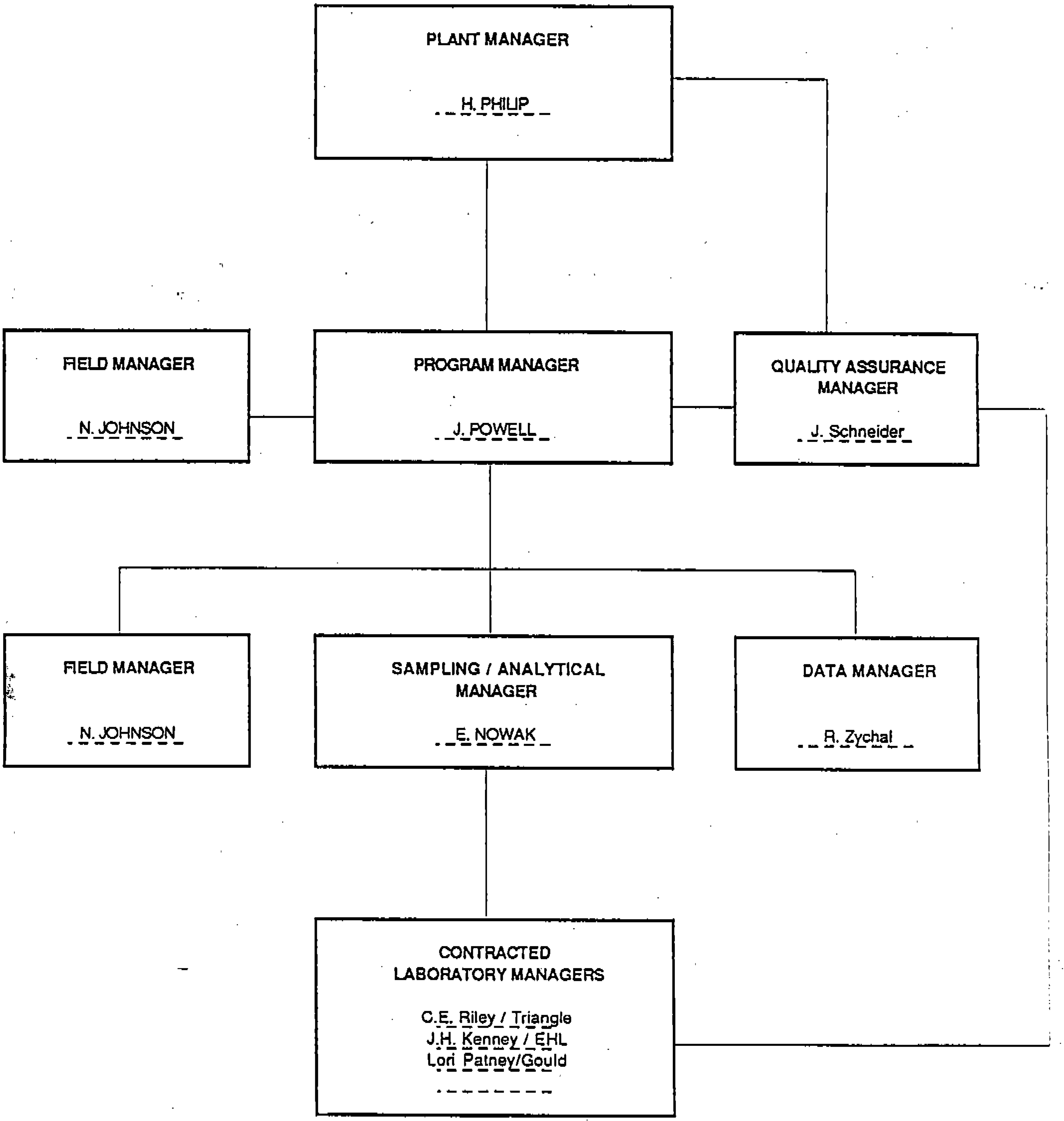
The above managers are a project team consisting of key personnel to coordinate all functions of the sampling program to ensure open communications with all parties involve. The responsibilities and functions of each manager is presented below.

Program Manager for the project is the overall supervisor for the project and to ensure all work is performed in accordance to approved protocols and test plans. All other parties report to the Program Manager with the status of their assigned areas. The Program Manager regularly meets with the Plant Manager for review and updates of the test program.

Quality Assurance Manager reviews and advises on all areas of concern related to QA/QC procedures. The QA Manager makes QC evaluations of field sampling methods, analytical analyses and data validation. Auditing of samples and QC procedures outlined are also performed.

Field Operations Manager is a facility person to instruct other facility personnel before and during field operations of the test program. The Field Operations

FIGURE 6-1
PROJECT ORGANIZATION CHART



Manager ensures the facility is operating at the proposed test conditions, coordinates the test program and records process data.

Sampling and Analytical Manager processes and coordinates all field samples and data recovery. The Sampling and Analytical Manager ensures sampling methods and analytical procedures are implemented and that supplies needed are available.

Data Manager reviews all data (sampling and process) from the test program. He evaluates data for accuracy, precision, sensitivity and completeness. The Data Manager develops a system to perform calculations, setup and present results and storage of files.

Laboratory Managers are individual mangers of the contracted laboratories to perform sample analyses. The Laboratory Managers implement QA/QC procedures in accordance with their laboratory and analytical sampling methods performed.

6.2 SAMPLING QUALITY ASSURANCE

Implementation of quality assurance procedures for source measurement programs is designed so that the work is done:

1. By competent, trained individuals experienced in the specific methodologies being used.

2. Using properly calibrated equipment.

3. Using approved procedures for sample handling and documentation.

Measurement devices, pitot tubes, dry gas meters, thermocouples and portable gas analyzers are uniquely identified and calibrated with documented procedures and acceptance criteria before and after each field effort. Records of all calibration data are maintained in the files.

Data are recorded on standard forms. Bound field notebooks are used to record observations and miscellaneous elements affecting data, calculations, or evaluation.

Prior to the test program APCC provided the following:

1. Filter numbers and tare weights of all filters available for the test.

2. The results of reagent blank runs on the reagents to be used during the test.

3. Calibrations of all pitot tubes, dry gas meters, orifice meters, sampling nozzles, and thermocouples which used during the test. All calibrations are performed within four months prior to the test date.

Specific details of APCC's QA program for stationary air pollution sources may be found in "Quality Assurance Handbook for Air Pollution Measurement Systems", Volume III (EPA-600/4-7-027b). Sampling methods are presented in Section 4 of the protocol.

6.2.1 EPA & SW Manual Methods

All particulate and metal sampling was 100% ± 10% isokinetic. Probe and filter temperatures were within the specified temperatures.

Prior to sampling, a clean-up evaluation of each sampling train was performed to ensure the accuracy of the sampling equipment and to determine the level of background contamination (if any). A clean-up evaluation was performed on each sampling train to be used in the test program. These tests were performed prior to testing on each fuel type and upon the conclusion of testing in the sample recovery area. The sampling train was precharged as if ready to test and then recovered and analyzed as specified for the actual test program. Results can be found in Section 6.8 of this report. In summary, these evaluation tests were designed to precondition the sample train, establish background values, evaluate sample recovery efficiencies and educate sample recovery personnel in the specific procedures.

In addition to the above, blank samples of each collection media (reagents and filters) were collected at the test site for background analyses. All clean-up evaluation and blank samples were analyzed in conjunction with actual test samples. Sampling results were corrected for these backgrounds as required.

Appropriate sample recovery data was recorded on the sample identification and handling logs, chain of custody forms and analytical data forms. Methods preparation and recovery sheets used are presented in the Appendix.

Recovered samples were stored in shock-proof containers for storage and shipment for analyses.

6.2.2 CEM System

The CEM system was calibrated at the beginning and end if each test and leak and bias checked twice daily. All calibration gases were either NBS certified or EPA Protocol 1. Multi-point calibrations were performed on each analyzer to establish linearity prior to sampling and then throughout the test program.

