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 33
Report Sect. 4
Reference 27

CalMat Company
P. O. Box 910
Mojave, California 93501

MOJAVE PLANT

(KILN, CRUSHER, AND CLINKER BAGHOUSES)

Prepared by

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

ANNUAL COMPLIANCE TEST

May 13-15, 1985

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

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

Report PS-85-469/Project 5451-85

Test Team Leader: Jim Steiner

Approved by: Jim Steiner
Jim Steiner, Project Manager
June 5, 1985

Source category: Portland Cement
Plant name : CalMatCo
Test date : May 13-15, 1985
Process : dry

FILE: PC_EF27.WQ1

Date: 05/17/93
Location: Mojave, CA
Ref. No.: 27

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	4.30	216	0.0099	0.0199		
		filt. PM	2	2.51	216	0.0058	0.0116		
		filt. PM	3	3.94	216	0.0091	0.0182		
		AVERAGE				0.0083	0.0166	RATING:	B
		cond. inorg. P	1	1.58	216	0.0037	0.0073		
		filt. PM	2	0.74	216	0.0017	0.0034		
		filt. PM	3	1.92	216	0.0044	0.0089		
		AVERAGE				0.0033	0.0065	RATING:	B
		sulfate	1	0.0005	216	1.2E-06	2.3E-06		
		sulfate	2	0.0003	216	6.9E-07	1.4E-06		
		sulfate	3	0.0005	216	1.2E-06	2.3E-06		
		AVERAGE				1.0E-06	2.0E-06	RATING:	B
		SO2	1	32.47	216	0.075	0.15		
		SO2	2	34.75	216	0.080	0.16		
		SO2	3	34.57	216	0.080	0.16		
		AVERAGE				0.079	0.16	RATING:	B
		NOx	1	532.1	216	1.2	2.5		
		NOx	2	540.4	216	1.3	2.5		
		NOx	3	533.4	216	1.2	2.5		
		AVERAGE				1.2	2.5	RATING:	B
		CO2	1	237,533	216	550	1,100	188,734	18.4
		CO2	2	242,857	216	562	1,124	187,859	18.9
		CO2	3	242,866	216	562	1,124	185,899	19.1
		AVERAGE				558	1,116	RATING:	B
		hydrocarbons	1	10.24	216	0.024	0.047		
		hydrocarbons	2	9.11	216	0.021	0.042		
		hydrocarbons	3	8.14	216	0.019	0.038		
		AVERAGE				0.021	0.042	RATING:	B
clinker cooler	fabric filter	BASED ON CLINKER FEED RATE							
		filt. PM	1	2.66	132.8	0.010	0.020		
		filt. PM	2	2.62	130.9	0.010	0.020		
		filt. PM	3	2.71	136.7	0.010	0.020		
		AVERAGE				0.010	0.020	RATING:	B

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

CalMat Company
P. O. Box 910
Mojave, California 93501

MOJAVE PLANT

(KILN, CRUSHER, AND CLINKER BAGHOUSES)

Prepared by

Pape & Steiner Envi
5801 Nor
Bakersfield, Ca

Reference 53:
(1) Coal-fired dry process kiln w/ bhouse
(1) Unspecified crusher w/ bhouse (Delete)
(1) Grate-type cooler w/ bhouse

Data Rating: B
Poor documentation

ANNUAL COMPLI

May 13-15,

Kern County A/C Numbers 10030

EPA Permit NSR 4-4-

Report PS-85-469/Project 5451-85

Test Team Leader: Jim Steiner

Approved by: Jim Steiner
Jim Steiner, Project Manager
June 5, 1985

CalMat Co

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

CalMat

CALIFORNIA PORTLAND
CEMENT DIVISION

June 13, 1985

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
1003001B, 1003026A, 1003027A, 1003030

Mr. Charles M. Seeley
Chief, Complaince Section
Air & 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 13-15, 1985, in compliance with Kern County APCD 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 10, 1985.

Attached is the Annual Compliance Test Report prepared by Pape & Steiner Environmental Services, the firm which conducted the tests. If there are any questions regarding the performance tests or the report, please communicate directly with Jim Steiner ((805) 393-8442) of Pape & Steiner Environmental Services.

Sincerely,

Steve A. Regis

Steve A. Regis
Process Engineer

SAR/dlr

Attachment

cc: J. Steiner
D. S. Cahn

JUN 17 1985

bcc: RP, DH, ERW

CalMat Company
P. O. Box 910
Mojave, California 93501

MOJAVE PLANT

(KILN, CRUSHER, AND CLINKER BAGHOUSES)

Prepared by

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

ANNUAL COMPLIANCE TEST

May 13-15, 1985

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

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

Report PS-85-469/Project 5451-85

Test Team Leader: Jim Steiner

Approved by: Jim Steiner
Jim Steiner, Project Manager
June 5, 1985

SUMMARY OF SOURCE TEST RESULTS FOR EPA

Company: CalMat Company

Permit Number: NSR 4-4-8; SJ 78-73

Unit Number or Name: Kiln H5-6-DC 1

Location: Baghouse Outlet

Pollutant/Other	Test Method	Test Date	Emission/Other*	
			Test Results	Permit Limit
Particulates	EPA Method 5	05/13/85	3.59 lb/hr	36.00 lb/hr
SO_2	EPA Method 8	05/13/85	33.93 lb/hr 17.85 ppm	616.00 lb/hr 2000.00 ppm
NO_x as NO_2				
Hydrocarbon				
Sulfur Content				
Fuel Usage				
Excess Oxygen				
Other				

*Emissions/Other should be at standard conditions (68°F and 29.92 inches of Hg) and in units of EPA's Authority to Construct/Modify.

Prepared by: Jim Steiner

Title: Project Manager

Date: June 5, 1985

SUMMARY OF SOURCE TEST RESULTS FOR EPA

Company: CalMat Company

Permit Number: NSR 4-4-8; SJ 78-73

Unit Number or Name: Crusher B2-DC 1

Location: Baghouse Outlet

Pollutant/Other	Test Method	Test Date	Emission/Other*	
			Test Results	Permit Limit
Particulates	EPA Method 5	05/14/85	1.22 lb/hr	5.00 lb/hr
SO_2				
NO_x as NO_2				
Hydrocarbon				
Sulfur Content				
Fuel Usage				
Excess Oxygen				
Other				

*Emissions/Other should be at standard conditions (68°F and 29.92 inches of Hg) and in units of EPA's Authority to Construct/Modify.

Prepared by: Jim Steiner

Title: Project Manager

Date: June 5, 1985

SUMMARY OF SOURCE TEST RESULTS FOR EPA

Company: CalMat Company

Permit Number: NSR 4-4-8; SJ 78-73

Unit Number or Name: Clinker H2-6-DC 1

Location: Baghouse Outlet

Pollutant/Other	Test Method	Test Date	Emission/Other*	
			Test Results	Permit Limit
Particulates	EPA Method 5	05/15/85	2.66 lb/hr	21.00 lb/hr
SO_2				
NO_x as NO_2				
Hydrocarbon				
Sulfur Content				
Fuel Usage				
Excess Oxygen				
Other				

*Emissions/Other should be at standard conditions (68°F and 29.92 inches of Hg) and in units of EPA's Authority to Construct/Modify.

Prepared by: Jim Steiner

Title: Project Manager

Date: June 5, 1985

SUMMARY OF SOURCE TEST RESULTS

Company CalMat Company Test Date 05/13/85 APCD No. 1003026A Unit No. Kiln

Pollutants	Emissions									Removal %	Emission Factor lb/MMBtu	
	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					0.0034 0.0019 0.0034 0.0029				5.88 3.25 5.86 5.00			0.03 0.02 0.03 0.02
Sulfate					0.0005 0.0003 0.0005 0.0004				0.86 0.45 0.86 0.72			
SO_2							15.64 16.83 16.90 16.46		32.47 34.75 34.57 33.93			
NO_x as NO_2 (dry)							387.50 395.33 394.33 892.39	633.45 649.21 633.05 638.57	532.11 540.35 533.36 535.27			
HC (C_1,>C_1)							2.75/18.70 1.74/17.41 2.26/15.06 2.25/17.06		1.31/8.93 0.83/8.28 1.06/7.08 1.07/8.10			

Scrubber Liquor Analysis: Chlorides -- Specific Gravity --

For Kern County Use Only:

Remarks CO (ppm, dry) = 179.17, 181.00, 194.67; Average 184.95
(lb/hr) = 149.73, 150.56, 160.24; Average 153.51

Test 1, 2, 3 216.0 TPH

SUMMARY OF SOURCE TEST RESULTS

Company CalMat Company Test Date 05/14/85 APCD No. 1003001B Unit No. Crusher

Pollutants	Emissions									Removal %	Emission Factor lb/MMBtu	
	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					0.0048 0.0032 0.0037 0.0039				1.48 1.01 1.15 1.22			0.0009 0.0006 0.0007 0.0007
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 1732 TPH

SUMMARY OF SOURCE TEST RESULTS

Company CalMat Company Test Date 05/15/85 APCD No. 1003027A Unit No. Clinker

Pollutants	Emissions									Removal %	Emission Factor lb/MMBtu	
	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					0.0024 0.0023 0.0024 0.0024				2.66 2.62 2.71 2.66			0.0200 0.0200 0.0198 0.0199
Sulfate												
SO_2												
NO_x as NO_2 (dry)												
HC												

Scrubber Liquor Analysis: Chlorides -- Specific Gravity --

For Kern County Use Only:

Remarks Test 1 132.78 TPH
Test 2 130.92 TPH
Test 3 136.68 TPH

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SECTION 1

INTRODUCTION

At the request of CalMat 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 13 through May 15, 1985.

Triplicate tests for particulates, sulfates and SO_2 were conducted on the effluent of the kiln baghouse using EPA Method 5/8 equipment and procedures. Triplicate tests for NO_x and CO were conducted on the kiln baghouse effluent using CARB Method 1-100. 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 Craig Werden conducted the test work for Pape & Steiner. These tests were observed by Ms. Linda Chester of the Kern County APCD. Mr. Steve Regis of CalMat Company 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	82.8	81.9	82.0
V_m	Sample gas vol, meter conditions, dcf	53.613	54.290	55.219
Y	Meter calibration factor	0.9972	0.9972	0.9972
P_{bar}	Barometric pressure, in. Hg	26.60	26.60	26.60
P_{stack}	Stack static pressure, In. H_2O	-0.93	-0.93	-0.93
ΔH	Avg meter pressure diff, in. H_2O	1.69	1.70	1.72
T_m	Absolute meter temp., ^oR	549.50	559.13	573.08
$V_{m(std)}$	Standard sample gas vol, dscf	45.1888	44.9725	44.6311
B_{ws}	Water vapor in gas stream	0.0783	0.0778	0.0785
MF	Moisture factor	0.9217	0.9222	0.9215
CO_2	Dry, volume %	18.40	18.90	19.10
O_2	Dry, volume %	9.95	10.00	9.75
N_2	Dry, volume %	71.632083	71.081900	71.130533
CO	Dry, volume %	0.017917	0.018100	0.019467
M_d	Molecular wt of stack gas, dry	31.34	31.42	31.45
M_s	Molecular wt of stack gas, wet	30.30	30.38	30.39
C_p	Pitot tube coefficient	0.84	0.84	0.84
$\sqrt{\Delta P}$	Avg of square roots of each ΔP	0.8890	0.8857	0.8750
T_s	Absolute stack temp., ^oR	705.08	705.17	701.58
A	Area of stack, ft^2	87.28	87.82	87.82
Q_{std}	Volumetric flowrate, dscfm	188734.02	187858.95	185899.27
A_n	Nozzle area, ft^2	0.000293	0.000293	0.000293
Θ	Sample time	72	72	72
%I	Isokinetic variation	99.03	99.02	99.30

A. FIELD DATA

	Station	Crusher	Crusher	Crusher
	Run No.	1	2	3
V_{1c}	Vol water collected in train, ml	24.4	25.0	22.1
V_m	Sample gas vol, meter conditions, dcf	68.311	70.617	70.047
Y	Meter calibration factor	0.9972	0.9972	0.9972
P_{bar}	Barometric pressure, in. Hg	26.40	26.40	26.40
P_{stack}	Stack static pressure, In. H_2O	-11.0	-11.0	-11.0
ΔH	Avg meter pressure diff, in. H_2O	2.79	2.90	2.82
T_m	Absolute meter temp., ^oR	548.03	554.68	559.25
$V_{m(std)}$	Standard sample gas vol, dscf	57.4744	58.7201	57.7574
B_{ws}	Water vapor in gas stream	0.0193	0.0194	0.0174
MF	Moisture factor	0.9807	0.9806	0.9826
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	28.84	28.84	28.84
M_s	Molecular wt of stack gas, wet	28.63	28.63	28.65
C_p	Pitot tube coefficient	0.84	0.84	0.84
$\sqrt{\Delta P}$	Avg of square roots of each ΔP	1.1318	1.1474	1.1281
T_s	Absolute stack temp., ^oR	527.0	527.75	527.40
A	Area of stack, ft^2	10.32	10.32	10.32
Q_{std}	Volumetric flowrate, dscfm	35330.58	35790.49	35256.42
A_n	Nozzle area, ft^2	0.000250	0.000250	0.000250
Θ	Sample time	70	70	70
%I	Isokinetic variation	96.10	96.92	96.78

