AP-42 Section 11.6
Reference 28
Report Sect. 4
Reference 21

California Portland Cement
Oak Creek Road
Mojave, California 93501

MOJAVE PLANT

(KILN, CLINKER, AND CRUSHER BAGHOUSES)

Prepared by

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

ANNUAL COMPLIANCE TEST

May 23-26, 1983

KCAPCD A to C Numbers
1003001B, 10030026A, 1003027A

Report PS-83-93/Project 5081-83

Test Team Leader: Jim Steiner

Approved Jim Steiner
Jim Steiner, Project Manager

Source category:	Portland Cement	Date:	01/11/93
Plant name :	California Portland Cement	Location:	Bakersfield, CA
Test date :	5/23 - 5/26/83	Ref. No.:	21
Process :	dry	Basis for process rate :	feed

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	fabric	BASED ON	RATE						
(coal-fired)	filter	SOx	1	111.45	225	0.248	0.495		
		SOx	2	112.76	225	0.251	0.501		
		SOx	3	108.83	218	0.250	0.499		
				AVERAGE		0.249	0.499	RATING:	C
		NOx	1	423.42	225	0.941	1.88		
		NOx	2	404.11	225	0.898	1.80		
		NOx	3	369.98	218	0.849	1.70		
				AVERAGE		0.896	1.79	RATING:	C
		CO2	1	235,588	225	524	1,047	200,248	17.2
		CO2	2	256,593	225	570	1,140	196,406	19.1
		CO2	3	230,752	218	529	1,058	193,883	17.4
				AVERAGE		541	1,082	RATING:	C
		CO	1	137	225	0.304	0.608	200,248	0.0156
		CO	2	153	225	0.340	0.681	196,406	0.0178
		CO	3	164	218	0.376	0.752	193,883	0.0193
				AVERAGE		0.340	0.680	RATING:	C

Notes:
1. Process rate is specified as production but unclear.
2. Poor documentation.
3. PM data not used due to negative filter weights and poor documentation.

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Jim Steiner, Project Manager

CALIFORNIA PORTLAND CEMENT COMPANY

POST OFFICE BOX 17964, LOS ANGELES, CALIFORNIA 90017-0964/TELEPHONE (213) 680-2316

DAVID S. CAHN
VICE PRESIDENT-REGULATORY MATTERS

June 28, 1983

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

Reference: KCAPCD Authorities to Construct
1003001B, 1003026A, 1003027A

Mr. Charles M. Seeley
Chief, Compliance 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 23-26, 1983, in compliance with Kern County APCD Rule 108.1 and Special Condition A of the above-referenced Approval to Construct/Modify a Stationary Source. The Test Plan and prior notice of the scheduled dates for these performance tests were submitted to each agency on April 13, 1983.

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, pleas communicate directly with Mr. Jim Steiner (805) 393-8442) of Pape & Steiner Environmental Services.

Sincerely,

DSC

Attachment

cc: J. Steiner, Pape & Steiner
Environmental Services

w/o encl.
bcc: R.H.Lamp
D. Hendricks
K. L. Hayden
P. R. Vogan
S + 3 CC

SUMMARY OF SOURCE TEST RESULTS

Company California Portland Cement · Test Date 5/23-5/24/83 APCD No. 1003026A Unit No. Kiln Baghouse

Pollutants	Emissions									Removal %	Emission Factor lb/ton	
	Inlet				Outlet							
	Concentration Wet			Mass Flow Rate lb/hr	Concentration Wet				Mass Flow Rate lb/hr			
	gr/scf	@ 12% CO_2	ppm_v		gr/scf	@ 12% CO_2	ppm_v	@ 3% O_2			Inlet	Outlet
Particulate					0.0551* 0.0094 0.0077 0.0086	0.0409* 0.0063 0.0057 0.0060			100.57* 16.96 13.72 15.34			0.45* 0.08 0.06 0.07
Sulfate												
SO_2							54.57 52.79 55.21 50.09 53.29		111.45 112.76 102.29 108.83			
NO_x as NO_2 (dry)							296.37 282.85 258.96 279.39	495.8 468.8 421.4 462.0	423.42 404.11 369.98 399.17			
HC												

Scrubber Liquor Analysis: Chlorides -- Specific Gravity --

For Kern County Use Only:

Remarks *Test 1 not included in average; probe/filter catch from test 1 agreed well with probe/filter catch from tests 2 & 3; however, impinger catch from test 1 was 9 times greater than tests 2 & 3, which agreed well; the cause of this large difference is unknown but obviously incorrect; therefore test 1 was eliminated; production rate for test 1 & 2 was 225 TPH; production rate for test 3 was 218 TPH (prorated).

SUMMARY OF SOURCE TEST RESULTS

Company California Portland Cement (Mojave) Test Date 5/25/83 APCD No. 1003001B Unit No. Crusher Baghouse

Pollutants	Emissions									Removal %	Emission Factor lb/ton	
	Inlet				Outlet							
	Concentration Wet			Mass Flow Rate lb/hr	Concentration Wet				Mass Flow Rate lb/hr			
	gr/scf	@ 12% CO_2	ppm_v		gr/scf	@ 12% CO_2	ppm_v	@ 3% O_2			Inlet	Outlet
Particulate					0.0032 0.0055 0.0045 0.0044				1.07 1.81 1.46 1.45			0.0006 0.0011 0.0009 0.0009
Sulfate												
SO_2												
NO_x as NO_2 (dry)												
HC												

Scrubber Liquor Analysis: Chlorides -- Specific Gravity --

For Kern County Use Only:

Remarks

Production rate was 1678 TPH for all 3 tests.

SUMMARY OF SOURCE TEST RESULTS

Company California Portland Cement (Mojave) Test Date 5/26/83 APCD No. 1003027A Unit No. Clinker Baghouse

Pollutants	Emissions									Removal %	Emission Factor lb/ton	
	Inlet				Outlet							
	Concentration Wet			Mass Flow Rate lb/hr	Concentration Wet				Mass Flow Rate lb/hr		Inlet	Outlet
	gr/scf	@ 12% CO_2	ppm_v		gr/scf	@ 12% CO_2	ppm_v	@ 3% O_2				
Particulate					0.0036 0.0020 0.0029 0.0028	0 0 0 0			6.37 3.58 4.98 4.98			0.05 0.03 0.04 0.04
Sulfate												
SO_2												
NO_x as NO_2 (dry)												
HC												

Scrubber Liquor Analysis: Chlorides -- Specific Gravity --

For Kern County Use Only:

Remarks
Production rate was 123 TPH for tests 1 and 2; rate was 126 TPH for test 3.

TABLE OF CONTENTS

SECTION 1

INTRODUCTION

At the request of the California Portland Cement Company, Pape & Steiner Environmental Services conducted a series of annual compliance tests on the outlets of the kiln baghouse, crusher baghouse, and clinker cooler baghouse from May 23 to May 26, 1983

Triplicate tests for particulates were conducted on the effluent of each baghouse using EPA Method 5 equipment and procedures. Triplicate tests for NO_x and SO_2 were conducted on the baghouse effluent serving the kiln using EPA Procedures dated November 19, 1981.

Messrs. Jim Steiner and Jim Oblak conducted the test work for Pape & Steiner Environmental Services. These tests were observed by Ms. Linda Chester of the Kern County APCD. Mr. Perry Vogan of California Portland Cement assisted with the test work and insured 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_{lc}	Vol water collected in train, ml	64.1	68.6	66.2
V_m	Sample gas vol, meter conditions, dcf	58.290	56.539	53.851
Y	Meter calibration factor	0.9863	0.9863	0.9863
P_{bar}	Barometric pressure, in. Hg	26.30	26.30	26.30
P_{stack}	Stack static pressure, In. H_2O	-0.90	-0.90	-0.75
ΔH	Avg meter pressure diff, in. H_2O	0.618	0.601	0.555
T_m	Absolute meter temp., ^oR	569.32	565.25	542.42
$V_{m(std)}$	Standard sample gas vol, dscf	46.2373	45.1691	53.851
B_{ws}	Water vapor in gas stream	0.0604	0.0658	0.0641
MF	Moisture factor	0.9396	0.9342	0.9359
CO_2	Dry, volume %	17.2	19.1	17.4
O_2	Dry, volume %	10.7	10.3	10.1
N_2	Dry, volume %	72.0844	70.5822	72.4807
CO	Dry, volume %	0.0156	0.0178	0.0193
M_d	Molecular wt of stack gas, dry	31.1800	31.4680	31.1880
M_s	Molecular wt of stack gas, wet	30.3841	30.5822	30.3430
C_p	Pitot tube coefficient	0.84	0.84	0.84
$\sqrt{\Delta P}$	Avg of square roots of each ΔP	0.9592	0.9408	0.9087
T_s	Absolute stack temp., ^oR	747.11	733.79	710.92
A	Area of stack, ft^2	87.2787	87.2787	87.2787
Q_{std}	Volumetric flowrate, dscfm	200248.3120	196406.1355	193882.860
A_n	Nozzle area, ft^2	0.000163	0.000163	0.000163
Θ	Sample time	120	120	120
%I	Isokinetic variation	102.8	102.4	102.9

A. FIELD DATA

Symbol	Parameter	Run 1	Run 2	Run 3
	Station	CRUSHER	CRUSHER	CRUSHER
	Run No.	1	2	3
V_{1c}	Vol water collected in train, ml	24.7	23.5	18.3
V_m	Sample gas vol, meter conditions, dcf	52.898	52.270	52.146
Y	Meter calibration factor	0.9863	0.9863	0.9863
P_{bar}	Barometric pressure, in. Hg	26.30	26.30	26.30
P_{stack}	Stack static pressure, In. H_2O	-9.0	-9.0	-9.0
ΔH	Avg meter pressure diff, in. H_2O	1.45	1.39	1.37
T_m	Absolute meter temp., ^oR	549.46	561.64	564.90
$V_{m(std)}$	Standard sample gas vol, dscf	43.5778	42.1196	41.7748
B_{ws}	Water vapor in gas stream	0.0256	0.0252	0.0199
MF	Moisture factor	0.9744	0.9748	0.9801
CO_2	Dry, volume %	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
M_d	Molecular wt of stack gas, dry	28.8360	28.8360	28.8360
M_s	Molecular wt of stack gas, wet	28.5586	28.5628	28.6203
C_p	Pitot tube coefficient	0.84	0.84	0.84
$\sqrt{\Delta P}$	Avg of square roots of each ΔP	1.2389	1.2018	1.1893
T_s	Absolute stack temp., ^oR	527.39	528.53	528.42
A	Area of stack, ft^2	10.3206	10.3206	10.3206
Q_{std}	Volumetric flowrate, dscfm	38492.3463	37311.5482	37091.095
A_n	Nozzle area, ft^2	0.000163	0.000163	0.000163
Θ	Sample time	72	72	72
%I	Isokinetic variation	99.4	99.1	98.9

A. FIELD DATA

	Station	CLINKER	CLINKER	CLINKER
	Run No.	1	2	3
V_{lc}	Vol water collected in train, ml	12.3	7.3	6.2
V_m	Sample gas vol, meter conditions, dcf	53.312	56.894	55.611
Y	Meter calibration factor	0.9863	0.9863	0.9863
P_{bar}	Barometric pressure, in. Hg	26.30	26.30	26.30
P_{stack}	Stack static pressure, In. H_2O	-0.44	-0.44	-0.44
ΔH	Avg meter pressure diff, in. H_2O	2.06	2.29	2.20
T_m	Absolute meter temp., ^oR	553.97	564.88	572.88
$V_{m(std)}$	Standard sample gas vol, dscf	43.6392	45.6969	44.0832
B_{ws}	Water vapor in gas stream	0.0129	0.0074	0.0065
MF	Moisture factor	0.9871	0.9926	0.9935
CO_2	Dry, volume %	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
M_d	Molecular wt of stack gas, dry	28.8360	28.8360	28.8360
M_s	Molecular wt of stack gas, wet	28.6962	28.7563	28.7658
C_p	Pitot tube coefficient	0.84	0.84	0.84
$\sqrt{\Delta P}$	Avg of square roots of each ΔP	0.7235	0.7570	0.7471
T_s	Absolute stack temp., ^oR	740.83	740.67	761.50
A	Area of stack, ft^2	106.1392	106.1392	106.1392
Q_{std}	Volumetric flowrate, dscfm	199526.9498	209741.7742	204294.057
A_n	Nozzle area, ft^2	0.000389	0.000389	0.000389
Θ	Sample time	60	60	60
%I	Isokinetic variation	99.6	99.2	98.3

B. PARTICULATE DATA

Date of Test: 5/23 & 5/24/83

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	175.58	46.2373	0.0586	0.0551	17.2	0.0409	100.57
KILN, 2	29.49	45.1691	0.0101	0.0094	19.1	0.0063	16.96
KILN, 3	23.98	44.8267	0.0083	0.0077	17.4	0.0057	13.72

B. PARTICULATE DATA

Date of Test: 5/25/83

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
CRUSHER, 1	9.19	43.5778	0.0033	0.0032	0	0	1.07
CRUSHER, 2	15.46	42.1196	0.0057	0.0055	0	0	1.81
CRUSHER, 3	12.40	41.7748	0.0046	0.0045	0	0	1.46