6.2.3 VOST- Method

Field Blanks - Blank Tenax and Tenax/Charcoal cartridges were taken to the sampling site and the end caps removed for the period of time required to exchange two pairs of traps on the sampling train (approximately 5 minutes). After the two trap had been exchanged, the end caps were replaced on the blank tubes which wei returned to storage on ice. This procedure was repeated a second time approximately 40 minutes later on the same traps. The pair was then returned to storage on ice until analysis. One pair of field blanks was included with each set of 8

VOST cartridge pairs collected. For Phase I, the field blank did not have any contaminants present above the method detection limit. The field blank for Phase II had only three compounds detected above the detection limit of 0.1 µg. The compounds detected and their respective concentrations were as follows: 0.7 µg of n-Hexane, 0.6 µg of Methylene Chloride, and 1.7 µg of Toluene.

Trip Blanks - One pair of blank cartridges (Tenax and Tenax/Charcoal) was included with shipment of cartridges to the site. These blanks are treated as any other cartridge except that the end caps are not removed. These cartridges were then analyzed to monitor potential contamination which occurred prior to shipment. For Phase I, the trip blank did not have any contaminants present above the method detection limit. The trip blank for Phase II had only two compounds detected above the detection limit of 0.1 µg. The compounds detected and their respective concentrations were as follows: 0.6 µg of Methylene Chloride, and 0.6 µg of Toluene.

The final blank for the VOST analysis were the condensate blanks. These blanks were performed by filling a 40 ml Volatile Organic Analysis (VOA) vile with zero head space using the same DI water as was utilized for the testing program. These blanks were performed on site and in the same manner as the actual samples. The results of the condensate blank for Phase I were as follows: 0.5 µg Methylene Chloride, 0.2 µg Toluene, and 2.0 µg Acetone. The results of the condensate blank for Phase II were as follows: 0.1µg 1,1,1-Trichloroethane, 3.1 µg Methylene Chloride, 0.1 µg Toluene, and 7.1 µg Acetone. Methylene Chloride, Toluene and Acetone are all solvents used in the recovery of the sampling trains and are the most likely source of the contamination. These levels of contamination are not considered to be abnormal.

Audit - Audit gas was not provided by MO DNR.

6.3 ANALYTICAL QUALITY CONTROL

APCC maintains a vigorous quality control program for all samples analyzed. This program is based on the general guidelines given in "Handbook for Analytical Quality Control in Water and Wastewater Laboratories" (EPA-600/4-79-019; March 1979). This program suggests guidelines in the areas of:

- Laboratory services
- Instrument selection
- Glassware
- Reagents
- Solvents
- Gases
- Analytical performance
- Data handling and reporting
- Water and wastewater sampling
- Laboratory safety

APCC has made additions to the EPA program which include the following:

1. Duplicate analysis performed on 10 percent of samples.

2. Ten percent of the samples are spiked by the laboratory manager with known amounts of the parameter of interest and re-analyzed to determine the percent recovery. A Shewhart control chart is used for the percent recovery control (EPA,Handbook of Analytical Quality Control in Water and Wastewater Laboratories, 1979).

3. Standards and curves are determined for each analysis using the appropriate standard. Least squares linear regressions calculations are used in determining the "best fit" to the data. Correlation coefficients are also calculated.

6.4 SAMPLE CHAIN OF CUSTODY PROCEDURES

The sample and analytical custody procedures were implemented and maintained in accordance with SW 846, Section 2 and APCC procedures. The Sampling Manager was responsible for maintaining and filing of the Chain of Custody.

Field samples were labeled with the field label. Sampling train operators filled out the field labels in detail with the appropriate information corresponding to the sampling method detailed in Section 4 of this protocol. Process sample labels were filled out as per the instructions of the Sampling and Analytical Manager. The train operators and samplers are responsible for collecting the sample, logging each container and securing the sample until transferred to the Sampling and Analytical Manager.

A data assessment of sampling results was performed by the Quality Assurance Manager and the Program Manager. The data assessment was performed during scheduled time periods to ensure quality data was collected and processed. Corrective action was implemented if warranted to ensure QA/QC procedures were met.

The Sampling and Analytical Manager filled out the sample Chain of Custody forms and logged each sample from the receiver. Chain of Custody forms are presented in the Appendix. The Chain of Custodies were used to verify sample ID's, sample conditions and volumes. The Sampling and Analytical Manager logged in blanks and audit samples on to the chain of custody. The samples were secured for storage until they were shipped to the laboratory.

6.5 LABORATORY QA/QC PROCEDURES

The Sampling and Analytical Manager worked with the individual Laboratory Managers to implement procedures that were performed on samples submitted based on the Chain of Custody, analytical methods, specific sampling method requirements and laboratory QA/QC procedures.

Information submitted to the Sampling and Analytical Manager from the Laboratory Manager was scrutinized for the following laboratory measurements: limits of detection, accuracy and precision prior to the field effort.

6.6 DATA REDUCTION AND REPORTING

The Data Manager develops a data reduction system to conform to the collection of field data to be reduced and quantitative result for the final report. The methods for data reduction was specified and presented to the Program Manager before the field effort.

Raw data was recorded on field data sheets, bound laboratory books and data logger strip charts which are presented in the Appendix. Parts of the data capture are checked manually or with QC check programs.

6.7 DATA VALIDATION

Validation of data was reviewed by the Quality Assurance Manager against the QA/QC criteria of the specific methods. The data was assessed to the quality / accuracy as required to meet the objectives of the sampling program. Audit samples were checked for accuracy and precision. Sample calculations were performed with raw data separate from the reported calculations and results. All documentation was be checked for correctness, completeness and verified as checked.

6.8 QUALITY ASSURANCE / QUALITY CONTROL RESULTS

Listed below is a summary of the quality assurance/quality control (QA/QC) laboratory data for this testing program. This synopsis includes an interpretation of reagent blanks and blank train results. Also included is where in the Appendix this data can be found along with the location of all audit sample data.

All the laboratories used for this testing program were accredited and have extensive experience in the analysis performed. The testing laboratories followed appropriate QA/QC procedures including blank runs, duplicates and three (or more) point calibrations. Additional QA/QC data can be found in the Addendum Appendix.

A summary of the chlorine, HCL, and particulate QA/QC data is presented in Table 6-1. This table illustrates the results of the blank trains from both phases, along with audit sample results. A summary of the metals QA/QC data is presented in Table 6-2, including blank train results for both phases, audit sample data, and reagent blank data. Table 6-3 presents the hexavalent chrome QA/QC data, consisting of reagent blank and blank train data. The sections below provide the location of the supportive data located in the Appendix.

6.8.1 Phase I: Coal Only

Test /AUDIT#	Parameter	Appendix Page
1	Particulate/Cl_2/HCl	C-1 Train Data C-9 Reagent Data
5	Metals	C-42
J1689	EPA chlorine Audit Filter	C-4
L-77, H-99	Metal Audit Samples	C-41

6.8.2 Phase II: Coal, WDF & Tires

Test /AUDIT #	Parameter	Appendix Page
1	Particulate/Cl_2/HCl	C-3 Train Data C-4 Reagent Data
6	Metals	C-44
6	Hexavalent Chrome	C-45
J1072, J1320	EPA chlorine Audit Filters	C-9
L-78, H-16	Metal Audit Samples	C-44

TABLE 6-1
CHLORINE, HCL, AND PARTICULATE Q.C. DATA
CERTIFICATION OF COMPLIANCE TEST
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

SAMPLE NUMBER	TOTAL PARTICULATE CATCH (mg)	CHLORINE CATCH (mg)	HYDROCHLORIC ACID CATCH (mg)
BLANK PHASE I	9.7	1.0	<0.70
BLANK PHASE II	2.9	<0.60	<0.017
J1689	*	40 (mg/L)	*
J1072	*	49 (mg/L)	*
J1320	*	707 (mg/L)	*

* Not applcable, audit sample were for chlorine only. All data is within desired limits.

