Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

AP-42 Section 11.6
Reference 20
Report Sect. 4
Reference 24

California Portland Cement
Oak Creek Road
Mojave, California 93501

MOJAVE PLANT

(KILN, CLINKER, AND CRUSHER BAGHOUSES)

Prepared by

Pape & Steiner Environmental Services
5801 Norris Road
Bakersfield, California 93308

ANNUAL COMPLIANCE TEST

May 15 - 18, 1984

Kern County A/C Numbers
1003001B, 1003026A, 1003027A

EPA Permit NSR 4-4-8; SJ 78-73

Report PS-84-249/Project 5233-84

Test Team Leader: Jim Steiner

Approved Jim Steiner
Jim Steiner, Project Manager
June 12, 1984

Source category: Portland Cement
Plant name : California Portland Cement
Test date : 5/15 - 5/18/84
Process : dry

Date: 05/17/93
Location: Mojave, CA
Ref. No.: 24

Basis for process rate :

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor kg/Mg	Emission factor lb/ton	Volumetric flow rate, DSCFM	Concen. ppm
rotary kiln (coal-fired)	fabric filter	BASED ON FEED RATE							
		filt. PM	1	4.88	231	0.0106	0.0211		
		filt. PM	2	10.53	236	0.0223	0.0446		
		filt. PM	3	7.00	245	0.0143	0.0286		
		AVERAGE				0.0157	0.0314	RATING:	B
		con. inorg. PM	1	2.58	231	0.00558	0.0112		
		con. inorg. PM	2	0.53	236	0.00112	0.00225		
		con. inorg. PM	3	0.61	245	0.00124	0.00249		
		AVERAGE				0.00265	0.00530	RATING:	B
		SO2	1	143.8	231	0.311	0.623		
		SO2	2	154.2	236	0.327	0.653		
		SO2	3	154.8	245	0.316	0.632		
		AVERAGE				0.318	0.636	RATING:	B
		SO3	1	1.88	231	0.00407	0.00814		
		SO3	2	1.89	236	0.00400	0.00801		
		SO3	3	0.58	245	0.00118	0.00237		
		AVERAGE				0.00309	0.00617	RATING:	B
		total sulfate	1	1.88	231	0.00407	0.00814		
		total sulfate	2	1.89	236	0.00400	0.00801		
		total sulfate	3	1.9	245	0.00388	0.00776		
		AVERAGE				0.00398	0.00797	RATING:	B
		NOx	1	503.5	231	1.09	2.18		
		NOx	2	501.7	236	1.06	2.13		
		NOx	3	546.6	245	1.12	2.23		
		AVERAGE				1.09	2.18	RATING:	B
		CO	1	170	231	0.368	0.736		
		CO	2	178.9	236	0.379	0.758		
		CO	3	170.7	245	0.348	0.697		
		AVERAGE				0.365	0.730	RATING:	B
		CO2	1	251,545	231	544	1,089	195,615	18.8
		CO2	2	246,929	236	523	1,046	196,413	18.38
		CO2	3	291,891	245	596	1,191	230,671	18.5
		AVERAGE				554	1,109	RATING:	B
		hydrocarbons	1	24.74	231	0.0535	0.107		
		hydrocarbons	2	13.36	236	0.0283	0.0566		
		hydrocarbons	3	15.06	245	0.0307	0.0615		
		AVERAGE				0.0375	0.0751	RATING:	B
clinker cooler	fabric filter	BASED ON CLINKER FEED RATE							
		filt. PM	1	2.18	250	0.00436	0.00872		
		filt. PM	2	1.61	250	0.00322	0.00644		
		filt. PM	3	1.60	250	0.00320	0.00640		
		AVERAGE				0.00359	0.00719	RATING:	B
		con. inorg. PM	1	0.00	250	0.00000	0.00000		
		con. inorg. PM	2	0.00	250	0.00000	0.00000		
		con. inorg. PM	3	0.50	250	0.00100	0.00200		
		AVERAGE				0.00033	0.00067	RATING:	B

Notes: 1. Crusher emission data not useable due to lack of adequate information.

California Portland Cement
Oak Creek Road
Mojave, California 93501

MOJAVE PLANT

(KILN, CLINKER, AND CRUSHER BAGHOUSES)

Prepared by

Pape & Steiner Environmental Services
5801 Norris Road
Bakersfield, California 93308

Reference SO:
(1) Coal-fired dry process kiln w/ bhouse (Ref. 45)
(Data Rating: B)
(1) Unspecified crusher w/ bhouse - Delete!
(1) Clinker cooler w/ bhouse
(Data Rating: B)

Test

Approved Jim Steiner
Jim Steiner, Project Manager
June 12, 1984

CALIFORNIA PORTLAND CEMENT COMPANY

P. O. BOX 910, MOJAVE, CALIFORNIA 93501 / TELEPHONE (805) 824-2401

June 22, 1984

Mr. Henry Mayrsohn, P.E.
Manager, Technical Services
Kern County Air Pollution Control District
1601 "H" Street, Suite 250
Bakersfield, CA 93301

Reference: KCAPCD Permits to Operate
1003001, 1003021-1003027, 1003030

Mr. Charles M. Seeley
Chief, Compliance Section
Air and Hazardous Materials Branch
Enforcement Division
U. S. Environmental Protection Agency, Region 9
215 Fremont Street
San Francisco, CA 94105

Reference: E-3-1
NSR 4-4-8
SJ 78-73

Gentlemen:

Annual performance tests were conducted May 15 to May 18, 1984, in compliance with Kern County Air Pollution Control District Rule 108.1, and Special Condition A of the above referenced Permits to Operate. The Test Plan and prior notice of the scheduled dates for these performance tests were submitted to each agency on April 13, 1984.

Enclosed is the Annual Compliance Test Report prepared by Pape & Steiner Environmental Services who conducted the tests. If you have any questions regarding the performance tests or the report, please contact Mr. Jim Steiner (805-393-8442) of Pape & Steiner Environmental Services.

Sincerely,

S. A. Whitley

S. A. Whitley
Production Assistant

Enclosure

cc: J. Steiner
D. S. Cahn
R. H. Lamp

SUMMARY OF SOURCE TEST RESULTS FOR EPA

Company: California Portland Cement Permit Number: NSR 4-4-8; SJ 78-73 Unit Number or Name: Kiln H5-6-DC1

Location: Baghouse Outlet

Pollutant/Other	Test Method	Test Date	Emission/Other*	
			Test Results	Permit Limit
Particulates	EPA Method 5	May 15, 1984	7.47 lb/hr	36.00 lb/hr
SO_2	CARB Method 1-100	May 15, 1984	150.91 lb/hr 76.00 ppm	616.00 lb/hr 2000.00 ppm
NO_x as NO_2				
Hydrocarbon				
Sulfur Content				
Fuel Usage				
Excess Oxygen				

* Emissions/Other should be at standard conditions (68 F and 29.92 inches of Hg) and in units of EP. Authority to Construct/modify.

Prepared by Jim Steiner Jim Steiner

Title Partner, Pape & Steiner Environmental Services

Date June 12, 1984

SUMMARY OF SOURCE TEST RESULTS FOR EPA

Company: California Portland Cement Permit Number: NSR 4-4-8; SJ 78-73 Unit Number or Name: Crusher B2-DC1

Location: Baghouse Outlet

Pollutant/Other	Test Method	Test Date	Emission/Other*	
			Test Results	Permit Limit
Particulates	EPA Method 5	May 16-17, 1984	0.60 lb/hr	5.00 lb/hr
SO_2				
NO_x as NO_2				
Hydrocarbon				
Sulfur Content				
Fuel Usage				
Excess Oxygen				

* Emissions/Other should be at standard conditions (68 F and 29.92 inches of Hg) and in units of EP. Authority to Construct/modify.

Prepared by Jim Steiner Jim Steiner

Title Partner, Pape & Steiner Environmental Services

Date June 12, 1984

SUMMARY OF SOURCE TEST RESULTS FOR EPA

Company: California Portland Cement Permit Number: NSR 4-4-8; SJ 78-73 Unit Number or Name: Clinker H2-6-DC1

Location: Baghouse Outlet

Pollutant/Other	Test Method	Test Date	Emission/Other*	
			Test Results	Permit Limit
Particulates	EPA Method 5	May 17 - 18, 1984	1.80 lb/hr	21.00 lb/hr
SO_2				
NO_x as NO_2				
Hydrocarbon				
Sulfur Content				
Fuel Usage				
Excess Oxygen				

* Emissions/Other should be at standard conditions (68 F and 29.92 inches of Hg) and in units of EP. Authority to Construct/modify.

Prepared by Jim Steiner Jim Steiner

Title Partner, Pape & Steiner Environmental Services

Date June 12, 1984

SUMMARY OF SOURCE TEST RESULTS

Company California Portland Cement Test Date 5/15/84 APCD No. 1003026A Unit No. Kiln

Pollutants	Emissions									Removal %	Emission Factor lb/Ton	
	Inlet				Outlet							
	Concentration Wet			Mass Flow Rate lb/hr	Concentration Wet				Mass Flow Rate lb/hr			
	gr/scf	@ 12% CO_2	ppm_v		gr/scf	@ 12% CO_2	ppm_v	@ 3% O_2			Inlet	Outlet
Particulate					0.0042 0.0062 0.0041 0.0048				7.46 11.06 7.61 8.71			0.03 0.05 0.03 0.04
Sulfate					0.0010 0.0011 0.0010 0.0010				1.88 1.89 1.90 1.89			
SO_2							67.79 72.81 73.45 71.35		143.76 154.17 154.80 150.91			
NO_x as NO_2 (dry)							353.75 352.50 382.50 362.92	605.94 606.71 658.34 623.66	503.48 501.70 546.62 517.27			
HC (C_1, >C_1)							1.1/48.9 0.0/27.0 0.0/30.3 0.37/35.40		0.54/24.20 0.00/13.36 0.00/15.06 0.18/17.54			

Scrubber Liquor Analysis: Chlorides -- Specific Gravity --

For Kern County Use Only:

Remarks

Feed Rates = 231, 236, 245 Tons/hour

SUMMARY OF SOURCE TEST RESULTS

Company California Portland Cement Test Date 5/16-17/84 APCD No. 1003001B Unit No. Crusher

Pollutants	Emissions									Removal %	Emission Factor lb/Ton	
	Inlet				Outlet							
	Concentration Wet			Mass Flow Rate lb/hr	Concentration Wet				Mass Flow Rate lb/hr			
	gr/scf	@ 12% CO_2	ppm_v		gr/scf	@ 12% CO_2	ppm_v	@ 3% O_2			Inlet	Outlet
Particulate					0.0026 0.0017 0.0014 0.0019				0.85 0.54 0.43 0.61			0.0006 0.0004 0.0003 0.0004
Sulfate												
SO_2												
NO_x as NO_2 (dry)												
HC												

Scrubber Liquor Analysis: Chlorides -- Specific Gravity --

For Kern County Use Only:

Remarks

Crusher Production Rate = 1500 tons/hour

SUMMARY OF SOURCE TEST RESULTS

Company California Portland Cement Test Date 5/17-18/84 APCD No. 1003027A Unit No. Clinker

Pollutants	Emissions									Removal %	Emission Factor lb/Ton	
	Inlet				Outlet							
	Concentration Wet			Mass Flow Rate lb/hr	Concentration Wet				Mass Flow Rate lb/hr			
	gr/scf	@ 12% CO_2	ppm_v		gr/scf	@ 12% CO_2	ppm_v	@ 3% O_2			Inlet	Outlet
Particulate					0.0019 0.0014 0.0019 0.0017				2.18 1.61 2.10 1.96			0.0087 0.0064 0.0084 0.0079
Sulfate												
SO_2												
NO_x as NO_2 (dry)												
HC												

Scrubber Liquor Analysis: Chlorides -- Specific Gravity --

For Kern County Use Only:

Remarks Clinker Feedrate was 250 tons/hour on 5/17 and 18

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SECTION 1

INTRODUCTION

At the request of the California Portland Cement Company, Pape & Steiner Environmental Services conducted a series of annual compliance tests on the outlets of the kiln baghouse, crusher baghouse, and clinker cooler baghouse from May 15 to May 18, 1984.

Triplicate tests for particulates and sulfates were conducted on the effluent of the kiln baghouse using EPA Method 5/8 equipment and procedures. Triplicate tests for NO_x, SO_2, and CO were conducted on the kiln baghouse effluent using EPA Procedures dated November 19, 1981. Triplicate hydrocarbon tests were also performed using a GC-FID procedure. Triplicate tests for particulates were conducted on the effluents of the crusher and clinker cooler baghouses using EPA Method 5 equipment and procedures.

Messrs. Jim Steiner and Jim Oblak conducted the test work for Pape & Steiner. These tests were observed by Ms. Linda Chester of the Kern County APCD. Mr. Steve Whitley of California Portland Cement was on site to assist with the test work and insure each process was operating properly during the test program.

SECTION 2

WET METHODS DATA SUMMARIES

A. FIELD DATA

	Station	Kiln	Kiln	Kiln
	Run No.	1	2	3
V_{1c}	Vol water collected in train, ml	69.5	67.8	60.0
V_m	Sample gas vol, meter conditions, dcf	51.772	52.331	53.949
Y	Meter calibration factor	1.0088	1.0088	1.0088
P_{bar}	Barometric pressure, in. Hg	26.20	26.20	26.20
P_{stack}	Stack static pressure, In. H_2O	-1.2	-1.2	-1.2
ΔH	Avg meter pressure diff, in. H_2O	1.60	1.62	1.73
T_m	Absolute meter temp., ^oR	514.60	520.79	523.63
$V_{m(std)}$	Standard sample gas vol, dscf	46.4213	46.3674	47.5564
B_{ws}	Water vapor in gas stream	0.0649	0.0635	0.0553
MF	Moisture factor	0.9351	0.9365	0.9447
CO_2	Dry, volume %	18.60	18.38	18.50
O_2	Dry, volume %	10.45	10.50	11.10
N_2	Dry, volume %	70.730375	71.100375	70.360000
CO	Dry, volume %	0.019625	0.019625	0.020000
M_d	Molecular wt of stack gas, dry	31.4260	31.3608	31.4040
M_s	Molecular wt of stack gas, wet	30.5547	30.5126	30.6634
C_p	Pitot tube coefficient	0.84	0.84	0.84
$\sqrt{\Delta P}$	Avg of square roots of each ΔP	0.9284	0.9296	0.9578
T_s	Absolute stack temp., ^oR	719.00	718.17	718.00
A	Area of stack, ft^2	87.2787	87.2787	87.2787
Q_{std}	Volumetric flowrate, dscfm	195615.4204	196413.6784	203671.4227
A_n	Nozzle area, ft^2	0.000290	0.000290	0.000290
Θ	Sample time	72	72	72
%I	Isokinetic variation	99.4366	98.9175	97.8387

A. FIELD DATA

	Station	Crusher	Crusher	Crusher
	Run No.	1	2	3
V_{1c}	Vol water collected in train, ml	18.4	22.3	20.7
V_m	Sample gas vol, meter conditions, dcf	69.712	68.411	66.978
Y	Meter calibration factor	1.0088	1.0088	1.0088
P_{bar}	Barometric pressure, in. Hg	26.25	26.25	26.26
P_{stack}	Stack static pressure, In. H_2O	-9.3	-9.3	-9.3
ΔH	Avg meter pressure diff, in. H_2O	2.61	2.51	2.42
T_m	Absolute meter temp., ^oR	532.13	540.19	530.13
$V_{m(std)}$	Standard sample gas vol, dscf	60.7335	58.6944	58.5629
B_{ws}	Water vapor in gas stream	0.0138	0.0173	0.0161
MF	Moisture factor	0.9862	0.9827	0.9839
CO_2	Dry, volume %	0.0	0.0	0.0
O_2	Dry, volume %	20.9	20.9	20.9
N_2	Dry, volume %	79.1	79.1	79.1
CO	Dry, volume %	0.0	0.0	0.0
M_d	Molecular wt of stack gas, dry	28.8360	28.8360	28.8360
M_s	Molecular wt of stack gas, wet	28.6859	28.6485	28.6613
C_p	Pitot tube coefficient	0.84	0.84	0.84
$\sqrt{\Delta P}$	Avg of square roots of each ΔP	1.1664	1.1369	1.1312
T_s	Absolute stack temp., ^oR	517.33	520.00	517.04
A	Area of stack, ft^2	10.3206	10.3206	10.3206
Q_{std}	Volumetric flowrate, dscfm	36897.5267	35769.4711	35733.9244
A_n	Nozzle area, ft^2	0.000238	0.000238	0.000238
Θ	Sample time	72	72	72
%I	Isokinetic variation	99.2083	98.9012	98.7778

A. FIELD DATA

	Station	Clinker	Clinker	Clinker
	Run No.	1	2	3
V_{1c}	Vol water collected in train, ml	5.2	8.6	11.7
V_m	Sample gas vol, meter conditions, dcf	72.4730	70.979	69.682
Y	Meter calibration factor	1.0088	1.0088	1.0088
P_{bar}	Barometric pressure, in. Hg	26.26	26.26	26.38
P_{stack}	Stack static pressure, In. H_2O	-0.19	-0.19	-0.24
ΔH	Avg meter pressure diff, in. H_2O	2.64	2.72	2.60
T_m	Absolute meter temp., ^oR	533.67	537.71	531.67
$V_{m(std)}$	Standard sample gas vol, dscf	63.0207	61.2374	61.0569
B_{ws}	Water vapor in gas stream	0.0038	0.0066	0.0088
MF	Moisture factor	0.9962	0.9934	0.9912
CO_2	Dry, volume %	0.0	0.0	0.0
O_2	Dry, volume %	20.9	20.9	20.9
N_2	Dry, volume %	79.1	79.1	79.1
CO	Dry, volume %	0.0	0.0	0.0
M_d	Molecular wt of stack gas, dry	28.8360	28.8360	28.8360
M_s	Molecular wt of stack gas, wet	28.7947	28.7643	28.7406
C_p	Pitot tube coefficient	0.84	0.84	0.84
$\sqrt{\Delta P}$	Avg of square roots of each ΔP	0.4745	0.4620	0.4539
T_s	Absolute stack temp., ^oR	697.58	694.42	694.50
A	Area of stack, ft^2	106.1392	106.1392	106.1392
Q_{std}	Volumetric flowrate, dscfm	135806.8923	132225.2166	129953.9317
A_n	Nozzle area, ft^2	0.000698	0.000698	0.000698
Θ	Sample time	72	72	72
%I	Isokinetic variation	98.0501	92.8557	99.2724