B. PARTICULATE DATA

Date of Test: 5/26/83

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
Clinker, 1	10.39	44.0832	0.0036	0.0036	0	0	6.37
Clinker, 2	5.90	45.6969	0.0020	0.0020	0	0	3.58
Clinker, 3	7.79	43.6392	0.0029	0.0029	0	0	4.98

SECTION 3

WET TEST METHOD CALCULATIONS

ISOKINETIC CALCULATIONS

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

Test 1 Date 5/23/83 Location Kiln Baghouse Out

T_m	109.32	V_m	58.290	O_2	10.7	Stack ID "	126.5
T_s	287.11	γ	.9863	CO_2	17.2	Stack Area Ft^2	87.2787
$\sqrt{\Delta P}$	.9592	P_b	26.30	Static	-0.9	Test Time	120
ΔH	.618	V_{1c}	64.1	C_p	0.84	N_d	0.1231

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 46.2373$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 2.9715$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0604$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.180$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.3841$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2338$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 66.6871$$

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

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 200248.3120$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 102.8$$

TEST 1

LOCATION Kiln

EMISSION RATE DATA -- 60^oF

Standard Temperature, $S_t = 60^oF$; 29.92 inches Hg

XEQ 60

XEQ FF

%H	
%C	
%S	
%N	
$\%O_2$	
Btu/lb	
Specific Gravity	

XEQ RAT

ENTER:

R-17 $V_{m,std}$	46.2373
R-19 Bwo	0.0604
R-26 Q_s	200246.3120
R-22 $O_2\%$	10.7
R-23 CO_2	17.2

LAB DATA:

Front Half Wash (g)	0.00851
Mass Filter (g)	-0.00154
Back Half Catch (g)	0.16661
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	0.0551
Total Sulfate gr/scf	4	
Total Particulate gr/dscf	8	0.0586
Total Particulate @ 12% CO_2	9	0.0409
Total Particulate lb/hr	10	100.57
Total Sulfate gr/dscf	11	
Total Sulfate @ 12% CO_2	12	
Total Sulfate lb/hr	13	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Total Particulate lb/mmBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/mmBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/mmBtu	27	
SO_2 lb/Bbl	28	

Pape & Steiner Environmental Services

TEST 1

LOCATION Kiln Baghouse Outlet

CM SO_2, NO_x EMISSION RATE DATA

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

XEQ FF

%H ______

%C ______

%S ______

%N ______

$\%O_2$ ______

Btu/lb ______

Specific Gravity ______

F ______

SO_2

ENTER:

R-15 SO_2 ppm 55.98

R-22 O_2 % 10.20

R-26 Q_s 196406.1355

XEQ SO2

RESULTS:

SO_2 lb/hr 111.45

SO_2 ppm @ 3% O_2 93.65

SO_2 lb/mmBtu ______

SO_2 lb/Bbl ______

NO_x

ENTER:

R-21 NO_x ppm 296.37

R-22 O_2 % 10.20

R-26 Q_s 196406.1355

XEQ NOX

RESULTS:

NO_x lb/hr 423.42

NO_x @ 3% O_2 495.80

NO_x lb/mmBtu ______

NO_x lb/Bbl ______

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 2 Date 5/23/83 Location Kiln Baghouse Out

T_m 105.25	V_m 56.539	O_2 10.3	Stack ID " 126.5
T_s 273.79	γ .9863	CO_2 19.1	Stack Area Ft^2 87.2787
$\sqrt{\Delta P}$ 0.9408	P_b 26.30	Static -0.9	Test Time 120
ΔH 0.601	V_{1c} 68.6	C_p 0.84	N_d 0.1731

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 45.1691$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.1801$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0658$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.4680$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.5822$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2338$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 64.6120$$

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

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 196406.1355$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 102.4$$

TEST 2

LOCATION Kiln

EMISSION RATE DATA -- 60^oF

Standard Temperature, $S_t = 60^oF$; 29.92 inches Hg

XEQ 60

XEQ FF

%H	
%C	
%S	
%N	
$\%O_2$	
Btu/lb	
Specific Gravity	

XEQ RAT

ENTER:

R-17 $V_{m,std}$	45.1691
R-19 Bwo	0.0658
R-26 Q_s	196406.1355
R-22 $O_2\%$	10.3
R-23 CO_2	19.1

LAB DATA:

Front Half Wash (g)	0.01583
Mass Filter (g)	-0.00735
Back Half Catch (g)	0.02101
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	0.0094
Total Sulfate gr/scf	4	
Total Particulate gr/dscf	8	0.0101
Total Particulate @ 12% CO_2	9	0.0063
Total Particulate lb/hr	10	16.96
Total Sulfate gr/dscf	11	
Total Sulfate @ 12% CO_2	12	
Total Sulfate lb/hr	13	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Total Particulate lb/mmBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/mmBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/mmBtu	27	
SO_2 lb/Bbl	28	

Pape & Steiner Environmental Services

TEST 2

LOCATION Kiln Baghouse Out

CM SO_2, NO_x EMISSION RATE DATA

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

XEQ FF

%H ____

%C ____

%S ____

%N ____

$\%O_2$ ____

Btu/lb ____

Specific Gravity ____

F ____

SO_2

ENTER:

R-15 SO_2 ppm 56.64

R-22 O_2 % 10.1

R-26 Q_s 196406.1355

XEQ SO2

RESULTS:

SO_2 lb/hr 112.76

SO_2 ppm @ 3% O_2 93.88

SO_2 lb/mmBtu ____

SO_2 lb/Bbl ____

NO_x

ENTER:

R-21 NO_x ppm 282.85

R-22 O_2 % 10.1

R-26 Q_s 196406.1355

XEQ NOX

RESULTS:

NO_x lb/hr 404.11

NO_x @ 3% O_2 468.80

NO_x lb/mmBtu ____

NO_x lb/Bbl ____

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 3 Date 5/24/83 Location Kiln Baghouse

T_m 82.42	V_m 53.851	O_2 10.1	Stack ID " 126.5
T_s 250.92	γ 0.9863	CO_2 17.4	Stack Area Ft^2 87.2787
$\sqrt{\Delta P}$ 0.9087	P_b 26.30	Static -0.75	Test Time 120
ΔH 0.555	V_{1c} 66.2	C_p 0.84	N_d 0.1731

1. Volume of dry gas sampled at standard conditions (dscf)
   (R-17)
   $$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 44.8267$$

2. Stack gas moisture condensed at standard conditions (scf)
   (R-18)
   ($V_{m,std}$ + $V_{w,std}$; R-04)
   $$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 3.0688$$

3. Stack gas proportion of water vapor, by volume
   (R-19)
   $$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0641$$

4. Stack gas dry molecular weight (lb/lb mole)
   (R-21)
   $$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.188C$$

5. Stack gas molecular weight (lb/lb mole)
   (R-22)
   $$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.3430$$

6. Pressure stack, in. Hg
   (R-23)
   $$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2449$$

7. Stack gas velocity, at stack conditions (ft/sec)
   (R-24)
   $$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 61.6558$$

8. Stack gas volume at standard conditions (dscfm)
   (R-26)
   (ACFM; R-25)
   $$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 193,882.8605$$

9. Test percent isokinetic
   (R-02)
   $$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 102.9$$

TEST 3

LOCATION Kiln

EMISSION RATE DATA -- $60^{o}F$

Standard Temperature, S_t = $60^{o}F$; 29.92 inches Hg

XEQ 60

XEQ FF

%H	
%C	
%S	
%N	
$\%O_2$	
Btu/lb	
Specific Gravity	

XEQ RAT

ENTER:

R-17 $V_{m,std}$	44.8267
R-19 Bwo	0.0641
R-26 Q_s	193882.8605
R-22 $O_2\%$	10.1
R-23 CO_2	17.4

LAB DATA:

Front Half Wash (g)	0.01851
Mass Filter (g)	-0.00360
Back Half Catch (g)	0.01707
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	0.0077
Total Sulfate gr/scf	4	
Total Particulate gr/dscf	8	0.0083
Total Particulate @ 12% CO_2	9	0.0057
Total Particulate lb/hr	10	13.72
Total Sulfate gr/dscf	11	
Total Sulfate @ 12% CO_2	12	
Total Sulfate lb/hr	13	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Total Particulate lb/mmBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/mmBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/mmBtu	27	
SO_2 lb/Bbl	28	

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TEST 3

LOCATION Kiln Baghouse Ou

CM SO_2, NO_x EMISSION RATE DATA

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

XEQ FF

%H ____

%C ____

%S ____

%N ____

$\%O_2$ ____

Btu/lb ____

Specific Gravity ____

F ____

SO_2

ENTER:

R-15 SO_2 ppm 51.38

R-22 O_2 % 9.90

R-26 Q_s 196406.1355

XEQ SO2

RESULTS:

SO_2 lb/hr 102.29

SO_2 ppm @ 3% O_2 83.61

SO_2 lb/mmBtu ____

SO_2 lb/Bbl ____

NO_x

ENTER:

R-21 NO_x ppm 258.96

R-22 O_2 % 9.9

R-26 Q_s - 196406.1355

XEQ NOX

RESULTS:

NO_x lb/hr 369.98

NO_x @ 3% O_2 421.40

NO_x lb/mmBtu ____

NO_x lb/Bbl ____

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 1 Date 5/25/83 Location Crusher Baghouse

T_m	89.46	V_m	52.898	O_2	20.9	Stack ID "	43.5
T_s	67.39	γ	0.9863	CO_2	0	Stack Area Ft^2	10.3206
$\sqrt{\Delta P}$	1.2389	P_b	26.30	Static	-90	Test Time	72
ΔH	1.45	V_{1c}	24.7	C_p	0.84	N_d	0.1231

1. Volume of dry gas sampled at standard conditions (dscf)
   (R-17)
   $$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 43.5778$$

2. Stack gas moisture condensed at standard conditions (scf)
   (R-18)
   ($V_{m,std}$ + $V_{w,std}$; R-04)
   $$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 1.1450$$

3. Stack gas proportion of water vapor, by volume
   (R-19)
   $$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0256$$

4. Stack gas dry molecular weight (lb/lb mole)
   (R-21)
   $$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.836$$

5. Stack gas molecular weight (lb/lb mole)
   (R-22)
   $$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.5586$$

6. Pressure stack, in. Hg
   (R-23)
   $$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.6382$$

7. Stack gas velocity, at stack conditions (ft/sec)
   (R-24)
   $$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 75.5065$$

8. Stack gas volume at standard conditions (dscfm)
   (R-26)
   (ACFM; R-25)
   $$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 38,492.346$$

9. Test percent isokinetic
   (R-02)
   $$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.4$$

TEST *Crusher*

LOCATION *1*

EMISSION RATE DATA -- $60^{o}F$

Standard Temperature, $S_t = 60^{o}F$; 29.92 inches Hg

XEQ 60

XEQ FF

%H	
%C	
%S	
%N	
$\%O_2$	
Btu/lb	
Specific Gravity	

XEQ RAT

ENTER:

R-17 $V_{m,std}$	*43.5778*
R-19 Bwo	*0.0256*
R-26 Q_s	*38492.3463*
R-22 $O_2\%$	*20.9*
R-23 CO_2	*0*

LAB DATA:

Front Half Wash (g)	*0.01113*
Mass Filter (g)	*-0.00194*
Back Half Catch (g)	*0*
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	*0.0032*
Total Sulfate gr/scf	4	
Total Particulate gr/dscf	8	*0.0033*
Total Particulate @ 12% CO_2	9	
Total Particulate lb/hr	10	*1.07*
Total Sulfate gr/dscf	11	
Total Sulfate @ 12% CO_2	12	
Total Sulfate lb/hr	13	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Total Particulate lb/mmBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/mmBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/mmBtu	27	
SO_2 lb/Bbl	28	

ISOKINETIC CALCULATIONS

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

Test 2 Date 5/25/83 Location Crusher Baghouse

T_m	101.64	V_m	52.270	O_2	20.9	Stack ID "	43.5
T_s	68.53	γ	0.9863	CO_2	0	Stack Area Ft^2	10.3206
$\sqrt{\Delta P}$	1.2018	P_b	26.30	Static	-9.0	Test Time	72
ΔH	1.39	V_{1c}	23.5	C_p	0.84	N_d	0.1731

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 42.1196$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 1.0894$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0252$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.83$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.5628$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.6382$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 73.3191$$

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

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 37311.548$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.1$$

TEST 2

LOCATION Crusher

EMISSION RATE DATA -- $60^{o}F$

Standard Temperature, S_t = $60^{o}F$; 29.92 inches Hg

XEQ 60

XEQ FF

%H	
%C	
%S	
%N	
$\%O_2$	
Btu/lb	
Specific Gravity	

XEQ RAT

ENTER:

R-17 $V_{m,std}$	42.1196
R-19 Bwo	0.0252
R-26 Q_s	37311.5482
R-22 $O_2\%$	20.9
R-23 CO_2	0

LAB DATA:

Front Half Wash (g)	0.01306
Mass Filter (g)	0.00161
Back Half Catch (g)	0.00079
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	0.0055
Total Sulfate gr/scf	4	
Total Particulate gr/dscf	8	0.0057
Total Particulate @ 12% CO_2	9	
Total Particulate lb/hr	10	1.81
Total Sulfate gr/dscf	11	
Total Sulfate @ 12% CO_2	12	
Total Sulfate lb/hr	13	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Total Particulate lb/mmBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/mmBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/mmBtu	27	
SO_2 lb/Bbl	28	