TABLE 6-2
METALS Q.C. DATA
CERTIFICATION OF COMPLIANCE TEST
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

Element	Blank Train Phase I Total (ug)	Blank Train Phase II Total (ug)	Audit Sample L77 Total (ug)	Audit Sample H99 Total (ug)	Audit Sample L78 Total (ug)	Audit Sample H16 Total (ug)	Reagent Blanks Total (ug)
Antimony (Sb)	0.670	*	4.02	8.22	3.63	5.10	*
Arsenic (As)	0.990	<0.473	9.00	16.60	7.57	20.30	1.00
Barium (Ba)	14.000	*	*	*	13.70	134.00	*
Beryllium (Be)	<0.050	<0.237	3.32	104.00	5.41	60.40	<0.20
Cadmium (Cd)	<0.100	3.390	8.19	69.30	14.10	67.50	<0.20
Chromium (Cr)	9.150	37.700	8.87	85.50	16.10	73.80	9.98
Copper (Cu)	*	*	22.80	77.60	*	*	*
Manganese (Mn)	*	*	10.10	77.10	*	*	*
Nickel (Ni)	*	*	20.40	341.00	*	*	*
Phosphorus (P)	*	*	79.40	42.00	*	*	*
Lead (Pb)	3.970	14.083	41.70	328.00	38.40	192.00	<.760
Silver (Ag)	<0.100	*	<0.7	4.08	18.30	29.50	*
Thallium (Tl)	<0.200	*	4.69	579.00	3.25	809.00	*
Zinc (Zn)	21.320	83.770	85.20	213.00	399.00	532.00	7.16
Mercury (Hg)	<1.12	<4.736	0.01	0.006	<0.40	<0.40	<0.800

*Not Applicable

TABLE 6-3
HEXAVALENT CHROME Q.C. DATA
CERTIFICATION OF COMPLIANCE
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NUMBER	HEXAVALENT CHROME (ug)	DESCRIPTION
6-1 CR	<0.683	Blank train solution
6-3 CR	<0.444	Potassium hydroxide blank
6-4 CR	<0.432	DI Water blank
6-5 CR	0.5	Nitric Acid blank

All the results were at or just above the detection limit, indicating no problems due to contamination.

LONESTAR APPENDIX LIST

TABLE A-1
PARTICULATE/CHLORINE/HCl DATA SUMMARY
BIF COC TEST PROGRAM/PHASE 1
LONE STAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NO.	2 CL	3 CL	4 CL
DATE:	4/13/92	4/13/92	4/13/92
TIME :	9:24 - 11:31	13:08 - 15:13	16:55 - 19:00
TEST DATA INPUT			
Barometric Pressure (in. Hg)	29.84	29.84	29.72
Stack Area (ft2)	95.03	95.03	95.03
Nozzle Diameter (in.)	0.191	0.191	0.191
Total Sampling Time (min.)	120	120	120
Calibration Factor (Y)	0.97	0.97	0.97
Pitot Coefficient	0.84	0.84	0.84
Average Square Root of Velocity Head (in. wc)	1.09	1.11	1.09
Average Orifice Pressure Drop (in. wc)	1.192	1.225	1.2
Average Meter Temp. (°F)	62	86	94
Average Stack Pressure (in. wc)	-0.47	-0.51	-0.45
Average Stack Temp. (°F)	240	238	239
Meter Volume @ Meter Conditions (ft3)	68.44	69.28	70.64
Total Water Collected (ml)	208	240	224
CO2 in Stack Gas (%)	18	17.4	17.7
O2 in Stack Gas (%)	10.2	10.3	10.6
CO in Stack Gas (%)	0.1	0.05	0.07
Total Particulate Catch (mg)	74.2	81.5	64.6
Total Chlorine Catch (mg)	0.7	0.39	0.9
Total HCl Catch (mg)	6.083	3.583	1.483
CALCULATED VALUES			
Meter Volume (dscf)	67.17	65.01	65.06
Water Vapor in Stack Gas (%)	12.72	14.80	13.95
Molecular Weight of Stack Gas (dry)	31.288	31.196	31.256
Molecular Weight of Stack Gas (wet)	29.60	29.24	29.41
Average Velocity of Stack Gas (fpm)	4,184	4,280	4,202
Actual Stack Gas Flowrate (acfm)	397,564	406,747	399,357
Stack Gas Flowrate (dscfm)	260,724	261,101	257,569
Isokinesis (%)	102.59	99.15	100.59
EMISSION CONCENTRATION			
Particulate Concentration (gr/acf)	0.011	0.012	0.010
Particulate Concentration (gr/dscf)	0.017	0.019	0.015
Particulate Concentration (lbs/dscf)	2.43E-06	2.76E-06	2.19E-06
Particulate Concentration (µg/m3)	25600	28438	22629
EMISSION RATE			
Particulate Emission Rate (lbs/hr)	38.06	43.26	33.80
Particulate Emission (gr/dscf@7%)	0.022	0.025	0.021
Chlorine Emission Rate (g/hr)	163.440	95.340	213.380
HCl Emission Rate (g/hr)	1416.480	862.600	354.120

H-

TABLE A-2
SUMMARY OF CHLORIDE MASS BALANCE DATA
BACKGROUND TEST/PHASE 1
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

SAMPLE IDENTIFICATION	% CHLORIDE WET BASIS
2-1 MB (Raw Feed)	0.035
2-2 MB (Coal-Kiln)	0.11
2-3 MB (Coal-Precalciner)	0.09
2-4 MB (Quench Water)	0.0056
2-6 MB (Bypass Dust)	0.99
2-7 MB (Clinker)	0.0063
2-8 MB (Kiln Dust)	0.47
3-1 MB (Raw Feed)	0.035
3-2 MB (Coal-Kiln)	0.11
3-3 MB (Coal-Precalciner)	0.11
3-4 MB (Quench Water)	0.0058
3-6 MB (Bypass Dust)	3.00
3-7 MB (Clinker)	0.0047
3-8 MB (Kiln Dust)	0.27
4-1 MB (Raw Feed)	0.034
4-2 MB (Coal-Kiln)	0.10
4-3 MB (Coal-Precalciner)	0.12
4-4 MB (Quench Water)	0.0054
4-6 MB (Bypass Dust)	1.60
4-7 MB (Clinker)	0.0063
4-8 MB (Kiln Dust)	0.26

TABLE A-3
METALS DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST/PHASE 1
LONE STAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NO.	6 ME	7 ME	8 ME
DATE:	4/14/92	4/14/92	4/14/92
TIME:	11:28 - 14:10	16:10 - 18:35	20:30 - 22:44
TEST DATA INPUT			
Barometric Pressure (in. Hg)	29.68	29.58	29.52
Stack Area (ft2)	95.03	95.03	95.03
Nozzle Diameter (in.)	0.191	0.191	0.191
Total Sampling Time (min.)	120	120	120
Calibration Factor (Y)	0.97	0.97	0.97
Pitot Coefficient	0.84	0.84	0.84
Average Square Root of Velocity Head (in. wc)	1.102	1.122	1.119
Average Orifice Pressure Drop (in. wc)	1.22	1.262	1.25
Average Meter Temp. (°F)	77	84	77
Average Stack Pressure (in. wc)	-0.6	-0.58	-0.66
Average Stack Temp. (°F)	238	237	235
Meter Volume @ Meter Conditions (ft3)	70.78	72.92	71.93
Total Water Collected (ml)	234	234	218
CO2 in Stack Gas (%)	17.8	17.5	17.2
O2 in Stack Gas (%)	10.2	10.6	10.6
CO in Stack Gas (%)	0.1	0.1	0.1
Total Catch Sb(mg)	0.0005	0.0009	0.00066
Total Catch As (mg)	0.00331	0.00451	0.00384
Total Catch Ba (mg)	0.0588	0.0664	0.307
Total Catch Be (mg)	0.00032	0.00012	0.00019
Total Catch Cd (mg)	0.00068	0.00079	0.00059
Total Catch Cr (mg)	0.0309	0.0305	0.0704
Total Catch Pb (mg)	0.0245	0.0256	0.0218
Total Catch Ag (mg)	0.00019	0.0002	0.00023
Total Catch Tl (mg)	0.00224	0.00149	0.00145
Total Catch Zn (mg)	0.0826	0.0624	0.183
Total Catch Hg (mg)	0.00813	0.00559	0.00557
CALCULATED VALUES			
Meter Volume (dscf)	67.17	68.08	67.90
Water Vapor in Stack Gas (%)	14.09	13.92	13.13
Molecular Weight of Stack Gas (dry)	31.256	31.224	31.176
Molecular Weight of Stack Gas (wet)	29.39	29.38	29.45
Average Velocity of Stack Gas (fpm)	4,251	4,332	4,315
Actual Stack Gas Flowrate (acfm)	403,942	411,704	410,029
Stack Gas Flowrate (dscfm)	260,019	265,017	266,550
Isokinesis (%)	102.87	102.31	101.44
EMISSION CONCENTRATION			
Concentration Sb (µg/Nm3)	0.27337	0.46677	0.34325
Concentration As (µg/Nm3)	1.74012	2.33902	1.99706
Concentration Ba (µg/Nm3)	30.91215	34.43694	159.66100
Concentration Be (µg/Nm3)	0.16823	0.06224	0.09881
Concentration Cd (µg/Nm3)	0.35749	0.40972	0.30684
Concentration Cr (µg/Nm3)	16.24465	15.81817	36.61282
Concentration Pb (µg/Nm3)	12.88006	13.27689	11.33749
Concentration Ag (µg/Nm3)	0.09989	0.10373	0.11962
Concentration Tl (µg/Nm3)	1.17761	0.77276	0.75410
Concentration Zn (µg/Nm3)	43.42421	32.36243	95.17252
Concentration Hg (µg/Nm3)	4.27408	2.89913	2.89678
EMISSION RATE			
Emission Rate Sb (g/hr)	0.12078	0.21019	0.15546
Emission Rate As (g/hr)	0.76883	1.05330	0.90451
Emission Rate Ba (g/hr)	13.65776	15.50756	72.31391
Emission Rate Be (g/hr)	0.07433	0.02803	0.04475
Emission Rate Cd (g/hr)	0.15795	0.18450	0.13897
Emission Rate Cr (g/hr)	7.17729	7.12320	16.58273
Emission Rate Pb (g/hr)	5.69073	5.97882	5.13499
Emission Rate Ag (g/hr)	0.04413	0.04671	0.05418
Emission Rate Tl (g/hr)	0.52030	0.34799	0.34155
Emission Rate Zn (g/hr)	19.18590	14.57337	43.10569
Emission Rate Hg(g/hr)	1.88839	1.30553	1.31201