B. PARTICULATE DATA

Date of Test: Kiln 5/15/84
Crusher 5/16, 5/17/84
Clinker 5/17, 5/18/84

Station/Run #	Final Particulate Weight (mg)	V_m(std)	gr/dscf	gr/scf	Stack % CO_2(dry)	(gr/dscf @ 12% CO_2) gr/scf @ 12% CO_2	lb/hr
Kiln 1	13.38	46.4813	0.0044	0.0042			7.46
2	19.74	46.3674	0.0066	0.0062			11.06
3	13.44	47.5564	0.0044	0.0041			7.61
Crusher 1	10.52	60.7335	0.0027	0.0026			0.85
2	6.75	58.6944	0.0018	0.0017			0.54
3	5.32	58.5629	0.0014	0.0014			0.61
Clinker 1	7.66	63.0707	0.0019	0.0019			2.18
2	5.63	61.2324	0.0014	0.0014			1.61
3	7.47	61.0569	0.0019	0.0019			2.10

C. SULFATE DATA

N_{BaCl_2} = 0.00980

Station/ Run	Sample	(V_{soln}/V_a)	(V_t-V_{tb})	grains	V_m(std)	gr/dscf	dscfm	lb/hr	gr/scf	%CO_2 (dry)	(gr/dscf @ 12% CO_2) gr/scf @ 12% CO_2
Kiln 1	Front Half	100/10	0.33-0.10	0.0170							
	Back Half	215/10	0.22-0.00	0.0550							
	Total			0.0520	46.4213	0.0011	145615	1.88	0.0010		
2	Front Half	100/10	0.30-0.10	0.0148							
	Back Half	240/10	0.21-0.00	0.0373							
	Total			0.0522	46.3674	0.0011	146414	1.89	0.0011		
3	Front Half	100/10	0.36-0.10	0.0193							
	Back Half	220/10	0.20-0.00	0.0326							
	Total			0.0519	41.5564	0.0011	203611	1.90	0.0010		
	Front Half										
	Back Half										
	Total										
	Front Half										
	Back Half										
	Total										
	Front Half										
	Back Half										
	Total										

E. HYDROCARBON DATA

Station	Run	C_1			$>C_1$			dscfm
		Area Counts	ppm	lb/hr	Area Counts	ppm	lb/hr	
Kiln	Initial Cal	21387						
	Final Cal	20327						
	Average	20857	48.9					
	1	488	1.1	0.54	20857	48.9	24.20	195615
	2	0	0.0	0.00	11523	27.0	13.36	195615
	3	0	0.0	0.00	12926	30.3	15.06	19644

SECTION 3

WET TEST METHOD CALCULATIONS

EMISSION RATE CALCULATIONS

1. Fuel factor at 68°F, 29.92 in. Hg (dscf/mmBtu)

$$\text{F Factor} = \frac{10^6[3.64(\%H) + 1.53(\%C) + 0.57(\%S) + 0.14(\%N) - 0.46(\%O_2)]}{\text{Btu/lb}}$$

2. Fuel factor at 60°F, 29.92 in. Hg (dscf/mmBtu)

$$\text{F Factor}_{60^o} = \text{F Factor}_{68^o}\left(\frac{60 + 460}{68 + 460}\right)$$

3. Emission concentration wet at standard conditions* (gr/scf)

$$\text{gr/scf} = 15.432\left(\frac{\text{Comp (g)}}{V_{m,std} + V_{w,std}}\right)$$

4. Emission concentration dry at standard conditions* (gr/dscf)

$$\text{gr/dscf} = 15.432\left(\frac{\text{Comp (g)}}{V_{m,std}}\right)$$

5. Emission concentration corrected to 12% CO_2

$$C\ @\ 12\%\ CO_2 = C_{measured}\left(\frac{12}{\%CO_2\ \text{measured}}\right)$$

6. Emission Rate lb/hr from gr/dscf

$$\text{lb/hr} = 0.00857(\text{gr/dscf})(Q_s)$$

7. Gaseous concentration in ppm

$$\text{ppm} = \frac{1.60864(S_t + 460)^*(\text{mg comp})}{MW(V_{m,std})}$$

8. Emission rate lb/hr from ppm

$$\text{lb/hr} = \frac{8.223 \times 10^{-5}(Q_s)(MW)(\text{ppm})}{(S_t + 460)^*}$$

9. Emission concentration corrected to 3% O_2

$$\text{ppm}\ @\ 3\%\ O_2 = \text{ppm measured}\left(\frac{20.9 - 3}{20.9 - \%O_2\ \text{measured}}\right)$$

---

*Standard temperature to be defined

EMISSION RATE CALCULATIONS
(Concluded)

10. Emission factor, lb/mmBtu at 0% O_2

$$\text{lb/mmBtu} = F(1.4286 \times 10^{-4}) \left(\frac{20.9}{20.9 - \%O_2}\right) (\text{gr/dscf})$$

$$\text{lb/mmBtu} = F(MW)\left(\frac{1.3711 \times 10^{-6}}{S_t + 460^*}\right)\left(\frac{20.9}{20.9 - \%O_2}\right) (\text{ppm})$$

11. Heating value of fuel, mmBtu/bbl

$$\text{mmBtu/bbl} = 349.786 \times 10^{-6}(\text{Btu/lb})(\text{SpGr})$$

12. Emission Factor, lb/bbl

$$\text{lb/bbl} = (\text{lb/mmBtu})(\text{mmBtu/bbl})$$

*Standard temperature to be defined

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test 1 Date 5/15/84 Location Kiln Baghouse Stack

T_m	54.60	V_m	51.772	O_2	10.45	Stack ID "	126.5
T_s	259.00	γ	1.0088	CO_2	18.80	Stack Area Ft^2	87.2787
$\sqrt{\Delta P}$	0.9284	P_b	26.20	Static	-1.2	Test Time	72
ΔH	1.60	V_{1c}	69.5	C_p	0.84	N_d	0.2304

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 46.4213$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.2218$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0649$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.4260$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.5547$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.1118$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 63.2903$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 195615.4204$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.4366$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test 2 Date 5/15/84 Location Kiln Baghouse Stack

T_m	60.79	V_m	52.331	O_2	10.5	Stack ID "	126.5
T_s	258.17	γ	1.0088	CO_2	18.38	Stack Area Ft^2	87.2787
$\sqrt{\Delta P}$	0.9296	P_b	26.20	Static	-1.2	Test Time	72
ΔH	1.62	V_{1c}	67.8	C_p	0.84	N_d	0.2304

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 46.3674$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.1430$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0635$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.3608$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.5126$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.1118$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 63.3791$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 196413.6784$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.9175$$

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test 3 Date 5/15/84 Location Kiln Stack

T_m	63.63	V_m	53.949	O_2	11.1	Stack ID "	126.5
T_s	258.00	γ	1.0088	CO_2	18.5	Stack Area Ft^2	87.2787
$\sqrt{\Delta P}$	.9578	P_b	26.20	Static	-1.2	Test Time	72
ΔH	1.73	V_{1c}	60.0	C_p	0.84	N_d	0.2304

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 47.5564$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 2.7814$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0553$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.4040$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.6634$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.1118$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 65.1334$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 203,671.4227$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 97.8387$$

Pape & Steiner Environmental Services

TEST 1,2,3

LOCATION Kiln Stack

EMISSION RATE DATA -- 60°F

XEQ 60

XEQ FF

XEQ RAT

Standard Temperature, S_t = 60°F; 29.92 inches Hg

		Test 1	Test 2	Test 3	Average
ENTER:	R-17 $V_{m,std}$	46.4213	46.3674	47.5564	
	R-19 Bwo	0.0649	0.0635	0.0553	
	R-26 Q_S	195615.4204	196413.6764	203671.4227	
	R-22 O_2%	10.45	10.50	11.10	
	R-23 CO_2	16.80	18.38	18.50	
LAB DATA					
	Front Half Wash (g)	0.00704	0.01670	0.00994	
	Mass Filter (g)	0.00172	0.00310	0.00242	
	Back Half Catch (g)	0.00462	0.00094	0.00108	
	Front Half Sulfate (mg H_2SO_4)	2.27	2.42	2.11	
	Back Half Sulfate (mg H_2SO_4)	1.10	0.96	1.25	
	H_2O_2 Catch (mg H_2SO_4)				
RESULTS					
F Factor	1				
Total Particulate (gr/scf)	2	0.0042	0.0062	0.0041	0.0048
Total Sulfate (gr/scf)	4	0.0010	0.0011	0.0010	0.0010
Total Particulate (gr/dscf)	8	0.0044	0.0066	0.0044	0.0051
Total Particulate (12% CO_2)	9	0.0028	0.0043	0.0028	0.0033
Total Particulate (lb/hr)	10	7.46	11.06	7.61	8.71
Total Sulfate (gr/dscf)	11	0.0011	0.0011	0.0011	0.0011
Total Sulfate (12% CO_2)	12	0.0007	0.0007	0.0007	0.0007
Total Sulfate (lb/hr)	13	1.88	1.89	1.90	1.89
SO_2 (ppm)					
SO_2 (lb/hr)					
SO_2 (3% O_2)					
SO_2 (lb/MMBtu)					
S (lb/MMBtu)					
SO_2 (ppm wet)					

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test #1 Date 5-16-84 Location Crusher

T_m	72.13	V_m	69.712	O_2	20.9	Stack ID "	43.5
T_s	57.33	γ	1.0088	CO_2	0.0	Stack Area Ft^2	10.3206
$\sqrt{\Delta P}$	1.1664	P_b	26.25	Static	-9.3	Test Time	72
ΔH	2.61	V_{1c}	18.4	C_p	.840	N_d	.2089

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 60.7335$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.8530$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0138$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.6859$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.5662$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 70.3491$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 36,897.5267$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.2083$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test #2 Date 5-16-84 Location Crusher

T_m	80.19	V_m	68.411	O_2	20.9	Stack ID "	43.5
T_s	60.0	γ	1.0088	CO_2	0.0	Stack Area Ft^2	10.3706
$\sqrt{\Delta P}$	1.1369	P_b	26.25	Static	-9.3	Test Time	72
ΔH	2.51	V_{1c}	22.3	C_p	.840	N_d	.2089

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 58.6944$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 1.0338$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0173$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.6485$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.5662$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 68.7915$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 35,769.4711$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.9012$$

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test #3 Date 5-17-84 Location Crusher

T_m	70.13	V_m	66.928	O_2	20.9	Stack ID "	43.5
T_s	57.04	γ	1.0088	CO_2	0.0	Stack Area Ft^2	10.3206
$\sqrt{\Delta P}$	1.1312	P_b	26.26	Static	-9.3	Test Time	72
ΔH	2.42	V_{1c}	20.7	C_p	.840	N_d	.2089

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 58.5629$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.9596$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0161$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.6613$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.5762$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 68.2229$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 35,733.9244$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.7778$$

Pape & Steiner Environmental Services

TEST 1,2,3

LOCATION Crusher Stack

EMISSION RATE DATA -- 60°F

XEQ 60

XEQ FF

XEQ RAT

Standard Temperature, S_t = 60°F; 29.92 inches Hg

		Test 1	Test 2	Test 3	Average
ENTER:	R-17 $V_{m,std}$	60.7335	58.6944	58.5629	
	R-19 Bwo	0.0138	0.0173	0.0161	
	R-26 Q_S	36897.5267	35769.4711	35733.9244	
	R-22 O_2%	20.9	20.9	20.9	
	R-23 CO_2	0.0	0.0	0.0	
LAB DATA					
	Front Half Wash (g)	0.01052	0.00675	0.00514	
	Mass Filter (g)	0.00000	0.00000	0.00000	
	Back Half Catch (g)	0.00000	0.00000	0.00018	
	Front Half Sulfate (mg H_2SO_4)				
	Back Half Sulfate (mg H_2SO_4)				
	H_2O_2 Catch (mg H_2SO_4)				

RESULTS

F Factor	1				
Total Particulate (gr/scf)	2	0.0026	0.0017	0.0014	0.0019
Total Sulfate (gr/scf)	4				
Total Particulate (gr/dscf)	8	0.0027	0.0018	0.0014	0.0020
Total Particulate (12% CO_2)	9				
Total Particulate (lb/hr)	10	0.85	0.54	0.43	0.61
Total Sulfate (gr/dscf)	11				
Total Sulfate (12% CO_2)	12				
Total Sulfate (lb/hr)	13				
SO_2 (ppm)					
SO_2 (lb/hr)					
SO_2 (3% O_2)					
SO_2 (lb/MMBtu)					
S (lb/MMBtu)					
SO_2 (ppm wet)					

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test #1 Date 5-17-84 Location clinker stack

T_m	73.67	V_m	72.4230	O_2	20.9	Stack ID "	139.05
T_s	237.58	γ	1.0088	CO_2	0.0	Stack Area Ft^2	106.1392
$\sqrt{\Delta P}$	0.4245	P_b	26.26	Static	-0.19	Test Time	72
ΔH	2.84	V_{1c}	5.2	C_p	.840	N_d	.3528

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 63.0207$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.2411$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0038$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.7947$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2460$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 32.7371$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 135,805.8923$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.0501$$

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test 2 Date 5/17/84 Location Clinker Stack

T_m	77.71	V_m	70.979	O_2	20.9	Stack ID "	139.5
T_s	234.42	γ	1.0088	CO_2	0.0	Stack Area Ft^2	106.1392
$\sqrt{\Delta P}$	0.4620	P_b	26.26	Static	-0.19	Test Time	72
ΔH	2.72	V_{1c}	8.8	C_p	0.84	N_d	0.3578

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 61.2374$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.4079$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0066$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.7643$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2460$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 31.8192$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 132225.2166$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 97.8557$$

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test 3 Date 5/18/84 Location Clinker Stack

T_m	71.67	V_m	69.682	O_2	20.9	Stack ID "	139.5
T_s	234.50	γ	1.0088	CO_2	0.0	Stack Area Ft^2	106.1392
$\sqrt{\Delta P}$	0.4534	P_b	26.38	Static	-0.24	Test Time	72
ΔH	2.60	V_{1c}	11.7	C_p	0.84	N_d	0.3578

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 61.0569$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.5424$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0088$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.7406$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.3624$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 31.2069$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 129953.9517$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.2724$$

Pape & Steiner Environmental Services

TEST 1, 2, 3

LOCATION Clinker

EMISSION RATE DATA -- 60°F

XEQ 60

XEQ FF

XEQ RAT

Standard Temperature, S_t = 60°F; 29.92 inches Hg

		Test 1	Test 2	Test 3	Average
ENTER:	R-17 $V_{m,std}$	63.0207	61.2374	61.0569	
	R-19 Bwo	0.0036	0.0066	0.0088	
	R-26 Q_S	135806.6923	132225.2466	129953.9317	
	R-22 O_2%	20.9	20.9	20.9	
	R-23 CO_2	0.0	0.0	0.0	
LAB DATA					
	Front Half Wash (g)	0.00766	0.00563	0.00569	
	Mass Filter (g)	0.00000	0.00000	0.00000	
	Back Half Catch (g)	0.00000	0.00000	0.00178	
	Front Half Sulfate (mg H_2SO_4)				
	Back Half Sulfate (mg H_2SO_4)				
	H_2O_2 Catch (mg H_2SO_4)				

RESULTS

F Factor	1				
Total Particulate (gr/scf)	2	0.0019	0.0014	0.0019	0.0017
Total Sulfate (gr/scf)	4				
Total Particulate (gr/dscf)	8	0.0019	0.0014	0.0019	0.0017
Total Particulate (12% CO_2)	9				
Total Particulate (lb/hr)	10	2.18	1.61	2.10	1.96
Total Sulfate (gr/dscf)	11				
Total Sulfate (12% CO_2)	12				
Total Sulfate (lb/hr)	13				
SO_2 (ppm)					
SO_2 (lb/hr)					
SO_2 (3% O_2)					
SO_2 (lb/MMBtu)					
S (lb/MMBtu)					
SO_2 (ppm wet)					

SECTION 4

CONTINUOUS METHODS DATA

A. RESULTS

NO_x					
Station/Run	$\%O_2$ (dry)	Corrected ppm (dry)	Corrected ppm (dry) @ 3% O_2	lb/hr	dscfm
Kiln 1	10.45	353.75	605.94	503.48	195615
2	10.50	352.50	606.71	501.70	195615
3	10.50	382.50	658.34	546.62	196414
Mean	10.48	362.92	623.66	517.27	195881

SO_2				
Station/Run	Corrected ppm (dry)	ppm (wet)	dscfm	lb/hr
Kiln 1	72.50	67.79	195615	143.76
2	77.75	72.81	195615	154.17
3	77.75	73.45	196414	154.80
Mean	76.00	71.35	195881	150.91

B. CALIBRATION AND CORRECTION DATA

Company CPC Mojave Date 5/15/84

Station Kiln Baghouse Stack Test Run 1

Time	$\%O_2$	$\%CO_2$	ppm CO		ppm SO_2		ppm NO_x	
			Drift Not Corrected	Drift Corrected	Drift Not Corrected	Drift Corrected	Drift Not Corrected	Drift Corrected
11:55	10.3	18.9	190		69		365	
12:05	10.3	19.2	195		72		360	
12:15	10.5	18.8	200		74		345	
12:25	10.7	18.3	200		75		345	
Mean:	10.45	18.80	196.25		72.50		353.75	

Calibration	$\%O_2$	$\%CO_2$	ppm CO	ppm SO_2	ppm NO_x
Zero Reading	0	0	0	0	0
Span Reading	8.03	18.02	397.0	79.7	193.4
Span Gas Value	8.03	18.02	397.0	79.7	193.4
Span Drift Correction Factor	none	none	none	none	none
Zero Drift Correction Factor	none	none	none	none	none

B. CALIBRATION AND CORRECTION DATA

Company CPC Mojave Date 5/15/84

Station Kiln Baghouse Stack Test Run 2

Time	$\%O_2$	$\%CO_2$	ppm CO		ppm SO_2		ppm NO_x	
			Drift Not Corrected	Drift Corrected	Drift Not Corrected	Drift Corrected	Drift Not Corrected	Drift Corrected
12:45	10.5	18.4	210		82		350	
12:55	10.6	18.3	203		81		355	
1:05	10.5	18.4	208		77		350	
1:15	10.4	18.5	205		71		355	
Mean:	10.50	18.40	206.50		77.75		352.50	

Calibration	$\%O_2$	$\%CO_2$	ppm CO	ppm SO_2	ppm NO_x
Zero Reading	0	0	0	0	0
Span Reading	8.03	18.02	391.0	79.7	193.4
Span Gas Value	8.03	18.02	397.0	79.7	193.4
Span Drift Correction Factor	none	none	none	none	none
Zero Drift Correction Factor	none	none	none	none	none

B. CALIBRATION AND CORRECTION DATA

Company CPC Mojave Date 5/15/84

Station Kiln Baghouse Stack Test Run 3

Time	$\%O_2$	$\%CO_2$	ppm CO		ppm SO_2		ppm NO_x	
			Drift Not Corrected	Drift Corrected	Drift Not Corrected	Drift Corrected	Drift Not Corrected	Drift Corrected
1:40	10.5	18.4	195		77		380	
1:50	10.5	18.4	195		78		385	
2:00	10.5	18.4	200		81		380	
2:10	10.5	18.3	195		75		385	
Mean:	10.5	18.38	196.25		77.75		382.50	

Calibration	$\%O_2$	$\%CO_2$	ppm CO	ppm SO_2	ppm NO_x
Zero Reading	0	0	0	0	0
Span Reading	8.03	18.02	397.0	79.7	193.4
Span Gas Value	8.03	18.02	397.0	79.7	193.4
Span Drift Correction Factor	none	none	none	none	none
Zero Drift Correction Factor	none	none	none	none	none

C. ZERO AND SPAN DRIFT PERCENT CALCULATIONS

Station Kiln Run 1	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_x (ppm)
Initial Span	8.03	18.02	397.0	79.7	193.4
Measured Span	8.00	17.80	387.0	77.0	194.0
Zero Drift	0.00	0.00	-15.0	-1.0	0.0
Final, Actual Span	8.00	17.80	402.0	78.0	194.0
Percent Drift	0.4	1.2	-1.3	2.1	-0.3
Station Kiln Run 2	**O_2 (%)**	**CO_2 (%)**	**CO (ppm)**	**SO_2 (ppm)**	**NO_x (ppm)**
Initial Span	8.03	18.02	397.0	79.7	193.4
Measured Span	7.70	18.00	410.0	78.0	190.0
Zero Drift	0.00	0.00	-6.0	0.0	0.0
Final, Actual Span	7.70	18.00	416.0	78.0	190.0
Percent Drift	4.1	0.1	-4.8	2.1	1.8
Station Kiln Run 3	**O_2 (%)**	**CO_2 (%)**	**CO (ppm)**	**SO_2 (ppm)**	**NO_x (ppm)**
Initial Span	8.03	18.02	397.0	79.7	193.4
Measured Span	7.70	17.40	397.0	79.8	195.0
Zero Drift	0.00	-0.10	-5.0	-3.0	0.0
Final, Actual Span	7.70	17.50	402.0	81.8	195.0
Percent Drift	4.1	2.9	-1.3	-2.6	-0.8

Pape & Steiner Environmental Services

TEST 1,2,3

LOCATION Kil.