A. FIELD DATA

	Station	Clinker	Clinker	Clinker
	Run No.	1	2	3
V_{1c}	Vol water collected in train, ml	5.5	0.7	2.5
V_m	Sample gas vol, meter conditions, dcf	76.510	77.205	74.906
Y	Meter calibration factor	0.9972	0.9972	0.9972
P_{bar}	Barometric pressure, in. Hg	26.30	26.34	26.34
P_{stack}	Stack static pressure, In. H_2O	-0.07	-0.07	-0.07
ΔH	Avg meter pressure diff, in. H_2O	3.18	3.42	3.32
T_m	Absolute meter temp., ^oR	549.46	539.33	542.13
$V_{m(std)}$	Standard sample gas vol, dscf	64.0331	65.9714	63.6587
B_{ws}	Water vapor in gas stream	0.0040	0.0005	0.0018
MF	Moisture factor	0.9960	0.9995	0.9982
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	28.84	28.84	28.84
M_s	Molecular wt of stack gas, wet	28.79	28.83	28.82
C_p	Pitot tube coefficient	0.84	0.84	0.84
$\sqrt{\Delta P}$	Avg of square roots of each ΔP	0.4597	0.4784	0.4716
T_s	Absolute stack temp., ^oR	743.17	735.42	738.75
A	Area of stack, ft^2	106.14	106.14	106.14
Q_{std}	Volumetric flowrate, dscfm	127572.86	133939.88	131596.21
A_n	Nozzle area, ft^2	0.000764	0.000764	0.000764
Θ	Sample time	72	72	72
%I	Isokinetic variation	96.96	95.15	93.45

B. PARTICULATE DATA

Date of Test: 5/13/85

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	10.65	45.1888	0.0036	0.0034			5.88
2	6.89	44.9725	0.0020	0.0019			3.25
3	10.63	44.6311	0.0037	0.0034			5.86
Crusher 1	18.27	57.4744	0.0049	0.0048			1.49
2	12.52	58.7201	0.0033	0.0032			1.01
3	14.27	57.7574	0.0038	0.0037			1.15
Clinker 1	10.09	64.0331	0.0024	0.0024			2.66
2	9.77	65.9714	0.0023	0.0023			2.62
3	9.90	63.6587	0.0024	0.0024			2.71

C. SULFATE DATA

N_{BaCl_2} = 0.0099

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	0.30-0.20	0.0076							
	Back Half	215/10	0.15-0.00	0.0165							
	Total			0.0241	45.1888	0.0005	188734	0.86	0.0005		
2	Front Half	100/10	0.25-0.20	0.0037							
	Back Half	218/10	0.10-0.00	0.0088							
	Total			0.0125	44.9725	0.0003	187859	0.45	0.0003		
3	Front Half	100/10	0.20-0.20	0.0000							
	Back Half	282/10	0.15-0.00	0.0241							
	Total			0.0241	44.6311	0.0005	185899	0.86	0.0005		
	Front Half										
	Back Half										
	Total										
	Front Half										
	Back Half										
	Total										
	Front Half										
	Back Half										
	Total										

AMF blank is 0.10 ml or 0.49 mg

D. SULFUR DIOXIDE DATA

N_{BaCl_2} = 0.0099

Station/Run	Vsoln/Va	$(V_t - V_{tb})$	V_m(std)	lb/dscf	dscfm	lb/hr	ppm (wet)
Kiln 1	360/10	5.20-0.05	45.1888	2.87×10^{-6}	188734	32.47	15.64
2	310/10	6.45-0.05	44.9725	3.08×10^{-6}	187859	34.75	16.83
3	368/10	5.15-0.05	44.6311	3.10×10^{-6}	185899	34.57	16.90

E. HYDROCARBON DATA

Station	Run	C_1			$>C_1$ as CH_4			dscfm
		Area Counts	ppm	lb/hr	Area Counts	ppm	lb/hr	
Kiln	Initial Cal	12579						
	Final Cal	14177						
	Avg	13378	53.59					
	1	686	2.75	1.31	4669	18.70	8.93	188734
	2	434	1.74	0.83	4346	17.41	8.28	187859
	3	565	2.26	1.06	3759	15.06	7.08	185899

SECTION 3

WET TEST METHOD CALCULATIONS

Tape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 1 Date 5/13/85 Location Kiln Stack

T_m	89.50	V_m	53.613	O_2	9.95	Stack ID "	186.5
T_s	245.08	γ	0.9972	CO_2	18.40	Stack Area Ft^2	87.28
$\sqrt{\Delta P}$	0.8890	P_b	26.60	Static	-0.93	Test Time	72
ΔH	1.69	V_{1c}	82.8	C_p	0.84	N_d	0.2319

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 45.1888$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.8383$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0783$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.34$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.30$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.53$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 59.79$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
313105.24

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 188734.02$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.03$$

ISOKINETIC CALCULATIONS

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

Test 2 Date 5/13/85 Location Kiln Stack

T_m	99.13	V_m	54.290	O_2	10.0	Stack ID "	126.5
T_s	245.17	γ	0.9972	CO_2	18.9	Stack Area Ft^2	87.28
$\sqrt{\Delta P}$	0.8857	P_b	26.60	Static	-0.93	Test Time	72
ΔH	1.70	V_{1c}	81.9	C_p	0.84	N_d	0.2319

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 44.9725$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.7966$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0778$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.42$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.38$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.53$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 59.49$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
311544.12

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 187858.95$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.02$$

Tape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 3 Date 5/13/85 Location Kiln Stack

T_m	113.08	V_m	55.219	O_2	9.75	Stack ID "	126.5
T_s	241.58	γ	0.9972	CO_2	19.10	Stack Area Ft^2	87.28
$\sqrt{\Delta P}$	0.8750	P_b	26.60	Static	-0.93	Test Time	72
ΔH	1.72	V_{1c}	82.0	C_p	0.84	N_d	0.2319

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 44.6311$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.8013$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0785$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.45$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.39$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.53$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 58.61$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
306936.75

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 185899.27$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.30$$

Pape & Steiner Environmental Services

TEST 1,2,3

LOCATION Kiln

EMISSION RATE DATA -- 60°F

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

XEQ FF

XEQ RAT

ENTER:	Test 1	Test 2	Test 3	Average
R-17 $V_{m,std}$	45.1888	44.9725	44.6311	
R-19 Bwo	0.0783	0.0778	0.0785	0.0782
R-26 Q_s	188734.02	187858.95	185899.27	187497.41
R-22 O_2%	9.95	10.00	9.75	9.90
R-23 CO_2	18.40	18.90	19.10	18.80

LAB DATA

Front Half Wash	(g)	0.00707	0.00447	0.00638	
Mass Filter	(g)	0.00071	0.00008	0.00077	
Back Half Catch	(g)	0.00287	0.00134	0.00348	
Front Half Sulfate	(mg H_2SO_4)	0.49	0.24	0.00	
Back Half Sulfate	(mg H_2SO_4)	1.07	0.57	1.56	
H_2O_2 Catch	(mg H_2SO_4)	89.94	96.24	95.99	

RESULTS

F-Factor		1				
Total Particulate	gr/scf	2	0.0034	0.0019	0.0034	0.0029
Total Sulfate	gr/scf	4	0.0005	0.0003	0.0005	0.0004
Total Particulate	gr/dscf	8	0.0036	0.0020	0.0037	0.0031
Total Particulate	12% CO_2	9	0.0024	0.0013	0.0023	0.0020
Total Particulate	lb/hr	10	5.88	3.25	5.86	5.00
Total Sulfate	gr/dscf	11	0.0005	0.0003	0.0005	0.0004
Total Sulfate	12% CO_2	12	0.0003	0.0002	0.0003	0.0003
Total Sulfate	lb/hr	13	0.86	0.45	0.86	0.72
SO_2	ppm		16.97	18.25	18.34	17.85
SO_2	lb/hr		32.47	34.75	34.57	33.93
SO_2	3% O_2		27.75	29.97	29.45	29.06
SO_2	lb/MMBtu					
S	lb/MMBtu					
SO_2	ppm wet		15.64	16.83	16.90	16.46

ISOKINETIC CALCULATIONS

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

Test 1 Date 5/14/85 Location Crusher

T_m	88.03	V_m	68.311	O_2	20.9	Stack ID "	43.5
T_s	67.00	γ	0.9972	CO_2	0.0	Stack Area Ft^2	10.32
$\sqrt{\Delta P}$	1.1318	P_b	26.40	Static	-11.0	Test Time	70
ΔH	2.79	V_{1c}	24.4	C_p	0.84	N_d	0.2140

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 57.4744$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 1.1311$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0193$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.63$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.59$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 68.93$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
42686.91

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 35330.58$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 96.10$$

ISOKINETIC CALCULATIONS

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

Test 2 Date 5/14/85 Location Crusher

T_m	94.68	V_m	70.617	O_2	20.9	Stack ID "	43.5
T_s	67.75	γ	0.9972	CO_2	0.0	Stack Area Ft^2	10.32
$\sqrt{\Delta P}$	1.1474	P_b	26.40	Static	-11.0	Test Time	70
ΔH	2.90	V_{1c}	25.0	C_p	0.84	N_d	0.2140

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 58.7201$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 1.1589$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0194$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.63$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.59$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 69.94$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
43306.51

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 35790.49$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 96.92$$

ISOKINETIC CALCULATIONS

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

Test 3 Date 5/14/85 Location Crusher

T_m	99.25	V_m	70.047	O_2	20.9	Stack ID "	43.5
T_s	67.40	γ	0.9972	CO_2	0.0	Stack Area Ft^2	10.32
$\sqrt{\Delta P}$	1.1281	P_b	26.40	Static	-11.0	Test Time	70
ΔH	2.82	V_{1c}	22.1	C_p	0.84	N_d	0.2140

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 57.7574$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 1.0245$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0174$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.65$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.59$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 68.71$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
42548.44

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 35256.42$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 96.78$$

Pape & Steiner Environmental Services

TEST 1,2,3

LOCATION Crusher

EMISSION RATE DATA -- 60°F

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

XEQ FF

XEQ RAT

		Test 1	Test 2	Test 3	Average
ENTER:	R-17 $V_{m,std}$	57.4744	58.7201	57.7574	
	R-19 Bwo	0.0193	0.0194	0.0174	0.0187
	R-26 Q_s	35330.58	35790.49	35256.42	35459.16
	R-22 O_2%	20.9	20.9	20.9	20.9
	R-23 CO_2	0.0	0.0	0.0	0.0

LAB DATA

Front Half Wash	(g)	0.01320	0.01089	0.01315	
Mass Filter	(g)	0.00507	0.00163	0.00112	
Back Half Catch	(g)	0.00000	0.00000	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				
Total Particulate	gr/scf	2	0.0048	0.0032	0.0037	0.0039
Total Sulfate	gr/scf	4				
Total Particulate	gr/dscf	8	0.0049	0.0033	0.0038	0.0040
Total Particulate	12% CO_2	9				
Total Particulate	lb/hr	10	1.49	1.01	1.15	1.22
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					

ISOKINETIC CALCULATIONS

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

Test 1 Date 5/15/95 Location Clinker

T_m	89.46	V_m	76.510	O_2	20.9	Stack ID "	139.5
T_s	283.17	γ	0.9972	CO_2	0.0	Stack Area Ft^2	106.14
$\sqrt{\Delta P}$	0.4597	P_b	26.30	Static	-0.07	Test Time	72
ΔH	3.18	V_{1c}	5.5	C_p	0.84	N_d	0.3742

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 64.0331$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.2550$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0040$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.79$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.29$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 32.71$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
208286.55

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 127572.86$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 96.96$$

ISOKINETIC CALCULATIONS

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

Test 2 Date 5/15/85 Location Clinker

T_m	79.33	V_m	77.205	O_2	20.9	Stack ID "	139.5
T_s	275.42	γ	0.9972	CO_2	0.0	Stack Area Ft^2	106.14
$\sqrt{\Delta P}$	0.4784	P_b	26.34	Static	-0.07	Test Time	72
ΔH	3.42	V_{1c}	0.7	C_p	0.84	N_d	0.3742

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 65.9714$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.0324$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0005$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.83$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.33$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 33.81$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
215321.66

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 133939.88$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 95.15$$

ISOKINETIC CALCULATIONS

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

Test 3 Date 5/15/85 Location Clinker

T_m	82.13	V_m	74.906	O_2	20.9	Stack ID "	139.5
T_s	278.75	γ	0.9972	CO_2	0.0	Stack Area Ft^2	106.14
$\sqrt{\Delta P}$	0.4716	P_b	26.34	Static	-0.07	Test Time	72
ΔH	3.32	V_{1c}	2.5	C_p	0.84	N_d	0.3742

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 63.6587$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.1159$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0018$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.82$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.33$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 33.41$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
212794.10

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 131596.21$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 93.45$$

Pape & Steiner Environmental Services

TEST 1, 2, 3

LOCATION Clinker

EMISSION RATE DATA -- 60°F

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

XEQ 60
XEQ FF
XEQ RAT

		Test 1	Test 2	Test 3	Average
ENTER:	R-17 $V_{m,std}$	64.0331	65.9714	63.6587	
	R-19 Bwo	0.0040	0.0005	0.0018	0.0021
	R-26 Q_S	127572.86	133939.88	131596.21	131036.32
	R-22 O_2%	20.9	20.9	20.9	20.9
	R-23 CO_2	0.0	0.0	0.0	0.0
LAB DATA					
	Front Half Wash (g)	0.00944	0.00945	0.00933	
	Mass Filter (g)	0.00065	0.00032	0.00057	
	Back Half Catch (g)	0.00000	0.00000	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				
Total Particulate (gr/scf)	2	0.0024	0.0023	0.0024	0.0024
Total Sulfate (gr/scf)	4				
Total Particulate (gr/dscf)	8	0.0024	0.0023	0.0024	0.0024
Total Particulate (12% CO_2)	9				
Total Particulate (lb/hr)	10	2.66	2.62	2.71	2.66
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	9.95	387.50	633.45	532.11	188734
2	10.00	395.33	649.21	540.35	187859
3	9.75	394.33	633.05	533.36	185899
Mean	9.90	392.39	638.57	535.36	187497