TABLE A-4
SUMMARY OF MASS BALLANCE METALS DATA
CERTIFICATION OF COMPLIANCE TEST/PHASE 1
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NUMBER (MATRIX)	ELEMENT										
	Antimony (Sb)	Arsenic (As)	Barium (Ba)	Beryllium (Be)	Cadmium (Cd)	Chromium (Cr)	Lead (Pb)	Silver (Ag)	Thallium (Tl)	Zinc (Zn)	Mercury (Hg)
	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
6 (RAW MIX)	0.458	1.220	19.400	0.080	0.608	5.540	10.500	<0.066	0.756	12.600	0.260
6 (COAL KILN)	<0.277	2.070	23.300	0.603	1.930	9.650	9.030	0.105	<0.111	37.800	0.167
6 (COAL PRECAL)	<0.353	3.450	46.700	0.508	2.790	8.340	11.200	<0.071	<0.141	51.200	0.230
6 (QUENCH H2O)*	<0.005	<0002	0.090	<.0005	<0.001	<0.005	0.049	<0.001	<0.002	<0.001	<0.001
6 (BYPASS DUST)	<0.368	1.600	40.300	0.388	2.120	19.400	67.900	0.465	0.372	21.200	0.100
6 (CLINKER)	<0.442	1.950	51.300	0.468	1.400	45.700	12.300	<0.088	0.177	23.700	<0.090
6 (KILN DUST)	<0.361	2.190	23.300	0.159	0.658	7.010	21.300	0.116	45.400	12.300	0.415
7 (RAW MIX)	0.410	1.340	19.500	0.104	0.632	5.900	30.300	<.075	1.200	13.100	0.228
7 (COAL KILN)	<0.327	1.020	15.300	0.321	1.620	9.690	4.540	0.131	<0.131	43.800	0.127
7 (COAL PRECAL)	<0.396	4.290	46.200	0.460	2.610	7.520	13.700	<0.079	<0.158	51.500	0.121
7 (QUENCH H2O)*	<0.005	0.003	0.087	<.0005	<0.001	<0.005	0.022	<0.001	<0.002	0.001	0.005
7 (BYPASS DUST)	<0.305	1.790	40.400	0.396	2.810	18.100	109.000	0.646	0.457	24.700	<0.078
7 (CLINKER)	<0.275	2.580	49.400	0.467	1.350	50.300	14.000	<0.055	<0.110	18.700	<0.086
7 (KILN DUST)	<0.335	1.690	23.400	0.168	0.819	7.760	24.300	0.107	46.500	18.800	0.335
8 (RAW MIX)	<0.371	1.210	18.400	0.126	0.476	5.870	14.700	40.100	2.210	9.200	0.473
8 (COAL KILN)	<0.335	2.740	22.900	0.817	1.870	9.190	8.250	0.080	<0.134	52.900	0.119
8 (COAL PRECAL)	<0.396	3.820	48.100	0.736	2.660	8.250	1.240	<0.079	<0.158	55.000	0.138
8 (QUENCH H2O)*	<0.005	0.004	0.094	<0.0005	<0.001	<0.005	<0.004	<0.001	<0.002	0.002	0.0004
8 (BYPASS DUST)	<0.364	1.860	37.700	0.480	2.720	18.200	105.000	0.837	0.582	28.400	<0.079
8 (CLINKER)	<0.298	1.730	46.600	0.524	1.400	48.100	15.700	0.077	<0.119	23.600	<0.083
8 (KILN DUST)	<0.454	1.310	21.200	0.245	0.518	6.960	21.500	0.118	58.900	25.500	0.275

* RESULTS REPORTED IN MG/L

TABLE A-5
VOST TRAIN WORKSHEET/PHASE 1
BIF COC TEST PROGRAM
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Apr-92

Test Number	2A	2B	2C	2D	Total/Avg.	Normal Liters	Concentration ug/l	Emission Rate g/hr
Sample Volume (l)	20.1	20.45	19.6	20.07	80.22	77.58		
Meter Temperature (°C)	23				23			
Barometric Press. (in.Hg.)					29.84			
Flowrate (dscfm)					260724			
Dry Gas Meter 'Y'					0.98			
Target Compounds (ug)								
Perchloroethylene					0.1		0.00129	0.571
Trichlorotrifluoromethane					0.1		0.00129	0.571
1,1,1 Trichloroethane					0.1		0.00129	0.571
1,1,2 Trichloroethane					0.1		0.00129	0.571
Test Number	3A	3B	3C	3D				
Sample Volume (l)	19.73	19.8	20	20.07	79.6	74.47		
Meter Temperature (°C)	33				33			
Barometric Press. (in.Hg.)					29.84			
Flowrate (dscfm)					261101			
Dry Gas Meter 'Y'					0.98			
Target Compounds (ug)								
Perchloroethylene					0.1		0.00134	0.596
Trichlorotrifluoromethane					0.1		0.00134	0.596
1,1,1 Trichloroethane					0.1		0.00134	0.596
1,1,2 Trichloroethane					0.1		0.00134	0.596
Test Number	4A	4B	4C	4D				
Sample Volume (l)	20	19.8	19.96	19.93	79.69	74.99		
Meter Temperature (°C)	30				30			
Barometric Press. (in.Hg.)					29.72			
Flowrate (dscfm)					257569			
Dry Gas Meter 'Y'					0.98			
Target Compounds (ug)								
Perchloroethylene					0.1		0.00133	0.583
Trichlorotrifluoromethane					0.1		0.00133	0.583
1,1,1 Trichloroethane					0.1		0.00133	0.583
1,1,2 Trichloroethane					0.1		0.00133	0.583

TABLE A-6-1
APCC CEM DATA SUMMARY
BACKGROUND TEST/PHASE 1
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Apr-92

DATE TEST NO.	TIME From	TIME To	CO (ppm)	OXYGEN (%)	CO2 (%)	CO @ 7% O2 (ppm)
4/13/92						
START TEST 2	9:28	9:43	900	10.0	18.2	1148
	9:43	9:59	875	10.2	17.8	1137
	9:59	10:15	787	10.2	18.0	1022
	10:15	10:31	980	10.1	18.0	1261
	10:31	10:47	950	9.9	18.3	1200
	10:47	11:03	950	10.1	18.1	1223
	11:03	11:19	850	10.0	18.3	1084
	11:19	11:35	800	11.5	16.2	1183
	11:35	11:51	500	10.3	17.7	656
	11:51	12:07	518	11.4	16.3	758
	12:07	12:23	1000	10.0	17.6	1275
	12:23	12:39	1000	10.1	155	1287
STOP TEST 2	12:39	12:55	933	9.9	190	1179
TEST AVERAGE			849	10.3	41.5	1112

Note: CO averages of 1000 are actually over range.

