Background Report Reference

AP-42 Section Number: 11.6

Background Chapter: 4

Reference Number: 39

Title: Test Report of Kiln Exhaust Emissions from Southwestern Portland Cement Company, Kilns Nos. 5 and 8 at the Victorville Plant and Kiln No. 1 at the Black Mountain Plant

Truesdail Laboratories, Inc.

Truesdail Laboratories, Inc.

September 1980

Victorville 5 + 8 coal (wet) Black Mtn #1 coal-coke (dry)

REPORT

AP-42 Section 11.6
Reference No. 1560
Report Sect. 4
Reference 39

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH - DEVELOPMENT - TESTING

4101 N. ..... EET
LOS ANGELES 90065
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Southwestern Portland Cement Company
Post Office Box 937
Victorville, California 92352
ATTN: Mr. Douglas MacIver

DATE December 5, 1980

RECEIVED September 5, 1980

LABORATORY NO. 33700

SAMPLE Kiln exhaust from Kilns No. 5 and 8 in Victorville plant and one kiln exhaust at Black Mountain Plant. 2 #1 Kilns

Copy to APCD T. Uptegrove 7/3/84

INVESTIGATION

Sampling and analysis for sulfur oxides (SO_x), nitrogen oxides (NO_x) and carbon monoxide (CO) in Kiln exhausts.

RESULTS

On October 9, 1980, representatives of Truesdail Laboratories, Incorporated, conducted kiln exhaust emissions tests at two Southwestern Portland Cement Company Plants: Victorville plant, kilns No. 5 and No. 8, Black Mountain plant, single kiln. The tests were made to determine SO_x, NO_x and CO concentrations, and emission rates of SO_x and NO_x.

Flue gas flow rates on the kilns No. 5 and No. 8 were determined by a standard velocity traverse measurement. In both cases, the flue gas samples were taken from the ducts, and the flow rate could be determined by this method.

The Black Mountain kiln exhaust samples were taken from the baghouse. There was no confined flow (in a duct or a stack), since the baghouse was emitting directly into atmosphere. Here the flue gas flow rate was determined from the coal feed rate, coal ultimate analysis, and flue gas analysis. The calculation sheet is submitted in the appendix of this report.

SO_x sampling was conducted over a 30 minute period. The sampling train consisted of an in-stack filter (alundum thimble) and a set of chilled impingers. The first impinger contained 80% isopropyl alcohol (100 ml), followed by two impingers with 100ml each of 3% hydrogen peroxide, the fourth impinger was empty, with a thermometer in it. The glass fiber filter was used between the first and second impinger.

Ref # 7 & 22

Kilns # 5 & 8 in Victorville
- long dry

Kiln # 1 from Blk. Mt.
Lost

Single run samples
for Kilns # 5 & 8. Not usable
as well as
Blk Mt

One run only

Data not used
by Dennis. But
FB used it.

NO_x and Co were determined on an integrated flue gas sample collected in a Tedlar bag. Phenoldisulfonic (PDSA) acid method was used for NO_x determinations. Three flasks of flue gas were collected for each test. CO_2 and O_2 were determined on the gas phase of each of the sample flasks by an Orsat analysis and CO was determined by gas chromotagraphy.

The SO_x determinations on the sample collections was made by a barium titrations (EPA method 8).

The results were as follows:

Victorville Plant

	Kiln #5	Kiln #8
Testing Time: Start	1311	1432
Finish	1341	1502
Barometric Pressure, IN Hg	26.15	26.15
Flue Gas: Temperature, °F	632.	445.
Velocity, Ft/Sec	63.8	44.4
Static Pressure, IN H_2O	-4.0	-5.0
Flue Dimensions, inches	60 x 47.75	60 x 84.75
Flue Area, Sq. Ft.	19.90	35.3
Gas Volume: CFM	76,180	94,040
SCFM	31,400	46,600
DSCFM	23,000	36,620
Water Vapor, % (by vol.)	26.7	21.4
Sulfur Oxides (SO_x)		
Concentration, ppm (dry)		
Sulfates (as SO_2)	4	4
Sulfur Dioxide (SO_2)	354.	118.
TOTAL:	358.	122.
Emission Rate, Lbs/Hour (as SO_2)	83.4	45.3
Nitrogen Oxides (NO_x)		
Concentration, ppm (dry)	1081	681
	1073	700
	1076	689
Avg:	1077	690
Emission Rate, Lbs/Hour (as NO_2)	180.	184.
Carbon Monoxide (CO), ppm (dry)	10.	< 10
Orsat Analysis: CO_2, %	16.1	16.9
O_2, %	8.5	9.8
Clinker - Tons/hr.	10.4	16.7
Coal - Tons/hr.		4.0
Coal - BTU/lb	12,905	12,905