SO_2				
Station/Run	Corrected ppm (dry)	ppm (wet)	dscfm	lb/hr
Mean				

B. CALIBRATION AND CORRECTION DATA

Company Cal-Mat Date 5/13/85

Station Kiln 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
10:25	9.9	18.4	175				395	
10:35	9.9	18.2	170				390	
10:45	10.0	18.3	180				395	
10:55	9.9	18.3	180				385	
11:05	10.0	18.6	185				380	
11:15	10.0	18.6	185				380	
Mean:	9.95	18.40	179.17				387.50	

Calibration	%O_2	%CO_2	ppm CO	ppm SO_2	ppm NO_x
Zero Reading	0.0	-0.10	2.0		0.0
Span Reading	7.65	14.90	402.0		442.0
Span Gas Value	7.58	15.07	400.6		457.25
Span Drift Correction Factor	na	na	na		na
Zero Drift Correction Factor	na	na	na		na

B. CALIBRATION AND CORRECTION DATA

Company Cal-Mat Date 5/13/85

Station Kiln 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
1:10	9.9	18.9	178				400	
1:20	10.3	18.9	175				395	
1:30	10.2	18.8	173				390	
1:40	10.2	18.9	185				395	
1:50	9.8	19.2	195				390	
2:00	9.6	18.7	180				402	
Mean:	10.0	18.90	181.00				395.33	

Calibration	%O_2	%CO_2	ppm CO	ppm SO_2	ppm NO_x
Zero Reading	0.0	0.00	15.0		4.0
Span Reading	7.45	14.90	408.0		458.0
Span Gas Value	7.58	15.07	400.6		457.25
Span Drift Correction Factor	na	na	na		na
Zero Drift Correction Factor	na	na	na		na

B. CALIBRATION AND CORRECTION DATA

Company CalMat Date 5/13/85

Station Kiln 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
2:40	9.45	19.5	300				380	
2:50	9.45	18.9	210				400	
3:00	9.60	18.9	183				400	
3:10	9.90	18.9	180				395	
3:20	9.90	19.2	190				393	
3:30	10.20	19.2	205				398	
Mean:	9.75	19.10	194.67				394.33	

Calibration	%O_2	%CO_2	ppm CO	ppm SO_2	ppm NO_x
Zero Reading	0.80	0.00	3.0		3.0
Span Reading	8.30	14.90	408.0		456.0
Span Gas Value	7.58	15.07	400.6		457.25
Span Drift Correction Factor	na	na	na		na
Zero Drift Correction Factor	na	na	na		na

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	7.58	15.07	400.6		457.25
Measured Span	7.65	14.90	402.0		442.00
Zero Drift	0.00	-0.10	2.0		0.00
Final, Actual Span	7.65	15.00	400.0		442.00
Percent Drift	-0.9	0.5	0.2		3.3
Station Kiln Run 2	**O_2 (%)**	**CO_2 (%)**	**CO (ppm)**	**SO_2 (ppm)**	**NO_x (ppm)**
Initial Span	7.58	15.07	400.6		457.25
Measured Span	7.45	14.90	408.0		458.00
Zero Drift	0.00	0.00	15.0		4.00
Final, Actual Span	7.45	14.90	393.0		454.00
Percent Drift	1.7	1.1	1.9		0.7
Station Kiln Run 3	**O_2 (%)**	**CO_2 (%)**	**CO (ppm)**	**SO_2 (ppm)**	**NO_x (ppm)**
Initial Span	7.58	15.07	400.6		457.25
Measured Span	8.30	14.90	408.0		456.00
Zero Drift	0.80	0.00	3.0		3.00
Final, Actual Span	7.50	14.90	405.0		453.00
Percent Drift	1.1	1.1	-1.1		0.9

Pape & Steiner Environmental Services

TEST 1,2,3

LOCATION Kiln

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%	9.95	10.00	9.75	9.90
R-26 Q_s	188734.02	187858.95	185899.27	187497.41
R-15 NO_x ppm	387.50	395.33	394.33	392.39
R-15 SO_2 ppm				
R-15 CO ppm	179.17	181.00	194.67	184.95
R-15 HC ppm	2.75/18.70	1.74/17.41	2.26/15.06	2.25/17.06
XEQ FF				
XEQ SO2	F Factor			

RESULTS:

	Test 1	Test 2	Test 3	Average
MW = 46				
NO_x lb/hr	532.11	540.35	533.36	535.27
NO_x ppm @ 3% O_2	633.45	649.21	633.05	638.57
NO_x lb/MMBtu				
NO_x lb/Bbl				
MW = 64.1				
SO_2 lb/hr				
SO_2 ppm @ 3% O_2				
SO_2 lb/MMBtu				
SO_2 lb/Bbl				
MW = 28				
CO lb/hr	149.73	150.56	160.24	153.51
CO ppm @ 3% O_2	292.89	297.24	312.52	300.88
CO lb/MMBtu				
CO lb/Bbl				
MW = 16				
HC lb/hr	1.31/8.93	0.83/8.28	1.06/7.08	1.07/8.10
HC ppm @ 3% O_2	4.50/30.57	2.86/28.59	3.63/24.18	3.66/27.78
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 the 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 ± 1 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 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:

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

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 electronic 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 completely 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 per traverse; 4 traverses at 90° for kiln and clinker; 10 points per traverse, 2 traverses at 90° for the crusher). Each point was sampled for an equal period of time (6 minutes per point for kiln and clinker; 3.5 minutes per point for the crusher) and all pertinent data was recorded on the data sheet for each point. The probe and sample box were maintained at $250^{o}F$ 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 (in tact) to the next sampling port. Another traverse of the stack was completed and the sampling train was withdrawn for the final leak check. This leak check was performed at 15 inches Mercury or at the highest vacuum 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 tin 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 front half 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.

6.5 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°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

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	0-1 V

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	0-1 V

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

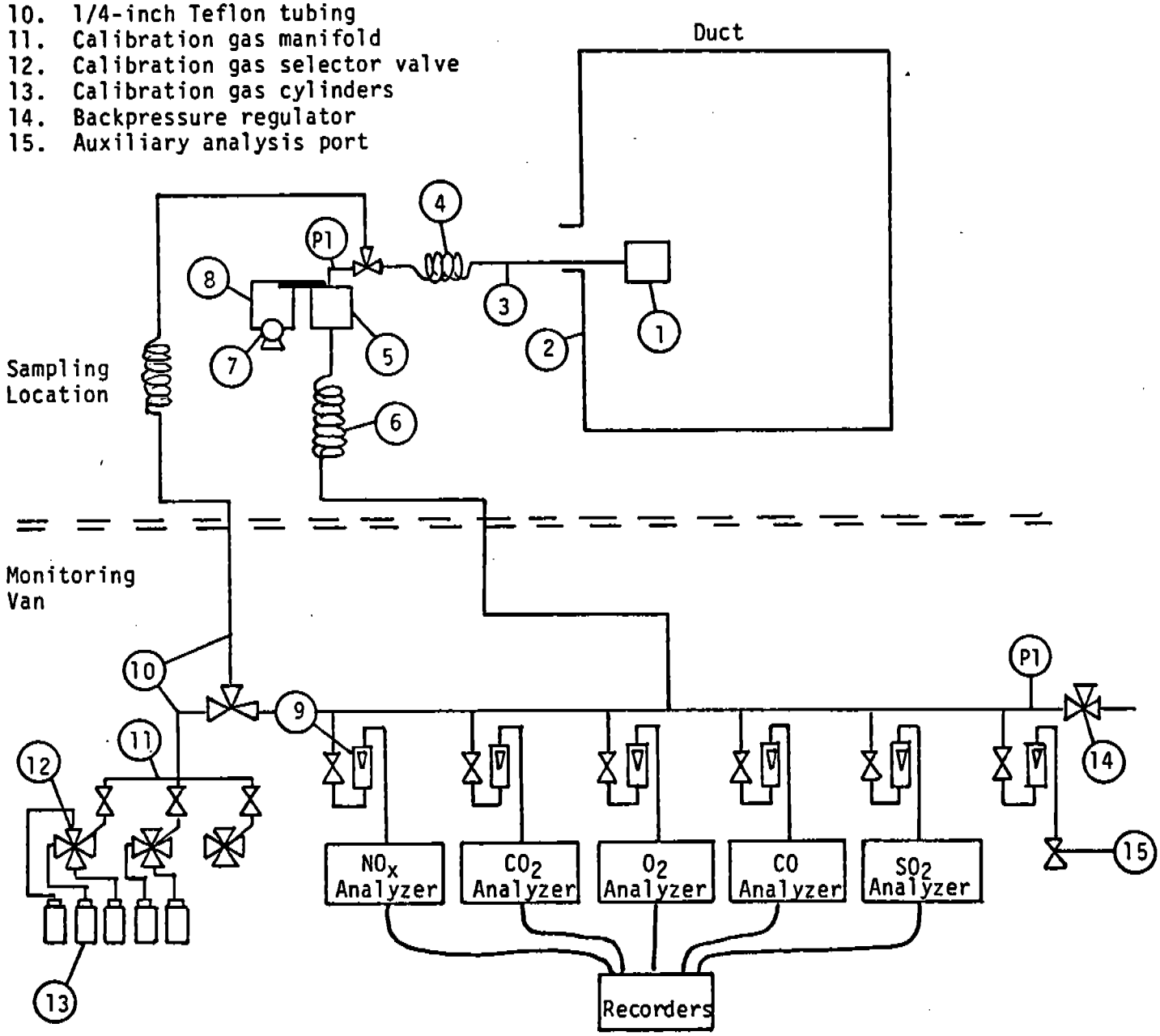


Figure 6-1. Schematic of Continuous Monitoring System.

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 ($\pm$ 1 percent) for fixed gas analysis. Copies of the gas certifications are included in the Quality Assurance Section of this report. All pertinent data (date, time, test locations, 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 corrected to zero percent O_2 (standard conditions 60^oF, 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.

6.6 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 the test series.

SECTION 7

RAW DATA

Pape & Steiner Environmental Services

SAMPLING POINT LOCATION DATA SHEET

Plant California Portland Cement

Date 5/13/85

Test Location Kiln Stack

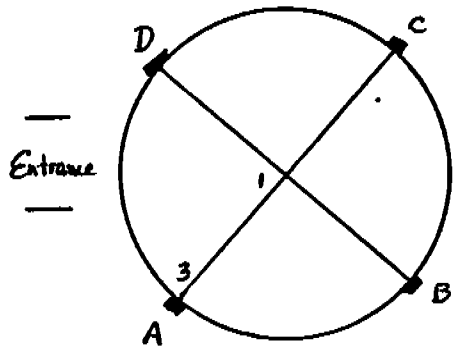
Upstream Dist./Dia. >2 ϕ

Downstream Dist./Dia. >8 ϕ

No. of Sampling Points 12

Stack Dimension 126.5

Coupling Length 12



Sample Point	Dist	Sample Point	Dist	Sample Point	Dist	Sample Point	Dist
1	17.5						
2	30.5						
3	49.4						

SAMPLING POINT RELOCATION: none

Pape & Steiner Environmental Services

VELOCITY TRAVERSE DATA SHEET

Plant California Portland Cement
Date 5/13/85
Test Location Kiln Stack
Static Pressure (in. wg) - 0.93
Barometric Pressure 26.60
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Stack Dimension 126.5

Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts	Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts
9:05 A 1	0.89	248									
2	0.85	249									
3	0.58	243									
B 1											
2											
3											
9:20 C 1	0.93	246									
2	0.89	245									
3	0.69	245									
9:26 D 1	0.91	246									
2	0.81	247									
3	0.70	243									

SAMPLING POINT RELOCATION:

Avg $\sqrt{\Delta P}$ = 0.8898
Avg ΔP = 0.7917
Avg Ts = 247

Pape & Steiner Enviro

Date 5/13/
Test Location
Run Number 1
Stack Diameter
Operator
Filter No.