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TABLE A-6-2

APCC CEM DATA SUMMARY

BACKGROUND TEST/PHASE 1

LONESTAR INDUSTRIES, INC.

CAPE GIRARDEAU, MISSOURI

Apr-92

DATE TEST NO.	TIME From	TIME To	CO (ppm)	OXYGEN (%)	CO2 (%)	CO @ 7% O2 (ppm)
4/13/92						
START TEST 3	13:11	13:26	1000	10.5	17.1	1337
	13:26	13:41	950	10.0	17.9	1211
	13:41	13:56	673	10.4	17.3	891
	13:56	14:11	675	10.1	17.7	869
	14:11	14:26	669	10.2	17.5	869
	14:26	14:41	670	10.3	17.4	879
	14:41	14:56	528	10.3	17.4	692
	14:56	15:11	800	10.3	17.3	1049
	15:11	15:26	695	10.2	17.4	903
	15:26	15:41	800	10.1	17.6	1030
	15:41	15:56	751	10.1	17.4	967
STOP TEST 3	15:56	16:11	900	10.1	17.5	1158
TEST AVERAGE			759	10.2	17.5	988

Note: CO averages of 1000 are actually over range.

TABLE A-6-3
APCC CEM DATA SUMMARY
BACKGROUND TEST/PHASE 1
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Apr-92

DATE TEST NO.	TIME From	TIME To	CO (ppm)	OXYGEN (%)	CO2 (%)	CO @ 7% O2 (ppm)
4/13/92						
START TEST 4	16:52	17:03	708	10.5	17.7	946
	17:03	17:19	586	10.8	17.5	806
	17:19	17:35	678	10.6	17.7	915
	17:35	17:51	566	10.5	17.4	756
	17:51	18:07	880	10.4	18.0	1165
	18:07	18:23	900	10.6	17.6	1215
	18:23	18:39	1000	10.5	17.7	1337
	18:39	18:55	1000	10.5	17.9	1337
	18:55	19:11	1000	10.5	17.8	1337
	19:11	19:27	680	10.5	17.6	909
	19:27	19:43	542	10.6	17.4	731
	19:43	19:59	584	10.4	17.9	773
STOP TEST 4	19:59	20:15	572	10.6	17.6	772
TEST AVERAGE			745.8	10.5	17.7	1000

Note: CO averages of 1000 are actually over range.

TABLE A-6-4

APCC CEM DATA SUMMARY

BACKGROUND TEST/PHASE 1

LONESTAR INDUSTRIES, INC.

CAPE GIRARDEAU, MISSOURI

Apr-92

DATE TEST NO.	TIME From	TIME To	CO (ppm)	OXYGEN (%)	CO2 (%)	CO @ 7% O2 (ppm)
4/13/92						
START TEST 6	11:28	11:49	990	10.2	17.7	1286.1
	11:49	12:05	1000	10.2	17.5	1299
	12:05	12:21	1100	10.2	17.7	1429
	12:35	12:51	1200	10.5	17.5	1604
	12:51	13:07	1150	10.1	17.9	1480
	13:07	13:23	1300	10.3	17.8	1705
	13:23	13:39	1350	10.2	17.8	1754
	13:39	13:55	1400	10.1	17.8	1802
STOP TEST 6	13:55	14:11	1150	10.1	17.7	1480
TEST AVERAGE			1182	10.2	17.7	1538

TABLE A-6-5
APCC CEM DATA SUMMARY
BACKGROUND TEST/PHASE 1
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Apr-92

DATE TEST NO.	TIME From	TIME To	CO (ppm)	OXYGEN (%)	CO2 (%)	CO @ 7% O2 (ppm)
4/13/92						
START TEST 7	16:12	16:30	1400	10.4	17.7	1853
	16:30	16:46	1300	10.6	17.5	1754
	16:46	17:02	1000	10.4	17.6	1324
	17:02	17:18	585	10.8	17.3	805
	17:18	17:34	780	10.8	17.3	1073
	17:34	17:50	1200	10.5	17.6	1604
	17:50	18:06	880	10.7	17.4	1199
	18:06	18:22	1200	10.5	17.6	1604
STOP TEST 7	18:22	18:38	800	10.6	17.4	1080
TEST AVERAGE			1016	10.6	17.5	1370

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TABLE A-6-6

APCC CEM DATA SUMMARY

BACKGROUND TEST/PHASE 1

LONESTAR INDUSTRIES, INC.

CAPE GIRARDEAU, MISSOURI

Apr-92

DATE TEST NO.	TIME From	TIME To	CO (ppm)	OXYGEN (%)	CO2 (%)	CO @ 7% O2 (ppm)
4/13/92						
START TEST 8	20:30	20:49	1100	11.0	17.1	1544
	20:49	21:04	1250	10.3	17.5	1639
	21:04	21:20	1250	10.8	16.9	1720
	21:20	21:36	900	10.5	17.2	1203
	21:36	21:51	801	10.8	17.0	1102
	21:51	22:07	1020	10.6	17.2	1377
	22:07	22:23	1000	10.4	17.3	1324
	22:23	22:38	1000	10.4	17.3	1324
STOP TEST 8	22:38	22:44	1020	10.3	17.2	1338
TEST AVERAGE			1038	10.6	17.2	1397

TABLE A-7
PARTICULATE/CHLORINE/HCl DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NO.	3-CL	4-CL	5-CL
DATE:	6/25/92	6/25/92	6/25/92
TIME :	8:38-10:46	17:50-19:56	22:02-00:10
TEST DATA INPUT			
Barometric Pressure (in. Hg)	29.2	29.2	29.25
Stack Area (ft2)	95.03	95.03	95.03
Nozzle Diameter (in.)	0.19	0.188	0.188
Total Sampling Time (min.)	120	120	120
Calibration Factor (Y)	1.02	1.02	1.02
Pitot Coefficient	0.84	0.84	0.84
Average Square Root of Velocity Head (in. wc)	1.132	1.163	1.15
Average Orifice Pressure Drop (in. wc)	1.187	1.254	1.225
Average Meter Temp. (°F)	87	100	86
Average Stack Pressure (in. wc)	-0.7	-0.7	-0.7
Average Stack Temp. (°F)	246	246	242
Meter Volume @ Meter Conditions (ft3)	69.78	72.91	71.04
Total Water Collected (ml)	248	250	250
CO2 in Stack Gas (%)	17.1	16.9	16.9
O2 in Stack Gas (%)	10.6	11	10.8
CO in Stack Gas (%)	0.2	0.1	0.1
Total Particulate (mg)	82.5	77.3	74.1
Total Chlorine (mg)	0.1	0.2	0.3
Total HCl (mg)	15.3	17.3	28.3
CALCULATED VALUES			
Meter Volume (dscf)	67.25	68.65	68.71
Water Vapor in Stack Gas (%)	14.79	14.63	14.62
Molecular Weight of Stack Gas (dry)	31.16	31.144	31.136
Molecular Weight of Stack Gas (wet)	29.21	29.22	29.22
Average Velocity of Stack Gas (fpm)	4,441	4,562	4,495
Actual Stack Gas Flowrate (acfm)	422,041	433,547	427,157
Stack Gas Flowrate (dscfm)	262,015	269,655	267,690
Isokinesis (%)	103.29	104.64	105.51
EMISSION CONCENTRATION			
Particulate Concentration (gr/acf)	0.012	0.011	0.010
Particulate Concentration (gr/dscf)	0.019	0.017	0.017
Particulate Concentration (lbs/dscf)	2.70E-06	2.48E-06	2.38E-06
Particulate Concentration (µg/m3)	26912.352	24748.511	23880.358
EMISSION RATE			
Particulate Emission Rate (lbs/hr)	42.48	40.13	38.15
Particulate Concentration (gr/dscf@7%02)	0.026	0.024	0.023
Chlorine Emission Rate (g/hr)	23.38	47.14	70.12
HCL Emission Rate (g/hr)	3,576.63	4,077.38	6,614.94

TABLE A-8
SUMMARY OF CHLORIDE MASS BALANCE DATA
CERTIFICATION OF COMPLIANCE TEST/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