CM SO_2, NO_x, HC, CO EMISSION RATE DATA

Standard Temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

ENTER		Test 1	Test 2	Test 3	Average
	R-22 O_2%	10.45	10.50	10.50	
	R-26 Q_s	195615.4204	196615.4204	196413.6784	
	R-15 NO_x ppm	353.75	358.50	348.50	362.92
	R-15 SO_2 ppm	72.50	77.75	77.75	76.00
	R-15 CO ppm	196.25	206.50	196.25	199.67
C_1; $>C_1$	R-15 HC ppm	1.1/48.9	0/27.0	0/30.3	0.37/35.40
XEQ FF					
XEQ SO2		F Factor			

RESULTS:

	Test 1	Test 2	Test 3	Average
MW = 46				
NO_x lb/hr	503.48	501.70	546.62	517.27
NO_x ppm @ 3% O_2	605.94	606.71	658.34	623.66
NO_x lb/MMBtu				
NO_x lb/Bbl				
MW = 64.1				
SO_2 lb/hr	143.76	154.17	154.80	150.91
SO_2 ppm @ 3% O_2	124.19	133.82	133.82	130.61
SO_2 lb/MMBtu				
SO_2 lb/Bbl				
MW = 28				
CO lb/hr	169.98	178.86	170.68	173.17
CO ppm @ 3% O_2	336.16	355.42	337.78	343.12
CO lb/MMBtu				
CO lb/Bbl				
MW = 16				
HC lb/hr	0.54/24.20	0.0/13.36	0.0/15.06	0.18/17.54
HC ppm @ 3% O_2	1.88/83.76	0.0/46.47	0.0/52.15	0.63/60.79
HC lb/MMBtu				
HC lb/Bbl				

SECTION 5

ANALYSIS PROCEDURES

This section of the report describes the procedures used to analyze the samples collected during the test program. All analyses were performed in the Pape & Steiner climate-controlled laboratory in Bakersfield.

5.1 ANALYSIS OF PARTICULATE-SO_x SAMPLES

5.1.1 Nozzle, Probe, Filter Holder Wash

The volume of the acetone washings were measured and the washings were transferred to clean, tared, aluminum weighing dishes. The dishes were placed on a hot plate in a fume hood and gently heated to dryness. The dishes with the dry residue were desiccated and weighed repeatedly at 6-hour intervals until a constant weight was achieved (to nearest 0.01 mg with a tolerance of <0.1 mg between weighings). The ACS reagent grade acetone blank was treated in the same manner.

5.1.2 Filter

The 100 mm filter was removed from its petri dish and transferred to an oven where it was heated for 2 hours at 105°C. The filter was then desiccated and weighed repeatedly at 6-hour intervals until a constant weight was achieved (to nearest 0.01 mg with a tolerance of <0.1 mg between weighings). An unused, tared blank filter was treated in the same manner.

5.1.3 Filterable Particulate Sulfate

The acetone washings residue and the 100 mm filter were combined and then leached with distilled water to remove sulfate and the leach was diluted to 100 ml. An aliquot was passed through ion exchange resin and titrated against 0.01N $BaCl_2$ (which was previously standardized against 0.0100N H_2SO_4) using the barium-thorin titration procedure specified in EPA Method 8. The acetone blank and 100 mm filter blank were treated in an identical manner.

5.1.4 Condensible Particulate, Sulfate, and SO_3

The 47-mm glass fiber filter was leached with distilled water and the leach was added to the contents and washings from impinger 1. The volume was measured and an aliquot was transferred to a clean, tared evaporating dish. The dish was placed on a hot plate in a fume hood and gently heated to dryness. The dish with the dry residue was desiccated and weighed repeatedly at 6-hour intervals until a constant weight was achieved (to nearest 0.01 mg with a tolerance of <0.1 mg between weighings). Another aliquot was taken and diluted to 100 ml and analyzed for sulfate using the barium-thorin titration procedure. A blank 47-mm filter and 80-percent IPA solution were treated in the same manner.

5.1.5 SO_2

The volume of contents and washings from bubbler 2 and impinger 3 was measured and an aliquot was analyzed for sulfate using the barium-thorin procedure. A 3-percent H_2O_2 blank was treated in the same manner.

5.2 ANALYSIS OF HYDROCARBON SAMPLES

The grab sample of hydrocarbons was analyzed using a Carle Model 211 AGC-FID. After purging the syringe three times, a 1-ml syringe sample was

extracted from the Tedlar sample bag and injected onto a 6-foot long, 1/8-inch stainless steel column containing 80/100 mesh PoraPac Q, maintained at 150°C. Any C_1 through C_5 hydrocarbons were speciated and the greater than C_5 hydrocarbons were backflushed to the detector for quantitation as a single peak. An HP Model 3390A reporting integrator was used to record and integrate the signal from the GC. A $\pm$ 2 percent certified calibration gas (C_1-C_6 HC in N_2) was used to calibrate the GC and to quantitate the C_1 through C_5 and greater than C_5 hydrocarbons.

SECTION 6

SAMPLING EQUIPMENT AND PROCEDURES

This section of the report describes the equipment and procedures used to conduct the particulate and gaseous tests on this program.

6.1 PRELIMINARY MEASUREMENTS

Before conducting the stack tests a series of preliminary measurements were made to determine:

- the location of the sampling site and the number and location of the sampling points to be used (EPA Method 1)
- the velocity, temperature, and pressure of the gases in the stack (EPA Method 2)
- the composition of the stack gases (EPA Method 3)
- the moisture content of the stack gases (psychrometric chart)

Using the results of these preliminary measurements and the calibration constants for the sampling train, a series of calculations were made to determine the value of K, a constant, and N_d, ideal nozzle diameter, required to run an isokinetic test according to the equation

$$\Delta H = \left\{ \frac{60^2 \pi^2 K_p^2 C_p^2 (1 - B_{wo})^2 P_s MW_d}{576^2 K_o^2 MW_s P_m} \right\} \left(N_d^4\right) \left(\frac{T_m}{T_s}\right) (\Delta P)$$

where

$$K = \left\{ \frac{60^2 \pi^2 K_p^2 C_p^2 (1 - B_{wo})^2 P_s MW_d}{576^2 K_o^2 MW_s P_m} \right\}$$

An actual nozzle, whose diameter was as close as possible to the ideal nozzle diameter, was selected for the test. Isokinetic sampling rates for each sampling point in the stack were computed using the equation

$$\Delta H = (K)(N_d^4)\left(\frac{T_m}{T_s}\right)(\Delta P)$$

Since K and N_d are known, and remain constant during a test, the only variables are the meter temperature, the stack temperature and the velocity pressure for each sampling point.

6.2 PREPARATION OF THE PARTICULATE-SO_x SAMPLING TRAIN

All sampling train components were cleaned in the laboratory (soap and water, tap water rinse, distilled water rinse, and IPA rinse) to eliminate previous contamination. The sampling train components were sealed and transported to the sampling site in a mobile lab. The EPA Method 5/8 equipment used to measure particulates (filterable and total) and SO_x consisted of:

- a calibrated 316 stainless steel nozzle for isokinetic sampling
- a heated Pyrex glass sampling probe (6 feet long) equipped with an S-type pitot tube and a thermocouple to measure stack velocity pressure and temperature
- a heated Pyrex glass filter holder containing a weighed 100-mm Reeve Angel 934 AH glass fiber filter

- a Pyrex glass impinger train in an icebath (impinger 1 contains 100 ml 80-percent IPA; a Pyrex glass filter holder containing a 47-mm Reeve Angel 934 AH filter; bubbler 2 and impinger 3 each contain 100 ml of 3-percent H_2O_2; bubbler 4 contains a weighed amount of silica gel)
- an umbilical to connect the probe and sample box to the control module
- a control module containing a vacuum pump, a calibrated dry gas meter and a calibrated orifice meter to measure the pressure, temperature and flowrate throughout the train.

The sampling train was charged in the mobile lab using freshly prepared reagents. Each impinger and its contents was weighed to the nearest 0.1 gm on a calibrated triple beam balance. Blanks of all filters and reagents were retained for subsequent analysis. The sampling point locations were marked on the probe using a high-temperature marker. The sampling train was completedly assembled and lifted to the sampling site.

6.3 SAMPLING PROCEDURES FOR PARTICULATE-SO_x SAMPLING TRAIN

Prior to a test, the sampling train was heated and leak-checked at 15 inches mercury to insure leakage was less than 0.02 cfm. The S-type pitot tube was also leak-checked. The sampling train was installed on the unirail and the probe was inserted into the stack at the farthest point. An isokinetic sampling rate was calculated using an HP-41CV calculator for each sampling point on the traverse (3 points/traverse, 4 traverses at 90°, 6 minutes/point for kiln/clinker; 12 points/traverse, 2 traverses, 3 minutes/point for crusher). All pertinent data was recorded on the data

for each point. The probe and sample box were maintained at 250°F throughout the traverse. The gases leaving the impinger train were maintained at $<70^{o}$F. At the end of a traverse, the probe was withdrawn from the stack and the entire sampling train was transferred to the next port. Another traverse of the stack was completed and the sampling train was withdrawn for the final leak-check, performed at 15 inches mercury or at the highest vaccum achieved during the test. The S-type pitot tube was also checked at this time. The sampling train was then purged with ambient air for 15 minutes using the highest ΔH measured during the test. After the train was purged, the probe, nozzle, filter holder, and impinger train was sealed with foil and lowered to the mobile lab for sample recovery.

6.4 SAMPLE RECOVERY PROCEDURES FOR PARTICULATE-SO_x SAMPLING TRAIN

Sample recovery occurred in the mobile lab. The nozzle and probe were brushed and rinsed three times using ACS reagent grade acetone into a polyethylene sample bottle. The 100-mm filter was removed from the 4-inch filter holder and sealed in its petri dish. The front half of the 4-inch glass filter holder was brushed and rinsed with acetone. Each impinger was removed from the icebath, wiped dry and weighed to the nearest 0.1 gm. The contents of impinger 1 were transferred to a polyethylene sample bottle. The back half of the 4-inch glass filter holder, the glass connectors, impinger 1, and the fronthalf of the 2-inch filter holder were rinsed with 80-percent IPA and the rinsings were transferred to this same bottle. The 47-mm filter from the 2-inch filter holder was sealed in its petri dish. The contents of bubbler 2 and impinger 3 were transferred to a polyethylene sample bottle. Distilled water rinsings of the back half

of the 2-inch filter holder, bubbler 2, the connector, and impinger 3 were transferred to this same bottle. All sample bottles and petri dishes were marked and labeled. A chain-of-custody log was completed and the field data sheet was also labeled with the sample ID numbers. The sampling train was then recharged in preparation for the next test.

6.6 SAMPLING PROCEDURES FOR CONTINUOUS MONITORING

The continuous monitors used in the Pape & Steiner Mobile Monitoring Lab are shown in Table 6-1. Figure 6-1 is a schematic of the continuous monitoring system. The procedures used to continuously monitor stack gases for NO_x, SO_2, CO, CO_2, and O_2 strictly follow CARB Method 1-100.

Sample was taken from the stack using a 316 stainless steel probe. A Balston filter holder and fiberglass filter (99.9999 percent efficiency retention of 0.6 micron particles) was connected to the outlet of the probe. Sample gas was transported through heated Teflon sample line (maintained at $>250^{o}F$) by a Teflon-lined diaphragm pump to a 316 stainless steel refrigeration type conditioner (Hankison Model E-4G-SS). The sample gas was passed through the conditioner two separate times under vacuum before entering the pump, then two additional times under pressure. The clean, dry sample gas ($\sim 35^{o}F$) was then transported to the continuous analyzer system through an unheated Teflon line. A series of flowmeters, valves, and regulators maintain constant flow through the system at a constant pressure.

Calibrations of the continuous analyzers were performed using EPA Protocol 1 calibration gases ($\pm$ 1 percent) for criteria pollutant analysis (NO_x/SO_2) and certified calibration gases ($\pm$ 2 percent) for fixed gas analysis. Copies of the gas certifications are included in the Quality Assurance

TABLE 6-1. CONTINUOUS MONITORING LAB

NO_x Chemiluminescent Analyzer -- Thermo Electron Model 10	
Response time (0 - 90%)	1.5 sec -- NO mode 1.7 sec -- NO_x mode
Zero drift	Negligible after 1/2 hour warmup
Linearity	± 1% of full scale
Accuracy	Derived from the NO or NO_2 calibration gas, ± 1% of full scale
Output	0.100 mV, 0 - 10 mV, 0 - 5 V, 0 - 10 V
O_2 Analyzer, Fuel Type -- Teledyne Model 326	
Response time (0 - 90%)	60 seconds
Accuracy	± 1% of scale at constant temperatures; ± 1% of scale of ± 5% of reading, whichever is greater, over the operating temperature range
Output	0 - 1V
CO_2/CO Infrared Analyzer -- Anarad Model AR-600	
Response time (0 - 90%)	5 seconds
Zero drift	± 1%
Span drift	± 1%
Linearity	1%
Resolution	Less than 1% of full scale
Output	0 - 1V
SO_2 UV Analyzer -- DuPont Model 400	
Response time (0 - 90%)	Less than 1 second
Zero drift	Less than 1% full scale in 24 hours
Linearity	± 1% full scale
Accuracy	± 2% full scale
Output	0 - 10 mV
Operating ranges	0 - 100 ppm, 0 - 1000 ppm
Strip Chart Recorders (3) -- Linear Model 486	
Pen response	20 inches/second
Span -- full scale	1 mV through 10 V
Zero set	Electronically adjustable full scale with 1 full scale of zero supression
Accuracy Dead Band Linearity Repeatability	Total limit of error ± 0.5%
Scotsman Trailer	
Fully insulated Air conditioned 8-ft x 14-ft x 11-ft	

1. Filter 0.6 μ, 99.9999 percent efficient
2. Duct
3. 316 stainless steel probe
4. 3/8-inch, heated (250°F) Teflon
5. Four-pass conditioner-dryer, 316 stainless steel internals
6. 3/8-inch, unheated Teflon
7. Teflon-lined sample pump
8. 3/8-inch unheated Teflon
9. Rotameter
10. 1/4-inch Teflon tubing
11. Calibration gas manifold
12. Calibration gas selector valve
13. Calibration gas cylinders
14. Backpressure regulator
15. Auxiliary analysis port

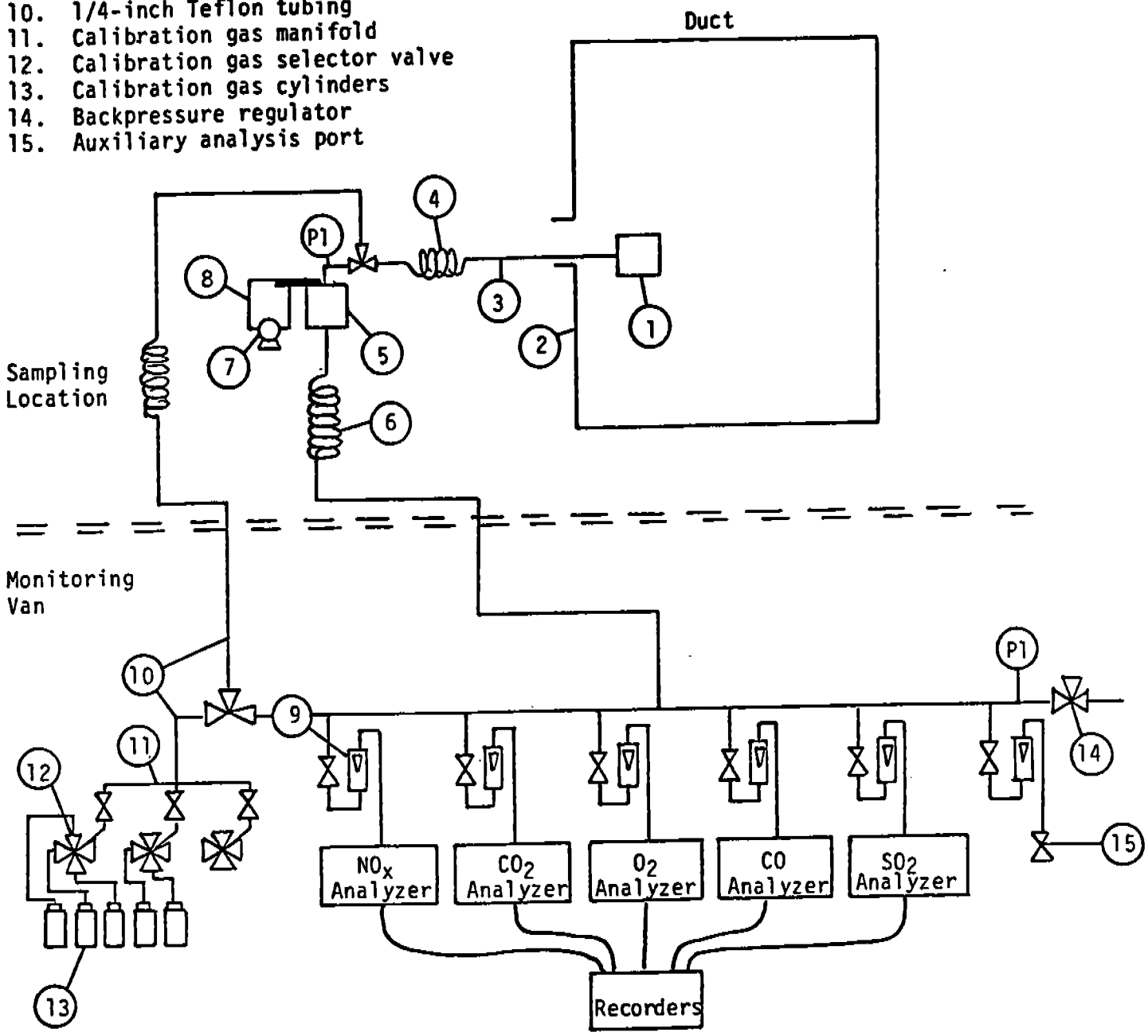


Figure 6-1. Schematic of Continuous Monitoring System.

section of this report. All pertinent data (date, time, test location, analyzer range, cal gas value) were recorded on both the field data sheets and continuous analyzer strip charts in the field.