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ISOKINETIC CALCULATIONS

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

Test 3 Date 5/25/83 Location Crusher Baghouse

T_m	104.90	V_m	52.146	O_2	20.9	Stack ID "	43.5
T_s	68.42	γ	0.9863	CO_2	0	Stack Area Ft^2	10.3206
$\sqrt{\Delta P}$	1.1893	P_b	26.30	Static	-9.0	Test Time	72
ΔH	1.37	V_{1c}	18.3	C_p	0.84	N_d	0.1731

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 41.7748$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.8483$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0199$$

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

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

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.6203$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 25.6382$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 72.4760$$

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

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 37091.0951$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.9$$

TEST 3

LOCATION Crusher

EMISSION RATE DATA -- 60°F

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

XEQ 60

XEQ FF

%H	
%C	
%S	
%N	
$\%O_2$	
Btu/lb	
Specific Gravity	

XEQ RAT

ENTER:

R-17 $V_{m,std}$	41.7748
R-19 Bwo	0.0199
R-26 Q_s	37091.0951
R-22 $O_2\%$	20.9
R-23 CO_2	0

LAB DATA:

Front Half Wash (g)	0.01155
Mass Filter (g)	0.00085
Back Half Catch (g)	0
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	0.0045
Total Sulfate gr/scf	4	
Total Particulate gr/dscf	8	0.0046
Total Particulate @ 12% CO_2	9	
Total Particulate lb/hr	10	1.46
Total Sulfate gr/dscf	11	
Total Sulfate @ 12% CO_2	12	
Total Sulfate lb/hr	13	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Total Particulate lb/mmBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/mmBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/mmBtu	27	
SO_2 lb/Bbl	28	

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ISOKINETIC CALCULATIONS

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

Test 1 Date 5/26/83 Location Clinker Baghouse

T_m 93.92	V_m 53.312	O_2 20.9	Stack ID " 139.5
T_s 280.83	γ 0.9863	CO_2 0	Stack Area Ft^2 106.1392
$\sqrt{\Delta P}$ 0.7235	P_b 26.30	Static -0.44	Test Time 60
ΔH 2.06	V_{1c} 12.3	C_p 0.84	N_d 0.267

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 43.6392$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.5702$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0129$$

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

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.836$$

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.6962$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2676$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 51.5074$$

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

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 199{,}526.9496$$

9. Test percent isokinetic
   (R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.6$$

TEST 1

LOCATION Clinker

EMISSION RATE DATA -- 60^{o}F

Standard Temperature, S_t = 60^{o}F; 29.92 inches Hg

XEQ 60

XEQ FF

%H	
%C	
%S	
%N	
$\%O_2$	
Btu/lb	
Specific Gravity	

XEQ RAT

ENTER:

R-17 $V_{m,std}$	44.0832
R-19 Bwo	0.0065
R-26 Q_s	204294.0570
R-22 $O_2\%$	20.9
R-23 CO_2	0

LAB DATA:

Front Half Wash (g)	0.00003
Mass Filter (g)	0.01026
Back Half Catch (g)	0.00010
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	0.0036
Total Sulfate gr/scf	4	
Total Particulate gr/dscf	8	0.0036
Total Particulate @ 12% CO_2	9	
Total Particulate lb/hr	10	6.37
Total Sulfate gr/dscf	11	
Total Sulfate @ 12% CO_2	12	
Total Sulfate lb/hr	13	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Total Particulate lb/mmBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/mmBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/mmBtu	27	
SO_2 lb/Bbl	28	

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

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

Test 2 Date 5/26/83 Location Clinker Baghouse

T_m	104.88	V_m	56.894	O_2	20.9	Stack ID "	139.5
T_s	280.67	γ	0.9863	CO_2	0	Stack Area Ft^2	106.1392
$\sqrt{\Delta P}$	0.7570	P_b	26.30	Static	-0.44	Test Time	60
ΔH	2.29	V_{1c}	7.3	C_p	0.84	N_d	0.267

1. Volume of dry gas sampled at standard conditions (dscf)
   (R-17)
   $$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 45.6969$$

2. Stack gas moisture condensed at standard conditions (scf)
   (R-18)
   ($V_{m,std}$ + $V_{w,std}$; R-04)
   $$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.3384$$

3. Stack gas proportion of water vapor, by volume
   (R-19)
   $$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0074$$

4. Stack gas dry molecular weight (lb/lb mole)
   (R-21)
   $$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 28.836$$

5. Stack gas molecular weight (lb/lb mole)
   (R-22)
   $$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.7563$$

6. Pressure stack, in. Hg
   (R-23)
   $$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2676$$

7. Stack gas velocity, at stack conditions (ft/sec)
   (R-24)
   $$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 53.8301$$

8. Stack gas volume at standard conditions (dscfm)
   (R-26)
   (ACFM; R-25)
   $$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 209,741.7742$$

9. Test percent isokinetic
   (R-02)
   $$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.2$$

TEST 2

LOCATION Clinker

EMISSION RATE DATA -- 60^oF

Standard Temperature, $S_t = 60^oF$; 29.92 inches Hg

XEQ 60

XEQ FF

%H	
%C	
%S	
%N	
$\%O_2$	
Btu/lb	
Specific Gravity	

XEQ RAT

ENTER:

R-17 $V_{m,std}$	45.6969
R-19 Bwo	0.0074
R-26 Q_s	209741.7742
R-22 $O_2\%$	20.9
R-23 CO_2	0

LAB DATA:

Front Half Wash (g)	0.00724
Mass Filter (g)	-0.00134
Back Half Catch (g)	0
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	0.0020
Total Sulfate gr/scf	4	
Total Particulate gr/dscf	8	0.0020
Total Particulate @ 12% CO_2	9	
Total Particulate lb/hr	10	3.58
Total Sulfate gr/dscf	11	
Total Sulfate @ 12% CO_2	12	
Total Sulfate lb/hr	13	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Total Particulate lb/mmBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/mmBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/mmBtu	27	
SO_2 lb/Bbl	28	

ISOKINETIC CALCULATIONS

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

Test 3 Date 5/26/83 Location Clinker Baghouse

T_m	112.21	V_m	55.611	O_2	20.9	Stack ID "	139.5
T_s	301.50	γ	0.9863	CO_2	0	Stack Area Ft^2	106.1392
$\sqrt{\Delta P}$	0.7471	P_b	26.30	Static	-0.44	Test Time	60
ΔH	2.20	V_{1c}	6.2	C_p	0.84	N_d	0.267

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

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 44.0832$$

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

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 0.2874$$

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

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0065$$

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

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

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

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 28.7658$$

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

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.2676$$

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

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 53.8591$$

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

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 204,294.0570$$

9. Test percent isokinetic
   (R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.3$$

TEST 3

LOCATION Clinker

EMISSION RATE DATA -- $60^{0}F$

Standard Temperature, $S_t = 60^{0}F$; 29.92 inches Hg

XEQ 60

XEQ FF

%H	
%C	
%S	
%N	
$\%O_2$	
Btu/lb	
Specific Gravity	

XEQ RAT

ENTER:

R-17 $V_{m,std}$	43.6392
R-19 Bwo	0.0129
R-26 Q_s	199526.9498
R-22 $O_2\%$	20.9
R-23 CO_2	0

LAB DATA:

Front Half Wash (g)	0.00838
Mass Filter (g)	-0.00064
Back Half Catch (g)	0.00050
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	0.0029
Total Sulfate gr/scf	4	
Total Particulate gr/dscf	8	0.0029
Total Particulate @ 12% CO_2	9	
Total Particulate lb/hr	10	4.98
Total Sulfate gr/dscf	11	
Total Sulfate @ 12% CO_2	12	
Total Sulfate lb/hr	13	
SO_2 ppm	16	
SO_2 lb/hr	17	
SO_2 @ 3% O_2	18	
Total Particulate lb/mmBtu	23	
Total Particulate lb/Bbl	24	
Total Sulfate lb/mmBtu	25	
Total Sulfate lb/Bbl	26	
SO_2 lb/mmBtu	27	
SO_2 lb/Bbl	28	

EMISSION RATE CALCULATIONS

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

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

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

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

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

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

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

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

5. Emission concentration corrected to 12% CO_2

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

6. Emission Rate lb/hr from gr/dscf

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

7. Gaseous concentration in ppm

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

8. Emission rate lb/hr from ppm

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

9. Emission concentration corrected to 3% O_2

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

*Standard temperature to be defined

EMISSION RATE CALCULATIONS
(Concluded)

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

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

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

11. Heating value of fuel, mmBtu/bbl

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

12. Emission Factor, lb/bbl

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

*Standard temperature to be defined

SECTION 4

CONTINUOUS METHODS DATA

A. RESULTS

NO_x					
Station/Run	%O_2 (dry)	Corrected ppm (dry)	Corrected ppm (dry) @ 3% O_2	lb/hr	dscfm
Kiln 1	10.20	296.37	495.80	423.42	196406
2	10.10	282.85	468.80	404.11	196406
3	9.90	258.96	421.40	369.98	196406
Mean	10.07	279.39	462.00	399.17	196406

SO_2				
Station/Run	Corrected ppm (dry)	ppm (wet)	dscfm	lb/hr
Kiln 1	55.98	54.57	196406	111.45
2	56.64	55.21	196406	112.76
3	51.38	50.09	196406	102.29
Mean	54.66	53.29	196406	108.83

NO_x and SO_2 emission rates computed using volumetric flowrate and moisture data from Particulate test 2 since all continuous monitoring was performed during this test.

B. CALIBRATION AND CORRECTION DATA

Company : California Portland Cement Date 5/23/83

Station Kiln Baghouse Outlet 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
4:50	10.2	17.4	165		60		280	
4:55	10.2	17.4	155	154.90	62	61.83	280	280.31
5:00	10.2	17.3	155		59		280	
5:05	10.2	17.6	145	144.78	57	56.45	300	301.03
5:10	10.2	17.6	150		53		300	
5:15	10.2	17.6	155	154.98	54	53.02	300	301.71
5:20	10.2	17.4	155		56		300	
5:25	10.2	17.6	165	164.05	54	52.61	300	302.40
5:30	10.2	17.6	160		52		300	
Mean:	10.2	17.6	156.11	154.55	56.33	55.98	293.33	296.37

Calibration	%O_2	%CO_2	ppm CO	ppm SO_2	ppm NO_x
Zero Reading	0.3	1.0	25	0	50
Span Reading	8.09	18.94	427	89.47	249.5
Span Gas Value	8.09	17.94	402.2	89.47	199.5
Span Drift Correction Factor	NR	NR	0.00609	-0.00690	- 0.00313
Zero Drift Correction Factor	NR	NR	- 0.75	0.75	0.25

NR = not required (per H. Mayrsohn 6/6/83)

B. CALIBRATION AND CORRECTION DATA

Company : California Portland Cement Date 5/23/83

Station Kiln Baghouse Outlet 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
5:50	10.2	18.0	175		57		290	
5:55	10.2	18.0	170	169.51	56	55.78	290	290.09
6:00	10.2	18.0	175		56		295	
6:05	10.2	18.2	170	168.54	55	54.32	300	300.28
6:10	9.9	18.6	170		51		270	
6:15	9.9	18.6	205	202.21	62	61.02	270	270.42
6:20	9.9	18.0	170		58		260	
6:25	10.2	18.1	185	181.40	57	55.42	270	270.59
6:30	10.2	18.2	185		57		265	
Mean:	10.10	18.30	181.33	180.42	53.55	56.64	277.89	282.85

Calibration	$\%O_2$	$\%CO_2$	ppm CO	ppm SO_2	ppm NO_x
Zero Reading	0.3	1.0	25	0	50
Span Reading	8.09	18.94	427	89.47	249.5
Span Gas Value	8.09	17.94	402.2	89.47	199.5
Span Drift Correction Factor	NR	NR	0.00423	-0.01025	-0.00063
Zero Drift Correction Factor	NR	NR	0.25	1.00	0

B. CALIBRATION AND CORRECTION DATA

Company California Portland Cement Date 5/23/83

Station Kiln Baghouse Outlet 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
6:50	9.9	18.2	185		72		250	
6:55	9.9	18.4	185	184.32	53	52.78	270	270.71
7:00	9.9	18.2	185		56		260	
7:05	9.9	18.2	190	187.90	55	54.35	255	257.05
7:10	9.9	18.1	190		57		260	
7:15	9.9	18.2	185	181.60	56	54.92	250	253.37
7:20	9.9	18.2	210		43		250	
7:25	9.9	18.2	205	199.73	45	43.44	250	254.72
7:30	9.9	18.7	200		64		240	
Mean:	9.9	18.27	191.78	188.39	51.67	51.38	253.88	258.96

Calibration	%O_2	%CO_2	ppm CO	ppm SO_2	ppm NO_x
Zero Reading	0.3	1.0	25	0	50
Span Reading	8.09	18.94	427	89.47	249.5
Span Gas Value	8.09	17.94	402.2	89.47	199.5
Span Drift Correction Factor	NR	NR	0.00733	-0.00131	-0.00439
Zero Drift Correction Factor	NR	NR	0	0.50	-0.25

C. ZERO AND SPAN DRIFT PERCENT CALCULATIONS

Station Run	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_x (ppm)
Initial Span	7.79	17.94	402.2	89.47	199.5
Measured Span	7.79	17.80	409	90.00	196.0
Zero Drift	0	0	−3.0	3.00	1.0
Final, Actual Span	7.79	17.80	412.0	87.00	197.0
Percent Drift	0	0.78	2.44	2.76	1.25