SAMPLE IDENTIFICATION	% CHLORIDE WET BASIS	SAMPLE IDENTIFICATION	% CHLORIDE WET BASIS
3-1 MB (Raw Feed)	0.045	7-1 MB (Raw Feed)	0.052
3-3 MB (Coal-Precalciner)	0.11	7-3 MB (Coal-Precalciner)	0.11
3-4 MB (Quench Water)	0.0031	7-4 MB (Quench Water)	0.0032
3-5 MB (Tires)	0.11	7-5 MB (Tires)	0.12
3-6 MB (Bypass Dust)	7.4	7-6 MB (Bypass Dust)	14.0
3-7 MB (Clinker)	0.200	7-7 MB (Clinker)	0.110
3-8 MB (Kiln Dust)	0.31	7-8 MB (Kiln Dust)	0.33
3-9 MB (WDSF)	0.12	7-9 MB (WDSF)	0.17
3-10 MB (WDLF)	4.82	7-10 MB (WDLF)	4.55
4-1 MB (Raw Feed)	0.049	8-1 MB (Raw Feed)	0.058
4-3 MB (Coal-Precalciner)	0.09	8-3 MB (Coal-Precalciner)	0.10
4-4 MB (Quench Water)	0.0033	8-4 MB (Quench Water)	0.0039
4-5 MB (Tires)	0.10	8-5 MB (Tires)	0.19
4-6 MB (Bypass Dust)	10.0	8-6 MB (Bypass Dust)	18.0
4-7 MB (Clinker)	0.093	8-7 MB (Clinker)	0.047
4-8 MB (Kiln Dust)	0.29	8-8 MB (Kiln Dust)	0.29
4-9 MB (WDSF)	0.20	8-9 MB (WDSF)	0.14
4-10 MB (WDLF)	4.65	8-10 MB (WDLF)	4.50
5-1 MB (Raw Feed)	0.051	9-1 MB (Raw Feed)	0.052
5-3 MB (Coal-Precalciner)	0.08	9-3 MB (Coal-Precalciner)	0.11
5-4 MB (Quench Water)	0.0035	9-4 MB (Quench Water)	0.0036
5-5 MB (Tires)	0.14	9-5 MB (Tires)	0.27
5-6 MB (Bypass Dust)	9.3	9-6 MB (Bypass Dust)	17.0
5-7 MB (Clinker)	0.140	9-7 MB (Clinker)	0.050
5-8 MB (Kiln Dust)	0.30	9-8 MB (Kiln Dust)	0.27
5-9 MB (WDSF)	0.24	9-9 MB (WDSF)	0.28
5-10 MB (WDLF)	4.58	9-10 MB (WDLF)	5.07

TABLE A-9
METALS DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NO. (6 BLANK)	7-ME	8-ME	9-ME
DATE:	6/26/92	6/26/92	6/26/92
TIME :	13:51-16:01	18:08-20:20	21:54-00:03
TEST DATA INPUT			
Barometric Pressure (in. Hg)	29.3	29.3	29.3
Stack Area (ft2)	95.03	95.03	95.03
Nozzle Diameter (in.)	0.188	0.188	0.188
Total Sampling Time (min.)	120	120	120
Calibration Factor (Y)	1.01	1.01	1.01
Pitot Coefficient	0.84	0.84	0.84
Average Square Root of Velocity Head (in. wc)	1.075	1.1045	1.077
Average Orifice Pressure Drop (in. wc)	0.909	1.003	0.996
Average Meter Temp. (°F)	100	99	95
Average Stack Pressure (in. wc)	-0.7	-0.7	-0.7
Average Stack Temp. (°F)	310	310	310
Meter Volume @ Meter Conditions (ft3)	62.47	65.17	64.73
Total Water Collected (ml)	240	240	240
CO2 in Stack Gas (%)	19	19.2	19.2
O2 in Stack Gas (%)	9.5	9.3	9.2
CO in Stack Gas (%)	0.2	0.2	0.2
Total Catch As (mg)	0.00264	0.00431	0.00418
Total Catch Be (mg)	0.00010	0.00010	0.00029
Total Catch Cd (mg)	0.00342	0.03021	0.00010
Total Catch Cr (mg)	0.02269	0.00010	0.00010
Total Catch Pb (mg)	0.02632	0.02369	0.05572
Total Catch Zn (mg)	0.05362	0.00010	0.03862
Total Catch Hg (mg)	0.07514	0.06893	0.25039
CALCULATED VALUES			
Meter Volume (dscf)	58.39	61.04	61.06
Water Vapor in Stack Gas (%)	16.21	15.62	15.61
Molecular Weight of Stack Gas (dry)	31.42	31.444	31.44
Molecular Weight of Stack Gas (wet)	29.24	29.34	29.34
Average Velocity of Stack Gas (fpm)	4,395	4,508	4,396
Actual Stack Gas Flowrate (acfm)	417,625	428,355	417,708
Stack Gas Flowrate (dscfm)	234,563	242,293	236,285
Isokinesis (%)	102.32	103.55	106.22
EMISSION CONCENTRATION			
Concentration As (µg/m3)	1.59653	2.49342	2.41727
Concentration Be (µg/m3)	0.06047	0.05785	0.16771
Concentration Cd (µg/m3)	2.06823	17.47706	0.05783
Concentration Cr (µg/m3)	13.72167	0.05785	0.05783
Concentration Pb (µg/m3)	15.91689	13.70512	32.22254
Concentration Zn (µg/m3)	32.42643	0.05785	22.33371
Concentration Hg (µg/m3)	45.44055	39.87732	144.79902
EMISSION RATE			
Emission Rate As (g/hr)	0.63633	1.02655	0.97052
Emission Rate Be (g/hr)	0.02410	0.02382	0.06733
Emission Rate Cd (g/hr)	0.82433	7.19537	0.02322
Emission Rate Cr (g/hr)	5.46903	0.02382	0.02322
Emission Rate Pb (g/hr)	6.34398	5.64245	12.93721
Emission Rate Zn (g/hr)	12.92418	0.02382	8.96689
Emission Rate Hg(g/hr)	18.11121	16.41764	58.13620

TABLE A-10
Cr DATA SUMMARY
CERTIFICATION OF OMPLIANCE TEST/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NO. (6 BLANK)	7-Cr	8-Cr	9-Cr
DATE:	6/26/92	6/26/92	6/26/92
TIME :	13:50-16:09	18:07-20:27	21:54-00:14
TEST DATA INPUT			
Barometric Pressure (in. Hg)	29.3	29.3	29.3
Stack Area (ft2)	95.03	95.03	95.03
Nozzle Diameter (in.)	0.188	0.188	0.188
Total Sampling Time (min.)	120	120	120
Calibration Factor (Y)	1.01	1.01	1.01
Pitot Coefficient	0.84	0.84	0.84
Average Square Root of Velocity Head (in. wc)	1.077	1.091	1.094
Average Orifice Pressure Drop (in. wc)	0.942	0.959	0.969
Average Meter Temp. (°F)	93	92	89
Average Stack Pressure (in. wc)	-0.7	-0.7	-0.7
Average Stack Temp. (°F)	310	310	310
Meter Volume @ Meter Conditions (ft3)	63.96	64	64.09
Total Water Collected (ml)	240	240	240
CO2 in Stack Gas (%)	19	19.2	19.2
O2 in Stack Gas (%)	9.5	9.3	9.2
CO in Stack Gas (%)	0.2	0.2	0.2
Total Cr6 Catch (mg)	0.0007	0.0007	0.0007
CALCULATED VALUES			
Meter Volume (dscf)	60.54	60.69	61.11
Water Vapor in Stack Gas (%)	15.72	15.69	15.60
Molecular Weight of Stack Gas (dry)	31.42	31.444	31.44
Molecular Weight of Stack Gas (wet)	29.31	29.33	29.34
Average Velocity of Stack Gas (fpm)	4,398	4,453	4,465
Actual Stack Gas Flowrate (acfm)	417,936	423,191	424,291
Stack Gas Flowrate (dscfm)	236,100	239,161	240,041
Isokinesis (%)	105.41	104.31	104.65
EMISSION CONCENTRATION			
Cr6 Concentration (gr/acf)	0.000	0.000	0.000
Cr6 Concentration (gr/dscf)	0.000	0.000	0.000
Cr6 Concentration (lbs/dscf)	2.55E-11	2.54E-11	2.52E-11
Cr6 Concentration (µg/Nm3)	4.09E-01	4.08E-01	4.05E-01
EMISSION RATE			
Cr6 Emission Rate (g/hr)	0.16	0.17	0.16