Pape & Steiner Environmental Services

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

Date 5/13/85
Test Location Kiln Stack
Run Number 1
Stack Diameter 126.5
Operator
Filter No. 10-506

Barometric Pressure 26.60
Static in. wg. -0.93
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size 1458/.2319

Impinger Volumes/Weights				Gas Composition			
Contents	Final	Initial	Net	Time	CO_2	O_2	CO
80% IPA	545.2	542.7	2.5				
3% H_2O	601.1	567.7	33.4				
3% H_2O_2	572.7	552.3	20.4				
				Leak Rate		cfm	"Hg
				Initial		0.018	16
S.G.	702.3	675.8	26.5				
		✓Total	82.8	Final			

Sample Point	Time
C 1	11:01 0
2	6
3	12
	18
D 1	11:21 0
2	6
3	12
	18

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	10:18 0	0.87	1.81	870.395	249	255	275	61	78	78	11.5	0.933	pitot ok
2	6	0.81	1.71	875.040	247	256	245	60	88	83	11.0	0.900	216 TPH
3	12	0.70	1.49	878.055	244	257	246	60	89	84	10.5	0.837	
	18			883.746									
B 1	10:38 0	0.84	1.78	883.746	244	260	259	58	89	85	10.5	0.917	
2	6	0.79	1.68	888.285	247	258	259	57	93	88	11.0	0.889	
3	12	0.66	1.42	892.724	240	255	273	57	94	88	10.0	0.812	
	18			896.946									

7-5

7-4

8

Pape & Steiner Environmental Services

Date 5/13/85 Barometr
Test Location Kiln Stack Static
Run Number 2 Probe T
Stack Diameter 126.5 Pitot C
Operator JS Meter B
Filter No. 507 Nozzle

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume
C 1	1:03 0	0.88	1.90	967.8
2	6	0.82	1.78	972.5
3	12	0.70	1.53	977.1
4	18			981.4
D 1	1:24 0	0.85	1.85	981.4
2	6	0.80	1.74	986.0
3	12	0.74	1.63	990.6
	18			995.2
			1.70	54.24

7-7

Pape & Steiner Environmental Services

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

Date 5/13/85 Barometric Pressure 26.60
Test Location Kiln Stack Static in. wg. −0.93
Run Number 2 Probe Type/Length glass/6'
Stack Diameter 126.5 Pitot Coefficient 0.84
Operator JS Meter Box No./γ 446/.9972
Filter No. 507 Nozzle No./Size 1458/.2318

Impinger Volumes/Weights			
Contents	Final	Initial	Net
80% IPA	539.7	530.2	9.5
3% H_2O_2	604.0	566.6	37.4
3% H_2O_2	563.4	550.3	13.1
S.G.	669.6	647.7	21.9
		✓ Total	81.9

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
A 1	12:19 0	0.85	1.79	940.910	251	239	253	60	90	88	13.0	0.922	pitot ok
2	6	0.79	1.70	945.550	246	240	275	59	98	93	12.5	0.889	
3	12	0.68	1.47	950.040	244	272	250	59	99	94	11.5	0.825	
	18			954.330									
B 1	12:40 0	0.90	1.94	954.330	246	267	251	60	98	94	13.5	0.949	
2	6	0.81	1.76	959.077	246	259	249	60	103	98	13.5	0.900	
3	12	0.62	1.36	963.677	241	269	255	60	103	99	11.5	0.787	
	18			967.869									

7-6

856882 | 85 6883 | 85 6884 | 856885 | 85 6886

Pape & Steiner Environmental Services

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

Date 5/13/85
Test Location Kiln Stack
Run Number 3
Stack Diameter 126.5
Operator JB
Filter No. 508

Barometric Pressure 26.60
Static in. wg. -0.93
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size 1458/.239

Impinger Volumes/Weights			
Contents	Final	Initial	Net
80% IPA	539.4	533.6	5.8
3% H_2O_2	564.8	533.1	31.7
3% H_2O_2	571.9	552.2	19.7
S.G.	723.7	698.9	24.8
		Total	82.0

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial	0.014	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
A 1	2:23 0	0.83	1.82	4.915	247	271	250	60	102	107	11.0	0.911	pitot ok
2	6	0.79	1.77	9.725	241	251	266	58	115	113	10.0	0.889	
3	12	0.71	1.60	14.320	238	252	272	60	116	113	9.0	0.843	
	18			19.000									
B 1	2:44 0	0.83	1.83	19.000	247	248	266	61	111	111	9.5	0.911	
2	6	0.80	1.78	23.637	242	247	265	56	114	111	10.0	0.894	
3	12	0.63	1.42	28.280	238	249	264	56	115	113	9.5	0.794	
	18			32.500									

85 6887 | 85 6888 | 85 6889 | 85 6890 | 85 6891

Pape & Steiner Environmental Services

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

Date 5/13/85
Test Location Kiln Stack
Run Number 3
Stack Diameter 126.5
Operator JB
Filter No. 508

Barometric Pressure 26.60
Static in. wg. -0.93
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9912
Nozzle No./Size 1458/.2319

Impinger Volumes/Weights			
Contents	Final	Initial	Net
S.G.			
		Total	

Gas Composition			
Time	CO_2	O_2	CO
Leak Rate		cfm	"Hg
Initial			
Final		0.010	13.5

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
C 1	3:05 0	0.86	1.91	32.500	245	261	264	61	112	112	10.5	0.927	
2	6	0.82	1.83	37.260	242	251	260	60	115	111	10.5	0.906	
3	12	0.71	1.60	41.985	238	257	263	61	115	112	9.5	0.843	
	18			46.621									
D 1	3:24 0	0.86	1.92	46.621	243	259	264	64	114	114	10.5	0.927	
2	6	0.77	1.73	51.350	241	257	253	58	117	113	9.5	0.877	
3	12	0.62	1.39	55.900	238	251	243	59	116	113	8.5	0.787	pitot ok
	18			60.134									purge for 15
													min with amb
													air
			1.72	55.219	241.58				113.08			0.8750	

Pape & Stein Environmental Services

CONTINUOUS MONITOR DATA SHEET

Plant: CPC Mojave
Date: 5-13-85
Test Location: Kiln Stack
Run Number: 1-2
Operator: C. Werder

Ambient Temperature:
Barometric Pressure:
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
																	AAL-12619 CO/CO_2/O_2
																	AAL-7915 NO_x
1015	Initial	Cal	7.58	15.07	400.6		457.35										Span Gas Value
																	-10 to 100% chart
1025			9.9	18.4	175			395									leak check OK
1035			9.9	18.2	170			390									
1045			10.0	18.3	180			395									Test #1 1020-1120
1055			9.9	18.3	180			385									216 TPH
1105			10.0	18.6	185			380									
1115			10.0	18.6	185			380									
	Cal Check		0	-0.1	2			0									Zero reading
			7.65	14.9	402			442									Span reading
1225	1310		9.9	18.9	178			400									
1235	1320		10.3	18.9	175			385									Test #2 1220-1320
1245	1330		10.2	18.8	173			390									1305-1405
1255	1340		10.2	18.9	185			395									
1305	1350		9.8	19.2	195			390									
1315	1400		9.6	18.7	180			402									
	Cal Check		0	0	15			4									Zero reading
			7.45	14.9	408			458									Span reading

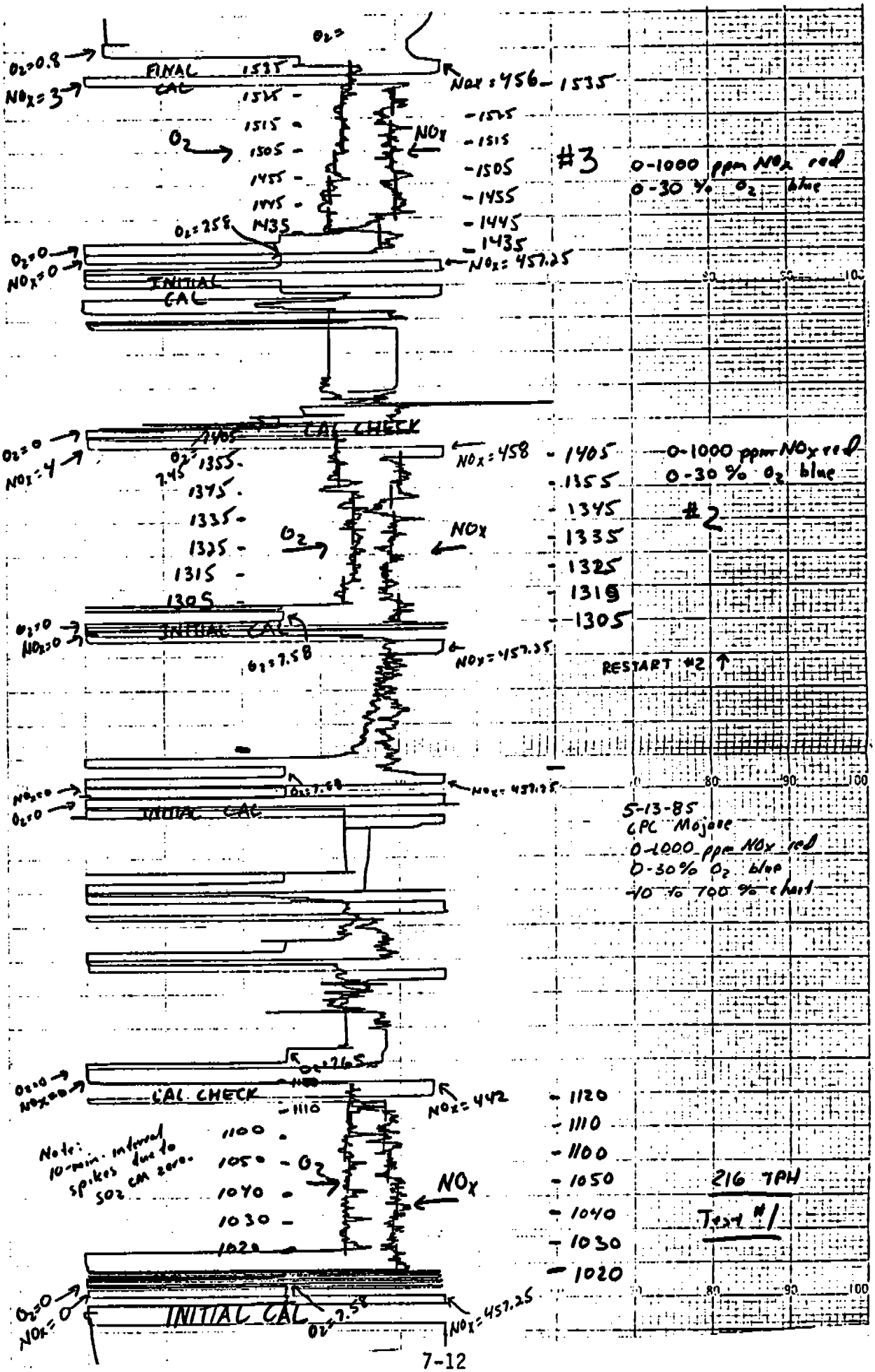
Pape & Steiner Environmental Services

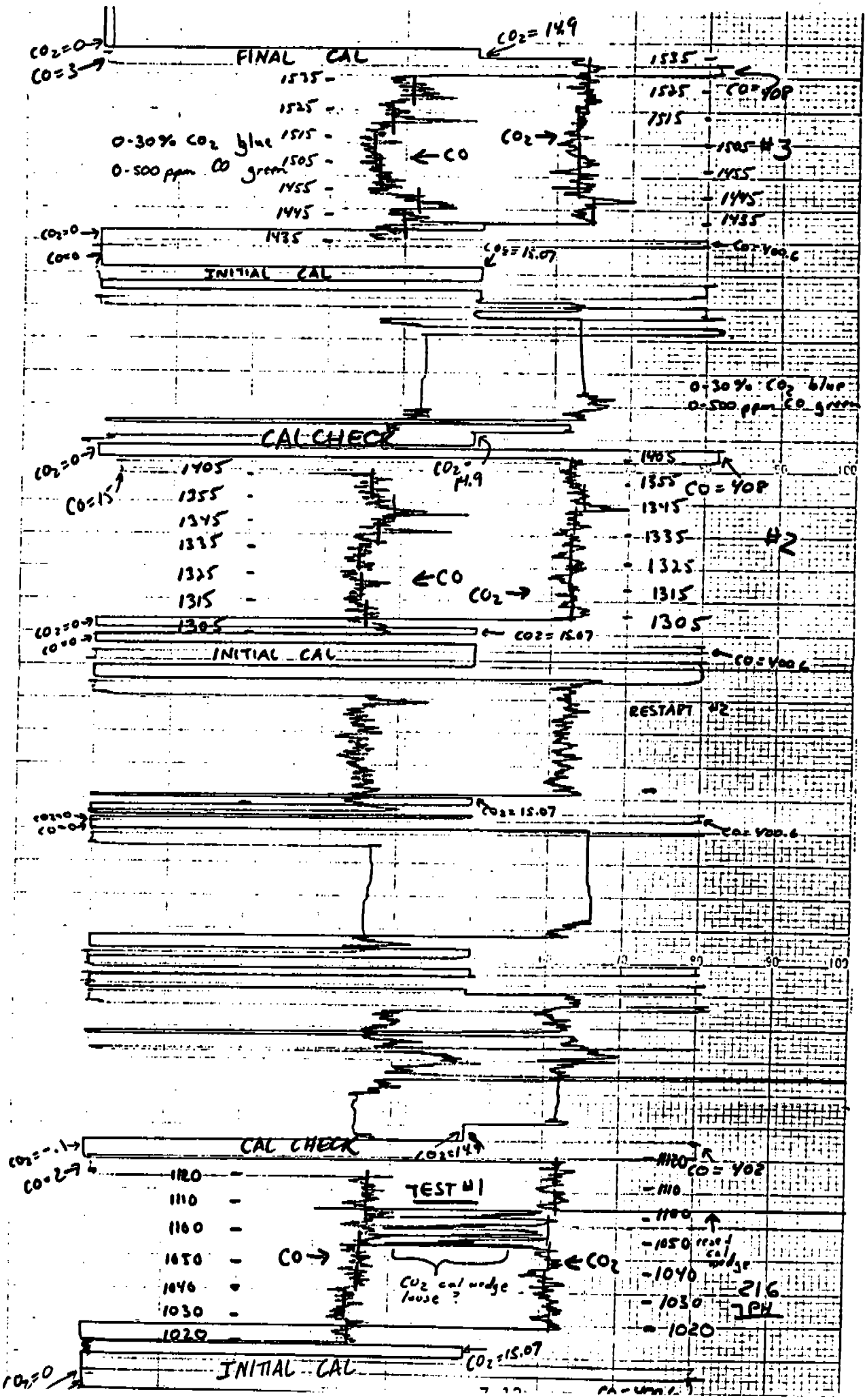
CONTINUOUS MONITOR DATA SHEET

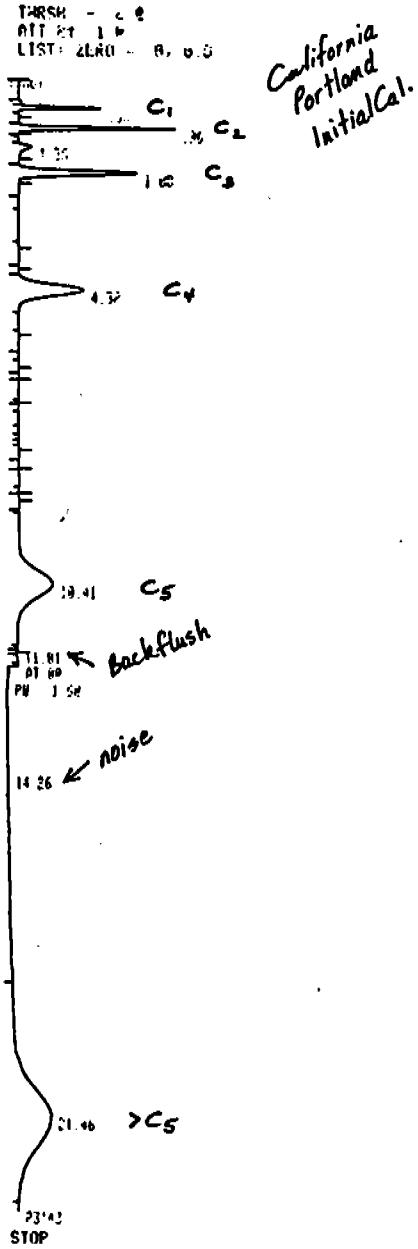
Plant: CPC Mojave
Date: 5-13-85
Test Location: Kiln Stack
Run Number: 3
Operator: C. Werden