At the start of the test, a leak-check was performed. The sample probe was removed from the stack and the end was sealed with a Swagelok cap. A leak-check is successful only if pressure at the analyzer system and flow through the rotameters to the individual analyzers all drop to zero. A mandatory leak-check was performed at the completion of each test.

An initial calibration was performed at the start of the test period by introducing zero and span gases for each analyzer and making the necessary adjustments. Calibration gas values were recorded on the continuous monitor strip charts and field data sheets. A calibration check was completed at the end of the test and adjustments (if necessary) to the analyzers were made in preparation for another test.

Test data was collected by recording 10-minute averages from the strip chart recordings onto the field data sheets. Data collected over the 2-hour test period was averaged and reported. A fuel oil analysis was used to calculate the F factor, dscf/MMBtu (standard conditions $60^{o}F$, 29.92 inches mercury), as described in 40 CFR 60.45. The NO_x and the F factor were used to calculate the emission factor in lb/MMBtu corrected to zero percent O_2.

6.7 SAMPLING PROCEDURES FOR HYDROCARBONS

The sampling train for hydrocarbons consisted of a probe (short piece of stainless steel), a Teflon sample line, a Tedlar sampling bag and a vacuum pump. The entire train was purged with stack gas three times before collecting a sample. After sample collection, the Tedlar bag was lowered to the mobile lab for subsequent analysis. Triplicate grab samples were collected during each test.

SECTION 7

RAW DATA

Pape & Steiner Environmental Services

SAMPLING POINT LOCATION DATA SHEET

Plant GPC Mojave

Date 5/15/84

Test Location Kiln Stack

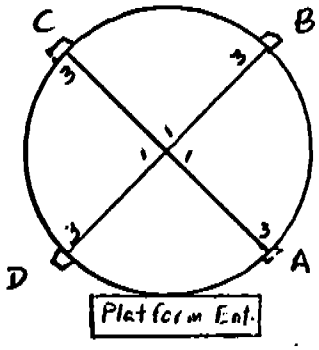
Upstream Dist./Dia. >2Ø

Downstream Dist./Dia. >11Ø

No. of Sampling Points 12

Stack Dimension 126.5

Coupling Length 13



Sample Point	Dist	Sample Point	Dist	Sample Point	Dist	Sample Point	Dist
1	18.5						
2	31.5						
3	50.4						

SAMPLING POINT RELOCATION:

Pape & Steiner Environmental Services

VELOCITY TRAVERSE DATA SHEET

Plant CPC Mojave
Date 5/15/84
Test Location Kiln Stack
Static Pressure (in. wg) -1.2
Barometric Pressure 26.30
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Stack Dimension 176.5

	Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts	Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts
7	A 1	0.98	360									
	2	0.92	354									
	3	0.78	352									
9:24	B 1	0.96	348									
	2	0.96	354									
	3	0.74	351									
9:32	C 1	0.99	359									
	2	0.95	361									
	3	0.81	357									
9:39	D 1	0.99	357									
	2	0.93	361									
	3	0.70	357									

SAMPLING POINT RELOCATION: none

Avg $\sqrt{\Delta P}$ = 0.943
Avg ΔP = 0.889
Avg T_s = 356.33

Pape & Steiner Environmental Services

CAL PORTLAND

PLANT MOJAVE TEST TYPE M5/8 FIELD TEST DATA SHEET (Page 1 of 2)

Date 5-15-84

Test Location Kiln Stack

Run Number 1

Stack Diameter 126.5

Operator JB

Filter No. 10-801

Barometric Pressure 26.20

Static in. wg. -1.2

Probe Type/Length glass/6'

Pitot Coefficient 0.84

Meter Box No./γ 446/1.088

Nozzle No./Size M5E/.2324

Impinger Volumes/Weights			
Contents	Final	Initial	Net
80% IPA	511.4	527.4	-15.5
3% H_2O_2	600.0	556.8	43.2
3% H_2O_2	559.6	540.7	18.9
S.G.	674.2	651.3	22.9
		Total	69.5

Gas Composition			
Time	CO_2	O_2	CO
CM	18.80	10.45	

Leak Rate	cfm	"Hg
Initial	0.020	15
Final		

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
D 1	10:23 0	0.98	1.78	454.473	268	275	258	37	52	52	10.0	0.990	pitot ok
2	3	0.91	1.66	456.740	266	275	259	37	53	52	9.0	0.954	
3	6	0.70	1.29	458.915	260	267	259	37	54	52	7.5	0.837	
	9			490.907									
G 1	10:36 0	0.94	1.72	490.907	265	238	254	38	53	52	9.0	0.970	
2	3	0.88	1.61	493.085	266	236	251	33	55	52	9.0	0.938	
3	6	0.70	1.29	495.350	259	242	248	33	56	53	7.5	0.837	
	9			497.250									
B 1	10:48 0	0.95	1.74	497.250	265	263	249	32	54	53	9.0	0.975	
2	3	0.87	1.60	499.474	262	270	249	33	55	54	9.0	0.933	
3	6	0.75	1.39	501.615	256	275	252	34	57	54	8.0	0.866	
	9			503.674									
A 1	11:02 0	0.97	1.79	503.674	260	275	255	32	55	55	9.5	0.985	
2	3	0.90	1.65	505.920	265	263	253	32	58	55	9.0	0.949	
3	6	0.75	1.40	508.090	255	252	253	31	58	55	8.0	0.866	
	9			510.166									

Pape & Steiner Environmental Services

PLANT Mojave TEST TYPE M5/6 FIELD TEST DATA SHEET (Page 1 of 2)

Date 5-15-84
Test Location Kiln Stack
Run Number 2
Stack Diameter 126.5
Operator GB
Filter No. 10-80L

Barometric Pressure 26.20
Static in. wg. -1.2
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0088
Nozzle No./Size 1456/.2304

Impinger Volumes/Weights			
Contents	Final	Initial	Net
80% IPA	534.7	550.6	-15.9
3% H_2O_2	603.2	560.4	42.8
3% H_2O_2	557.9	536.5	21.4
S.G.	635.3	615.8	19.5
		Total	67.8

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial	0.014	16
Final		

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
A 1	1:54 0	0.96	1.74	545.802	260	258	229	33	56	57	6.5	0.980	pitot ok
2	6	0.84	1.57	550.360	256	263	238	33	59	56	6.0	0.917	
3	12	0.69	1.31	554.611	247	269	238	35	62	58	5.0	0.831	acc #2 843775
	18			558.560									MF #2 843776
B 1	2:15 0	1.00	1.86	556.560	260	257	246	34	59	59	6.5	1.000	
2	6	0.96	1.79	563.165	262	275	250	36	62	60	6.5	0.980	IPA #2 843777
3	12	0.75	1.42	567.699	254	275	254	37	64	60	5.5	0.866	AMF #2 843778
	18			571.883									
C 1	2:31 0	0.99	1.85	571.883	260	254	254	37	61	61	6.5	0.995	H_2O_2 #3 843779
2	6	0.93	1.73	576.500	264	225	243	34	64	61	6.5	0.964	
3	12	0.73	1.36	580.984	254	232	236	33	65	62	5.5	0.854	
	18			585.047									

Pape & Steiner Environmental Services

PLANT Mojave TEST TYPE M5/8 FIELD TEST DATA SHEET (Page 1 of 2)

Date 5/15/84
Test Location Kiln Stack
Run Number 3
Stack Diameter 126.5
Operator JB
Filter No. 10-803

Barometric Pressure 26.26
Static in. wg. -1.2
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0088
Nozzle No./Size 1456/.2304

Impinger Volumes/Weights			
Contents	Final	Initial	Net
80% DI	490.5	513.3	-22.8
5% H_2O_2	579.3	539.1	40.2
5% H_2O_2	593.6	572.9	20.7
S.G.	627.9	606.0	21.9
		Total	60.0

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial	0.023	15
Final		

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
A 1	4:42 0	1.05	1.95	609.026	263	261	225	40	60	62	9.5	1.025	pitot ok
2	6	0.93	1.75	613.743	258	275	225	41	63	62	8.5	0.964	
3	12	0.79	1.50	618.265	249	275	225	43	64	62	7.5	0.889	ace #3 843780
	18			622.584									MF #3 843781
B 1	5:06 0	1.05	1.97	622.584	260	266	225	44	62	62	9.5	1.025	
2	6	0.95	1.79	627.400	260	275	225	44	64	62	9.0	0.975	IPA #3 843782
3	12	0.80	1.53	632.100	249	275	225	44	65	62	8.0	0.894	AMF #3 843783
	18			636.275									
C 1	5:27 0	1.05	1.97	636.275	260	260	225	43	63	63	9.5	1.025	H_2O_2 #3 843784
2	6	0.97	1.82	641.280	262	225	225	39	66	63	9.0	0.985	
3	12	0.77	1.46	645.607	255	225	225	39	66	64	7.5	0.877	
	18			649.790									

Pape & Stein Environmental Services

CONTINUOUS MONITOR DATA SHEET

Plant: California Portland Cement

Date: 5-15-84

Test Location: Kiln outlet 1003036A KCAPCD

Run Number: 1 and 2 SJ 78-73 EPA

Operator: JCO

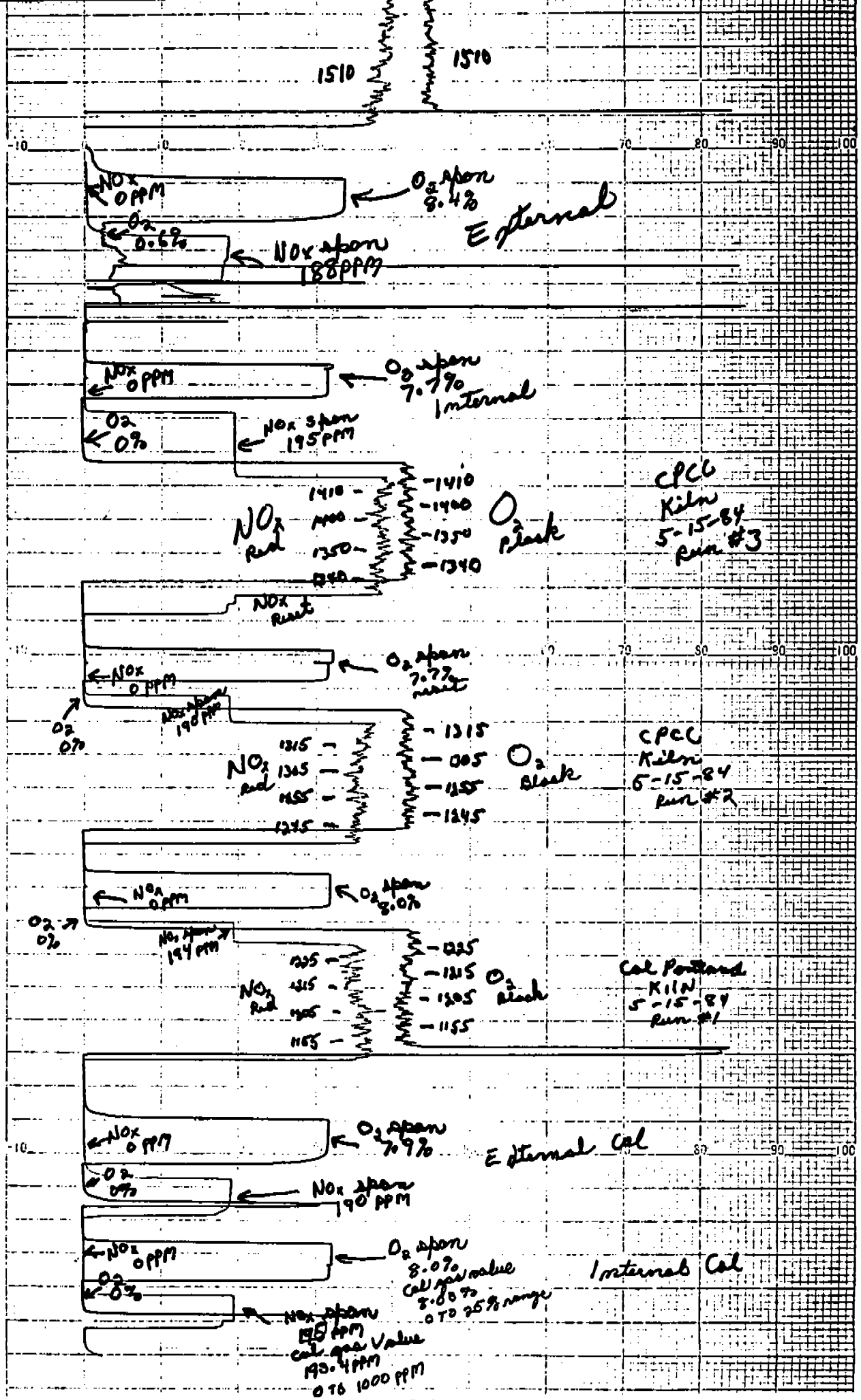
Ambient Temperature:

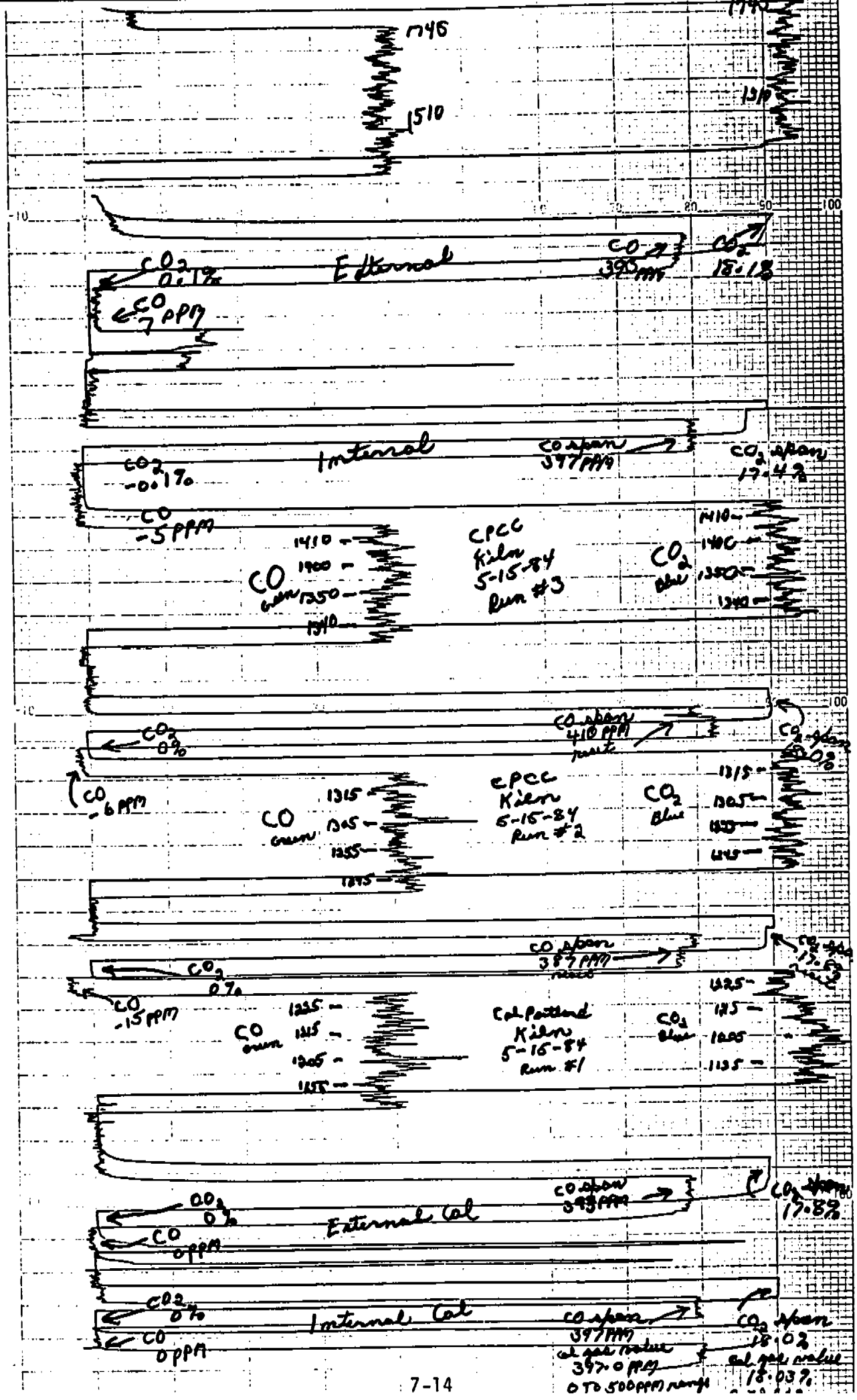
Barometric Pressure: 26.3

Static Pressure Duct:

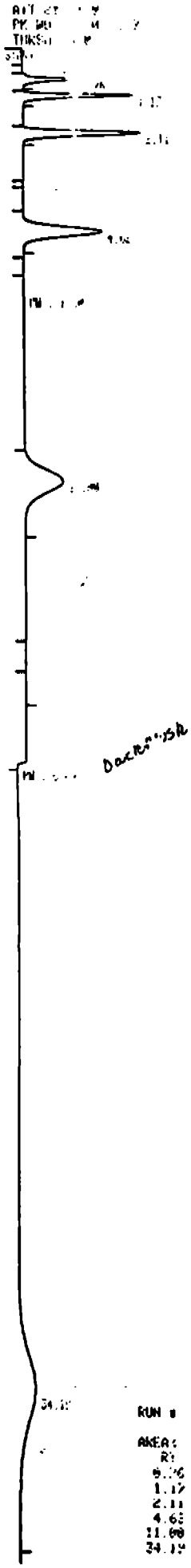
Fuel:

Time	Sample Point	Fuel Flow	Dry Uncorrected O_2 %	Dry Uncorrected CO_2 %	Dry Uncorrected CO ppm	Dry Uncorrected SO_2 ppm	Dry Uncorrected NO ppm	Dry Uncorrected NO_x ppm	3% O_2 Dry ppm	3% O_2 Dry NO_x ppm	Hydrocarbons THC	Hydrocarbons CH_4	Hydrocarbons Non CH_4				Comments
			0	0	0	0		0									offset
			8.03	18.02	397.0	79.7		193.4									cal gas value
	Internal		8.0	18.0	397	79.7		185									span
1150	External		7.9	17.8	393	74		190									span
1155			10.9	18.9	190	69		365									Run #1
1205			10.7	19.2	195	72		360									
1215			10.5	18.8	200	74		345									N_2 AAI 8095
1225			10.7	18.3	200	75		345									NOX AAI 12617
1230			0	0	-15	-1		0									offset
1240			8.0	17.8	387	77		194									span
1245			10.5	18.4	210	82		350									Run #2
1255			10.6	18.3	203	81		355									
1305			10.5	18.4	208	77		350									O_2, CO, CO_2 AAI 190
1315			10.4	18.5	205	71		355									SO_2 AAI 7540
1320			0	0	-6	0		0									offset
1335			7.7	18.0	410	78		190									span


1510
1510
NOx 0 PPM
O2 span 8.4%
O2 0.6%
NOx span 188 PPM
External
NOx 0 PPM
O2 span 7.7% Internal
O2 0%
NOx span 195 PPM
1410
1400
1350
1340
NO2 Red
O2 Black
CPCC Kiln 5-15-84 Run #3
NOx Reset
O2 span 7.7% reset
NOx 0 PPM
O2 0%
NOx span 190 PPM
1315
1305
1255
1245
NO2 Red
O2 Black
CPCC Kiln 5-15-84 Run #2
NOx 0 PPM
O2 span 8.0%
O2 0%
NOx span 194 PPM
1325
1315
1305
1155
NO2 Red
O2 Black
Cal Portland Kiln 5-15-84 Run #1
NOx 0 PPM
O2 span 7.9%
External Cal
O2 0%
NOx span 190 PPM
NOx 0 PPM
O2 span 8.0% cal gas value 8.00% 0 TO 25% range
Internal Cal
O2 0%
NOx span 190 PPM cal gas value 190.4 PPM 0 TO 1000 PPM


1745
1510
1310
External
CO2 0.1%
CO 7 PPM
CO span 395 PPM
CO2 18.1%
Internal
CO2 -0.1%
CO -5 PPM
CO span 397 PPM
CO2 span 17.4%
CPCC Kiln 5-15-84 Run #3
CO green
CO2 blue
CO span 410 PPM
CO2 0%
CO -6 PPM
CPCC Kiln 5-15-84 Run #2
CO span 387 PPM
CO2 0%
CO -15 PPM
Cal Portland Kiln 5-15-84 Run #1
CO span 395 PPM
CO2 17.89%
External Cal
CO2 0%
CO 0 PPM
Internal Cal
CO span 397 PPM
cal gas value 397.0 PPM
0 TO 500 PPM range
CO2 span 18.02
cal gas value 18.03%

Initial C_1-C_6 Cal



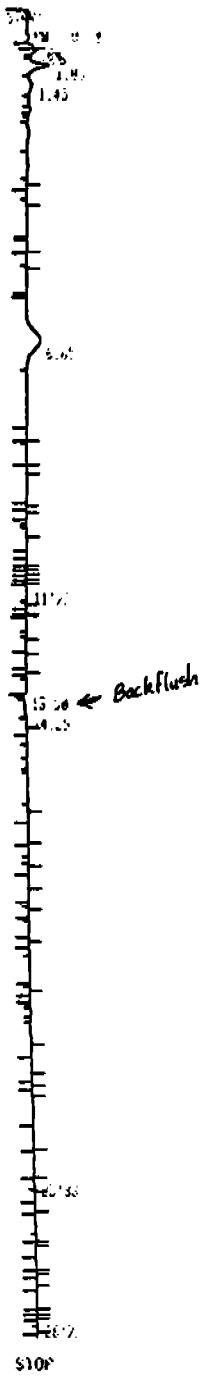
RUN # 1 MAY/16/84 [illegible]

AREA:

RT	AREA	TYPE	HW/HT	AREA%
0.76	[illegible]	PB	[illegible]	[illegible]
1.17	[illegible]	PB	[illegible]	[illegible]
2.11	[illegible]	PB	[illegible]	[illegible]
4.63	[illegible]	PB	[illegible]	[illegible]
11.00	[illegible]	BB	[illegible]	[illegible]
34.19	[illegible]	BB	[illegible]	[illegible]

TOTAL AREA= 431724
MUL FAC AREA= 1.0000E+00

Kiln Stack Run 1

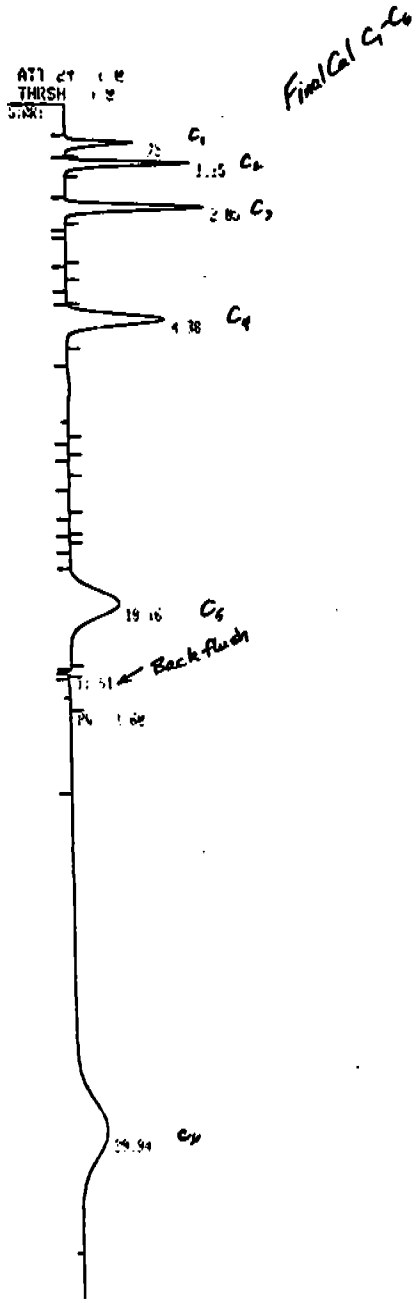


RUN # 4 MAY/16/84 14:52:52

AREA:

RT	AREA	TYPE	HW/HT	AREA%
0.64	323	PB	0.052	1.736
0.76	488	BP	0.063	2.574
1.05	3379	VP	0.124	17.825
1.45	1230	PV	0.193	6.489
5.05	10863	PB	0.512	57.317
13.98	1192	PV	0.066	1.488 ← Back flush
19.29	2383	VV	0.123	12.571

TOTAL AREA= 18956
MUL FAC AREA= 1.0000E+00



RUN # 11 MAY 16/84 12:40:12

AREA%

RT	AREA	TYPE	HA/HT	AREA%
0.75	21827	PB	0.183	5.529
1.15	36523	BB	0.187	9.534
2.85	55762	BB	0.143	15.167
4.38	75011	BB	0.279	20.457
10.16	85965	BB	0.542	23.654
11.61	113	PB	0.017	0.030 Back flush
20.94	98242	PV	1.232	25.226

TOTAL AREA= 367658
NUL FACTOR= 1.0000E+00

Pape & Steiner Environmental Services

SAMPLE HANDLING/LOG-IN

Date 5-15-84 Test Location Kiln

	Sample Type	Volume	Comments
1.	843806 5/8 Meth ac. Sample #1 Test		
2.	843807 5/8 Meth MF Sample #1 Test		
3.	843808 5/8 Meth IPA Sample #1 Test		
4.	843809 5/8 Meth AMF Sample #1 Test		
5.	843774 5/8 Meth H_2O_2 Sample #1 Test		
6.			
7.	843775 5/8 Meth ac. Sample #2 Test		
8.	843776 5/8 Meth MF Sample #2 Test		
9.	843777 5/8 Meth IPA Sample #2 Test		
10.	843778 5/8 Meth AMF Sample #2 Test		
11.	843779 5/8 Meth H_2O_2 Sample #3 Test		
12.			

CHAIN OF CUSTODY

SO

Pape & Steiner Environmental Services

SAMPLING POINT LOCATION DATA SHEET

Plant CPC Mojave

Date 5/16/84

Test Location Crusher Baghouse

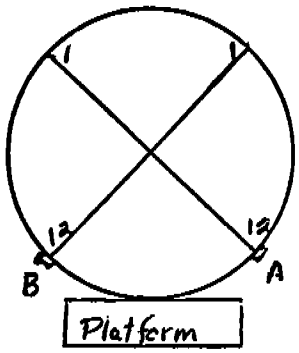
Upstream Dist./Dia. 56"/1.3 ø

Downstream Dist./Dia. 222"/5.1 ø

No. of Sampling Points 24

Stack Dimension 43.5

Coupling Length 3.25



Sample Point	Dist	Sample Point	Dist	Sample Point	Dist	Sample Point	Dist
1	4.2						
2	6.2						
3	8.4						
4	11.0						
5	14.1						
6	18.7						
7	31.3						
8	35.9						
9	39.0						
10.	41.6						
11.	43.8						
12	45.8						

SAMPLING POINT RELOCATION:

Pape & Steiner Environmental Services

VELOCITY TRAVERSE DATA SHEET

Plant CPC Mojave
Date 5/16/84
Test Location Crusher
Static Pressure (in. wg) -9.3
Barometric Pressure 26.25
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Stack Dimension 43.5

7:40			7:44								
Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts	Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts
B 1	1.4	55	A1	1.4	55						
2	1.7	55	2	1.4	55						
3	1.7	55	3	1.3	55						
4	1.6	55	4	1.25	55						
5	1.5	54	5	1.2	54						
6	1.6	54	6	1.15	54						
7	1.3	54	7	1.5	54						
8	1.3	54	8	1.5	54						
9	1.4	54	9	1.55	54						
10	1.3	53	10	1.45	53						
11	1.3	52	11	1.4	53						
12	1.3	52	12	1.5	53						

SAMPLING POINT RELOCATION:

Avg $\sqrt{\Delta P}$ = 1.189
Avg ΔP = 1.413
Avg T_s = 54.00

Pape & Ste. Environmental Services

PLANT CPC Mojave TEST TYPE M 5 FIELD TEST DATA SHEET (Page 1 of 2)

Date 5/16/84
Test Location Crusher
Run Number 1
Stack Diameter 43.5
Operator JB
Filter No. 10-804

Barometric Pressure 24.25
Static in. wg. -9.3
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0088
Nozzle No./Size 1505/.2069

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100ml H_2O	538.2	546.4	-8.2
100ml H_2O	544.8	539.1	5.7
dry	458.5	455.7	2.8
S.G.	695.4	677.3	18.1
		Total	18.4

Gas Composition			
Time	CO_2	O_2	CO
ambient	0	20.9	
air			

Leak Rate	cfm	"Hg
Initial	0.020	16
Final		

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
A 1	4:04 0	1.40	2.68	674.835	57	229	252	43	71	72	13.0	1.183	pitot ok
2	3	1.40	2.69	677.695	56	248	251	38	72	72	13.5	1.183	
3	6	1.40	2.69	680.598	56	245	251	40	72	72	13.5	1.183	
4	9	1.20	2.31	683.535	56	235	251	41	73	72	11.5	1.095	
5	12	1.20	2.31	686.330	56	253	250	39	73	72	11.5	1.095	
6	15	1.20	2.30	689.050	56	268	251	39	73	71	11.5	1.095	
7	18	1.45	2.78	691.788	57	236	249	38	74	72	14.5	1.204	
8	21	1.50	2.87	694.710	58	244	249	37	73	71	15.0	1.225	
9	24	1.60	3.07	697.727	57	244	250	39	73	71	15.5	1.265	
10	27	1.55	2.96	700.795	58	249	248	40	73	71	15.5	1.245	
11	30	1.40	2.67	703.860	58	254	248	41	72	71	14.0	1.183	
12	33	1.25	2.39	706.845	57	256	250	42	73	71	13.0	1.118	
	36			709.750									

Pape & Ste... Environmental Services

PLANT CPC Mojave TEST TYPE M 5 FIELD TEST DATA SHEET (Page 1 of 2)

Date 5/16/84
Test Location Crusher
Run Number 2
Stack Diameter 43.5
Operator [illegible]
Filter No. 10-805

Barometric Pressure 26.25
Static in. wg. -9.3
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0088
Nozzle No./Size 1505/.2084

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100 ml H_2O	568.9	572.6	-3.7
100 ml H_2O	540.0	532.2	7.8
dry	464.8	462.9	1.9
S.G.	667.2	650.9	16.3
		Total	22.3

Gas Composition			
Time	CO_2	O_2	CO
	0.0	20.9	

Leak Rate	cfm	"Hg
Initial	0.017	17
Final		

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
A 1	11:39 C	1.30	2.46	747.692	64	275	254	48	73	73	9.0	1.140	pitot ok
2		1.25	2.39	750.345	60	225	255	45	75	73	8.5	1.118	
3	6	1.10	2.11	753.615	60	225	253	46	76	74	7.5	1.049	
4		1.08	2.07	756.255	61	252	251	45	77	74	7.5	1.039	
5	12	1.08	2.07	758.820	60	275	250	45	78	74	7.5	1.039	
6		1.10	2.11	761.380	60	275	253	44	79	75	7.5	1.049	
7	18	1.25	2.41	763.970	59	275	252	44	80	76	8.5	1.118	
8		1.45	2.80	766.690	59	277	251	44	81	76	10.0	1.204	
9	24	1.45	2.80	769.665	59	277	249	44	81	77	10.0	1.204	
10		1.45	2.81	772.685	59	267	251	44	82	78	10.0	1.204	
11	30	1.25	2.42	775.825	59	268	250	44	82	79	9.0	1.118	
12		1.15	2.22	778.620	61	270	252	45	83	79	8.0	1.072	
	36			781.420									

Pape & Ste Environmental Services

PLANT CPC Mojave TEST TYPE M5 FIELD TEST DATA SHEET (Page 1 of 2)

Date 5/17/84
Test Location Crusher
Run Number 3
Stack Diameter 43.5
Operator JB
Filter No. 10-- 806

Barometric Pressure 26.26
Static in. wg. -9.3
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0008
Nozzle No./Size 1505/.2089

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100 ml. H_2O	533.1	530.3	-2.2
100 ml. H_2O	583.1	575.2	7.9
dry	440.3	437.5	2.8
S.G.	645.6	628.4	17.2
		Total	20.7

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial	0.020	16
Final		

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
A 1	7:24 0	1.25	2.41	817.917	59	225	225	56	84	84	10.5	1.118	pitot ok
2		1.35	2.64	820.135	57	225	225	50	85	83	11.5	1.162	
3	6	1.45	2.63	823.091	61	225	232	36	54	54	12.0	1.204	crusher down
4		1.50	2.75	826.169	60	225	234	37	59	58	12.0	1.225	@ 7:29
5	12	1.50	2.77	829.200	68	225	233	37	62	59	13.0	1.225	
6		1.35	2.50	832.080	57	229	233	39	63	60	12.5	1.162	
7	18	1.15	2.13	834.940	57	233	233	40	64	61	10.5	1.072	
8		1.07	1.99	837.535	56	240	233	41	64	61	9.5	1.034	
9	24	1.07	2.00	840.035	56	241	234	42	67	63	9.5	1.034	
10		1.15	2.15	842.510	56	243	235	43	68	64	10.0	1.072	
11	30	1.20	2.25	845.055	56	242	235	44	69	65	10.5	1.095	
12		1.20	2.25	847.685	56	244	235	45	70	66	10.5	1.095	
	36			850.460									

Pape & Steiner Environmental Services

SAMPLING POINT LOCATION DATA SHEET

Plant CPC Mojave

Date 6/17/84

Test Location Clinker Stack

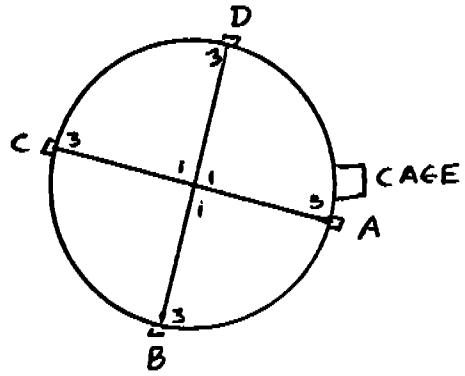
Upstream Dist./Dia. 296/2.1 ϕ

Downstream Dist./Dia. 1110/8.0 ϕ

No. of Sampling Points 12

Stack Dimension 139.5

Coupling Length 13.5



Sample Point	Dist	Sample Point	Dist	Sample Point	Dist	Sample Point	Dist
1	16.6						
2	32.9						
3	53.8						

SAMPLING POINT RELOCATION:

Pape & Steiner Environmental Services

VELOCITY TRAVERSE DATA SHEET

Plant CPC Mojave

Date 5/17/84

Test Location Clinker Stack

Static Pressure (in. wg) -0.19

Barometric Pressure 26.26

Probe Type/Length glass 16'

Pitot Coefficient 0.84

Stack Dimension 139.5

	Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts	Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts
.42	A 1	0.24	234									
	2	0.21	233									
	3	0.17	227									
1:48	B 1	0.23	232									
	2	0.22	234									
	3	0.17	231									
1:54	C 1	0.24	231									
	2	0.24	235									
	3	0.19	230									
1:59	D 1	0.25	231									
	2	0.23	232									
	3	0.20	229									

SAMPLING POINT RELOCATION: none

Avg $\sqrt{\Delta P}$ = 0.464

Avg ΔP = 0.215

Avg T_s = 231.58

Pape & Steiner Environmental Services

PLANT CPCC MOJAVE TEST TYPE M 5 FIELD TEST DATA SHEET (Page 1 of 2)