TABLE A-11
MASS BALANCE METALS DATA
CERTIFICATION OF COMPLIANCE TEST/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI

TEST NUMBER (MATRIX)	ELEMENT										
	Silver (Ag) mg/kg	Arsenic (As) mg/kg	Barium (Ba) mg/kg	Beryllium (Be) mg/kg	Cadmium (Cd) mg/kg	Chromium (Cr) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Antimony (Sb) mg/kg	Thallium (Tl) ',mg/kg	Zinc (Zn) mg/kg
7(RAW FEED)	0.665	0.764	14.100	0.517	3.510	18.700	0.414	8.890	0.295	4.760	20.300
7(COAL PRECAL)	0.489	5.460	60.700	0.331	0.237	16.600	0.205	6.300	0.383	0.727	53.400
7(QUENCHH2O)*	0.007	0.005	0.104	0.004	0.001	0.150	0.004	0.008	0.005	0.002	0.066
7(TIRES)	0.460	0.959	13.200	0.053	1.820	4.830	0.094	10.800	7.900	0.105	5584.000
7(BYPASS DUST)	2.520	18.100	55.300	0.528	346.000	32.200	0.093	685.000	0.767	1.690	113.000
7(CLINKER)	0.540	15.500	56.400	0.830	3.270	39.700	0.088	23.800	0.389	0.179	92.800
7(KILN DUST)	0.364	2.220	14.700	0.210	3.640	8.550	0.624	19.400	0.274	49.200	26.300
7(WDSF)	6.190	8.260	309.000	0.196	1.280	204.000	9.710	65.500	2.430	0.270	637.000
7(WDLF)*	3.670	200.000	912.000	2.400	289.000	612.000	1.840	595.000	19.050	0.109	951.000
	Silver (Ag) mg/kg	Arsenic (As) mg/kg	Barium (Ba) mg/kg	Beryllium (Be) mg/kg	Cadmium (Cd) mg/kg	Chromium (Cr) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Antimony (Sb) mg/kg	Thallium (Tl) mg/kg	Zinc (Zn) mg/kg
8(RAW FEED)	0.411	1.430	12.400	0.608	1.590	20.400	0.510	14.600	0.281	3.940	20.900
8(COAL PRECAL)	0.546	3.950	51.500	0.580	0.175	15.700	0.078	5.590	0.302	0.671	46.100
8(QUENCHH2O)*	0.007	0.001	0.100	0.004	0.001	0.283	0.004	0.009	0.005	0.002	0.062
8(TIRES)	0.685	3.660	20.200	0.081	16.600	56.800	0.096	31.200	6.530	0.162	16200.000
8(BYPASS DUST)	4.270	16.800	80.800	0.449	501.000	38.500	0.094	1060.000	0.588	2.260	128.000
8(CLINKER)	0.444	16.500	60.200	0.771	4.480	33.000	0.083	14.900	0.368	0.147	84.800
8(KILN DUST)	0.475	2.480	15.300	0.219	5.030	10.400	0.798	20.700	0.294	56.500	29.900
8(WDSF)	0.503	6.660	368.000	0.237	2.060	187.000	9.840	54.600	1.750	0.525	658.000
8(WDLF)*	3.940	185.000	826.000	2.420	280.000	605.000	1.420	611.000	11.650	0.123	441.000
	Silver (Ag) mg/kg	Arsenic (As) mg/kg	Barium (Ba) mg/kg	Beryllium (Be) mg/kg	Cadmium (Cd) mg/kg	Chromium (Cr) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Antimony (Sb) mg/kg	Thallium (Tl) mg/kg	Zinc (Zn) mg/kg
9(RAW FEED)	0.408	0.754	11.400	0.536	1.330	16.900	0.495	11.500	0.350	4.440	20.700
9(COAL PRECAL)	0.535	3.190	70.800	0.254	0.242	20.400	0.135	3.960	0.303	0.418	65.200
9(QUENCHH2O)*	0.007	0.002	0.109	0.002	0.001	0.012	0.004	0.006	0.005	0.002	0.080
9(TIRES)	0.684	1.070	6.430	0.099	35.100	99.800	0.085	25.800	1.240	0.179	8650.000
9(BYPASS DUST)	4.230	17.800	82.200	0.551	467.000	32.900	0.154	1000.000	2.550	5.230	126.000
9(CLINKER)	0.440	17.900	63.900	0.894	4.090	32.200	0.078	30.200	0.754	0.149	86.400
9(KILN DUST)	0.559	3.120	16.700	0.296	4.320	6.190	0.825	33.400	0.399	88.800	29.300
9(WDSF)	0.495	15.200	356.000	0.269	2.470	277.000	11.500	60.700	3.410	0.774	806.000
9(WDLF)*	3.130	168.000	490.210	2.590	277.000	589.000	1.860	621.000	10.810	0.155	297.000

*RESULTS REPORTED IN MG/L

Corrected

TABLE A-12
VOST TRAIN WORKSHEET
BIF COC TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

						Normal	Concentration	Emission Rate
Test Number	3A	3B	3C	3D	Total/Avg.	Liters	ug/l	g/hr
Sample Volume (l)	20.61	21.58	21.37	21.05	84.61	75.31		
Meter Temperature (°C)	34				34			
Barometric Press. (in.Hg.)					29.2			
Flowrate (dscfm)					262015			
Dry Gas Meter 'Y'					0.956			
Target Compounds (ug)								
Perchloroethylene					0.1		0.00133	0.591
Trichlorotrifluoromethane					0.1		0.00133	0.591
1,1,1 Trichloroethane					0.1		0.00133	0.591
1,1,2 Trichloroethane					0.1		0.00133	0.591
Test Number	4A	4B	4C	4D				
Sample Volume (l)	21.46	20.64	20.87	20.79	83.76	73.13		
Meter Temperature (°C)	40				40			
Barometric Press. (in.Hg.)					29.2			
Flowrate (dscfm)					269655			
Dry Gas Meter 'Y'					0.956			
Target Compounds (ug)								
Perchloroethylene					0.1		0.00137	0.626
Trichlorotrifluoromethane					0.1		0.00137	0.626
1,1,1 Trichloroethane					0.1		0.00137	0.626
1,1,2 Trichloroethane					0.1		0.00137	0.626
Test Number	5A	5B	5C	5D				
Sample Volume (l)	20.57	20.7	20.9	22.3	84.47	75.56		
Meter Temperature (°C)	33				33			
Barometric Press. (in.Hg.)					29.25			
Flowrate (dscfm)					267690			
Dry Gas Meter 'Y'					0.956			
Target Compounds (ug)								
Perchloroethylene					0.1		0.00132	0.602
Trichlorotrifluoromethane					0.1		0.00132	0.602
1,1,1 Trichloroethane					0.1		0.00132	0.602
1,1,2 Trichloroethane					0.1		0.00132	0.602

TABLE A-13-1
CEM DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

TEST# DATE	TIME From	TIME To	CO (ppm)	CO2 (%)	O2 (%)	NOx (ppm)	SO2 (ppm)	THC (ppm)	CO Corr. (ppm)	THC Corr. (ppm dry)	CO Corr. Rolling Avg	THC Corr. Rolling Avg
6/25/92												
Start #3	8:33	8:48	4144	17.3	10.6	137	131	25	5578	40		
	8:48	9:03	3617	17.6	10.3	136	111	23	4733	35		
	9:03	9:18	3409	18.1	10	115	93	22	4339	33	5143	42
	9:18	9:33	3446	18	10.2	103	88	23	4467	35	4779	36
	9:33	9:48	3458	17.9	10.2	95	87	22	4483	34	4505	34
	9:48	10:03	3696	17.7	10.2	92	84	23	4791	35	4520	34
	10:03	10:18	2405	17.5	10.1	104	73	23	3089	35	4207	35
	10:18	10:33	1668	16.9	10.4	106	58	24	2203	37	3641	35
	10:33	10:48	1743	16.1	11	110	50	24	2440	40	3131	37
	10:48	11:03	1114	16.1	11.3	111	42	26	1608	44	2335	39
	11:03	11:18	809	16.2	11.2	111	37	24	1156	40	1852	40
End #3	11:18	11:33	787	15.8	11.2	107	32	23	1124	39	1582	41
	11:33	11:48	563	15.7	11.6	107	30	24	839	42	1182	41
	11:48	12:03	258	14.6	12.1	104	25	23	406	43	881	41
TEST AVG.			2223	16.8	10.7	110	67	24	2947	38	3147	38