Ambient Temperature
Barometric Pressure
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
1440			9.45	19.5	200			380									Test #3 1435-1535
1450			9.45	18.9	210			400									
1500			9.6	18.9	183			400									
1510			9.9	18.9	180			395									
1520			9.9	19.2	190			393									
1530			10.2	19.2	205			398									
	Final Cal		0.8	0	3			3									Zero Reading
			8.3	14.9	408			456									Span Reading
																	Leak Check OK


FINAL CAL
INITIAL CAL
CAL CHECK
INITIAL CAL
INITIAL CAL
CAL CHECK
INITIAL CAL
NOx
O2
#3
0-1000 ppm NOx red
0-30 % O2 blue
#2
RESTART #2
5-13-85
GPC Mojave
0-1000 ppm NOx red
0-30% O2 blue
-10 to 100 % chart
216 TPH
Test #1
Note: 10-min. interval spikes due to SO2 cal zero.


FINAL CAL
CO2=14.9
CO2=0
CO=3
0-30% CO2 blue
0-500 ppm CO green
CO
CO2
CO=408
#3
INITIAL CAL
CO2=15.07
CO=400.6
CAL CHECK
CO2=14.9
CO=15
CO=408
#2
INITIAL CAL
RESTART #2
CO2=15.07
CO=400.6
CAL CHECK
CO2=14.9
CO=402
TEST #1
CO2 cal wedge loose ?
216
JPH
INITIAL CAL
CO2=15.07



RUN # 1 MAY/13/85 19:36:53

AREA%

RT	AREA	TYPE	HR/HT	AREA%	
0.41	542	BV	0.060	0.173	
0.55	12519	VV	0.055	3.974	C1
0.96	26285	PB	0.061	8.335	C2
1.35	4148	PB	0.111	1.316	
1.89	38583	BB	0.118	12.190	C3
4.32	49572	BP	0.274	15.668	C4
10.41	81912	VV	0.293	25.876	
11.81	176	PB	0.023	0.056	BF
14.26	1798	VB	2.997	0.568	
21.46	100650	BV	1.721	31.857	noise

TOTAL AREA= 316554
MUL FACTOR= 1.0000E+00

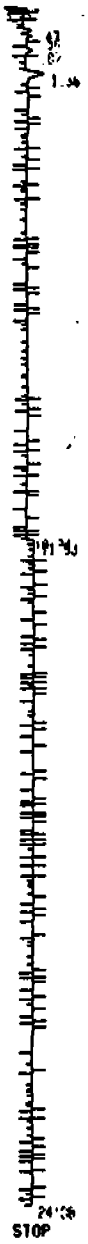
RUN # 2 MAY/13/85 20:01:55

AREA%

RT	AREA	TYPE	HR/HT	AREA%	
0.43	690	PV	0.071	11.541	
0.56	686	VV	0.064	11.333	C1
0.87	853	VV	0.073	14.092	
1.37	3092	PV	0.116	51.082	>C1
1.77	236	HP	0.106	3.899	
2.47	414	PV	0.107	6.840	
4.75	74	PV	0.040	1.223	

TOTAL AREA= 6053
MUL FACTOR= 1.0000E+00

Test2



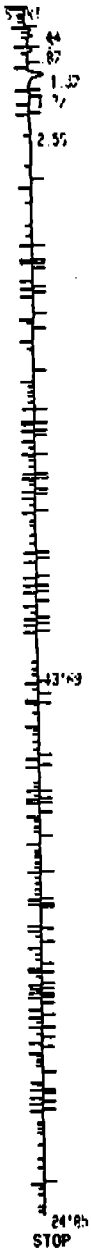
RUN # 3 MAY/13/85 20:29:49

AREA%

RT	AREA	TYPE	AR/HT	AREA%	
0.43	608	PV	0.063	11.204	
0.56	434	VB	0.052	8.055	C_1
0.87	625	PR	0.064	11.340	
1.36	2892	PV	0.116	53.675	$>C_1$
10.94	70	PP	0.045	1.299	
11.83	759	PV	0.083	14.087	

TOTAL AREA= 5388
NUL FACTOR= 1.0000E+00

Test3



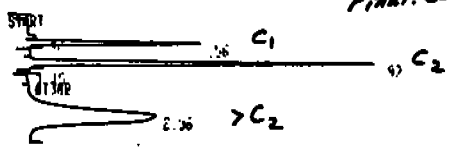
RUN # 4 MAY/13/85 20:57:35

AREA%

RT	AREA	TYPE	AR/HT	AREA%	
0.44	595	PV	0.067	12.096	
0.57	563	VV	0.059	11.436	C_1
0.87	558	PV	0.073	11.344	
1.37	2714	BB	0.125	55.174	$>C_1$
1.77	39	PB	0.046	0.793	
2.55	448	PV	0.249	9.108	

TOTAL AREA= 4913
NUL FACTOR= 1.0000E+00

Final. Calib.



RUN # 5 MAY/13/85 21:23:35

AREA%

RT	AREA	TYPE	AR/HT	AREA%	
0.42	726	PV	0.070	0.265	
0.56	14177	VB	0.066	5.181	C_1
0.97	29667	VB	0.063	10.850	C_2
1.15	186	PB	0.021	0.068	$>C_2$
1.34	58	PV	0.075	0.033	
2.06	228760	VB	0.326	83.603	

TOTAL AREA= 273620
MUL FACTOR= 1.000OE+00

Pape & Steiner Environmental Services

SAMPLING POINT LOCATION DATA SHEET

Plant CPC Mojave

Date 5-14-85

Test Location Crusher Baghouse

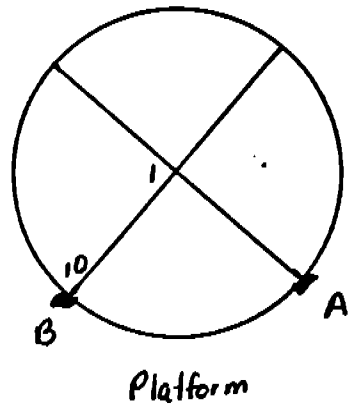
Upstream Dist./Dia. 222" (5.1 S.D.)

Downstream Dist./Dia. 56" (1.3 S.D.)

No. of Sampling Points 20

Stack Dimension 43.5

Coupling Length 3.0



Sample Point	Dist	Sample Point	Dist	Sample Point	Dist	Sample Point	Dist
1	4.1						
2	6.6						
3	9.4						
4	12.8						
5	17.9						
6	31.6						
7	36.7						
8	40.1						
9	42.9						
10	45.4						

SAMPLING POINT RELOCATION:

Pape & Steiner Environmental Services

VELOCITY TRAVERSE DATA SHEET

Plant CPC Mojave
Date 3-14-85
Test Location Crusher Baghouse
Static Pressure (in. wg) -11.0
Barometric Pressure 25.40
Probe Type/Length glass / 6'
Pitot Coefficient 0.84
Stack Dimension 43.5 ø

Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts	Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts
1	1.4	68									
2	1.4	67									
3	1.2	66									
4	1.2	66									
5	1.2	66									
6	1.3	66									
7	.97	66									
8	1.3	66									
9	1.7	68									
10											

SAMPLING POINT RELOCATION:

Pape & Steiner Environmental Services

PLANT CAC Mojave TEST T... M5 FIELD TEST DATA SHEET (Page 1 of 2)

Date 5/14/85
Test Location Crusher
Run Number 1
Stack Diameter 43.5
Operator JK
Filter No. 509

Barometric Pressure 26.40
Static in. wg. -11.0
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size #1505/0.2440

Impinger Volumes/Weights			
Contents	Final	Initial	Net
H_2O	560.3	559.7	0.6
H_2O	569.9	560.2	9.7
—	455.9	454.7	1.2
S.G.	633.1	620.2	12.9
		Total	24.4

Gas Composition			
Time	CO_2	O_2	CO
	0	20.9	

Leak Rate	cfm	"Hg
Initial	0.018	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	9:15 0	1.25	2.67	72.267	66	251	269	65	79	79	8.0	1.118	pitot ok
2	3.5	1.25	2.67	75.740	66	251	238	61	84	81	8.0	1.118	
3	7	1.20	2.60	79.100	65	250	275	58	86	82	8.0	1.095	
4		1.10	2.38	82.373	65	249	253	60	87	82	7.5	1.049	
5	14	1.08	2.34	85.600	65	249	253	60	88	82	7.5	1.039	Stop @ 9:30
6		1.35	2.93	88.485	65	249	234	61	88	83	8.5	1.162	start @ 9:33
7	21	1.40	3.04	91.950	65	273	273	57	88	83	9.0	1.183	
8		1.40	3.05	95.560	65	259	254	59	90	84	9.0	1.183	
9	28	1.45	3.13	99.165	69	259	257	58	91	85	9.5	1.204	
10		1.20	2.58	102.815	72	258	238	58	92	86	8.0	1.095	
	35			106.358									

85 6913 85 6914 85 6915

Pape & Steiner Environmental Services

PLANT CPC Mojave TEST T... M5 FIELD TEST DATA SHEET (Page 2 of 2)

Date 5/14/85
Test Location Crusher
Run Number 1
Stack Diameter 43.5
Operator GS
Filter No. 509

Barometric Pressure 26.40
Static in. wg. -11.0
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/0.9972
Nozzle No./Size 1505/.2140

Impinger Volumes/Weights			
Contents	Final	Initial	Net
S.G.			
		Total	

Gas Composition			
Time	CO_2	O_2	CO
Leak Rate		cfm	"Hg
Initial			
Final		0.011	9.5

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
B 1	9:53 0	1.35	2.93	106.358	65	258	251	62	89	85	8.5	1.162	
2		1.40	3.06	109.120	65	258	253	60	92	86	9.0	1.183	
3	7	1.50	3.26	112.745	69	255	260	61	93	87	9.5	1.225	
4		1.40	3.05	116.435	68	255	263	62	94	87	9.0	1.183	
5	14	1.40	3.06	120.110	68	257	263	61	99	88	9.0	1.183	
6		1.20	2.63	123.795	65	256	263	60	95	89	8.0	1.095	
7	21	1.15	2.52	127.250	67	250	262	61	95	89	7.5	1.072	stop @ 10:17
8		1.15	2.50	130.450	70	251	262	64	93	88	7.5	1.072	start @ 10:20
9	28	1.30	2.84	133.630	69	252	261	63	96	90	8.0	1.140	
10		1.15	2.50	137.090	71	251	263	62	96	90	8.0	1.072	pitot ok
	35			140.578									
			2.79	68.311	67.00				88.03			1.1318	

Pape & Steiner Environmental Services

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

Date 5/14/85
Test Location Crusher
Run Number 2
Stack Diameter 42.5
Operator JB
Filter No. 510

Barometric Pressure 26.40
Static in. wg. -11.0
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.9972
Nozzle No./Size 1505/.2142

Impinger Volumes/Weights			
Contents	Final	Initial	Net
H_2O	547.2	542.6	4.6
H_2O	560.7	556.7	4.0
—	466.5	463.9	2.6
S.G.	663.6	649.8	13.8
		Total	25.0

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
A 1	11:24 0	1.30	2.77	141.604	75	250	245	78	85	85	11.0	1.140	pitotok
2		1.35	2.94	145.155	69	262	239	69	93	90	12.0	1.162	
3	7	1.20	2.62	148.683	69	237	241	68	95	91	11.5	1.095	
4		1.15	2.52	152.135	68	224	246	68	96	91	10.5	1.072	
5	14	1.10	2.41	155.499	67	231	244	67	96	91	10.0	1.049	
6		1.30	2.86	158.760	66	235	246	66	97	91	11.0	1.140	
7	21	1.45	3.19	162.194	66	233	249	65	97	92	12.5	1.204	
8		1.50	3.30	165.810	67	238	245	64	97	92	14.0	1.225	
9	28	1.30	2.85	169.500	67	237	248	64	97	92	12.0	1.140	
10		1.30	2.84	173.080	71	240	246	64	98	92	11.5	1.140	
	35			176.868									

Pape & Steiner Environmental Services

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

Date 5/14/85
Test Location Crusher
Run Number 2
Stack Diameter 43.5
Operator JS
Filter No. 510

Barometric Pressure 26.40
Static in. wg. -11.0
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size 1505/.2140