Station Run	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_x (ppm)
Initial Span	7.79	17.94	402	89.47	199.5
Measured Span	7.79	17.80	410	89.80	199.0
Zero Drift	0	0	1.0	4.0	0
Final, Actual Span	7.79	17.80	409.0	85.80	199.0
Percent Drift	0	0.78	1.74	4.10	0.25

Station Run	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_x (ppm)
Initial Span	7.79	17.94	402	89.47	199.5
Measured Span	7.79	17.40	414	91.00	195.0
Zero Drift	−0.05	−0.22	0	2.00	−1.0
Final, Actual Span	7.84	17.62	414	89.00	196.0
Percent Drift	−0.64	1.12	2.98	0.52	1.75

D. SPAN AND ZERO DRIFT CORRECTION FACTOR CALCULATIONS

Span Drift Correction Calculations					
Station/Run	Gas	Drift %	Number of Increments	Drift Per Increment	Midpoint Increment
Kiln 1	CO	2.4	4	0.00609	0.00305
	SO_2	2.76	4	-0.00690	-0.00345
	NO_x	1.25	4	-0.00313	-0.00157

Zero Drift Correction Calculations					
Station/Run	Gas	Drift ppm	Number of Increments	Drift Per Increment	Midpoint Increment
Kiln 1	CO	-3.0	4	-0.75	-0.375
	SO_2	3.0	4	0.75	0.375
	NO_x	1.0	4	0.25	0.125

Span Drift Correction Calculations					
Station/Run	Gas	Drift %	Number of Increments	Drift Per Increment	Midpoint Increment
Kiln 2	CO	1.74	4	0.00423	0.00212
	SO_2	4.10	4	-0.01025	-0.00513
	NO_x	0.25	4	-0.00063	-0.00032

Zero Drift Correction Calculations					
Station/Run	Gas	Drift ppm	Number of Increments	Drift Per Increment	Midpoint Increment
Kiln 2	CO	1.0	4	0.25	0.125
	SO_2	4.0	4	1.00	0.500
	NO_x	0	0	0	0

Span Drift Correction Calculations					
Station/Run	Gas	Drift %	Number of Increments	Drift Per Increment	Midpoint Increment
Kiln 3	CO	2.98	4	0.00733	0.00366
	SO_2	0.52	4	-0.00131	-0.000655
	NO_x	1.75	4	-0.00439	-0.00219

Zero Drift Correction Calculations					
Station/Run	Gas	Drift ppm	Number of Increments	Drift Per Increment	Midpoint Increment
Kiln 3	CO	0		0	0
	SO_2	2.0	4	0.50	0.25
	NO_x	-1.0	4	-0.25	-0.125

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 SAMPLES

5.1.1 Nozzle, Probe, Filter Holder Wash

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

5.1.2 Filter

The filter 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). An unused blank filter was treated in the same manner.

5.1.3 Condensible Particulate

The volume of distilled water and washings were measured. An aliquot of the liquid was transferred to a clean, tared glass evaporating dish. The dish was placed on a temperature controlled 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). A blank of the distilled water was also treated in an identical manner.

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Method 5

DATE 6/4/83

SAMPLE COMPONENT Acetone Residue

ANALYST SP

REQUESTED BY

ANALYTICAL METHOD Gravimetric

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample) gm.	
					Uncorrected	Blank corrected
Kiln	1	190	190		0.01126	0.00851
	2	165	165		0.01824	0.01583
	3	200	200		0.01343	0.01051
Crusher	1	150	150		0.01332	0.01113
	2	165	165		0.01547	0.01306
	3	170	170		0.01403	0.01155
Clinker	1	200	200		0.01318	0.01026
	2	240	240		0.01074	0.00724
	3	155	155		0.01064	0.00838
BLANK			100		0.00146	

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Method 5

DATE 6/4/83

SAMPLE COMPONENT Mass Filters

ANALYST SP

REQUESTED BY

ANALYTICAL METHOD Gravimetric

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample) gm.	
					Uncorrected	Blank corrected
Kiln	1					- 0.00154
	2					- 0.00735
	3					- 0.00360
Crusher	1					- 0.00194
	2					0.00161
	3					0.00085
Clinker	1					0.00003
	2					-0.00134
	3					- 0.00064
BLANK				no correction		- 0.00007

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Methods

DATE 6/4/83

SAMPLE COMPONENT Distilled Water

ANALYST SP

REQUESTED BY

ANALYTICAL METHOD Gravimetric

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample)	
					Uncorrected	Blank corrected
Kiln	1	340	100			0.16861
	2	340	100			0.02101
	3	340	100			0.01707
Crusher	1	290	100			0
	2	315	100			0.00079
	3	330	100			0
Clinker	1	260	100			0.00010
	2	245	100			0
	3	250	100			0.00050
BLANK			100		0.00026	

SECTION 6

SAMPLING PROCEDURES

This section of the report describes the procedures used to conduct the particulate test 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 the 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 (EPA Method 4)

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

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

where

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

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

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

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

6.2 PREPARATION OF THE PARTICULATE 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. EPA Method 5 procedures were used to measure particulates (filterable and total) and consisted of:

- a calibrated 316 stainless steel nozzle for isokinetic sampling;
- a heated 316 stainless steel (10 feet long for kiln and clinker) and a Pyrex glass (4 feet long for crusher) sampling probe, equipped with a calibrated 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 No. 1 contains 100 ml distilled water; bubbler No. 2 contains 100 ml of distilled water; impinger No. 3 was dry; bubbler No. 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. 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 hoisted to the sampling site.

6.3 SAMPLING PROCEDURES FOR PARTICULATE SAMPLING TRAIN

Prior to a test, the sampling train was heated and leak-checked at 15 in. Hg 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. Each point was sampled for an equal period of time and all pertinent data was recorded on the data sheet for each point. Three points per traverse (4 traverses at 90^{0}, 12 points total) were sampled for 10 minutes on the kiln stack. Eighteen points per traverse (2 traverses at 90^{0}, 36 points total) were sampled for 2 minutes on the crusher stack. Three points per traverse (4 traverses at 90^{0}, 12 points total) were sampled for

5 minutes on the clinker cooler stack. 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 (intact) 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. After the train was leak-checked, the probe, nozzle, filter holder, and impinger train were sealed with tin foil and lowered to the lab for sample recovery.

6.4 SAMPLE RECOVERY PROCEDURES FOR PARTICULATE 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, and the volume of water condensed was measured gravimetrically. The contents of impingers 1, 2, and 3 were transferred to a polyethylene sample bottle. The back half of the 4-inch glass filter holder, the glass connectors, impingers 1, 2, and 3 were rinsed with distilled water and these rinsings 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.

6.5 SAMPLING PROCEDURES FOR NO_x, CO_2, SO_2, O_2, AND CO

Continuous samples of the stack gases were taken during the particulate tests on the kiln stack using the Pape & Steiner emission monitoring trailer and EPA procedures as shown in Table 6-1 and Figure 6-1.

TABLE 6-1. CONTINUOUS MONITORING EQUIPMENT

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	$\pm$ 1% of full scale
Accuracy	Derived from the NO or NO_2 calibration gas, $\pm$ 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	$\pm$ 1% of scale at constant temperatures; $\mp$ 1% of scale of $\pm$ 5% of reading, whichever is greater, over the operating temperature range
Output	0 - 1V
CO_2/CO Infrared Analyzer -- Anarad Model AR-600	
Response time (0 - 90%)	5 seconds
Zero drift	$\pm$ 1%
Span drift	$\mp$ 1%
Linearity	1%
Resolution	Less than 1% of full scale
Output	0 - 1V
SO_2 UV Analyzer -- DuPont Model 400	
Response time (0 - 90%)	Less than 1 second
Zero drift	Less than 1% full scale in 24 hours
Linearity	$\pm$ 1% full scale
Accuracy	$\mp$ 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	Total limit of error $\pm$ 0.5%
Dead Band	
Linearity	
Repeatability	
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

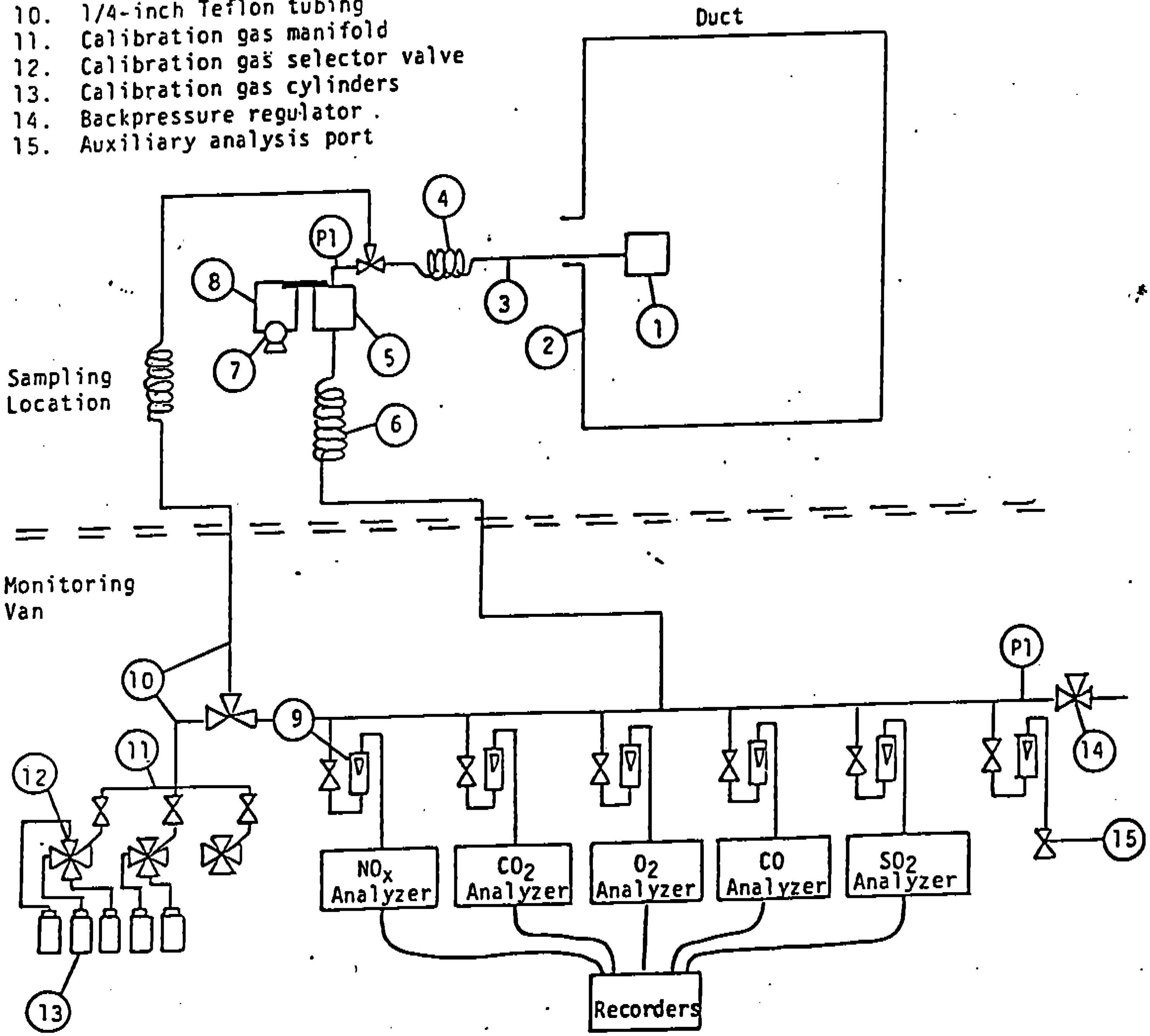


Figure 6-1. Schematic of Continuous Monitoring System.

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 $>250^{\circ}F$) by a Teflon-lined diaphragm pump to a 316 stainless steel refrigeration type conditioner two separate times under vacuum before entering the pump, then two additional times under pressure. The clean, dry sample gas ($\sim 35^{\circ}F$) 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 for criteria pollutant analysis (NO_x and SO_2) and certified calibration gases ($\pm$ 2 percent) for fixed gas analysis. Copies of the gas certificates are included in the Section 8 of this report. All pertinent data (date, time, test location, analyzer range, cal gas value) were recorded on both the field data sheets and continuous analyzer strip charts in the field.

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

An initial calibration was performed at the start of each 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. In this way, the amount of drift can be easily seen. Once a calibration check was complete, adjustments (if necessary) to the analyzers may be made in preparation for another test.

Test data was collected by recording 5-minute averages from the strip chart recordings onto the field data sheets. Data collected over the 40-minute test period was averaged and reported.

The O_2 data, collected simultaneously with the NO_x data, was used to correct the measured NO_x concentrations to 3-percent O_2. The O_2, CO_2, and CO data obtained during the particulate tests was also used to calculate the molecular wieght of the stack gases.