Date 5/17/84
Test Location Clinker Stack
Run Number 1
Stack Diameter 139.5
Operator JS
Filter No. 10-807

Barometric Pressure 26.26
Static in. wg. 0.19
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.00818
Nozzle No./Size 1316/.3578

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100ml H_2O	531.3	544.7	13.4
100ml H_2O	546.8	545.4	1.4
DRY	457.3	455.3	2.0
S.G.	663.0	647.8	15.2
		Total	5.2

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial	0.019	15
Final		

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
D 1	12:39 0	0.26	3.22	885.948	244	245	255	54	70	70	14.0	0.510	pitot ok
2	6	0.23	2.85	892.230	243	268	254	55	71	70	13.0	0.480	
3	12	0.24	3.00	898.315	239	247	255	54	74	71	13.0	0.490	
	18			904.476									
C 1	1:06 0	0.25	3.11	904.476	243	275	255	47	72	72	13.0	0.500	
2	6	0.23	2.87	910.670	243	265	256	49	75	73	12.5	0.480	
3	12	0.19	2.39	916.775	239	251	256	51	76	73	10.0	0.436	
	18			922.433									
B 1	1:30 0	0.24	3.02	922.433	237	225	235	45	74	74	12.5	0.490	
2	6	0.22	2.78	928.590	236	229	225	43	75	74	12.0	0.469	
3	12	0.17	2.16	934.660	231	247	225	44	77	74	9.0	0.412	
	18			940.103									

Pape & Steiner Environmental Services

PLANT CPCC Mojave TEST TYPE M 5 FIELD TEST DATA SHEET (Page 1 of 2)

Date 5/17/84
Test Location Clinker Stack
Run Number 2
Stack Diameter 139.5
Operator JB
Filter No. 10-808

Barometric Pressure 26.26
Static in. wg. -0.19
Probe Type/Length g/435/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0088
Nozzle No./Size 1376/.3578

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100ml H_2O	555.1	562.5	-12.4
100ml H_2O	542.6	538.2	4.4
DRY	464.0	462.4	1.6
S.G.	650.5	635.3	15.2
		Total	8.8

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial	0.017	15
Final		

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
A 1	3:11 0	0.24	3.02	961.607	235	225	239	54	72	73	8.0	0.490	pitot ok
2	6	0.23	2.90	967.710	235	225	248	52	75	73	8.0	0.480	
3	12	0.19	2.42	973.755	230	269	249	54	77	74	7.0	0.436	
	18			979.471									
B 1	3:34 0	0.24	3.06	979.471	230	229	255	50	75	75	8.0	0.490	
2	6	0.20	2.51	985.615	241	258	250	45	77	75	7.5	0.447	
3	12	0.18	2.32	991.380	227	239	250	46	80	77	6.5	0.424	
	18			996.999									
C 1	3:57 0	0.24	3.07	996.999	231	235	252	44	78	78	8.0	0.490	
2	6	0.21	2.68	1003.049	236	235	253	46	81	79	7.5	0.458	
3	12	0.19	2.42	1008.939	237	240	256	48	81	79	7.0	0.436	
	18			1014.646									

Pape & Stein... Environmental Services

PLANT CPCC MOJAVE TEST TYPE M 5 FIELD TEST DATA SHEET (Page 1 of 2)

Date 5/18/84
Test Location Clinker Stack
Run Number 3
Stack Diameter 134.5
Operator JB
Filter No. 10-809

Barometric Pressure 26.38
Static in. wg. -0.24
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0088
Nozzle No./Size 1316/.3576

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100 ml. DI	506.8	525.3	-18.5
100 ml. DI	526.1	520.6	5.5
dry	439.9	437.2	2.7
S.G.	678.2	656.2	22.0
		Total	11.7

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial	0.023	15
Final		

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
D 1	7:52 0	0.24	2.97	38.796	235	225	225	50	63	63	12.0	0.490	pitot ok
2	6	0.23	2.87	44.865	233	267	235	53	67	64	12.0	0.480	
3	12	0.18	2.27	50.922	227	275	238	55	70	67	9.5	0.424	
	18			56.454									
C 1	8:17 0	0.23	2.87	56.459	235	243	241	56	69	68	12.0	0.480	
2	6	0.21	2.53	62.450	233	275	243	57	73	70	10.5	0.447	
3	12	0.20	2.55	68.230	228	275	243	58	75	71	11.0	0.447	
	18			74.027									
B 1	8:38 0	0.22	2.77	74.027	235	245	228	59	73	72	11.5	0.469	
2	6	0.22	2.77	79.985	237	253	225	51	76	73	12.0	0.469	
3	12	0.18	2.27	85.980	237	240	225	50	77	74	9.0	0.424	
	18			91.502									

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE EPA Method 5/8 DATE 5/19/84

SAMPLE COMPONENT Acetone Residue ANALYST SP

REQUESTED BY CPC Mojave

ANALYTICAL METHOD Gravimetric

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample) gm.	
					Uncorrected	Blank corrected
Kiln	1	180	180			0.00704
	2	233	233			0.01670
	3	234	234			0.00994
Crusher	1	275	275			0.01052
	2	248	248			0.00675
	3	195	195			0.00514
Clinker	1	225	225			0.00766
	2	225	225			0.00563
	3	150	150			0.00569
	BL		100		0.00044	

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE EPA Method 5/8 DATE 5/19/84

SAMPLE COMPONENT Condensible Particulate ANALYST SP

REQUESTED BY CPC Mojave

ANALYTICAL METHOD gravimetric

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample) gm.	
					Uncorrected	Blank corrected
Kiln	1	315	100			0.00462
	2	240	100			0.00094
	3	220	100			0.00108
IPA	BL		100		0.00051	
AMF	BL		50		0.00048	
Crusher	1	360	100			0.00000
	2	432	100			0.00000
	3	460	100			0.00018
Clinker	1	415	100			0.00000
	2	410	100			0.00000
	3	335	100			0.00178
	BL		100		0.00056	

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Method 5/8 DATE 5/25/84

SAMPLE COMPONENT Condensible Sulfates ANALYST RS

REQUESTED BY CPC Mojave

ANALYTICAL METHOD

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls	Analytical Result (total sample) mg. H_2SO_4		
					Uncorrected	Blank corrected	
Kiln	1	215	10	0.22		2.27	
	2	240	10	0.21		2.42	45.2% dup
	3	220	10	0.20		2.11	103.9% spike
IPA	BL		10	0.00	0.00		
AMF	BL		10	0.00	0.00		

SECTION 8

QUALITY ASSURANCE

8.1 PARTICULATE/SO_x SAMPLING EQUIPMENT

A detailed record of repair and maintenance to each sampling train is kept. Preventative maintenance to each system is performed periodically to avoid complete component breakdown during a field test.

A detailed record of sampling system calibrations is also kept. Calibration data for the sampling nozzles, pitot tubes, dry gas meters and orifice meters are available for review. Results of the EPA Quality Assurance Branch biannual audits of the dry gas meter and orifice meter combinations are also logged and verify our in-house calibration data. The calibration data for the equipment used on this program can be found at the end of this section.

8.2 LAB ANALYSIS

All field samples are assigned a label and an ID number. This ID is also affixed to a chain-of-custody log and to the field data sheet to eliminate any chance of sample mixup.

Prior to analysis, all glassware is thoroughly cleaned (soap and water, tap water rinse, distilled water rinse, IPA rinse) to eliminate any contamination. The evaporating dishes used to evaporate the washings are treated the same as a sample (dried in an oven, desiccated and weighed repeatedly at 6-hour intervals until a constant weight is achieved). The

glassware used to measure volumes and make transfers and dilutions are all NBS Class A to insure accurate measurements. All weighings are carried out on a Mettler Model H54AR analytical balance supported by a marble table in a separate room from the main analytical laboratory. The balance is calibrated regularly against an NBS Class S-1 weight.

All reagents used in the field and in the laboratory are ACS reagent grade and blanks of these reagents are evaluated for every set of tests. Blanks are taken in the field from the squeeze bottles and not the original container. Records are kept on these blanks to insure consistent quality of the reagents. Prior to use, the IPA is also analyzed to insure no peroxides are present which could lead to high SO_3 and low SO_2 values.

A quality control program consisting of duplicate analyses (to measure precision), spikes (to measure recovery efficiency) or analysis of blind standards supplied by EPA's Quality Assurance Branch (to measure accuracy) is implemented for each test program. Table 8-1 summarizes the results of the QC checks on this program. Records of our lab's participation in the EPA biannual audits for SO_2 are kept on file and verify our in-house QA/QC efforts.

8.3 CONTINUOUS MONITORS

The NO_x and SO_2 analyzers are calibrated before and after each test using an EPA Protocol 1 gas ($\pm$ 1 percent) traceable to NBS. The CO, CO_2, and O_2 analyzers are calibrated before and after each test using a certified gas mixture ($\pm$ 2 percent). A multipoint calibration (0, 8 percent, 87 percent of span) linearity check of the NO_x and SO_2 analyzers was performed. The results of this check are summarized in Table 8-2. The NO_x and SO_2 analyzers

met the CARB multipoint calibration requirements. The calibration certificates for the gases used on this test program appear at the end of this section.

TABLE 8-1. QUALITY ASSURANCE RESULTS

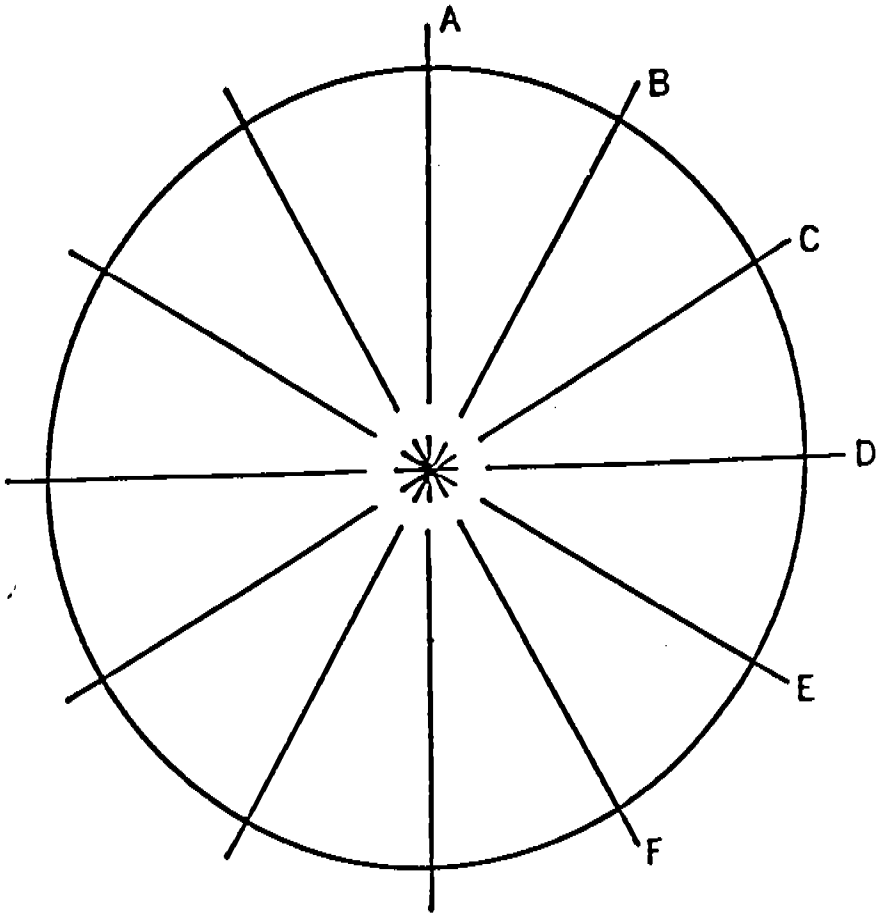
Test	Sample Description	Duplicate (%)	Spike Recovery (%)
1	Filterable Sulfate	95.7	
2	Filterable Sulfate		102.9
2	Condensible Sulfate	96.2	
3	Condensible Sulfate		103.9

TABLE 8-2. MULTIPOINT CALIBRATION LINEARITY CHECKS

Gas	Cal Gas (ppm)	Final Reading (ppm)	Difference (ppm)	CARB Allowable (± 2% Full Scale)
NO_x	0	0	0	0
	84.75	82.00	-2.75	±20
	202.00	202.00	0.00	±20
	818.40	818.00	-0.40	±20
SO_2	0	0	0	0
	49.60	51.5	+1.9	± 2
	70.00	71.9	+1.9	± 2
	85.00	85.00	0.00	± 2

Pape & Steiner Environmental Services

NOZZLE CALIBRATION DATA



DIAMETER (in.)

A 0.2095

B 0.2090

C 0.2090

D 0.2090

E

F

AVG. 0.2089

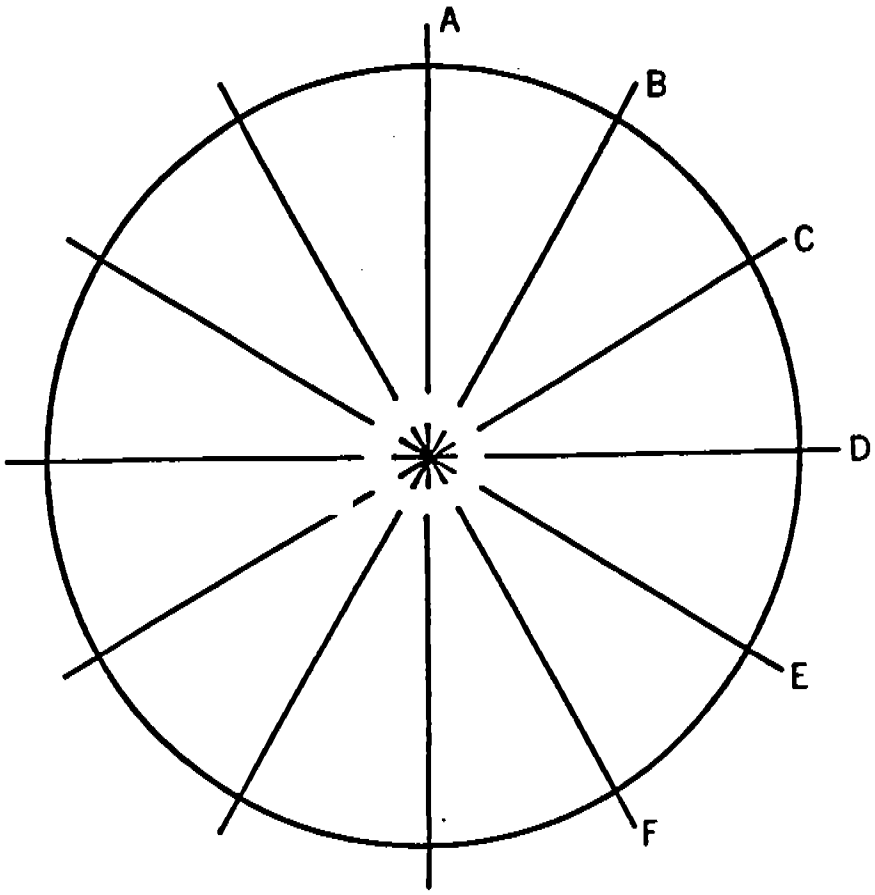
DATE 8-29-83

NOZZLE NO. SN 15C 5

OPERATOR J. Steiner

Pape & Steiner Environmental Services

NOZZLE CALIBRATION DATA



DIAMETER (in.)

A 0.2295

B 0.2295

C 0.2310

D 0.2315

E

F

AVG. 0.2304

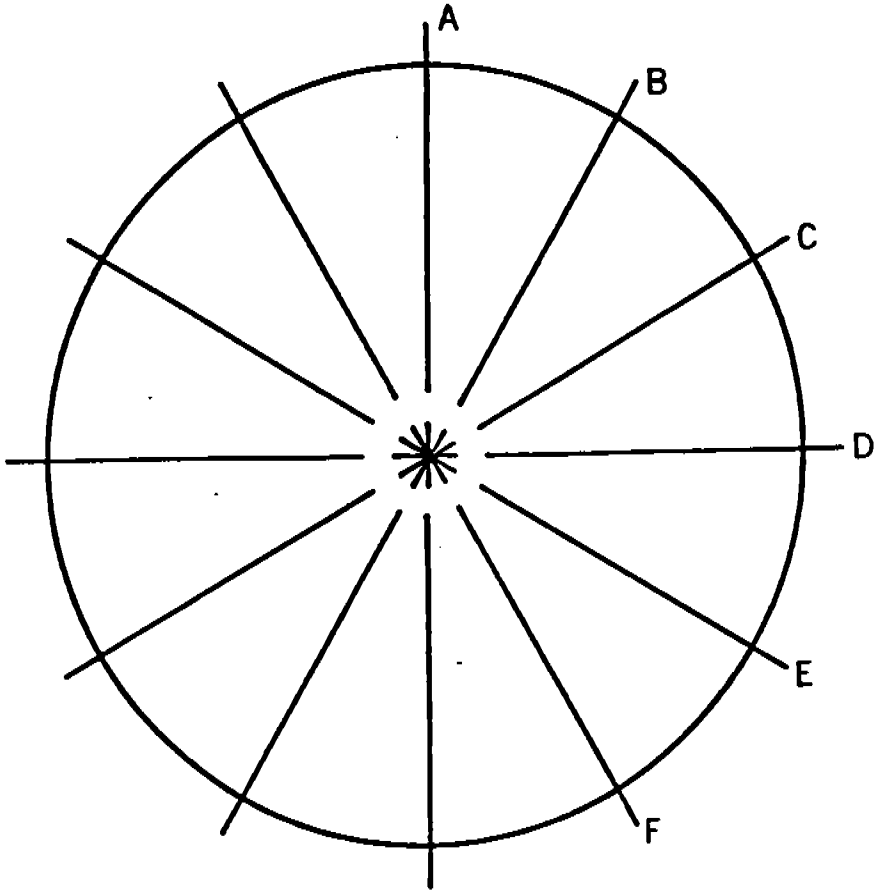
DATE 7/7/83

NOZZLE NO. 145E

OPERATOR JS

Pape & Steiner Environmental Services

NOZZLE CALIBRATION DATA



DIAMETER (in.)