Impinger Volumes/Weights			
Contents	Final	Initial	Net
S.G.			
		Total	

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial		
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
B 1	12:03 0	1.50	3.26	176.868	71	270	249	67	95	92	13.0	1.225	
2		1.50	3.30	180.400	68	260	248	67	98	93	13.0	1.225	
3	7	1.50	3.30	183.850	68	250	245	68	98	93	14.0	1.225	
4		1.50	3.31	187.640	66	244	249	68	99	94	14.0	1.225	
5	14	1.45	3.20	191.400	66	243	254	66	99	94	13.5	1.204	
6		1.20	2.65	195.099	66	249	242	66	99	94	10.5	1.095	
7	21	1.20	2.66	198.570	65	251	242	65	100	94	10.5	1.095	
8		1.30	2.88	201.975	65	254	245	65	100	95	11.5	1.140	
9	28	1.15	2.55	205.448	65	255	241	66	101	95	10.5	1.072	
10		1.15	254	208.825	68	255	247	67	101	95	10.5	1.072	
	35			212.221									
			2.90	70.617	67.75				94.68			1.1474	

85 6916 | 85 6917 | 85 6918

Pape & Steiner Environmental Services

PLANT CPC Mojave TEST T. - M5 FIELD TEST DATA SHEET (Page 1 of 2)

Date 5/14/85
Test Location Crusher
Run Number 3
Stack Diameter 43.5
Operator JS
Filter No. 511

Barometric Pressure 26.40
Static in. wg. -11.0
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size 1505/.2140

Impinger Volumes/Weights			
Contents	Final	Initial	Net
DI	552.8	551.0	1.8
DI	540.8	532.2	8.6
dry	442.2	442.2	0.0
S.G.	675.2	663.5	11.7
		Total	22.1

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial	0.016	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	1:04 0	1.30	2.86	212.670	68	240	225	70	96	96	14.5	1.140	
2		1.30	2.88	215.700	67	269	225	68	101	98	15.0	1.140	
3	7	1.15	2.55	219.735	67	274	230	57	101	98	13.5	1.072	
4		1.08	2.39	223.122	68	273	246	54	102	98	12.0	1.039	stop @ 1:18
5	14	1.08	2.39	226.550	68	271	244	60	99	98	11.5	1.039	start @ 1:39
6		1.20	2.65	229.915	70	255	226	58	102	100	12.5	1.095	
7	21	1.40	3.10	233.240	69	270	246	55	103	100	15.0	1.183	
8		1.45	3.23	236.798	66	275	246	55	102	100	15.0	1.204	
9	28	1.45	3.22	240.434	67	272	247	54	102	100	15.0	1.204	
10		1.15	2.53	244.053	71	244	251	54	101	100	13.5	1.072	
	35			247.494									

85 6919 | 85 6920 | 85 6921

Pape & Steine[illegible] Environmental Services

PLANT CPC Mojave TEST T[illegible] M5 FIELD TEST DATA SHEET (Page 2 o[illegible] 2)

Date 5/14/85
Test Location Crusher
Run Number 3
Stack Diameter 43.5
Operator JB
Filter No. 511

Barometric Pressure 26.40
Static in. wg. -11.0
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size 1505/.2140

Impinger Volumes/Weights			
Contents	Final	Initial	Net
S.G.			
		Total	

Gas Composition			
Time	CO_2	O_2	CO

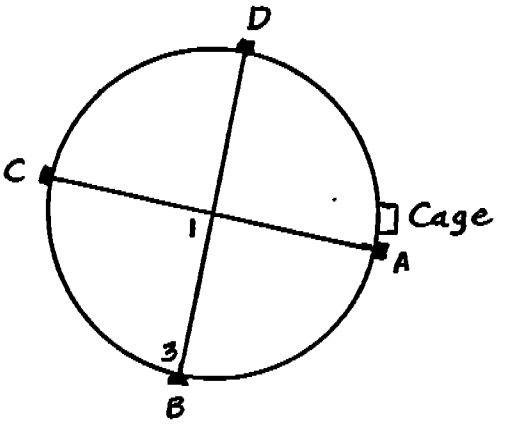
Leak Rate	cfm	"Hg
Initial		
Final	0.013	15

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
B1	2:04 0	1.30	2.87	247.494	69	230	254	53	99	98	14.5	1.140	
2		1.40	3.11	250.735	69	221	253	51	99	98	15.0	1.183	
3	7	1.40	3.11	254.830	66	241	250	51	101	98	15.0	1.183	
4		1.40	3.11	258.438	66	242	252	52	101	98	15.0	1.183	
5	14	1.40	3.11	262.048	66	232	254	51	101	98	15.0	1.183	
6		1.20	2.66	265.650	67	233	254	53	100	97	13.0	1.095	
7	21	1.25	2.78	269.160	65	242	253	54	101	97	13.5	1.118	
8		1.30	2.88	272.025	66	245	248	54	102	96	14.0	1.140	
9	28	1.20	2.66	275.952	66	248	251	55	100	96	13.5	1.095	
10		1.10	2.41	279.322	71	253	253	54	100	96	12.5	1.045	pitot ok
	35			282.717									
			2.82	70.047	67.40				99.25			1.1281	

Pape & Steiner Environmental Services

SAMPLING POINT LOCATION DATA SHEET

Plant California Portland
Date 5/15/85
Test Location Clinker Stack
Upstream Dist./Dia. 296"/2.0 Ø
Downstream Dist./Dia. 1110"/8.0 Ø
No. of Sampling Points 12
Stack Dimension 139.5
Coupling Length 12



Sample Point	Dist	Sample Point	Dist	Sample Point	Dist	Sample Point	Dist
1	18.1						
2	32.4						
3	53.3						

SAMPLING POINT RELOCATION:

Pape & Steiner Environmental Services

VELOCITY TRAVERSE DATA SHEET

Plant California Portland
Date 5/15/85
Test Location Clinker Stack
Static Pressure (in. wg) -0.07
Barometric Pressure 26.30
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Stack Dimension 139.5

Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts	Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts
8:33 D1	0.23	282									
2	0.22	284									
3	0.20	284									
8:37 C1	0.22	284									
2	0.22	284									
3	0.21	282									
8:41 B1	0.23	280									
2	0.23	280									
3	0.19	280									
8:45 A1	0.23	280									
2	0.23	280									
3	0.19	280									

SAMPLING POINT RELOCATION:

Avg $\sqrt{\Delta P}$ = 0.4652
Avg ΔP = 0.2164

Avg Ts ~ 280

Pape & Steiner Environmental Services

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

Date 5/15/85
Test Location Clinker
Run Number 1
Stack Diameter 134.5
Operator JB
Filter No. 518

Barometric Pressure 26.30
Static in. wg. -0.07
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size 814/.3742

Impinger Volumes/Weights			
Contents	Final	Initial	Net
H_2O	533.2	545.0	-11.8
H_2O	541.9	537.7	+4.2
—	454.9	454.1	+0.8
S.G.	648.3	636.0	+12.3
		Total	5.5

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial	0.014	15.5
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
A 1	9:00 0	0.23	3.38	283.179	284	250	276	61	78	78	8.5	0.480	pitot ok
2	6	0.225	3.35	289.600	282	250	275	55	86	80	8.5	0.474	
3	12	0.19	2.85	296.060	281	251	275	55	90	84	7.5	0.436	
	18			302.108									
				302.108									
B 1	9:30 0	0.22	3.29	302.108	282	252	269	56	88	85	8.0	0.469	
2	6	0.225	3.38	308.540	284	252	249	55	93	86	8.5	0.474	
3	12	0.19	2.88	314.985	280	253	255	56	96	88	7.5	0.436	
	18			321.181									

85 6901 | 85 6902 | 85 6903

Pape & Steiner Environmental Services

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

Date 5/15/85
Test Location Clinker
Run Number 1
Stack Diameter 139.5
Operator GS
Filter No. 518

Barometric Pressure 26.30
Static in. wg. -0.07
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size 814/.3742

Impinger Volumes/Weights			
Contents	Final	Initial	Net
S.G.			
		Total	

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial		
Final	0.007	8.5

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
C 1	9:42 0	0.23	3.47	321.181	282	252	257	62	93	90	8.5	0.480	
2	6	0.22	3.32	327.730	284	255	256	61	96	89	8.5	0.469	
3	12	0.19	2.88	334.230	283	250	258	60	98	91	8.0	0.436	
	18			340.395									
				340.395									
D 1	10:03 0	0.22	3.31	340.395	284	252	263	63	93	90	8.5	0.469	
2	6	0.21	3.16	346.775	288	253	261	62	97	91	8.5	0.458	
3	12	0.19	2.88	353.050	284	257	262	60	97	91	7.5	0.436	
	18			359.689									
			3.18	76.510	283.17				89.46			0.4597	

Pape & Steiner Environmental Services

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

Date 5/15/85
Test Location Clinker
Run Number 2
Stack Diameter 139.5
Operator JS
Filter No. 519

Barometric Pressure 26.34
Static in. wg. -0.07
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size 814/.3742

Impinger Volumes/Weights			
Contents	Final	Initial	Net
H_2O	528.8	544.4	-15.6
H_2O	545.0	548.0	-3.0
—	468.6	463.8	+4.8
S.G.	654.7	640.2	+14.5
		Total	0.7

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial	0.013	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
D1	10:53 0	0.23	3.38	360.437	279	275	252	73	75	75	12.5	0.480	pitot ok
2	6	0.22	3.28	366.945	274	275	245	72	81	76	13.0	0.469	
3	12	0.20	3.00	373.333	272	272	252	71	83	78	11.0	0.447	
	18			379.520									
C1	11:21 0	0.245	3.63	379.520	275	275	252	70	76	76	14.0	0.495	
2	6	0.24	3.57	386.000	277	275	251	69	83	77	14.5	0.490	
3	12	0.22	3.30	392.558	272	225	258	69	83	78	12.5	0.469	
	18			398.963									

85 6904 85 6905 85 6906

Pape & Steiner Environmental Services

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

Date 5/15/85
Test Location Clinker
Run Number 2
Stack Diameter 139.5
Operator JB
Filter No. 519

Barometric Pressure 26.34
Static in. wg. -0.07
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size B14/.3742

Impinger Volumes/Weights			
Contents	Final	Initial	Net
S.G.			
		Total	

Gas Composition			
Time	CO_2	O_2	CO
Leak Rate		cfm	"Hg
Initial			
Final		0.017	15 nozzle

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
B 1	11:44 0	0.245	3.65	398.963	275	225	240	69	80	78	14.0	0.495	
2	6	0.24	3.58	405.500	276	275	238	67	83	78	14.0	0.490	
3	12	0.205	3.08	412.055	272	225	236	67	83	79	10.5	0.453	
	18			418.189									
A 1	12:06 0	0.245	3.65	418.189	275	225	237	70	80	78	14.0	0.495	
2	6	0.24	3.55	424.685	283	232	234	67	83	79	14.0	0.490	
3	12	0.22	3.29	431.220	275	237	228	67	83	79	12.0	0.469	
	18			437.642									pitot ok
			3.42	77.205	275.42				79.33			0.4784	

Pape & Steiner Environmental Services

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

Date 5/15/85
Test Location Clinker
Run Number 3
Stack Diameter 139.5
Operator JS
Filter No. S20

Barometric Pressure 26.34
Static in. wg. -0.07
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size 814/.3742

Impinger Volumes/Weights			
Contents	Final	Initial	Net
H_2O	532.3	544.2	-11.9
H_2O	556.4	559.4	-3.0
—	434.6	432.3	2.3
S.G.	699.2	684.1	15.1
		Total	2.5

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
A1	1:05 0	0.23	3.38	438.159	281	242	225	53	75	75	16.5	0.480	pitot ok
2	6	0.23	3.39	444.340	281	256	228	56	80	76	16.5	0.480	
3	12	0.22	3.27	450.590	278	248	225	54	81	78	16.5	0.469	
	18			456.909									
B1	1:25 0	0.23	3.40	456.909	281	224	228	50	80	78	16.5	0.480	
2	6	0.23	3.40	463.380	286	259	245	48	84	80	16.5	0.480	
3	12	0.21	3.14	469.565	278	267	249	49	85	81	16.5	0.458	
	18			475.810									

85 6907 | 85 6908 | 85 6909

Pape & Steiner Environmental Services

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

Date 5/15/85
Test Location Clinker
Run Number 3
Stack Diameter 139.5
Operator [illegible]
Filter No. 520

Barometric Pressure 26.34
Static in. wg. -0.07
Probe Type/Length glass/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9972
Nozzle No./Size 814/.3742

Impinger Volumes/Weights			
Contents	Final	Initial	Net
S.G.			
		Total	

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial		
Final	0.015	17 nozzle

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
C 1	1:48 0	0.23	3.41	475.810	281	262	242	52	82	80	16.5	0.480	
2	6	0.22	3.29	482.000	278	260	237	51	86	81	16.5	0.469	
3	12	0.21	3.17	488.240	275	266	232	50	88	84	16.5	0.458	
	18			494.500									
P 1	2:10 0	0.23	3.45	494.500	277	269	234	51	85	83	16.5	0.480	
2	6	0.22	3.33	500.000	277	275	241	52	91	86	16.5	0.469	
3	12	0.21	3.19	506.875	272	267	242	51	88	85	16.5	0.458	pitot ok
	18			513.065									
			3.32	74.406	278.75				82.13			0.4716	

Pape & Steiner Environmental Services

SAMPLE HANDLING/LOG-IN

Date 5-13-85 Test Location Kiln

	Sample Type	Volume	Comments
1.	85 6877 5/8 (Meth) FHA (Sample) 1 (Test)		
2.	85 6878 5/8 (Meth) MF (Sample) 1 (Test)		
3.	85 6879 5/8 (Meth) BHW (Sample) 1 (Test)		
4.	85 6880 5/8 (Meth) AMF (Sample) 1 (Test)		
5.	85 6881 5/8 (Meth) SO_2 (Sample) 1 (Test)		
6.	856882 5/8 (Meth) FHA (Sample) 2 (Test)		
7.	85 6883 5/8 (Meth) MF (Sample) 2 (Test)		
8.	85 6884 5/8 (Meth) BHW (Sample) 2 (Test)		
9.	856885 5/8 (Meth) AMF (Sample) 2 (Test)		
10.	856886 5/8 (Meth) SO_2 (Sample) 2 (Test)		
11.	85 6887 5/8 (Meth) FHA (Sample) 3 (Test)		
12.	85 6888 5/8 (Meth) MF (Sample) 3 (Test)		

CHAIN OF CUSTODY

AW

Pape & Steiner Environmental Services

SAMPLE HANDLING/LOG-IN

Date 5-13-85 Test Location Kiln

	Sample Type	Volume	Comments
1.	85 6889 5/8 (Meth) BHW (Sample) 3 (Test)		
2.	85 6890 5/8 (Meth) AMF (Sample) 3 (Test)		
3.	85 6891 5/8 (Meth) SO_2 (Sample) 3 (Test)		
4.	85 6892 Acetone Blank (Meth Sample Test)		
5.	85 6893 RA100 Blank (Meth Sample Test)		
6.	85 6894 IPA Blank (Meth Sample Test)		
7.	85 6895 RA47 Blank (Meth Sample Test)		
8.	856896 3% H_2O_2 Blank (Meth Sample Test)		
9.			
10.			
11.			
12.			