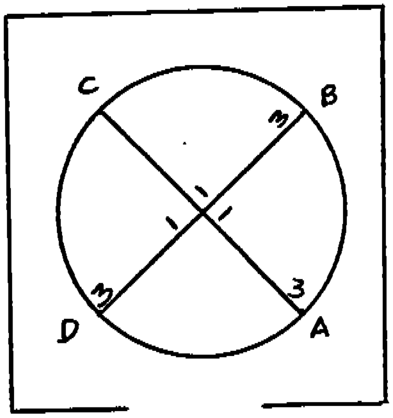
SECTION 7

RAW DATA

Pape & Steiner Environmental Services

SAMPLING POINT LOCATION DATA SHEET

Plant California Portland
Date 5/23/83
Test Location Kiln Baghouse Outlet
Upstream Dist./Dia. 172 ø
Downstream Dist./Dia. 116' / 11 ø
No. of Sampling Points 12
Stack Dimension 126.5
Coupling Length 17.5



Sample Point	Dist	Sample Point	Dist	Sample Point	Dist	Sample Point	Dist
A 1	23.0						
2	36.0						
3	54.9						

SAMPLING POINT RELOCATION: none

Pape & Steiner Environmental Services

VELOCITY TRAVERSE DATA SHEET

Plant California Portland (Mojave)
Date 5/23/83
Test Location Kiln Baghouse Out
Static Pressure (in. wg) -0.9
Barometric Pressure 26.30
Probe Type/Length SS/10'
Pitot Coefficient 0.84
Stack Dimension 126.5

Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts	Smpl Pt.	ΔP	Ts	Smpl Pt	ΔP	Ts
A1	1.1	295									
2	0.9	295									
3	0.85	295									

SAMPLING POINT RELOCATION: none

Pape & Steiner environmental Services

PLANT Portland Cement TEST TYPE M5 FIELD TEST DATA SHEET (Page 1 of 2)

note! Exactly 100 ml H_2O used so yes can clean up volumetrically or grav.

Date Hawaii +1 5/23/83
Test Location Kiln Baghouse
Run Number 1
Stack Diameter 126.5
Operator JS
Filter No. 10-369

Barometric Pressure 26.30
Static in. wg. -0.90
Probe Type/Length SS/10'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9863
Nozzle No./Size 1350/.1231

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100.0 ml H_2O	598.5	550.7	47.8
100.0 ml H_2O	570.0	564.4	5.6
empty	453.6	453.1	0.5
S.G.	685.4	675.2	10.2
		Total	64.1

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	12:47 0	1.05	0.68	946.210	295	325	249	67	99	99	4.0	1.025	pitot ok
	5	1.05	0.68	948.760	295	249	252	63	102	100	4.0	1.025	
2	10	0.93	0.61	951.245	292	271	254	63	103	101	3.5	0.964	
	15	0.95	0.63	953.650	290	275	252	61	103	100	3.5	0.975	
3	20	0.87	0.57	956.250	292	263	254	64	105	103	3.5	0.933	
	25	0.87	0.58	958.435	292	246	256	62	106	105	3.5	0.933	
	30			960.762									
B 1	1:02 0	1.05	0.69	960.762	296	346	247	68	106	108	4.0	1.025	
	5	1.00	0.66	963.250	297	275	251	65	109	109	4.0	1.000	
2	10	0.91	0.60	965.740	293	273	252	60	107	107	3.5	0.954	
	15	0.78	0.52	968.150	287	275	249	59	108	108	3.5	0.883	
3	20	0.80	0.54	970.420	283	275	251	60	110	110	3.5	0.894	
	25	0.80	0.54	972.675	283	272	252	63	110	111	3.5	0.894	
	30			974.949									1:47 baghouse pump comp. down
													wait to start next traverse
													2:16 ready to go

Pape & Steiner Environmental Services

PLANT *California Portland (Mojave)* TEST TYPE *MS* FIELD TEST DATA SHEET (Page *2* of *2*)

Date *5/23/83*
Test Location *Kiln Baghouse*
Run Number *1*
Stack Diameter *136.5*
Operator *JE*
Filter No. *10-389*

Barometric Pressure *26.30*
Static in. wg. *-0.9*
Probe Type/Length *SS/10'*
Pitot Coefficient *0.84*
Meter Box No./γ *446/.9863*
Nozzle No./Size *1350/.1131*

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

Gas Composition			
Time	CO_2	O_2	CO
Leak Rate	cfm	"Hg	
Initial			
Final	0.01	7	

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
C 1	2:17 0	0.96	0.64	974.949	286	272	253	75	106	107	4.0	0.980	
	5	0.98	0.66	977.400	283	257	251	64	107	107	4.0	0.990	
2	10	0.93	0.63	979.860	277	256	250	60	108	106	4.0	0.964	
	15	0.93	0.63	982.300	281	260	248	59	110	107	4.0	0.964	
3	20	0.89	0.60	984.740	281	259	249	59	112	109	4.0	0.943	
	25	0.90	0.61	987.150	279	264	247	58	114	112	4.0	0.949	
	30			989.560									
D 1	2:57 0	1.05	0.72	989.560	282	225	243	68	118	121	4.0	1.025	
	5	0.96	0.66	992.135	284	228	243	63	122	122	4.0	0.980	
2	10	0.92	0.63	994.665	284	232	252	61	121	121	4.0	0.959	
	15	0.92	0.63	997.125	283	245	250	61	120	121	4.0	0.959	
3	20	0.92	0.63	999.570	281	268	246	60	120	120	4.0	0.959	
	25	0.90	0.62	1002.100	281	274	243	59	120	119	4.0	0.949	pitot ok
	30			1004.500									
			0.618	58.290	281.11				109.32			0.9592	

Pape & Steiner Environmental Services

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

Date 5-23-83
Test Location Kiln Baghouse
Run Number #2
Stack Diameter 126.5
Operator JS
Filter No. 10-390

Barometric Pressure 26.30
Static in. wg. -0.90
Probe Type/Length SS/10'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9863
Nozzle No./Size 1350/.1231

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100ml DI	579.2	535.4	43.8
100ml DI	560.4	548.4	12.0
dry	439.2	436.7	2.5
S.G.	622.8	612.5	10.3
		Total	68.6

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	Gas Meter Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
D1	4:35 0	0.95	0.66	5.000	279	260	250	67	124	125	4.5	0.975	pitot ok
	5	0.93	0.65	7.545	277	250	252	62	124	127	4.5	0.964	
2	10	0.91	0.63	10.045	280	255	252	63	122	126	4.5	0.954	
	15	0.90	0.62	12.545	282	257	251	60	119	124	4.5	0.949	
3	20	0.72	0.49	14.920	281	257	250	59	116	120	4.0	0.849	
	25	0.78	0.53	17.135	278	259	249	58	112	116	4.0	0.883	
	30			19.354									
C1	5:26 0	1.00	0.68	19.354	279	227	237	60	107	112	5.0	1.000	
	5	0.96	0.65	21.810	278	235	243	57	107	108	4.5	0.980	
2	10	0.92	0.62	24.240	280	252	244	58	107	107	4.5	0.959	
	15	0.89	0.60	26.900	280	258	245	59	107	107	4.5	0.943	
3	20	0.90	0.61	28.970	280	252	245	60	106	106	4.5	0.949	
	25	0.89	0.60	31.310	275	254	245	61	105	105	4.5	0.943	
	30			33.664									

Pape & Steiner Environmental Services

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

Date 6/23/83
Test Location Kiln Baghouse
Run Number 2
Stack Diameter 126.5
Operator Jf
Filter No. 10-390

Barometric Pressure 26.30
Static in. wg. -0.9
Probe Type/Length SS/10'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9863
Nozzle No./Size 1350/.1731

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

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial		
Final	0.005	7

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
B 1	6:08 0	0.93	0.62	33.664	274	255	240	54	105	112	4.5	0.964	
	5	0.95	0.64	36.010	273	254	239	50	100	100	4.5	0.975	
2	10	0.90	0.61	38.385	270	266	233	52	99	99	4.5	0.949	
	15	0.83	0.56	40.750	270	248	236	52	99	98	4.5	0.911	
3	20	0.76	0.51	43.010	265	250	236	53	98	97	4.5	0.872	
	25	0.76	0.52	45.245	260	251	236	53	97	97	4.5	0.872	
	30			47.400									
A 1	6:50 0	0.98	0.65	47.400	271	264	224	52	93	97	5.0	0.990	
	5	0.98	0.66	49.840	270	259	232	48	95	95	5.0	0.990	
2	10	0.86	0.58	52.260	267	257	231	49	95	95	4.5	0.927	
	15	0.89	0.60	54.700	267	269	235	49	94	94	4.5	0.943	
3	20	0.86	0.57	56.950	266	268	239	49	94	94	4.5	0.922	
	25	0.84	0.56	59.250	268	268	242	49	93	93	4.5	0.917	
	30			61.549									
			0.601	56.539	273.79			105.25				0.9408	

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

Date 5/24/83
Test Location Kiln Baghouse
Run Number #3
Stack Diameter 126.5
Operator JE
Filter No. 10-391

Barometric Pressure 28.30
Static in. wg. -0.75
Probe Type/Length SS/10'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9863
Nozzle No./Size 1350/.131

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100ml. DI	600.6	551.5	49.1
100ml. DI	570.0	565.0	5.0
dry	453.9	453.0	0.9
S.G.	696.6	685.4	11.2
		Total	66.2

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	Gas Meter Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
A 1	11:43am 0	0.75	0.51	62.656	252	240	258	60	89	89	4.0	0.866	pitot ok
	5	0.80	0.53	64.860	271	269	256	57	90	89	3.5	0.894	
2	10	0.78	0.51	67.065	280	260	254	56	91	89	3.5	0.883	
	15	0.73	0.47	69.248	286	263	256	56	92	90	3.5	0.854	
3	20	0.88	0.59	71.363	242	225	248	51	76	76	4.0	0.938	stop @ 12:01 @ 18.3 min @ 70.652
	25	0.87	0.59	73.580	241	225	251	49	78	76	4.0	0.933	restart 9:29 pm K = 960.616
	30			75.891									KND = .880
B 1	9:54pm 0	0.90	0.60	75.891	250	225	239	53	77	80	4.0	0.949	very windy
	5	0.93	0.62	78.200	250	230	241	51	79	78	4.0	0.964	
2	10	0.87	0.58	80.560	249	235	242	52	81	79	4.0	0.933	
	15	0.85	0.57	82.850	248	234	243	52	82	79	4.0	0.922	
3	20	0.81	0.55	85.120	245	233	245	52	82	80	4.0	0.900	
	25	0.73	0.49	87.360	244	234	244	53	83	81	3.5	0.854	
	30			89.485									

Pape & Steiner Environmental Services

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

Portland (Mojave)

Date 5/24/83

Test Location Kiln Baghouse

Run Number 3

Stack Diameter 126.5

Operator JS

Filter No. 10-391

Barometric Pressure 26.30

Static in. wg. -0.75

Probe Type/Length 55/10'

Pitot Coefficient 0.84

Meter Box No./γ 446/.9863

Nozzle No./Size 1350/.1731

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

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial		
Final	.005	7

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
C 1	10:50 am 0	0.88	0.60	89.485	244	227	234	53	79	83	4.0	0.938	
	5	0.86	0.58	91.815	247	226	234	49	82	81	4.0	0.927	
2	10	0.80	0.54	94.100	248	228	241	48	83	81	4.0	0.894	
	15	0.80	0.54	96.300	247	228	245	49	83	82	3.5	0.894	
3	20	0.77	0.52	98.500	246	226	245	50	84	82	3.5	0.877	
	25	0.77	0.52	100.675	245	226	247	49	84	82	3.5	0.877	
	30			102.858									
D 1	11:27 pm 0	0.84	0.57	102.858	244	225	233	55	80	84	4.0	0.917	
	5	0.86	0.58	105.125	251	233	235	54	81	82	4.0	0.927	
2	10	0.86	0.58	107.450	250	234	238	53	82	82	4.0	0.927	
	15	0.93	0.63	109.750	250	235	238	52	83	81	4.0	0.964	
3	20	0.76	0.51	112.300	246	233	236	53	84	81	3.5	0.872	
	25	0.81	0.54	114.320	246	234	237	53	83	81	3.5	0.900	pitot ok
	30			116.507									
			0.565	53.851	250.92				82.4			.9087	

Pape & Steiner Environmental Services

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CONTINUOUS MONITOR DATA SHEET

Plant CPG

Date 5-23-83

Test Location Kiln OUTLET

Run Number #2, #3

Operator

Ambient Temperature

Barometric Pressure

Static Pressure Duct

Fuel

Time	Sample Point	Fuel Flow	Dry Uncorrected						3% O_2 Dry		Hydrocarbons						Comments
			O_2 %	CO_2 %	CO ppm	SO_2 ppm	NO ppm	NO_x ppm	ppm	NO_x ppm	THC	CH_4	Non CH_4				
1830			10.5	19.2	210	57		315									
1840			0.3	1.00	26	4		50									zero
			8.09	18.8	435	29.8		249									span
1850			10.2	19.2	210	~~58~~	22	300									
1855			10.2	19.4	210	53		320									
1900			10.2	19.2	210	56		310									
1905			10.2	19.2	215	55		305									
1910			10.2	19.1	215	57		310									
1915			10.2	19.2	210	56		300									
1920			10.2	19.2	235	43		~~290~~	300								
1925			10.2	19.2	230	45		300									
1930			10.2	19.2	225	64		290									
			0.25	0.28	25	2		49									zero
1940			8.09	18.40	439	91		245									span