A 0.3570

B 0.3580

C 0.3580

D 0.3580

E

F

AVG. 0.3578

DATE 7/6/83

NOZZLE NO. 1376

OPERATOR JS

Pape & Steiner Environmental Services

DRY GAS METER/ORIFICE METER CALIBRATION DATA

Date 3/30/84

Barometric Pressure, in. Hg 29.55

Meter Box No. 446

Dry Gas Meter No. 39009

Standard Test Meter No. 69279

Operator JF 57°F ambient

	Standard Test Meter			Meter Box				Time	γ	K_o
	Pres. ΔH_s ("Wg)	Temp. T_s (°F)	Volume V_s (Ft^3)	Pres. ΔH ("Wg)	Temp. T_{d_i}	T_{d_o} (°F)	Volume V_d (Ft^3)	(min)		
		56	875.032		71	71	90.069			
29.555	-1.3	56	858.829	0.5	70	70	73.530	40.0	0.9996	0.7429
		56	16.153		70.5		16.539			
		56	919.734		77	75	135.543			
29.58	-2.1	57	896.427	1.0	73	70	111.733	41.0	1.0006	0.7366
29.57		57.5	23.307		73.75		23.810			
		59	951.065		80	77	167.360			
29.57	-2.8	59	930.199	1.5	79	77	146.170	30.0	1.0104	0.7354
29.56		59	20.866		78.25		21.190			
		60	971.444		82	79	187.932			
29.55 29.56	-3.6	60	955.357	2.0	81	78	171.692	20.0	1.0144	0.7341
		60	16.087		80.00		16.240			
		61	993.756		85	80	210.252			
29.54 29.55	-5.0	61	976.001	3.0	84	79	192.484	18.0	1.0190	0.7307
		61	17.755		82.0		17.768			
				4.0						

Average 1.0088 0.7359

Std.Dev. 0.0085 (0.8%) 0.0045 (0.6%)

$$\gamma = \frac{V_s\left(P_{bar} + \frac{\Delta H_s}{13.6}\right)\left(\frac{T_{d_i} + T_{d_o}}{2} + 460\right)}{V_d\left(P_{bar} + \frac{\Delta H}{13.6}\right)\left(T_s + 460\right)}$$

$$K_o = \frac{\left(\frac{V_s}{t}\right)\left(\frac{T_{d_o}}{T_s}\right)\left(\frac{P_{bar} + \frac{\Delta H_s}{13.6}}{P_{bar} + \frac{\Delta H}{13.6}}\right)}{\left(\frac{T_{d_o}\,\Delta H}{\left(P_{bar} + \frac{\Delta H}{13.6}\right)\left(M_m\right)}\right)^{0.5}}$$

where

ΔH_s = Standard meter pressure drop

T_s = Standard meter temperature

V_s = Standard test meter dry gas volume

ΔH = Meter box orifice meter pressure drop

T_{d_i} = Meter box inlet temperature

T_{d_o} = Meter box outlet temperature

V_d = Meter box dry gas volume

γ = Meter box correction factor

K_o = Orifice meter calibration constant

t = Calibration time in minutes

M_m = Molecular weight of air (28.96 lb/lb-mole)

P_{bar} = Barometric pressure

Scott Specialty Gases a division of Scott Environmental Technology, Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: (215) 766-8861 TWX: 510-665-9344

Pape & Steiner
5801 Norris Road
Bakersfield, CA 93308

Date: April 4, 1984
Our Project No.: 43633
Your P.O. No.: SP1951

Gentlemen:

Thank you for choosing Scott for your Specialty Gas needs. The analyses for the gases ordered, as reported by our laboratory, are listed below. Results are in volume percent, unless otherwise indicated.

ANALYTICAL REPORT

Cyl. No. AL3703 Analytical Accuracy ±2%

Component	Concentration
METHANE	48.9PPM
ETHANE	50.5PPM
PROPANE	50.5PPM
BUTANE	52.9PPM
PENTANE	49.5PPM
HEXANE	51.3PPM
BALANCE	NITROGEN

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Analyst _____

Approved By _____

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

CERTIFIED REFERENCE MATERIALS EPA PROTOCOL GASES
ACUBLEND® CALIBRATION & SPECIALTY GAS MIXTURES PURE GASES
ACCESSORY PRODUCTS CUSTOM ANALYTICAL SERVICES
TROY, MICHIGAN / SAN BERNARDINO, CALIFORNIA / HOUSTON, TEXAS

Scott Specialty Gases a division of Scott Environmental Technology, Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: (215) 766-8861 TWX: 510-665-9344

Pape & Steiner
5801 Norris Road
Bakersfield, CA 93308

Date: January 30, 1984
Our Project No.: 43633
Your P.O. No.: SP1951

Gentlemen:

Thank you for choosing Scott for your Specialty Gas needs. The analyses for the gases ordered, as reported by our laboratory, are listed below. Results are in volume percent, unless otherwise indicated.

ANALYTICAL REPORT

Cyl. No. AL4779 Analytical Accuracy ±2%

Component	Concentration
Carbon Monoxide	398.0PPM
Carbon Dioxide	18.01%PPM
Oxygen	8.07%PPM
Nitrogen	Balance

Carbon Monoxide traceable to SRM 3720-475PPM

**Gravimetric Master

Cyl. No. AL190 Analytical Accuracy ±2%

Component	Concentration
Carbon Monoxide	397.0PPM
Carbon Dioxide	18.02%PPM
Oxygen	8.03%PPM
Nitrogen	Balance

**Gravimetric Master

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

**Certified to have been blended against NBS certified weights and verified correct by independent analysis.

Analyst _____

Approved By J. Morgan Davis

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

CERTIFIED REFERENCE MATERIALS EPA PROTOCOL GASES
ACUBLEND® CALIBRATION & SPECIALTY GAS MIXTURES PURE GASES
ACCESSORY PRODUCTS CUSTOM ANALYTICAL SERVICES
TROY, MICHIGAN / SAN BERNARDINO, CALIFORNIA / HOUSTON, TEXAS

Scott Specialty Gases

Scott Environmental Technology, Inc.

2600 CAJON BLVD. SAN BERNARDINO, CA 92411 PHONE (714) 887-2571

Date Shipped 2-22-84

Our Project No: 43633

Your P.O. No: SP1951

Page 1 of 1

PAPE & STEINER
5801 NORRIS RD
BAKERSFIELD, CA 93308

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*

(Concentrations are in mole % or ppm)

Cylinder Number AAL12617 Certified Accuracy ±1% % NBS Traceable Analysis Dates: First 2-8-84 Last 2-21-84

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	REPLICATE CONCENTRATIONS SECOND
NITRIC OXIDE	189.9 PPM	8-22-84	CHEMI	CRM1685B	189.5PPM	190.4PPM
NOX	193.4PPM				193.8PPM	192.9PPM
NITROGEN	BALANCE					

Cylinder Number AAL12627 Certified Accuracy ±1% % NBS Traceable Analysis Dates: First 2-8-84 Last 2-21-84

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	REPLICATE CONCENTRATIONS SECOND
NITRIC OXIDE	190.8PPM	8-22-84	CHEMI	CRM1685B	190.7PPM	190.9PPM
NOX	194.0 PPM				194.1PPM	193.9PPM
NITROGEN	BALANCE					

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No: 1

Analyst _____ Approved By _____

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

CERTIFIED REFERENCE MATERIALS ■ EPA PROTOCOL GASES ■ ACUBLEND™ ■ CALIBRATION & SPECIALTY GAS MIXTURES
PURE GASES ■ ACCESSORY PRODUCTS ■ CUSTOM ANALYTICAL SERVICES

TROY, MICHIGAN / PLUMSTEADVILLE, PENNSYLVANIA

APPENDIX A

RESULTS AT EPA STANDARD CONDITIONS

Table A-1 presents the summary of source emission test data collected during this program. The data is presented at EPA standard conditions ($68^{o}F$, 29.92 inches mercury).

The particulate mass is reported in two ways -- front half and front half plus back half. The front half catch (nozzle, probe, filter holder wash and filter) represent matter which is filterable at $250^{o}F$. EPA bases compliance on this value. The back half catch represents condensible matter which is caught in the 80 percent isopropanol impinger and the acid mist filter. Kern County APCD bases compliance on the combined front half and back half catches. The sulfate data is reported as H_2SO_4 and represents the total sulfate measured in the front and back half catches. Kern County bases compliance on this value. The SO_3 data reported represents that portion of the sulfate catch not filterable at $250^{o}F$. This data is presented as SO_3 not H_2SO_4 as in the sulfate data reported for Kern County. The SO_2 values reported represent the SO_2 collected in the hydrogen peroxide portion of the sample train.

TABLE A-1. SUMMARY OF SOURCE EMISSION TEST DATA

UNIT TESTED: Kiln LOCATION: Baghouse Outlet

	1	2	3	Average
Test number	1	2	3	
Date	5/15/84	5/15/84	5/15/84	
Test condition	231 TPH	236 TPH	245 TPH	
Barometric pressure (in. Hg)	26.20	26.20	26.20	
Stack pressure (in. Hg)	26.11	26.11	26.11	
Stack area (Ft^2)	87.28	87.28	87.28	
Elapsed sampling time (min)	72	72	72	
Volume gas sampled (dscf)	47.1355	47.0808	48.2880	
F factor				
GAS DATA				
Average gas velocity (fps)	63.3	63.4	65.1	63.9
Average gas temperature (^oF)	259.0	258.2	258.0	258.4
Gas flowrate (dscfm)	198625	199435	206805	201621
Gas analysis (dry percent basis)				
Carbon dioxide	18.80	18.38	18.50	
Oxygen	10.45	10.50	11.10	
Carbon monoxide	0.00	0.00	0.00	
Water	6.49	6.35	5.53	
EMISSION CONCENTRATION				
Filterable particulate (gr/dscf)	0.0029	0.0062	0.0040	0.0044
Total particulate (gr/dscf)	0.0044	0.0065	0.0043	0.0051
Total sulfate (gr/dscf)	0.0011	0.0011	0.0011	0.0011
SO_3 (ppm)	0.20	0.20	0.20	0.20
SO_2 (ppm)	67.79	72.81	73.45	71.35
NO_x (ppm)	353.75	352.50	382.50	362.92
EMISSION RATE				
Filterable particulate (lb/hr)	4.88	10.53	7.00	7.47
Total particulate (lb/hr)	7.46	11.06	7.61	8.71
Total sulfate (lb/hr)	1.88	1.89	1.90	1.89
SO_3 (lb/hr)	0.50	0.44	0.58	0.51
SO_2 (lb/hr)	143.76	154.17	154.80	150.91
NO_x (lb/hr)	503.48	501.70	546.62	517.27
Lb/MMBtu-EMISSION FACTOR				
Filterable particulate				
Total particulate				
Total sulfate				
SO_2				
NO_x				
Lb/Bbl-EMISSION FACTOR				
Total particulate				
Total sulfate				
SO_2				
NO_x				

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 1 Date 5/15/84 Location Kiln Baghouse Stack

T_m	54.60	V_m	51.772	O_2	10.45	Stack ID "	126.5
T_s	259.00	γ	1.0088	CO_2	18.80	Stack Area Ft^2	87.2787
$\sqrt{\Delta P}$	0.9284	P_b	26.20	Static	-1.2	Test Time	72
ΔH	1.60	V_{1c}	69.5	C_p	0.84	N_d	0.2304

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 47.1355$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.2714$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0649$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.4260$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.5547$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.1118$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 63.2903$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 198624.8854$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.4366$$

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 2 Date 5/15/84 Location Kiln Baghouse Stack

T_m	60.79	V_m	52.331	O_2	10.50	Stack ID "	126.5
T_s	258.17	γ	1.0088	CO_2	18.38	Stack Area Ft^2	87.2787
$\sqrt{\Delta P}$	[redacted]	P_b	26.70	Static	-1.2	Test Time	72
ΔH	1.62	V_{lc}	[redacted] 67.8	C_p	[redacted] 0.84	N_d	0.2304

1. Volume of dry gas sampled at standard conditions (dscf)

(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 47.0808$$

2. Stack gas moisture condensed at standard conditions (scf)

(R-18)

$(V_{m,std} + V_{w,std}; R\text{-}04)$

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{lc}) = 3.1413$$

3. Stack gas proportion of water vapor, by volume

(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0635$$

4. Stack gas dry molecular weight (lb/lb mole)

(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.3608$$

5. Stack gas molecular weight (lb/lb mole)

(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.5126$$

6. Pressure stack, in. Hg

(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.1118$$

7. Stack gas velocity, at stack conditions (ft/sec)

(R-24)

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 2 Date 5/15/84 Location Kiln Baghouse Stack

T_m	60.79	V_m	52.331	O_2	10.50	Stack ID "	126.5
T_s	258.17	γ	1.0088	CO_2	18.38	Stack Area Ft^2	87.2787
$\sqrt{\Delta P}$	0.9296	P_b	26.20	Static	-1.2	Test Time	72
ΔH	1.62	V_{1c}	67.8	C_p	0.84	N_d	0.2304

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 47.0808$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.1913$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0635$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.3608$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.5126$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.1118$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 63.3791$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 199435.4242$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.9175$$

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 2 Date 5/16/84 Location Crusher Baghouse

T_m	80.19	V_m	68.411	O_2	20.9	Stack ID "	43.5
T_s	60.0	γ	1.0088	CO_2	0.0	Stack Area Ft^2	10.3206
$\sqrt{\Delta P}$	1.1369	P_b	26.25	Static	-9.3	Test Time	72
ΔH	2.51	V_{1c}	23.3	C_p	0.84	N_d	0.2089

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 59.5974$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 1.0491$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0173$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.6485$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.5662$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 68.7915$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 36319.7701$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.9012$$

TABLE A-3. SUMMARY OF SOURCE EMISSION TEST DATA

UNIT TESTED: Clinker Cooler LOCATION: Baghouse Outlet

Test number	1	2	3	Average
Date	5/17/84	5/17/84	5/18/84	
Test condition	250 TPH	250 TPH	250 TPH	
Barometric pressure (in. Hg)	26.26	26.26	26.38	
Stack pressure (in. Hg)	26.25	26.25	26.36	
Stack area (Ft^2)	106.14	106.14	106.14	
Elapsed sampling time (min)	72	72	72	
Volume gas sampled (dscf)	63.9903	62.1795	61.9962	
F factor				
GAS DATA				
Average gas velocity (fps)	32.7	31.8	31.2	31.9
Average gas temperature (^oF)	237.6	234.4	234.5	235.5
Gas flowrate (dscfm)	137895	134259	131953	134702
Gas analysis (dry percent basis)				
Carbon dioxide	0.0	0.0	0.0	
Oxygen	20.9	20.9	20.9	
Carbon monoxide	0.0	0.0	0.0	
Water	0.38	0.66	0.88	
EMISSION CONCENTRATION				
Filterable particulate (gr/dscf)	0.0018	0.0014	0.0014	0.0015
Total particulate (gr/dscf)	0.0018	0.0014	0.0019	0.0017
Total sulfate (gr/dscf)				
SO_3 (ppm)				
SO_2 (ppm)				
NO_x (ppm)				
EMISSION RATE				
Filterable particulate (lb/hr)	2.18	1.61	1.60	1.80
Total particulate (lb/hr)	2.18	1.61	2.10	1.96
Total sulfate (lb/hr)				
SO_3 (lb/hr)				
SO_2 (lb/hr)				
NO_x (lb/hr)				
Lb/MMBtu-EMISSION FACTOR				
Filterable particulate				
Total particulate				
Total sulfate				
SO_2				
NO_x				
Lb/Bbl-EMISSION FACTOR				
Total particulate				
Total sulfate				
SO_2				
NO_x				

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 1 Date 5/17/84 Location Clinker Baghouse

T_m	73.67	V_m	72.473	O_2	20.9	Stack ID "	139.5
T_s	237.58	γ	1.0088	CO_2	0.0	Stack Area Ft^2	106.1392
$\sqrt{\Delta P}$	0.4745	P_b	26.26	Static	-0.19	Test Time	72
ΔH	3.84	V_{1c}	5.2	C_p	0.84	N_d	0.3578

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 63.9903$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.2448$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0038$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.7947$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2460$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 32.7371$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 137895.2116$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.0501$$

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 2 Date 5/17/84 Location Clinker Baghouse

T_m	72.71	V_m	70.979	O_2	20.9	Stack ID "	139.5
T_s	234.42	γ	1.0088	CO_2	0.0	Stack Area Ft^2	106.1392
$\sqrt{\Delta P}$	0.4620	P_b	26.26	Static	−0.19	Test Time	72
ΔH	2.72	V_{1c}	8.8	C_p	0.84	N_d	0.3578

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 62.1795$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.4142$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0066$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.7643$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2460$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 31.8192$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 134259.4487$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 97.8557$$

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 2 Date 5/15/84 Location Kiln Baghouse Stack

T_m	60.79	V_m	52.331	O_2	10.50	Stack ID "	126.5
T_s	258.17	γ	1.0088	CO_2	18.38	Stack Area Ft^2	87.2787
$\sqrt{\Delta P}$	0.9296	P_b	26.20	Static	-1.2	Test Time	72
ΔH	1.62	V_{1c}	67.8	C_p	0.84	N_d	0.2304

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 47.0808$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.1913$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0635$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.3608$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.5126$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.1118$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 63.3791$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 199435.4242$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.9175$$

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 3 Date 5/15/84 Location Kiln Baghouse Stack

T_m	63.63	V_m	53.949	O_2	11.1	Stack ID "	126.5
T_s	258.00	γ	1.0088	CO_2	18.5	Stack Area Ft^2	87.2787
$\sqrt{\Delta P}$	0.9578	P_b	26.20	Static	-1.2	Test Time	72
ΔH	1.73	V_{1c}	60.0	C_p	0.84	N_d	0.2304

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 48.2880$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std}$ + $V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 2.8242$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0553$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.4040$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.6634$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.1118$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 65.1334$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 206804.8260$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 97.8387$$

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TEST 1

LOCATION Kiln Baghouse outlet

EMISSION RATE DATA -- 68°F

Standard Temperature, S_t = 68°F; 29.92 inches Hg

XEQ 68

XEQ FF

%H _____

%C _____

%S _____

%N _____

$\%O_2$ _____

Btu/lb _____

Specific Gravity _____

XEQ RAT

ENTER:

R-17 $V_{m,std}$ 47.1355

R-26 Q_s 198624.8854

R-22 O_2 % 10.45

LAB DATA:

Front Half Wash (g) 0.00704

Mass Filter (g) 0.00172

Back Half Catch (g) 0.00462

Front Half Sulfate (mg H_2SO_4) 2.27

Back Half Sulfate (mg H_2SO_4) 1.10

H_2O_2 Catch (mg H_2SO_4) _____

RESULTS

F Factor	1	
Filterable Particulate gr/dscf	6	0.0029
Filterable Particulate lb/hr	7	4.88
Total Particulate gr/dscf	8	0.0044
Total Particulate lb/hr	10	7.46
Total Sulfate gr/dscf	11	0.0011
Total Sulfate lb/hr	13	1.88
SO_3 ppm	14	0.20
SO_3 lb/hr	15	0.50
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Filterable Particulate lb/MMBtu	22	
Total Particulate lb/MMBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/MMBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/MMBtu	27	
SO_2 lb/Bbl	28	