CHAIN OF CUSTODY

AW

Pape & Steiner Environmental Services

SAMPLE HANDLING/LOG-IN

Date 5-14-85 Test Location Crusher

	Sample Type	Volume	Comments
1.	85 6913 S (Meth) FHA (Sample) 1 (Test)		
2.	85 6914 S (Meth) MF (Sample) 1 (Test)		
3.	85 6915 S (Meth) H_2O (Sample) 1 (Test)		
4.	85 6916 S (Meth) FHA (Sample) 2 (Test)		
5.	85 6917 S (Meth) MF (Sample) 2 (Test)		
6.	85 6918 S (Meth) H_2O (Sample) 2 (Test)		
7.	85 6919 S (Meth) FHA (Sample) 3 (Test)		
8.	85 6920 S (Meth) MF (Sample) 3 (Test)		
9.	85 6921 S (Meth) H_2O (Sample) 3 (Test)		
10.			
11.			
12.			

CHAIN OF CUSTODY

CW

Pape & Steiner Environmental Services

SAMPLE HANDLING/LOG-IN

Date 5-15-85 Test Location Cooler Baghouse

	Sample Type	Volume	Comments
1.	85 6901 5 Meth FHA Sample 1 Test		
2.	85 6902 5 Meth MF Sample 1 Test		
3.	85 6903 5 Meth H_2O Sample 1 Test		
4.	85 6904 5 Meth FHA Sample 2 Test		
5.	85 6905 5 Meth MF Sample 2 Test		
6.	85 6906 5 Meth H_2O Sample 2 Test		
7.	85 6907 5 Meth FHA Sample 3 Test		
8.	85 6908 5 Meth MF Sample 3 Test		
9.	85 6909 5 Meth H_2O Sample 3 Test		
10.			
11.			
12.			

CHAIN OF CUSTODY

CW

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Front Half Wash DATE 6/3/85

SAMPLE COMPONENT Acetone ANALYST JK

REQUESTED BY CPC

ANALYTICAL METHOD Gravimetric

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample) grams	
					Uncorrected	Blank corrected
Kiln	1	158	158		0.01080	0.00707
	2	199	199		0.00917	0.00447
	3	167	167		0.01032	0.00638
Cooler	1	142	142		0.01279	0.00944
	2	142	142		0.01280	0.00945
	3	127	127		0.01233	0.00933
Crusher	1	162	162		0.01702	0.01320
	2	159	159		0.01464	0.01089
	3	148	148		0.01664	0.01315
	Blk	100	100		0.00236	

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Filterable Particulate DATE 6/3/85

SAMPLE COMPONENT 100mm filter ANALYST SK

REQUESTED BY CPC

ANALYTICAL METHOD Gravimetric

Sample ID No.	Test No.	Filter No.	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample) grams	
					Uncorrected	Blank corrected
Kiln	1	10-506			0.00084	0.00071
	2	10-507			0.00021	0.00008
	3	10-508			0.00090	0.00077
Cooler	1	10-518			0.00078	0.00065
	2	10-519			0.00045	0.00032
	3	10-520			0.00070	0.00057
Crusher	1	10-509			0.00520	0.00507
	2	10-510			0.00176	0.00163
	3	10-511			0.00125	0.00112
	Blk	10-521			0.00013	

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Condensible Particulate DATE 6/3/85

SAMPLE COMPONENT 80% IPA + AMF ANALYST SK

REQUESTED BY CPC

ANALYTICAL METHOD Gravimetric

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample) grams		
					Uncorrected	Blank corrected	
Kiln	1	215	100		0.00247	0.00287	
	2	218	100		0.00174	0.00134	
	3	282	100		0.00220	0.00348	
Cooler	1	258	100		0.00030	0.00000	
	2	256	100		0.00040	0.00000	
	3	265	100		0.00061	0.00000	100% Dup
Crusher	1	317	100		0.00081	0.00000	
	2	310	100		0.00020	0.00000	
	3	300	100		0.00025	0.00000	100% Dup
IPA	Blk.	100	100		0.00042		
AMF	Blk.	100	50		0.00077		

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Front Half Sulfate DATE 6/3/85

SAMPLE COMPONENT Front half wash + filter ANALYST JK

REQUESTED BY CPC

ANALYTICAL METHOD Barium-Thorin

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls	Analytical Result (total sample) mg H_2SO_4		
					Uncorrected	Blank corrected	
	1	100	10	0.30		0.49	100% Du
	2	100	10	0.25		0.24	
	3	100	10	0.20		0.00	100% Spi
	Blk.	100	10	0.20	0.97		
Standardization							
0.0100N H_2SO_4			5	5.05	$\frac{(0.01)(5)}{5.05} = 0.0099N$		
$BaCl_2$			5	5.05			

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Condensible Sulfate DATE 6/3/85

SAMPLE COMPONENT 80% IPA ANALYST SK

REQUESTED BY CPC

ANALYTICAL METHOD Barium-Thorin

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	0.15		1.07	100% Dup
	2	218	10	0.10		0.57	
	3	282	10	0.15		1.56	103.5% spike
IPA Blk.		100	10	0.00	0.00		
AMF Blk.		100	10	0.10	0.49		
standardization							
0.0100N H_2SO_4			5	5.05	$\frac{(0.01)(5)}{5.05} = 0.00990$		
BaCl			5	5.05			

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE SO_2 DATE 6/3/85

SAMPLE COMPONENT H_2O_2 ANALYST SK

REQUESTED BY CPC

ANALYTICAL METHOD Barium-Thorin

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls	Analytical Result (total sample) mg H_2SO_4		
					Uncorrected	Blank corrected	
Kiln	1	360	10	5.20		89.94	100%
	2	310	10	6.45		96.24	
	3	388	10	5.15		95.99	102% sp
	Blk.	100	10	0.05	0.24		
standardization							
0.0100N H_2SO_4			5	5.05	$\frac{(0.01)(5)}{5.05} = 0.0099N$		
$BaCl_2$			5	5.05			

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 (± 1 percent). Copies of these certifications are included in this section of this report.

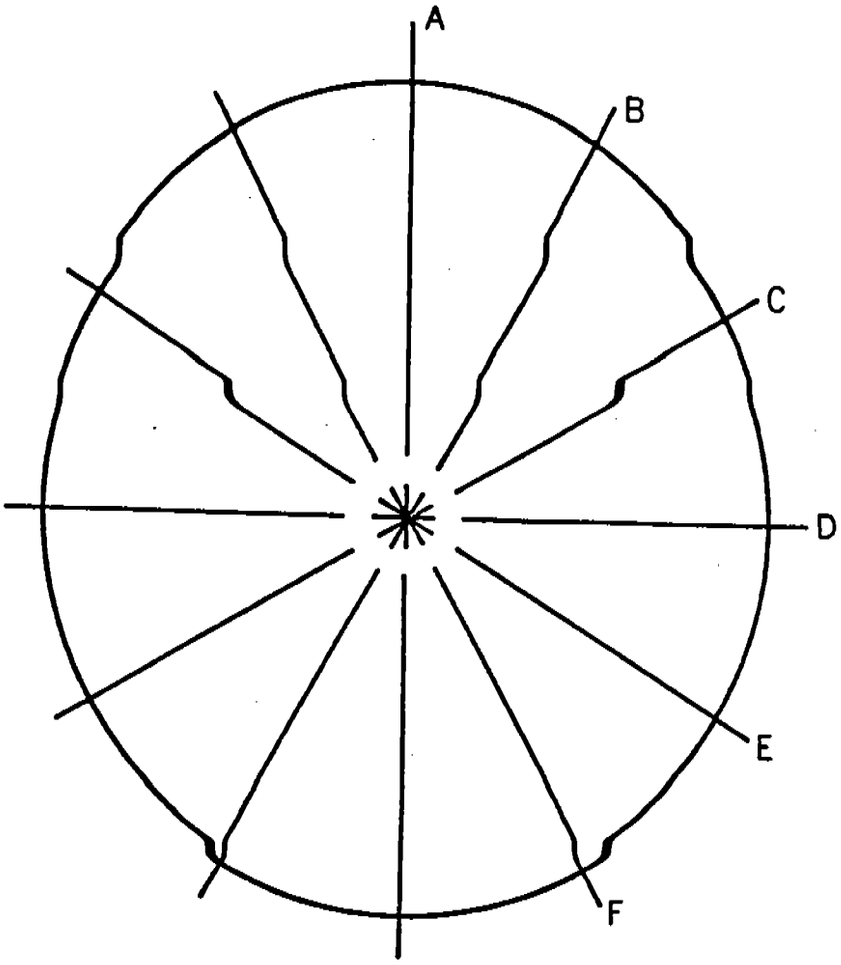
A system check was performed during calibration checks. This was done by introducing span gas at the inlet to the sampling handling system (after the heated line) and measuring the response. The purpose of this test is to check the sampling handling portion of the continuous monitor system for sample loss.

The CO interferences in NDIR-type analyzers described in EPA Method 10, caused by CO_2, have been eliminated by utilizing an electronic cross-talk feature in the dual CO/CO_2 analyzer. The crosstalk is setup by injecting a known amount of CO-free CO_2 and balancing out the CO interference response. Once this has been done, the CO values will automatically be corrected for the amount of CO_2 being analyzed at any particular instant.

A multipoint calibration linearity check of the continuous analyzers were performed on January 15, 1985. These results were well within CARB limitations of ±2 percent of full scale. Table 8-2 lists the results of this check.

Pape & Steiner Environmental Services

NOZZLE CALIBRATION DATA



DIAMETER (in.)

A 0.3741

B 0.3738

C 0.3740

D 0.3748

E

F

AVG. 0.3742

DATE 01-02-85

NOZZLE NO. 814

OPERATOR RKC

Pape & Steiner Environmental Services

TEST 1, 2, 3

LOCATION Kiln

EMISSION RATE DATA -- 68°F

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

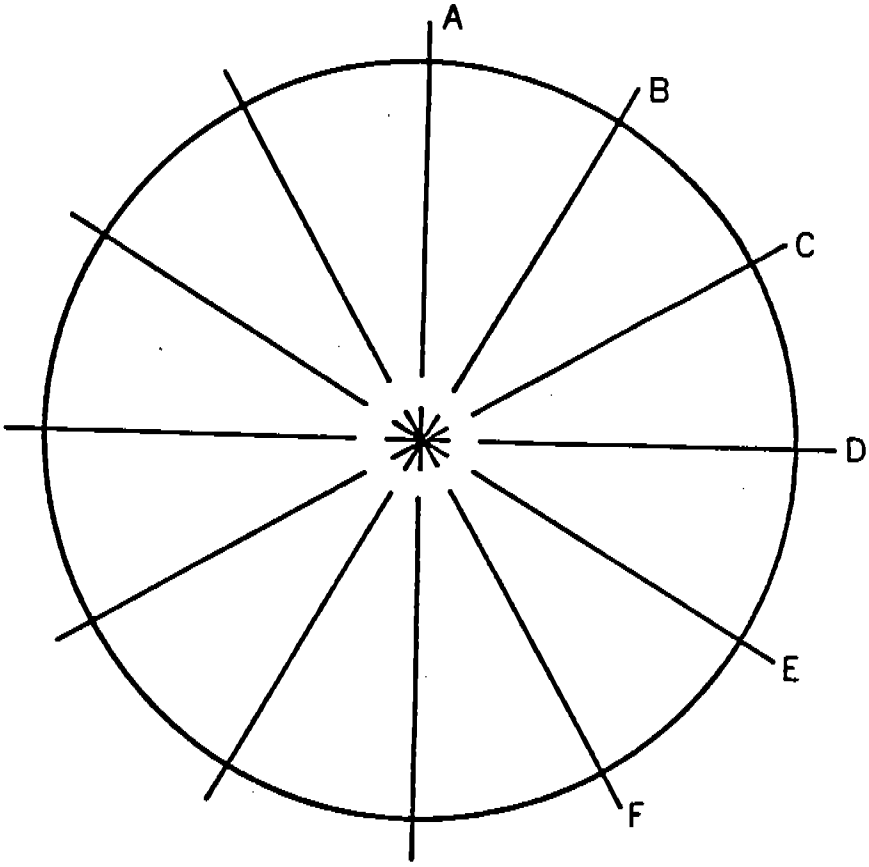
XEQ FF

XEQ RAT

ENTER:		Test 1	Test 2	Test 3	Average
R-17	$V_{m,std}$	45.8840	45.6644	45.3177	
R-26	Q_s	191637.62	191637.62	188759.26	
R-22	$Q_{\%}$				

Pape & Steiner Environmental Services

NOZZLE CALIBRATION DATA



DIAMETER (in.)