Pape & Steiner Environmental Services

of 2

ELE 3600

CONTINUOUS MONITOR DATA SHEET

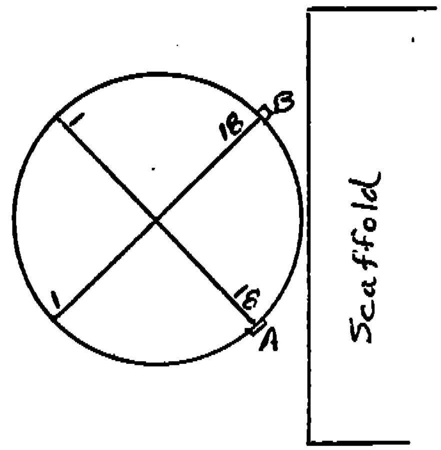
Plant: CPC Kiln Outlet
Date: 5-23-82
Test Location: Kiln Baghouse Outlet
Run Number: #1, #2
Operator: O. Ilaki

Ambient Temperature: 80°F
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
			0.3	1.0	25	0		50									offset
			8.09	17.94	402	89.47		199.5									calges values
1646			8.09	18.94	427	89.47		149.5									
1650		10.5	~~11.0~~	18.4	190	60		330									
1655		10.5	~~11.0~~	18.4	180	62		330									
1700		10.5	—	18.3	180	59		330									
1705			10.5	18.6	170	57		350									
1710			10.5	18.6	175	53		350									
1715			10.5	18.6	180	54		350									
1720			10.5	18.4	180	56		350									
1725			10.5	18.6	190	54		350									
1730			10.5	18.6	185	52		350									
			0.3	1.0	22	3		51									zero
1745			8.09	18.8	434	90		248									span
1750			10.5	19.0	200	57		340									
1755			10.5	19.0	195	56		340									
1800			10.5	19.0	200	56		345									
1805			10.5	19.2	195	58		350									
1810			10.3	20.6	195	51		320									
1815			10.2	18.6	230	62		330									
1820			10.2	19.0	195	57		310									
1825			10.5	19.1	210	57		320									

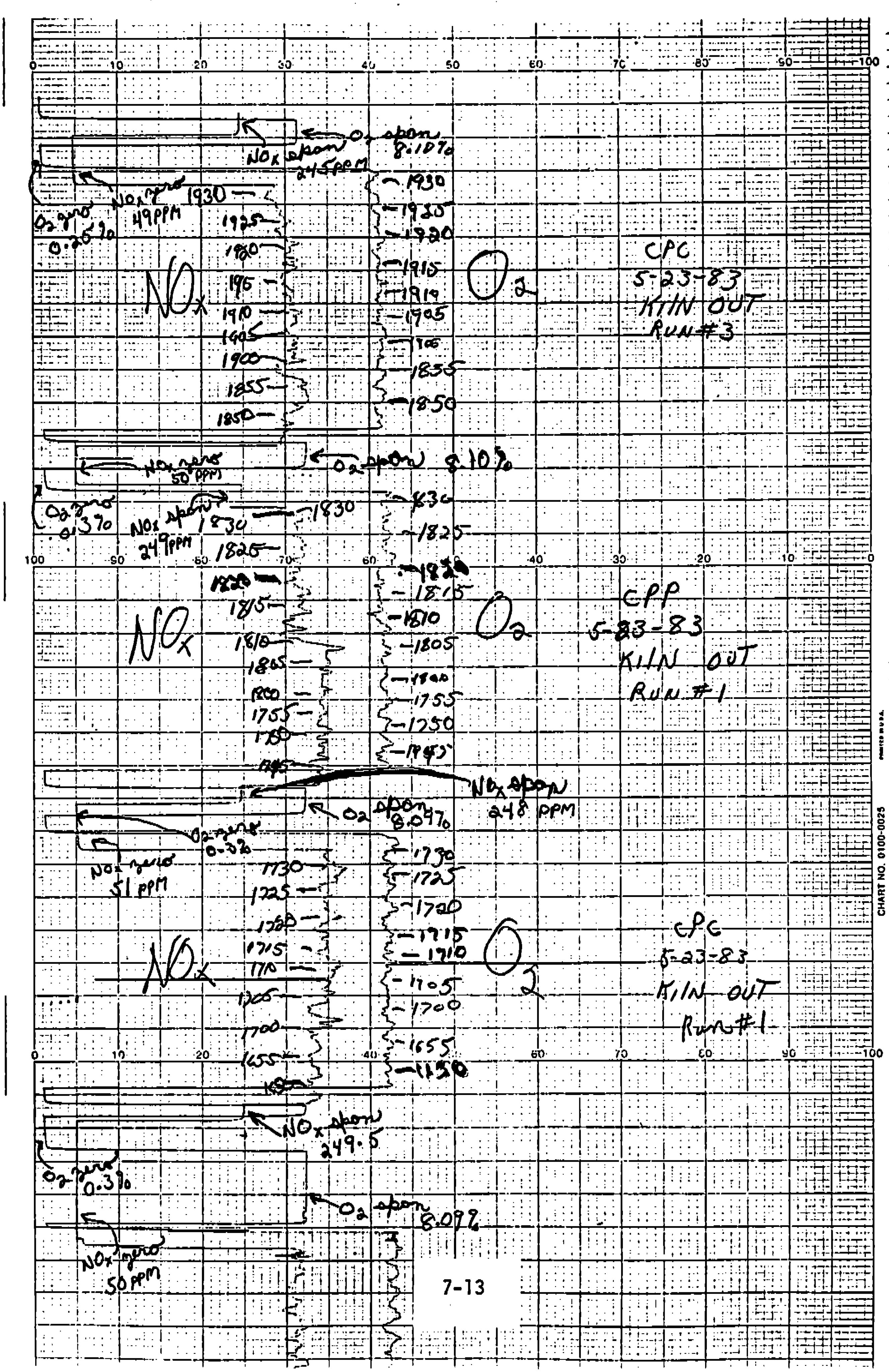
SAMPLING POINT LOCATION DATA SHEET

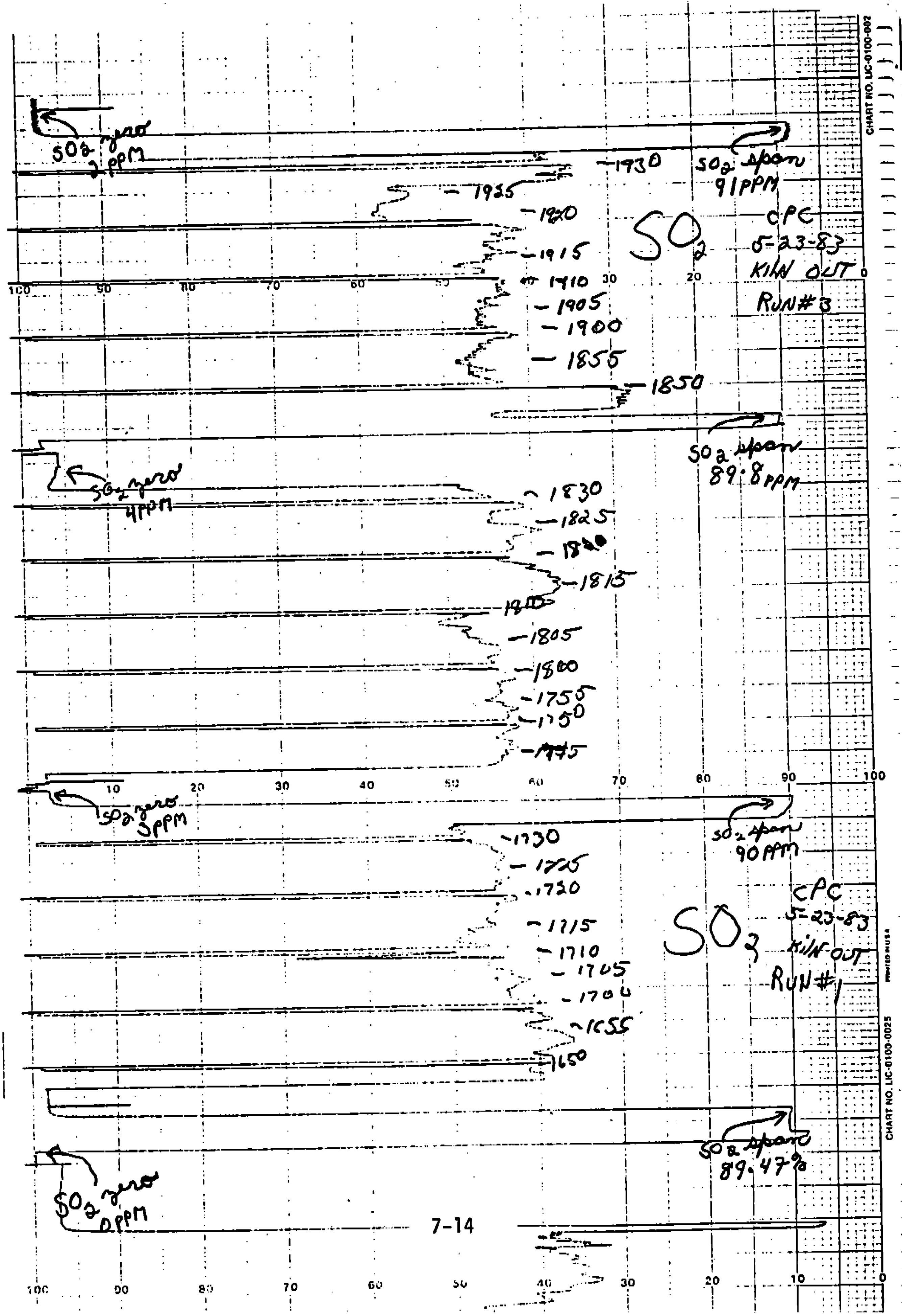
Plant California Portland
Date 5/24/83
Test Location Crusher Baghouse
Upstream Dist./Dia. 56"/ 1.3∅
Downstream Dist./Dia. 222"/5.1∅
No. of Sampling Points 36
Stack Dimension 43.5
Coupling Length 5.0

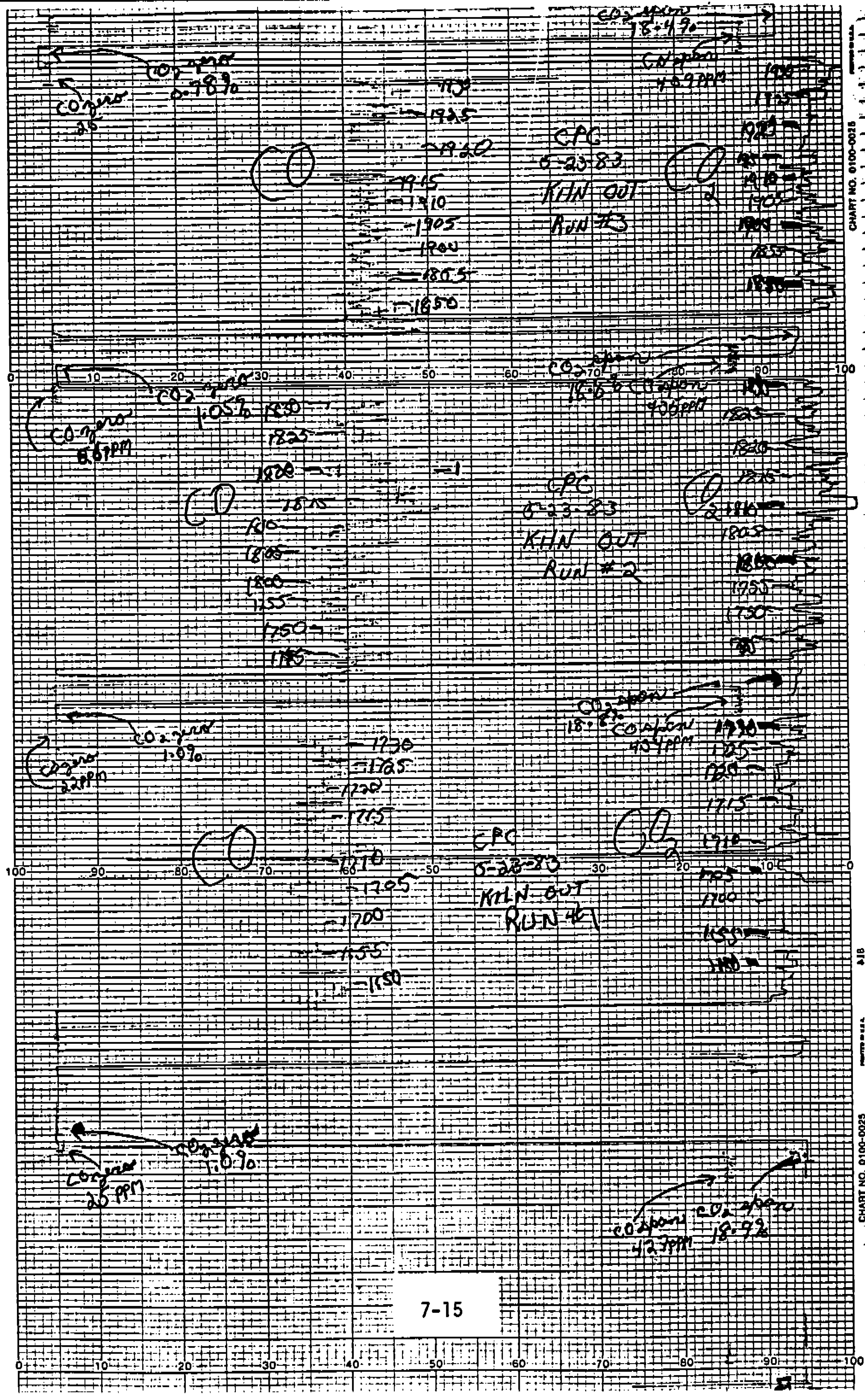


Sample Point	Dist	Sample Point	Dist	Sample Point	Dist	Sample Point	Dist
1	5.6	13	40.3				
2	6.9	14	42.1				
3	8.3	15	43.8				
4	9.7	16	45.2				
5	11.4	17	46.6				
6	13.2	18	47.8				
7	15.3						
8	17.9						
9	21.6						
10	31.9						
11	35.6						
12	38.2						