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TEST 2

LOCATION Kiln Baghouse Stack

EMISSION RATE DATA -- 68°F

Standard Temperature, S_t = 68°F; 29.92 inches Hg

XEQ 68

XEQ FF

%H _____

%C _____

%S _____

%N _____

$\%O_2$ _____

Btu/lb _____

Specific Gravity _____

XEQ RAT

ENTER:

R-17 $V_{m,std}$ 47.0808

R-26 Q_s 199435.4242

R-22 O_2 % 10.50

LAB DATA:

Front Half Wash (g) 0.01670

Mass Filter (g) 0.00010

Back Half Catch (g) 0.00094

Front Half Sulfate (mg H_2SO_4) 2.42

Back Half Sulfate (mg H_2SO_4) 0.96

H_2O_2 Catch (mg H_2SO_4) _____

RESULTS

F Factor	1	
Filterable Particulate gr/dscf	6	0.0062
Filterable Particulate lb/hr	7	10.53
Total Particulate gr/dscf	8	0.0065
Total Particulate lb/hr	10	11.06
Total Sulfate gr/dscf	11	0.0011
Total Sulfate lb/hr	13	1.89
SO_3 ppm	14	0.2
SO_3 lb/hr	15	0.44
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Filterable Particulate lb/MMBtu	22	
Total Particulate lb/MMBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/MMBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/MMBtu	27	
SO_2 lb/Bbl	28	

Pape & Steiner Environmental Services

TEST 3

LOCATION Kiln Baghouse Stack

EMISSION RATE DATA -- 68°F

Standard Temperature, S_t = 68°F; 29.92 inches Hg

XEQ 68

XEQ FF

%H _____

%C _____

%S _____

%N _____

$\%O_2$ _____

Btu/lb _____

Specific Gravity _____

XEQ RAT

ENTER:

R-17 $V_{m,std}$ 48.2880

R-26 Q_s 206804.8260

R-22 O_2 % 11.1

LAB DATA:

Front Half Wash (g) 0.00994

Mass Filter (g) 0.00242

Back Half Catch (g) 0.00108

Front Half Sulfate (mg H_2SO_4) 2.11

Back Half Sulfate (mg H_2SO_4) 1.25

H_2O_2 Catch (mg H_2SO_4) _____

RESULTS

F Factor	1 _____
Filterable Particulate gr/dscf	6 0.0040
Filterable Particulate lb/hr	7 2.00
Total Particulate gr/dscf	8 0.0043
Total Particulate lb/hr	10 2.61
Total Sulfate gr/dscf	11 0.0011
Total Sulfate lb/hr	13 1.90
SO_3 ppm	14 0.2
SO_3 lb/hr	15 0.58
SO_2 ppm	16 _____
SO_2 lb/hr	17 _____
SO_2 @ 3% O_2	18 _____
Filterable Particulate lb/MMBtu	22 _____
Total Particulate lb/MMBtu	23 _____
Total Particulate lb/Bbl	24 _____
Total Sulfate lb/MMBtu	25 _____
Total Sulfate lb/Bbl	26 _____
SO_2 lb/MMBtu	27 _____
SO_2 lb/Bbl	28 _____

TABLE A-2. SUMMARY OF SOURCE EMISSION TEST DATA

UNIT TESTED: Crusher LOCATION: Baghouse Outlet

	1	2	3	Average
Test number	1	2	3	
Date	5/16/84	5/16/84	5/17/84	
Test condition	1500 TPH	1500 TPH	1500 TPH	
Barometric pressure (in. Hg)	26.25	26.25	26.26	
Stack pressure (in. Hg)	25.57	25.57	25.58	
Stack area (Ft^2)	10.32	10.32	10.32	
Elapsed sampling time (min)	72	72	72	
Volume gas sampled (dscf)	60.7335	58.6944	58.5629	
F factor				
GAS DATA				
Average gas velocity (fps)	70.3	68.8	68.2	69.1
Average gas temperature (^oF)	57.3	60.0	57.0	58.1
Gas flowrate (dscfm)	36898	35769	35734	36134
Gas analysis (dry percent basis)				
Carbon dioxide	0.0	0.0	0.0	
Oxygen	20.9	20.9	20.9	
Carbon monoxide	0.0	0.0	0.0	
Water	1.38	1.73	1.61	
EMISSION CONCENTRATION				
Filterable particulate (gr/dscf)	0.0026	0.0017	0.0013	0.0019
Total particulate (gr/dscf)	0.0026	0.0017	0.0014	0.0019
Total sulfate (gr/dscf)				
SO_3 (ppm)				
SO_2 (ppm)				
NO_x (ppm)				
EMISSION RATE				
Filterable particulate (lb/hr)	0.85	0.54	0.41	0.60
Total particulate (lb/hr)	0.85	0.54	0.43	0.61
Total sulfate (lb/hr)				
SO_3 (lb/hr)				
SO_2 (lb/hr)				
NO_x (lb/hr)				
Lb/MMBtu-EMISSION FACTOR				
Filterable particulate				
Total particulate				
Total sulfate				
SO_2				
NO_x				
Lb/Bbl-EMISSION FACTOR				
Total particulate				
Total sulfate				
SO_2				
NO_x				

ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test #1 Date 5/16/84 Location Crusher Baghouse

T_m	72.13	V_m	64.712	O_2	20.9	Stack ID "	43.5
T_s	57.33	γ	1.0066	CO_2	0.0	Stack Area Ft^2	10.3206
$\sqrt{\Delta P}$	1.1664	P_b	26.25	Static	-9.3	Test Time	72
ΔH	2.61	V_{1c}	18.4	C_p	0.84	N_d	0.2089

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 61.6678$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.8661$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0138$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.6859$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.5662$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 70.3491$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 37465.1804$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.2083$$

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 2 Date 5/16/84 Location Crusher Baghouse

T_m	80.19	V_m	68.411	O_2	20.9	Stack ID "	43.5
T_s	60.0	γ	1.0088	CO_2	0.0	Stack Area Ft^2	10.3206
$\sqrt{\Delta P}$	1.1369	P_b	26.25	Static	-9.3	Test Time	72
ΔH	2.51	V_{1c}	23.3	C_p	0.84	N_d	0.2089

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 59.5974$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 1.0491$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0173$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8366$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.6485$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.5662$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 68.7915$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 36319.7701$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.9012$$

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 3 Date 5/17/84 Location Crusher Baghouse

T_m	70.13	V_m	66.978	O_2	20.9	Stack ID "	43.5
T_s	57.04	γ	1.0088	CO_2	0.0	Stack Area Ft^2	10.3206
$\sqrt{\Delta P}$	1.1312	P_b	26.26	Static	-9.3	Test Time	72
ΔH	2.42	V_{1c}	26.7	C_p	0.84	N_d	0.2089

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 59.4639$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std}$ + $V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.9743$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0161$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.6613$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.5762$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 68.2229$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 36283.6765$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.7778$$

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TEST 1

LOCATION Crusher Baghouse

EMISSION RATE DATA -- 68°F

Standard Temperature, S_t = 68°F; 29.92 inches Hg

XEQ 68

XEQ FF

%H _____

%C _____

%S _____

%N _____

$\%O_2$ _____

Btu/lb _____

Specific Gravity _____

XEQ RAT

ENTER:

R-17 $V_{m,std}$ 61.6678

R-26 Q_s 37465.1804

R-22 O_2 % 20.9

LAB DATA:

Front Half Wash (g) 0.01052

Mass Filter (g) 0.00000

Back Half Catch (g) 0.00000

Front Half Sulfate (mg H_2SO_4) _____

Back Half Sulfate (mg H_2SO_4) _____

H_2O_2 Catch (mg H_2SO_4) _____

RESULTS

F Factor	1	
Filterable Particulate gr/dscf	6	0.0026
Filterable Particulate lb/hr	7	0.85
Total Particulate gr/dscf	8	0.0026
Total Particulate lb/hr	10	0.85
Total Sulfate gr/dscf	11	
Total Sulfate lb/hr	13	
SO_3 ppm	14	
SO_3 lb/hr	15	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Filterable Particulate lb/MMBtu	22	
Total Particulate lb/MMBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/MMBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/MMBtu	27	
SO_2 lb/Bbl	28	

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TEST 2

LOCATION Crusher Baghouse

EMISSION RATE DATA -- 68°F

Standard Temperature, S_t = 68°F; 29.92 inches Hg

XEQ 68

XEQ FF

%H _____

%C _____

%S _____

%N _____

$\%O_2$ _____

Btu/lb _____

Specific Gravity _____

XEQ RAT

ENTER:

R-17 $V_{m,std}$ 59.5974

R-26 Q_s 36319.7701

R-22 O_2 % 20.9

LAB DATA:

Front Half Wash (g) 0.00675

Mass Filter (g) 0.00000

Back Half Catch (g) 0.00000

Front Half Sulfate (mg H_2SO_4) _____

Back Half Sulfate (mg H_2SO_4) _____

H_2O_2 Catch (mg H_2SO_4) _____

RESULTS

F Factor	1	
Filterable Particulate gr/dscf	6	0.0017
Filterable Particulate lb/hr	7	0.54
Total Particulate gr/dscf	8	0.0017
Total Particulate lb/hr	10	0.54
Total Sulfate gr/dscf	11	
Total Sulfate lb/hr	13	
SO_3 ppm	14	
SO_3 lb/hr	15	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Filterable Particulate lb/MMBtu	22	
Total Particulate lb/MMBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/MMBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/MMBtu	27	
SO_2 lb/Bbl	28	

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TEST 3

LOCATION Crusher Baghouse

EMISSION RATE DATA -- 68°F

Standard Temperature, S_t = 68°F; 29.92 inches Hg

XEQ 68

XEQ FF

%H _____

%C _____

%S _____

%N _____

$\%O_2$ _____

Btu/lb _____

Specific Gravity _____

XEQ RAT

ENTER:

R-17 $V_{m,std}$ 59.4639

R-26 Q_s 36283.6765

R-22 O_2 % 20.9

LAB DATA:

Front Half Wash (g) 0.00514

Mass Filter (g) 0.00000

Back Half Catch (g) 0.00016

Front Half Sulfate (mg H_2SO_4) _____

Back Half Sulfate (mg H_2SO_4) _____

H_2O_2 Catch (mg H_2SO_4) _____

RESULTS

F Factor	1	
Filterable Particulate gr/dscf	6	0.0013
Filterable Particulate lb/hr	7	0.41
Total Particulate gr/dscf	8	0.0014
Total Particulate lb/hr	10	0.43
Total Sulfate gr/dscf	11	
Total Sulfate lb/hr	13	
SO_3 ppm	14	
SO_3 lb/hr	15	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Filterable Particulate lb/MMBtu	22	
Total Particulate lb/MMBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/MMBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/MMBtu	27	
SO_2 lb/Bbl	28	

TABLE A-3. SUMMARY OF SOURCE EMISSION TEST DATA

UNIT TESTED: Clinker Cooler LOCATION: Baghouse Outlet

	1	2	3	Average
Test number	1	2	3	
Date	5/17/84	5/17/84	5/18/84	
Test condition	250 TPH	250 TPH	250 TPH	
Barometric pressure (in. Hg)	26.26	26.26	26.38	
Stack pressure (in. Hg)	26.25	26.25	26.36	
Stack area (Ft^2)	106.14	106.14	106.14	
Elapsed sampling time (min)	72	72	72	
Volume gas sampled (dscf)	63.9903	62.1795	61.9962	
F factor				
GAS DATA				
Average gas velocity (fps)	32.7	31.8	31.2	31.9
Average gas temperature (^oF)	237.6	234.4	234.5	235.5
Gas flowrate (dscfm)	137895	134259	131953	134702
Gas analysis (dry percent basis)				
Carbon dioxide	0.0	0.0	0.0	
Oxygen	20.9	20.9	20.9	
Carbon monoxide	0.0	0.0	0.0	
Water	0.38	0.66	0.88	
EMISSION CONCENTRATION				
Filterable particulate (gr/dscf)	0.0018	0.0014	0.0014	0.0015
Total particulate (gr/dscf)	0.0018	0.0014	0.0019	0.0017
Total sulfate (gr/dscf)				
SO_3 (ppm)				
SO_2 (ppm)				
NO_x (ppm)				
EMISSION RATE				
Filterable particulate (lb/hr)	2.18	1.61	1.60	1.80
Total particulate (lb/hr)	2.18	1.61	2.10	1.96
Total sulfate (lb/hr)				
SO_3 (lb/hr)				
SO_2 (lb/hr)				
NO_x (lb/hr)				
Lb/MMBtu-EMISSION FACTOR				
Filterable particulate				
Total particulate				
Total sulfate				
SO_2				
NO_x				
Lb/Bbl-EMISSION FACTOR				
Total particulate				
Total sulfate				
SO_2				
NO_x				

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 1 Date 5/17/84 Location Clinker Baghouse

T_m	73.67	V_m	72.473	O_2	20.9	Stack ID "	139.5
T_s	237.58	γ	1.0088	CO_2	0.0	Stack Area Ft^2	106.1392
$\sqrt{\Delta P}$	0.4745	P_b	26.26	Static	-0.19	Test Time	72
ΔH	2.84	V_{1c}	5.2	C_p	0.84	N_d	0.3578

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 63.9903$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.2448$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0038$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.7947$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2460$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 32.7371$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 137895.2116$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.0501$$

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ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 2 Date 5/17/84 Location Clinker Baghouse

T_m	77.71	V_m	70.979	O_2	20.9	Stack ID "	139.5
T_s	254.42	γ	1.0088	CO_2	0.0	Stack Area Ft^2	106.1342
$\sqrt{\Delta P}$	0.4620	P_b	26.26	Static	-0.19	Test Time	72
ΔH	2.72	V_{1c}	8.8	C_p	0.84	N_d	0.3578

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 62.1795$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.4142$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0066$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8360$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.7643$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2460$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 31.8192$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 134259.4487$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 97.8557$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

Standard temperature, S_t 68 (XEQ 60 or 68); 29.92 inches Hg

Test 3 Date 5/18/84 Location Clinker Baghouse

T_m	71.67	V_m	69.682	O_2	20.9	Stack ID "	139.5
T_s	234.50	γ	1.0088	CO_2	0.0	Stack Area Ft^2	106.1392
$\sqrt{\Delta P}$	0.4539	P_b	26.38	Static	-0.24	Test Time	72
ΔH	2.60	V_{1c}	11.7	C_p	0.84	N_d	0.3578

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 61.9962$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.5507$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0088$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.8366$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.7406$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.3624$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 31.2069$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 131{,}953.2209$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.2724$$

Pape & Steiner Environmental Services

TEST 1

LOCATION Clinker Baghouse

EMISSION RATE DATA -- 68°F

Standard Temperature, S_t = 68°F; 29.92 inches Hg

XEQ 68

XEQ FF

%H _____

%C _____

%S _____

%N _____

$\%O_2$ _____

Btu/lb _____

Specific Gravity _____

XEQ RAT

ENTER:

R-17 $V_{m,std}$ 63.9903

R-26 Q_s 137695.2116

R-22 O_2 % 20.9

LAB DATA:

Front Half Wash (g) 0.00766

Mass Filter (g) 0.00000

Back Half Catch (g) 0.00000

Front Half Sulfate (mg H_2SO_4) _____

Back Half Sulfate (mg H_2SO_4) _____

H_2O_2 Catch (mg H_2SO_4) _____

RESULTS

F Factor	1 _____
Filterable Particulate gr/dscf	6 0.0018
Filterable Particulate lb/hr	7 2.18
Total Particulate gr/dscf	8 0.0018
Total Particulate lb/hr	10 2.18
Total Sulfate gr/dscf	11 _____
Total Sulfate lb/hr	13 _____
SO_3 ppm	14 _____
SO_3 lb/hr	15 _____
SO_2 ppm	16 _____
SO_2 lb/hr	17 _____
SO_2 @ 3% O_2	18 _____
Filterable Particulate lb/MMBtu	22 _____
Total Particulate lb/MMBtu	23 _____
Total Particulate lb/Bbl	24 _____
Total Sulfate lb/MMBtu	25 _____
Total Sulfate lb/Bbl	26 _____
SO_2 lb/MMBtu	27 _____
SO_2 lb/Bbl	28 _____

Pape & Steiner Environmental Services

TEST 2

LOCATION Clinker Baghouse

EMISSION RATE DATA -- 68°F

Standard Temperature, S_t = 68°F; 29.92 inches Hg

XEQ 68

XEQ FF

%H _____

%C _____

%S _____

%N _____

$\%O_2$ _____

Btu/lb _____

Specific Gravity _____

XEQ RAT

ENTER:

R-17 $V_{m,std}$ 63.1795

R-26 Q_s 134259.4487

R-22 O_2 % 20.9

LAB DATA:

Front Half Wash (g) 0.00563

Mass Filter (g) 0.00000

Back Half Catch (g) 0.00000

Front Half Sulfate (mg H_2SO_4) _____

Back Half Sulfate (mg H_2SO_4) _____

H_2O_2 Catch (mg H_2SO_4) _____

RESULTS

F Factor	1	
Filterable Particulate gr/dscf	6	0.0014
Filterable Particulate lb/hr	7	1.61
Total Particulate gr/dscf	8	0.0014
Total Particulate lb/hr	10	1.61
Total Sulfate gr/dscf	11	
Total Sulfate lb/hr	13	
SO_3 ppm	14	
SO_3 lb/hr	15	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Filterable Particulate lb/MMBtu	22	
Total Particulate lb/MMBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/MMBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/MMBtu	27	
SO_2 lb/Bbl	28	

Pape & Steiner Environmental Services

TEST 3

LOCATION Clinker Baghouse

EMISSION RATE DATA -- 68°F

Standard Temperature, S_t = 68°F; 29.92 inches Hg

XEQ 68

XEQ FF

%H _____

%C _____

%S _____

%N _____

$\%O_2$ _____

Btu/lb _____

Specific Gravity _____

XEQ RAT

ENTER:

R-17 $V_{m,std}$ 61.9962

R-26 Q_s 131953.2204

R-22 O_2 % 20.9

LAB DATA:

Front Half Wash (g) 0.00564

Mass Filter (g) 0.00000

Back Half Catch (g) 0.00178

Front Half Sulfate (mg H_2SO_4) _____

Back Half Sulfate (mg H_2SO_4) _____

H_2O_2 Catch (mg H_2SO_4) _____

RESULTS

F Factor	1	
Filterable Particulate gr/dscf	6	0.0014
Filterable Particulate lb/hr	7	1.60
Total Particulate gr/dscf	8	0.0019
Total Particulate lb/hr	10	2.10
Total Sulfate gr/dscf	11	
Total Sulfate lb/hr	13	
SO_3 ppm	14	
SO_3 lb/hr	15	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Filterable Particulate lb/MMBtu	22	
Total Particulate lb/MMBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/MMBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/MMBtu	27	
SO_2 lb/Bbl	28	