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TABLE A-13-2
CEM DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

TEST# DATE	TIME From	TIME To	CO (ppm)	CO2 (%)	O2 (%)	NOx (ppm)	SO2 (ppm)	THC (ppm)	CO Corr. (ppm)	THC Corr. (ppm dry)	CO Corr. Rolling Avg	THC Corr. Rolling Avg
6/25/92												
Start #4	17:48	18:03	1856	17.7	10.7	190	101	22	2523	35	2198	34
	18:03	18:18	1430	17.2	11	203	99	22	2002	36	2176	34
	18:18	18:33	1449	17.6	10.9	185	103	22	2009	36	2129	34
	18:33	18:48	1691	17.4	11	170	111	22	2367	36	2225	36
	18:48	19:03	2226	17.6	10.8	148	117	21	3055	34	2358	36
	19:03	19:18	1621	17.2	10.8	172	102	22	2225	36	2414	35
	19:18	19:33	882	16.6	11	218	92	22	1235	36	2221	35
	19:33	19:48	766	16.8	11	250	92	22	1072	36	1897	35
	19:48	20:03	538	16.4	11.1	290	97	21	761	35	1323	36
	20:03	20:18	442	16.1	11.4	309	96	21	645	36	928	36
	20:18	20:33	535	16.4	11.3	240	93	21	772	36	812	36
End #4	20:33	20:48	445	15.7	11.6	219	87	20	663	35	710	35
TEST AVG.			1156.8	16.9	11.1	216	99	22	1611	36	1783	35

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TABLE A-13-3
CEM DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

TEST# DATE	TIME From	TIME To	CO (ppm)	CO2 (%)	O2 (%)	NOx (ppm)	SO2 (ppm)	THC (ppm)	CO Corr. (ppm)	THC Corr. (ppm dry)	CO Corr. Rolling Avg	THC Corr. Rolling Avg
6/25/92												
Start #5	21:48	22:03	1823	17	10.9	206	89	21	2527	34	1339	35
	22:03	22:18	1417	17.6	10.5	210	93	20	1889	31	1529	34
	22:18	22:33	1388	17.5	10.7	178	98	20	1887	32	1824	33
	22:33	22:48	1860	17.4	10.6	172	98	20	2504	32	2202	32
	22:48	23:03	1732	17.6	10.3	174	93	20	2266	31	2136	31
	23:03	23:18	1981	17.4	10.7	175	91	20	2693	32	2337	32
	23:18	23:33	1163	17.7	10.2	203	86	21	1508	32	2243	32
	23:33	23:48	699	16.4	11	227	78	21	979	35	1861	32
	23:48	0:03	930	16.5	11.1	229	85	21	1315	35	1623	33
	0:03	0:18	640	16.4	11.1	254	93	21	905	35	1177	34
	0:18	0:33	515	16.4	11.2	263	104	20	736	34	984	35
	0:33	0:48	324	15.8	11.5	304	93	20	477	35	858	35
End #5	0:48	1:03	409	16.3	11.1	283	76	19	578	32	674	34
TEST AVG.			1144.7	16.9	10.8	221	91	20	1559	33	1599	33

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TABLE A-13-4
CEM DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

TEST# DATE	TIME From	TIME To	CO (ppm)	CO2 (%)	O2 (%)	NOx (ppm)	SO2 (ppm)	THC (ppm)	CO Corr. (ppm)	THC Corr. (ppm dry)	CO Corr. Rolling Avg	THC Corr. Rolling Avg
6/26/92												
Start #7	13:49	14:04	3800	19.5	9.1	171	216	43	4471	60	3614	54
	14:04	14:19	4359	20.4	8.5	204	215	48	4882	63	4086	58
	14:19	14:34	3831	20.2	8.7	221	215	43	4360	58	4236	59
	14:34	14:49	3074	19.6	8.9	232	232	65	3557	88	4317	67
	14:49	15:04	1948	20.7	8.8	255	217	43	2235	58	3759	67
	15:04	15:19	1620	20.1	9.1	223	187	41	1906	57	3015	65
	15:19	15:34	1269	17.4	10.7	181	109	36	1725	58	2356	65
	15:34	15:49	1654	17.5	10.4	188	83	33	2185	51	2013	56
	15:49	16:04	1173	17.1	10.6	186	84	31	1579	49	1849	54
	16:04	16:19	1423	17.2	10.4	197	89	32	1879	50	2877	81
	16:19	16:34	1452	17.3	10.6	205	89	30	1955	48	1900	50
End #7	16:34	16:49	1295	17.4	10.4	230	93	30	1710	47	1781	48
TEST AVG.			2242	18.7	9.7	208	152	40	2704	57	2983	60

TABLE A-13-5
CEM DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

TEST# DATE	TIME From	TIME To	CO (ppm)	CO2 (%)	O2 (%)	NOx (ppm)	SO2 (ppm)	THC (ppm)	CO Corr. (ppm)	THC Corr. (ppm dry)	CO Corr. Rolling Avg	THC Corr. Rolling Avg
6/26/92												
	17:49	18:04	1942	20	9	245	211	41	2266	56	2133	55
Start #8	18:04	18:19	3475	20.7	8.6	220	220	43	3923	57	2633	56
	18:19	18:34	3135	20.5	8.4	263	219	46	3483	60	3026	58
	18:34	18:49	2979	20.2	8.6	280	223	47	3363	62	3259	59
	18:49	19:04	2556	20.3	8.7	309	223	43	2909	58	3420	59
	19:04	19:19	1718	20.2	8.6	349	232	43	1940	57	2924	59
	19:19	19:34	1579	20	8.8	328	239	41	1812	55	2506	58
	19:34	19:49	931	18.4	9.7	303	170	37	1153	54	1954	56
	19:49	20:04	1185	17.4	10.4	264	223	34	1565	53	1618	55
	20:04	20:19	1126	17.1	10.4	254	117	32	1487	50	1504	53
End #8	20:19	20:34	1074	17.2	10.6	239	103	31	1446	49	1413	51
	20:34	20:49	1300	17.3	10.6	235	100	32	1750	51	1562	51
TEST AVG.			1917	19.1	9.4	274	190	39	2258	55	2329	56

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TABLE A-13-6
CEM DATA SUMMARY
CERTIFICATION OF COMPLIANCE TEST PROGRAM/PHASE 2
LONESTAR INDUSTRIES, INC.
CAPE GIRARDEAU, MISSOURI
Jun-92

TEST# DATE	TIME From	TIME To	CO (ppm)	CO2 (%)	O2 (%)	NOx (ppm)	SO2 (ppm)	THC (ppm)	CO Corr. (ppm)	THC Corr. (ppm dry)	CO Corr. Rolling Avg	THC Corr. Rolling Avg
6/26/92-												
	21:34	21:49	1308	17.1	18.8	214	164	28	8324	210	3454	87
Start #9	21:49	22:04	2605	19.5	9.3	229	218	36	3117	51	3822	88
	22:04	22:19	4047	20.6	8.3	212	229	42	4461	54	4434	90
	22:19	22:34	4185	20.4	8.5	239	236	46	4687	61	5147	94
	22:34	22:49	3406	20.5	8.4	287	243	44	3784	58	4012	56
	22:49	23:04	2827	20.4	8.2	319	250	43	3092	55	4006	57
	23:04	23:19	1187	20	9	340	245	42	1385	58	3237	58
	23:19	23:34	917	18.5	9.4	307	184	36	1107	51	2342	55
	23:34	23:49	973	17.4	10.3	271	132	34	1273	52	1714	54
	23:49	0:04	1120	17.5	10.5	255	119	35	1493	55	1314	54
End #9	0:04	0:19	1614	17.4	10.4	231	115	33	2132	51	1501	52
	0:19	0:34	2159	17.5	10.1	204	109	33	2773	50	1918	52
TEST AVG.			2196	19	10	259	187	38	3136	67	3075	66

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