SAMPLING POINT RELOCATION: #1 → 6.0
#18 → 47.0


O2 span 8.10%
NOx span 245 PPM
NOx zero 49 PPM
O2 zero 0.25%
NOx
O2
CPC
5-23-83
KILN OUT
RUN #3
NOx zero 50 PPM
O2 span 8.10%
O2 zero 0.3%
NOx span 249 PPM
NOx
O2
CPP
5-23-83
KILN OUT
RUN #1
NOx span 248 PPM
O2 span 8.09%
O2 zero 0.3%
NOx zero 51 PPM
NOx
O2
CPC
5-23-83
KILN OUT
Run #1
NOx span 249.5
O2 zero 0.3%
O2 span 8.09%
NOx zero 50 PPM
CHART NO. 0100-0025


SO2 zero 2 ppm
SO2 span 91PPM
-1930
-1925
-1920
-1915
-1910
-1905
-1900
-1855
-1850
SO2
CPC
5-23-83
KILN OUT
RUN#3
SO2 span 89.8 ppm
SO2 zero 4PPM
-1830
-1825
-1820
-1815
1810
-1805
-1800
-1755
-1750
-1745
SO2 zero 3ppm
SO2 span 90PPM
-1730
-1725
-1720
-1715
-1710
-1705
-1700
-1655
1650
SO2
CPC
5-23-83
KILN OUT
RUN#1
SO2 span 89.47%
SO2 zero 0PPM
CHART NO. LIC-0100-002
CHART NO. LIC-0100-0025
100
90
80
70
60
50
40
30
20
10
0



CO_2 span 18.4%
CO_2 zero 0.78%
CO zero 25
CO span 439 PPM
CO
CO_2
CPC
5-23-83
KILN OUT
RUN #3
1930
1925
1920
1915
1910
1905
1900
1855
1850
CO_2 span 18.6%
CO_2 zero 1.05%
CO span 436 PPM
CO zero 8.6 PPM
CPC
5-23-83
KILN OUT
RUN #2
1830
1825
1820
1815
1810
1805
1800
1755
1750
1745
CO_2 span 18.8%
CO_2 zero 1.0%
CO zero 22 PPM
CO span 434 PPM
CPC
5-23-83
KILN OUT
RUN #1
1730
1725
1720
1715
1710
1705
1700
1655
1650
CO_2 zero 1.0%
CO zero 25 PPM
CO span 427 PPM
CO_2 span 18.9%
0
10
20
30
40
50
60
70
80
90
100
CHART NO. 0100-0025

Pape & Steiner Environmental Services

PLANT California Portland (Mojave) TEST TYPE M5 FIELD TEST DATA SHEET (Page 1 of 3)

Date 5/25/83
Test Location Crusher
Run Number 1
Stack Diameter 43.5
Operator JS
Filter No. 10-392

Barometric Pressure 26.30
Static in. wg. -9.0
Probe Type/Length glass/4'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9863
Nozzle No./Size 1350/.1731

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100ml. DI	542.8	534.1	8.7
100ml. DI	553.8	548.6	5.2
dry	437.5	436.7	0.8
S.G.	680.6	670.6	10.0
		Total	24.7

Gas Composition			
Time	CO_2	O_2	CO
	0	20.9	

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	Gas Meter Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
A 1	8:12 0	1.60	1.48	117.248	66	250	255	57	77	78	6.5	1.265	pitot ok
2		1.60	1.48	118.100	66	250	256	56	80	78	6.5	1.265	K= 100s.554
3	4	1.60	1.49	120.160	65	265	256	55	81	79	6.5	1.265	KNO= .903
4		1.60	1.49	121.650	65	270	257	52	81	79	6.5	1.265	
5	8	1.60	1.49	123.150	66	270	257	51	83	80	6.5	1.265	
6		1.50	1.39	124.620	67	274	256	52	84	81	6.0	1.225	
7	12	1.40	1.30	126.065	66	265	257	51	85	81	6.0	1.183	stop @ 8:27 - down
8		1.20	1.12	127.473	72	273	255	47	88	88	5.5	1.095	restart @ 9:00
9	16	1.20	1.13	128.820	68	275	255	46	89	88	5.5	1.095	
10		1.40	1.32	130.120	67	275	256	45	90	88	6.0	1.183	
11	20	1.50	1.41	131.500	67	275	257	44	90	89	6.0	1.225	
12		1.50	1.41	132.935	67	269	254	44	91	89	6.0	1.225	
13	24	1.60	1.51	134.370	67	261	257	43	91	89	6.5	1.265	
14		1.60	1.50	135.865	68	255	257	43	91	89	6.5	1.265	
15	28	1.60	1.61	137.500	68	248	257	44	91	89	6.5	1.265	
16		1.65	1.54	138.840	71	240	256	44	92	89	6.5	1.285	
17	32	1.50	1.40	140.345	73	235	256	44	92	89	6.0	1.225	

Pape & Steine. Environmental Services

PLANT California Portland (Mojave) TEST TYPE M5 FIELD TEST DATA SHEET (Page 2 of 3)

Date 5/25/83
Test Location Crusher
Run Number 1
Stack Diameter 43.5
Operator JB
Filter No. 10-392

Barometric Pressure 26.30
Static in. wg. -9.0
Probe Type/Length glass/4'
Pitot Coefficient 0.84
Meter Box No./γ 446/.9863
Nozzle No./Size 1350/.1731

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	Gas Meter Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
18		1.85	1.72	141.810	74	233	256	44	92	89	7.0	1.360	
	36			143.393									
B1	0	1.75	1.65	143.393	67	235	256	44	89	90	6.5	1.323	
2		1.75	1.66	144.950	65	245	253	43	92	90	6.5	1.323	
3	4	1.65	1.56	146.500	65	246	252	43	93	90	6.5	1.283	
4		1.80	1.71	148.050	64	248	251	42	93	90	7.0	1.342	
5	8	1.80	1.71	149.100	65	249	250	42	93	90	7.0	1.342	
6		1.60	1.52	151.200	65	248	247	44	94	91	6.5	1.265	
7	12	1.50	1.43	152.850	64	247	251	45	94	91	6.5	1.225	
8		1.55	1.48	154.265	64	244	251	46	94	91	6.5	1.245	
9	16	1.55	1.48	156.000	63	245	251	46	94	91	6.5	1.245	
10		1.30	1.24	157.240	63	252	240	49	94	91	6.0	1.140	
11	20	1.30	1.24	158.640	64	253	249	48	94	91	5.5	1.140	
12		1.30	1.24	160.000	65	255	251	48	95	92	5.5	1.140	
13	24	1.40	1.33	161.360	65	258	250	48	95	92	6.0	1.183	
14		1.50	1.42	162.750	67	259	252	50	95	92	6.0	1.225	
15	28	1.60	1.52	164.200	68	260	253	50	96	93	6.5	1.265	

Pape & Steiner Environmental Services

PLANT California Portland (Mojave) TEST TYPE M5 FIELD TEST DATA SHEET (Page 2 of 3)

Date 5/25/83
Test Location Crusher
Run Number 1
Stack Diameter 43.5
Operator JB
Filter No. 10-392

Barometric Pressure 26.30
Static in. wg. -9.0
Probe Type/Length glass/4'
Pitot Coefficient 0.84
Meter Box No./γ 446/.983
Nozzle No./Size 1350/.1731

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

Gas Composition			
Time	CO_2	O_2	CO

Leak Rate	cfm	"Hg
Initial		
Final	0.004	8

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
16		1.50	1.41	165.695	73	260	253	50	96	93	6.5	1.225	
17	32	1.65	1.54	167.165	78	260	254	51	96	93	6.5	1.285	
18		1.40	1.31	168.680	78	265	254	51	97	94	6.5	1.183	pitot ok
	36			170.146									
			1.45	52.898	67.39				89.46			1.2389	

7-18

1	12.8
2	27.2
3	48.0

SAMPLING POINT RELOCATION: none

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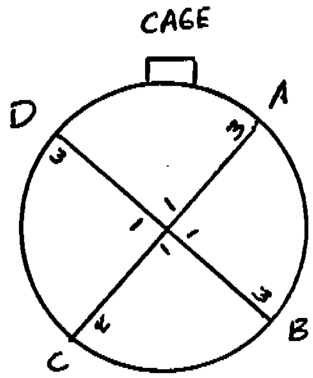
SAMPLING POINT LOCATION DATA SHEET



Plant California Portland (Mojave)

Date 5/26/83

Test Location Clinker Baghouse

Upstream Dist./Dia. 296" / 2.1 ∅

Downstream Dist./Dia. 1110" / 8.0 ∅

No. of Sampling Points 12

Stack Dimension 139.5

Coupling Length 6.75

Sample Point	Dist	Sample Point	Dist	Sample Point	Dist	Sample Point	Dist
1	12.8						
2	27.2						
3	48.0						

SAMPLING POINT RELOCATION: none

Pape & Steiner Environmental Services

PLANT california Portland (MOJAVE) TEST TYPE M5 FIELD TEST DATA SHEET (Page 1 of 1)

Date 5/26/83
Test Location Clinker Bagh.
Run Number 1
Stack Diameter 139.5
Operator JS
Filter No. 10-402

Barometric Pressure 26.30
Static in. wg. -0.44
Probe Type/Length SS/10'
Pitot Coefficient 0.84
Meter Box No./Y 446/.9863
Nozzle No./Size 563/.267

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100ml. DI	564.9	567.3	-2.4
100ml. DI	549.7	548.0	1.7
dry	453.8	452.9	0.9
S.G.	683.4	671.3	12.1
		Total	12.3

Gas Composition			
Time	CO_2	O_2	CO
	0	20.9	

Leak Rate	cfm	"Hg
Initial	0.014	15
Final	0.012	11

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	9:06 0	0.53	2.08	276.828	258	229	249	66	79	79	9.0	0.728	pitot ok
2	5	0.50	1.99	281.210	253	273	253	57	83	79	9.0	0.707	
3	10	0.45	1.79	285.875	255	274	256	58	85	81	8.0	0.671	
	15			289.713									
B 1	9:46 0	0.48	1.88	289.713	270	225	248	61	87	88	8.0	0.693	
2	5	0.46	1.81	293.900	270	225	247	52	92	87	7.5	0.678	
3	10	0.41	1.63	298.045	267	258	248	54	94	90	7.0	0.640	
	15			302.037									
C 1	10:13 0	0.52	2.02	302.037	291	225	247	60	98	98	8.0	0.721	
2	5	0.57	2.20	306.375	300	247	248	50	102	99	9.0	0.755	
3	10	0.56	2.16	310.960	302	249	235	53	103	100	9.5	0.748	
	15			315.631									
D 1	10:39 0	0.67	2.58	315.631	307	225	250	64	103	104	10.0	0.819	
2	5	0.63	2.45	320.620	302	232	252	61	106	104	10.0	0.794	
3	10	0.53	2.08	325.530	295	264	253	65	106	105	8.5	0.728	pitot ok
	15			330.140									
			2.06	53.312	280.83				93.92			0.7235	

Pape & Steiner Environmental Services

PLANT California Portland (Mojave) TEST TYPE M5 FIELD TEST DATA SHEET (Page 1 of 1)

Date 5/26/83
Test Location Clinker Bagh.
Run Number 2
Stack Diameter 139.5
Operator JS
Filter No. 10-403

Barometric Pressure 26.30
Static in. wg. -0.44
Probe Type/Length ss/10'
Pitot Coefficient 0.84
Meter Box No./ϒ 446/.9863
Nozzle No./Size 563/.267

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100ml. DI	541.2	548.2	-7.0
100ml. DI	537.9	536.1	1.8
dry	436.8	435.5	1.3
S.G.	692.0	680.8	11.2
		Total	7.3

Gas Composition			
Time	CO_2	O_2	CO
	0	20.9	

Leak Rate	cfm	"Hg
Initial	0.014	15
Final	0.01	12.5

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
D 1	12:18 0	0.65	2.58	330.839	278	225	231	50	99	102	8.5	0.806	pitot ok
2	5	0.63	2.52	335.795	275	244	248	46	102	101	9.0	0.794	
3	10	0.52	2.10	340.730	270	237	251	47	103	101	7.5	0.721	
	15			345.386									
C 1	12:45 0	0.61	2.44	345.386	277	275	241	53	101	103	8.5	0.781	
2	5	0.60	2.38	350.220	265	261	232	52	105	102	8.5	0.775	
3	10	0.50	1.99	355.040	283	267	228	50	106	103	7.5	0.707	
	15			359.549									
B 1	1:12 0	0.58	2.34	359.549	274	275	225	60	104	107	8.0	0.762	
2	5	0.58	2.33	364.320	279	270	246	58	108	107	8.5	0.762	
3	10	0.50	2.01	369.130	261	268	252	53	109	107	7.5	0.707	
	15			373.673									
A 1	1:43 0	0.62	2.48	373.673	283	231	246	57	106	107	8.0	0.787	
2	5	0.59	2.34	378.375	291	272	253	55	110	107	8.5	0.768	
3	10	0.51	2.02	383.150	292	260	248	54	110	107	7.5	0.714	pitot ok
	15			387.733									
			2.29	56.894	280.67				104.88			0.7570	