A 0.3741

B 0.3738

C 0.3740

D 0.3748

E

F

AVG. 0.3742

DATE 01-02-85

NOZZLE NO. 814

OPERATOR RKC

Pape & Steiner Environmental Services

DRY GAS METER/ORIFICE METER CALIBRATION DATA

Date 3/3/85 Dry Gas Meter No. 39009

Barometric Pressure, in. Hg 29.79 Standard Test Meter No. 69279

Meter Box No. 446 Operator JB

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} (°F)	Temp. T_{d_o} (°F)	Volume V_d (Ft^3)		(min)		
	53	80.038		76	71	214.976				
-1.3	52	59.927	0.5	73	69	193.847		51.0	0.9841	0.7330
	52.5	20.111		72.25		21.129				
	54	107.065		80	75	243.354				
-2.0	53	83.968	1.0	78	72	29.101		42.0	0.9872	0.7221
	53.5	23.097		76.25		24.253				
	56	133.813		83	77	271.182				
-2.7	55	110.191	1.5	81	75	246.601		35.0	0.9944	0.7208
	55.5	23.622		79.00		24.581				
	57	167.686		85	79	306.115				
-3.4	56	138.783	2.0	84	78	276.313		37.0	1.0033	0.7210
	56.5	28.903		81.50		29.802				
	58	204.459		88	81	343.415				
-4.7	57	173.492	3.0	87	80	312.005		32.0	1.0168	0.7260
	57.5	30.967		84.00		31.410				
			4.0							

Average 0.9972 0.7246

Std.Dev. 0.0132 (1.3%) 0.0052 (0.7%)

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

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

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

Date Shipped 12-4-84
Our Project No: 46592
Your P.O. No: LT7308
Page 1 of 1

PAPE & STEINER
5801 NORRIS ROAD
BAKERSFIELD, CA 93308

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*

(Concentrations are in mole % or ppm)

Cylinder Number AAL10103 Certified Accuracy ±1% % NBS Traceable Analysis Dates: First 11-19-84 Last 11-26-84

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND
NITRIC OXIDE	205.4PPM	6-4-85	CHEMI.	SRM1685B	204.2PPM	206.6PPM
NITROGEN	BALANCE					

returned 5/29/85

8-10

Cylinder Number AAL7915 Certified Accuracy ±1% % NBS Traceable Analysis Dates: First 11-19-84 Last 11-26-84

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND
NITRIC OXIDE	457.25PPM	6-4-85	CHEMI.	SRM 1685B	455.5PPM	459.0PPM
NITROGEN	BALANCE					

returned 5/29/85

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

Analyst _____ Approved By Wayne A. McGowan

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

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: 3-5-85
Our Project No.: 47447
Your P.O. No.: SP7339

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. AAL12619 Analytical Accuracy ±1%

Component	Concentration
CARBON MONOXIDE	400.6PPM
NBS TRACEABLE TO SRM 1680 B	
CARBON DIOXIDE	15.07%
OXYGEN	7.58%
NITROGEN	BALANCE

returned 5/29/85

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Analyst _____

Approved By James H. Ross

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

Date: October 23, 1984
Our Project No.: 46123
Your P.O. No.: SP 7290

PAPE & STEINER
5801 Norris Road
Bakersfield CA 93308

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. AAL 8335 Analytical Accuracy ±2%

Component	Concentration
Methane	53.59 PPM
Ethane	54.4 PPM
Propane	53.30 PPM
Butane	50.66 PPM
Pentane	53.86 PPM
Hexane	47.04 PPM
Nitrogen	Balance

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Analyst _____

Approved By Wayne McGowan

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.

8-12

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

Date: October 23, 1984
Our Project No.: 46123
Your P.O. No.: SP 7290

PAPE & STEINER
5801 Norris Road
Bakersfield CA 93308

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. AAL 8335 Analytical Accuracy ±2%

Component	Concentration
Methane	53.59 PPM
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Propane	53.30 PPM
Butane	50.66 PPM
Pentane	53.86 PPM
Hexane	47.04 PPM
Nitrogen	Balance

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Analyst _____

Approved By Wayne McGowan

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

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.

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 1 Date 5/13/85 Location Kiln

T_m	89.50	V_m	53.613	O_2	9.95	Stack ID "	126.5
T_s	245.08	γ	0.9972	CO_2	18.40	Stack Area Ft^2	87.28
$\sqrt{\Delta P}$	0.8890	P_b	26.60	Static	-0.93	Test Time	72
ΔH	1.69	V_{1c}	82.8	C_p	0.84	N_d	0.2319

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 45.8840$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.8974$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0783$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.34$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.30$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.53$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 59.79$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
3/3105.24

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 191637.62$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.03$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 2 Date 5/13/85 Location Kiln

T_m	99.13	V_m	54.290	O_2	10.0	Stack ID "	126.5
T_s	245.17	γ	0.9972	CO_2	18.9	Stack Area Ft^2	87.28
$\sqrt{\Delta P}$	0.8857	P_b	26.60	Static	-0.93	Test Time	72
ΔH	1.70	V_{1c}	81.9	C_p	0.84	N_d	0.2319

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 45.6644$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.8550$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0778$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.42$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.38$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.53$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 59.49$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
311544.12

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 191637.62$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.02$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 3 Date 5/13/85 Location Kiln Stack

T_m	113.08	V_m	55.219	O_2	9.75	Stack ID "	126.5
T_s	241.58	γ	0.9972	CO_2	18.10	Stack Area Ft^2	87.28
$\sqrt{\Delta P}$	0.8750	P_b	26.60	Static	-0.93	Test Time	72
ΔH	1.72	V_{1c}	82.0	C_p	0.84	N_d	0.2319

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 45.3177$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.8597$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0785$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.45$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.39$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.53$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 58.61$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
306936.75

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 188759.26$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.30$$

Pape & Steiner Environmental Services

TEST 1, 2, 3

LOCATION Kiln

EMISSION RATE DATA -- 68°F

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

XEQ FF

XEQ RAT

		Test 1	Test 2	Test 3	Average
ENTER:	R-17 $V_{m,std}$	45.8840	45.6644	45.3177	
	R-26 Q_s	191637.62	191637.62	188759.26	
	R-22 O_2%	9.95	10.0	9.75	

LAB DATA

Front Half Wash	(g)	0.00707	0.00447	0.00638	
Mass Filter	(g)	0.00071	0.00008	0.00077	
Back Half Catch	(g)	0.00287	0.00134	0.00348	
Front Half Sulfate	(mg H_2SO_4)	0.49	0.24	0.00	
Back Half Sulfate	(mg H_2SO_4)	1.07	0.57	1.56	
H_2O_2 Catch	(mg H_2SO_4)	88.94	96.24	95.99	

RESULTS

F-Factor		1				
Filt. Particulate	gr/dscf	6	0.0026	0.0015	0.0024	0.0022
Filt. Particulate	lb/hr	7	4.30	2.53	3.94	3.59
Total Particulate	gr/dscf	8	0.0036	0.0020	0.0036	0.0031
Total Particulate	lb/hr	10	5.88	3.27	5.86	5.00
Total Sulfate	gr/dscf	11	0.0005	0.0003	0.0005	0.0004
Total Sulfate	lb/hr	13	0.86	0.45	0.86	0.72
SO_3	ppm	14	0.2	0.1	0.3	0.2
SO_3	lb/hr	15	0.48	0.26	0.70	0.48
SO_2	ppm	16	16.97	18.25	18.34	17.85
SO_2	lb/hr	17	32.47	34.92	34.57	33.93
SO_2	@3% O_2	18	27.75	29.97	29.45	29.06
SO_2	lb/MMBtu					
S	lb/MMBtu					
Filt. Particulate	lb/MMBtu					

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 1 Date 5/14/85 Location Crusher

T_m	88.03	V_m	68.311	O_2	20.9	Stack ID "	43.5
T_s	62.00	γ	0.9972	CO_2	0.0	Stack Area Ft^2	10.32
$\sqrt{\Delta P}$	1.1318	P_b	26.40	Static	-11.0	Test Time	70
ΔH	2.79	V_{1c}	24.4	C_p	0.84	N_d	0.2140

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 58.3586$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 1.1485$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0193$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.63$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.59$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 68.93$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
42686.91

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 35874.12$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 96.10$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 2 Date 5/14/85 Location Crusher

T_m	94.68	V_m	70.617	O_2	20.9	Stack ID "	43.5
T_s	67.75	γ	0.9972	CO_2	0.0	Stack Area Ft^2	10.32
$\sqrt{\Delta P}$	1.1474	P_b	26.40	Static	-11.0	Test Time	70
ΔH	2.90	V_{1c}	25.0	C_p	0.84	N_d	0.2140

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 59.6235$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 1.1768$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0194$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.63$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.59$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 69.94$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
43306.51

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 36341.11$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 96.92$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 3 Date 5/14/85 Location Crusher

T_m	99.25	V_m	70.047	O_2	20.9	Stack ID "	43.5
T_s	67.40	γ	0.9972	CO_2	0.0	Stack Area Ft^2	10.32
$\sqrt{\Delta P}$	1.1281	P_b	26.40	Static	-11.0	Test Time	70
ΔH	2.82	V_{1c}	22.1	C_p	0.84	N_d	0.2140

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 58.6460$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 1.0402$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0174$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.65$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.59$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 68.71$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
42548.44

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 35798.82$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 96.78$$

Pape & Steiner Environmental Services

TEST 1,2,3

LOCATION Crusher

EMISSION RATE DATA -- 68°F

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

XEQ FF

XEQ RAT

ENTER:	Test 1	Test 2	Test 3	Average
R-17 $V_{m,std}$	58.3586	59.6235	58.6460	
R-26 Q_s	35874.12	36341.11	35798.82	
R-22 O_2%	20.9	20.9	20.9	

LAB DATA

Front Half Wash (g)	0.01320	0.01089	0.01315	
Mass Filter (g)	0.00507	0.00163	0.00112	
Back Half Catch (g)	0.00000	0.00000	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				
Filt. Particulate gr/dscf	6	0.0048	0.0032	0.0038	0.0039
Filt. Particulate lb/hr	7	1.49	1.01	1.15	1.22
Total Particulate gr/dscf	8	0.0048	0.0032	0.0038	0.0039
Total Particulate lb/hr	10	1.49	1.01	1.15	1.22
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				
SO_2 lb/MMBtu					
S lb/MMBtu					

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ISOKINETIC CALCULATIONS

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

Test 1 Date 5/15/85 Location Clinker

T_m	89.46	V_m	76.510	O_2	20.9	Stack ID "	139.5
T_s	283.17	γ	0.9972	CO_2	0.0	Stack Area Ft^2	106.14
$\sqrt{\Delta P}$	0.4597	P_b	26.30	Static	-0.07	Test Time	72
ΔH	3.18	V_{1c}	5.5	C_p	0.84	N_d	0.3742

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 65.0182$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.2589$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0040$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.79$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.29$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 32.71$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
208286.55

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 129535.52$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 96.96$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 2 Date 5/15/85 Location Clinker

T_m	79.33	V_m	77.205	O_2	20.9	Stack ID "	139.5
T_s	275.42	γ	0.9972	CO_2	0.0	Stack Area Ft^2	106.14
$\sqrt{\Delta P}$	0.4784	P_b	26.34	Static	-0.07	Test Time	72
ΔH	3.42	V_{1c}	0.7	C_p	0.84	N_d	0.3742

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 66.9864$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.0329$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0005$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.83$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.33$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 33.81$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
215321.66

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 136000.50$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 95.15$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 3 Date 5/15/85 Location Clinker

T_m	82.13	V_m	74.906	O_2	20.9	Stack ID "	139.5
T_s	278.75	γ	0.9972	CO_2	0.0	Stack Area Ft^2	106.14
$\sqrt{\Delta P}$	0.4716	P_b	26.34	Static	-0.07	Test Time	72
ΔH	3.32	V_{1c}	2.5	C_p	0.84	N_d	0.3742

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 64.6381$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.1177$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0018$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.84$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.82$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.33$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 33.41$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
212794.10

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 133620.76$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 93.45$$

Pape & Steiner Environmental Services

TEST 1, 2, 3

LOCATION Clinker

EMISSION RATE DATA -- 68°F

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

		Test 1	Test 2	Test 3	Average
XEQ FF					
XEQ RAT					
ENTER:	R-17 $V_{m,std}$	65.0182	66.9864	64.6381	
	R-26 Q_s	129535.52	136000.50	133620.76	
	R-22 O_2%	20.9	20.9	20.9	

LAB DATA					
Front Half Wash	(g)	0.00944	0.00945	0.00933	
Mass Filter	(g)	0.00065	0.00032	0.00057	
Back Half Catch	(g)	0.00000	0.00000	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			
Filt. Particulate	gr/dscf	6 0.0024	0.0023	0.0024	0.0024
Filt. Particulate	lb/hr	7 2.66	2.62	2.71	2.66
Total Particulate	gr/dscf	8 0.0024	0.0024	0.0024	0.0024
Total Particulate	lb/hr	10 2.66	2.62	2.71	2.66
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			
SO_2	lb/MMBtu				
S	lb/MMBtu				
Filt. Particulate	lb/MMBtu				