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PLANT *California* TEST TYPE *M5* FIELD TEST DATA SHEET (Page *1* of *1*)

Portland (Mojave)

Date *5/26/83*

Test Location *Clinker Bagh*

Run Number *3*

Stack Diameter *139.5*

Operator *JS*

Filter No. *10-404*

Barometric Pressure *26.30*

Static in. wg. *-0.44*

Probe Type/Length *SS/10'*

Pitot Coefficient *0.84*

Meter Box No./γ *446/.9663*

Nozzle No./Size *563/.267*

Impinger Volumes/Weights			
Contents	Final	Initial	Net
100ml DI	541.5	547.5	-6.0
100ml DI	538.7	537.9	0.8
dry	438.0	436.8	1.2
S.G.	702.2	692.0	10.2
		Total	6.2

Gas Composition			
Time	CO_2	O_2	CO
	0	20.9	

Leak Rate	cfm	"Hg
Initial	0.016	15
Final	0.007	11.5

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	4:00 0	0.55	2.20	388.682	292	225	225	56	115	116	7.5	0.742	pitot ok
2	5	0.54	2.14	393.280	298	252	247	50	113	113	7.5	0.735	
3	10	0.53	2.10	397.880	296	236	248	54	113	113	7.5	0.728	
	15			402.358									
B 1	4:25 0	0.51	2.04	402.358	289	275	249	57	111	112	7.5	0.714	
2	5	0.51	2.03	406.750	294	254	259	54	112	112	7.5	0.714	
3	10	0.44	1.74	411.150	296	248	257	56	113	112	7.0	0.663	
	15			415.350									
C 1	4:51 0	0.56	2.21	415.350	297	275	242	65	111	111	8.0	0.748	
2	5	0.58	2.27	420.030	304	241	250	54	113	111	8.5	0.762	
3	10	0.57	2.21	424.680	312	249	247	57	114	111	8.5	0.755	
	15			429.381									
D 1	5:16 0	0.68	2.62	429.381	317	275	246	57	111	113	9.5	0.825	
2	5	0.67	2.60	434.440	312	275	246	50	111	112	9.5	0.819	
3	10	0.58	2.25	439.435	311	275	248	53	110	111	9.0	0.762	pitot ok
	15			444.293									
			2.20	55.611	301.60				112.21			0.7471	

SECTION 8

QUALITY ASSURANCE

8.1 PARTICULATE SAMPLING EQUIPMENT

A detailed record of repair and maintenance to each sampling system 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.

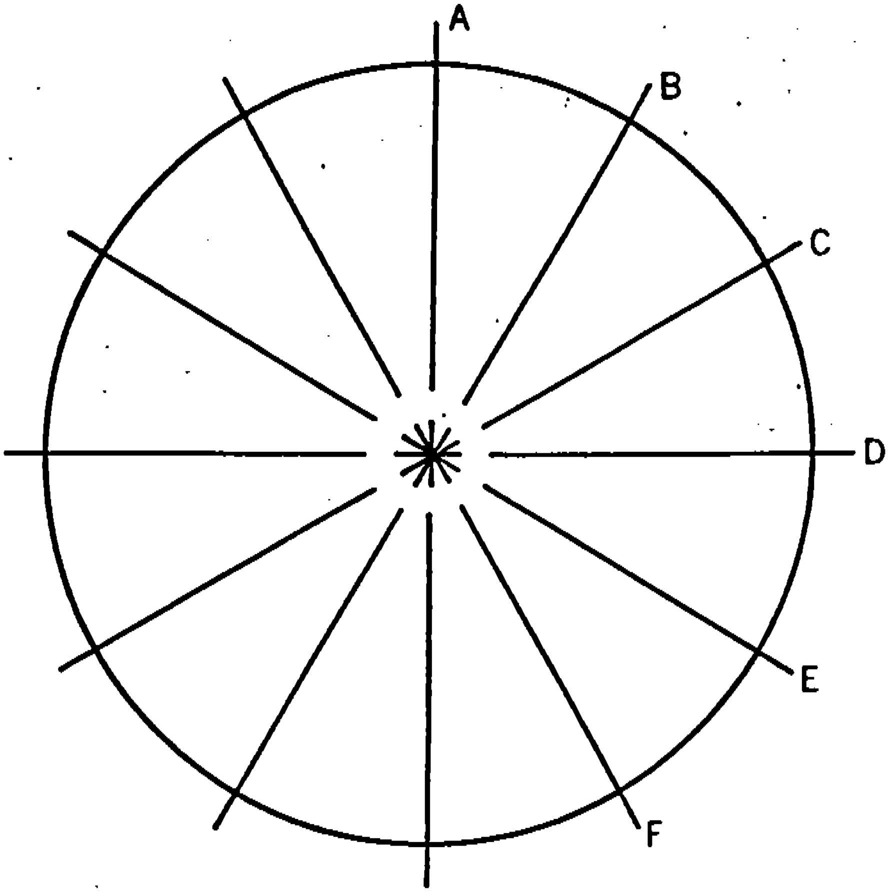
All reagents used in the field and in the laboratory are ACS reagent grade and blanks of these reagents are evaluated for every set of tests. Blanks are taken in the field from the squeeze bottles and not the original container. Records are kept on these blanks to insure consistent quality of the reagents. 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. Records of our lab's participation in the EPA semiannual audits for SO_2 are kept on file and verify our in-house QA/QC efforts.

8.3 CONTINUOUS MONITORS

The NO_x and SO_2 analyzers are calibrated before and after each test using an EPA Protocol 1 gas ($\pm$ 1 percent) traceable to NBS. The CO, CO_2, and O_2 analyzers are calibrated before and after each test using a certified gas mixture ($\pm$ 2 percent). The calibration certificates for the gases used on this test program appear at the end of this section.

Pape & Steiner Environmental Services

NOZZLE CALIBRATION DATA



DIAMETER (in.)

A 0.1725

B 0.1730

C 0.1730

D 0.1740

E

F

AVG. 0.1731

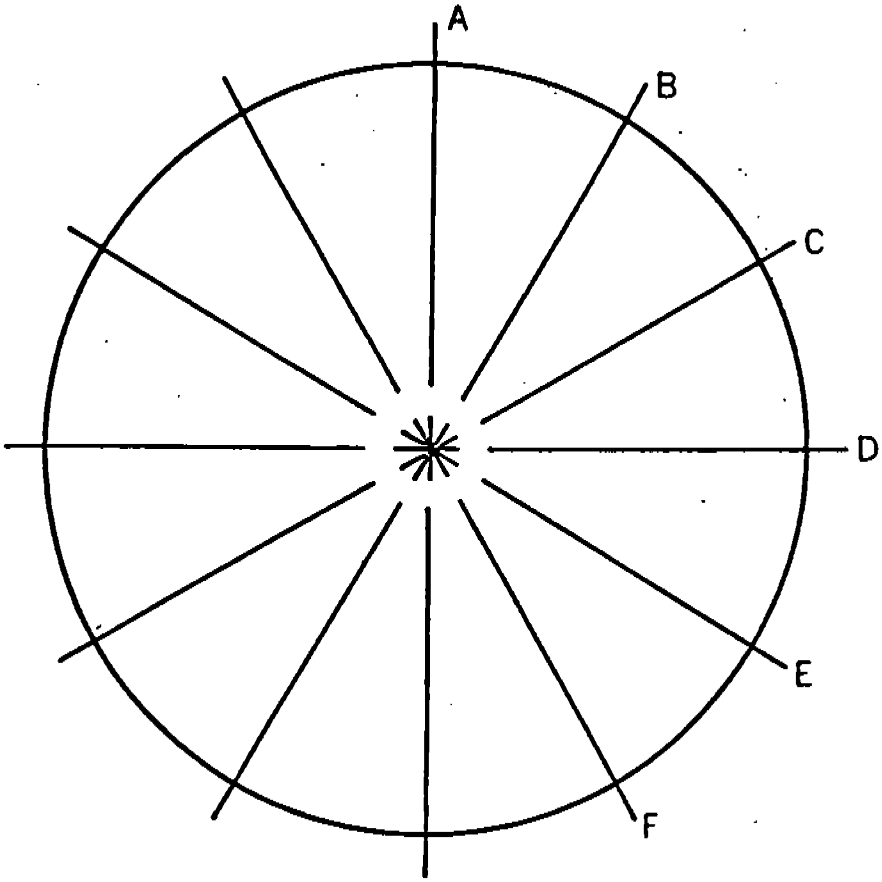
DATE Jan 19, 1983

NOZZLE NO. 1350

OPERATOR JS

Pape & Steiner Environmental Services

NOZZLE CALIBRATION DATA



DIAMETER (in.)

A .266

B .266

C

D .268

E .266

F

AVG. .267

DATE 6-5-82

NOZZLE NO. 563

OPERATOR RAD

Pape & Steiner Environmental Services

DRY GAS METER/ORIFICE METER CALIBRATION DATA

Date Mar. 20, 1983 Dry Gas Meter No. 39009

Barometric Pressure, in. Hg 29.56 Standard Test Meter No. 69279

Meter Box No. 446 Operator JS

Standard Test Meter			Meter Box						
Pres. ΔH_s ("Wg)	Temp. T_s (^oF)	Volume Vs (Ft^3)	Pres. ΔH_s ("Wg)	Temp. Td_i (^oF)	Temp. Td_o (^oF)	Volume V_d (Ft^3)	Time (min)	γ	K_o
	54	792.022		71	72	743.513			
-1.1	50	776.315	0.5	72	73	726.994	40	0.9841	0.7298
	52	15.707		72		16.519			
	56	814.575		74	73	767.052			
-1.7	55	798.753	1.0	71	72	750.536	29	0.9829	0.7107
	55.5	15.822		72.5		16.516			
	56	831.637		76	74	784.804			
-2.4	56	818.317	1.5	74	73	770.940	20	0.9851	0.7066
	56	13.320		74.25		13.864			
	57	855.056		78	75	809.051			
-3.1	57	836.518	2.0	76	74	789.860	24	0.9884	0.7073
	57	18.538		75.75		19.191			
	58	876.053		81	76	830.677			
-4.3	57	859.952	3.0	79	75	814.097	17	0.9909	0.7051
	57.5	16.101		77.75		16.580			
			4.0						

Average 0.9863 0.7119

Std.Dev. 0.0033 (0.3%) 0.0102 (1.4%)

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

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

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

Td_i = Meter box inlet temperature

Td_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 Environmental Technology Inc.

Plumsteadville, PA 18949
(215) 766-8861

Troy, MI 48084
(313) 589-2950

San Bernardino, CA 92411
(714) 887-2571

SPECIALTY GAS DIVISION

Date: 4-28-93
Our Project No.: 41108
Your P.O. No.: SP3498

Pape and Steiner
5801 Noris Rd
Bakersfield, Calif 93308

ATTN: Sue Powers

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. AAL5246 Analytical Accuracy ±1%

Component	Concentration
NITRIC OXIDE	197.6 PPM
NOX	199.5 PPM
NITROGEN	BALANCE

Cyl. No. Analytical Accuracy

Component	Concentration

Cyl. No. Analytical Accuracy

Component	Concentration

Cyl. No. Analytical Accuracy

Component	Concentration

Analyst

Approved By [signature]

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

Date Shipped 8-5-82
Our Project No: 48275
Your P.O. No: SP3424
Page 1 of 1

PAPE & STEINER ENVIRONMENTAL
5801 NORRIS ROAD
BAKERSFIELD, CA. 93308

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*
(Concentrations are in mole % or ppm)

Cylinder Number AAL1254 Certified Accuracy 1 % NBS Traceable Analysis Dates: First 7-29-82 Last 8-5-82

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND
SULFUR DIOXIDE	89.47 PPM	2-5-83	N.D.I.R.	SRM#1694	89.44 PPM	89.50 PPM
NITROGEN	BALANCE					

Cylinder Number ______ Certified Accuracy ______ % NBS Traceable Analysis Dates: First ______ Last ______

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No: 2

Analyst ______ Approved By James 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.

Scott Environmental Technology Inc.

Plumsteadville, PA 18949 (215) 766-8861 · Troy, MI 48084 (313) 589-2950 · San Bernardino, CA 92411 (714) 887-2571

SPECIALTY GAS DIVISION

Date: 4-12-83
Our Project No.: 40927
Your P.O. No.: JS3481

PAPE AND STEINER
5801 NORRIS RD
BAKERSFIELD, CALIF. 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. AAL4146 Analytical Accuracy ±2%

Component	Concentration
CARBON MONOXIDE	402.2 PPM
CARBON DIOXIDE	17.94%
OXYGEN	8.09%
NITROGEN	BALANCE

Analyst

Approved By

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

[illegible]