Black Mountain Kiln Exhaust

Coal Feed Rate, tons/hour		11.8
Testing time:	Start	0931
	Finish	1001
Calculated Flue Gas Flow Rate,	DSCFH	6.65×10^6
	DSCFM	110,830 – @ 60°F
Sulfur Oxides (SO_x) Concentration, ppm (dry)		
Sulfates (as SO_2)		3.
Sulfur Dioxide (SO_2)		68.
TOTAL:		71
Emission Rate, lbs/hour (as SO_2)		79.7
Nitrogen Oxides (NO_x) Concentration, ppm (dry)		784
		762
		763
Avg:		770
Emission Rate, lbs/hour (as NO_2)		621.
Carbon Monoxide (CO, ppm (dry)		150.
Orsat Analysis:	CO_2, %	16.9
	O_2, %	9.8
Ultimate Coal Analysis:	Moisture, %	3.83
	Carbon, %	73.92
	Hydrogen, %	5.17
	Nitrogen, %	1.58
	Sulfur, %	0.63
	Ash, %	5.97
	Oxygen (by Difference), %	8.90

~ 7.35 #NO₂/T cl

130 T/hr feed x 84.5 T cl/hr

~ 7.18 T cl / T coal

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Ignas Bandziulis

Ignas Bandziulis
Supervisor, Air Pollution Testing

KF rate – 130 T/hr
Clinker – 84.5 T/hr
Coal rate – 11.8 T/hr
Coal – 13020 BTU/lb.

APPENDIX

TRUESDAIL LABORATORIES INC.

DATE: 10-9-80

Sampling Location: SOUTH W. PORTLAND CEMENT KILN #5

Static Pressure, Ps: −4.0

Test No.: 1

Barometric Pressure: 26.15

Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec
4.0 W1	.62	600	68.10		2.51	590	61.77		1.39	625	54.01
11.9 2	.68	625	71.32		.58	625	65.87		.42	635	56.05
19.9 3	.72	640	73.39		.52	635	62.37		.48	640	59.92
27.9 4	.76	630	75.40		.57	630	65.30		.56	635	64.72
35.8 5	.78	630	76.39		.52	635	62.37		.63	630	68.65
43.75 6	.66	625	70.26		.62	630	68.10		.62	635	66.10
4 1	.82	635	78.32	E 1	.23	635	41.48				
2	.65	645	69.73	2	.35	645	51.17				
3	.52	640	62.37	3	.36	650	51.89				
4	.48	635	59.92	4	.28	640	45.77				
5	.47	635	59.29	5	.30	640	47.37				
6	.51	635	61.77	6	.38	635	53.32				
			DOUG MILLER WANTS								
			OUR DATA SHEETS (XEROX COPIES								

$2.9 \times \sqrt{1092} \times .84 \times \sqrt{\frac{29.9}{25.9}} \times \sqrt{\Delta H} = 86.49 \times \sqrt{\Delta H}$

A. AVERAGE VELOCITY (TRAVERSE) ft/sec 62.5

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec

C. AVERAGE VELOCITY (REFERENCE PT.) ft/sec

D. FLUE FACTOR C/B

E. PITOT TUBE CORRECTION FACTOR .84

F. GAS DENSITY CORRECTION FACTOR 1.02

G. CORRECTED VELOCITY, AxExF, ft/sec 63.8

or, AxDxExF, ft/sec

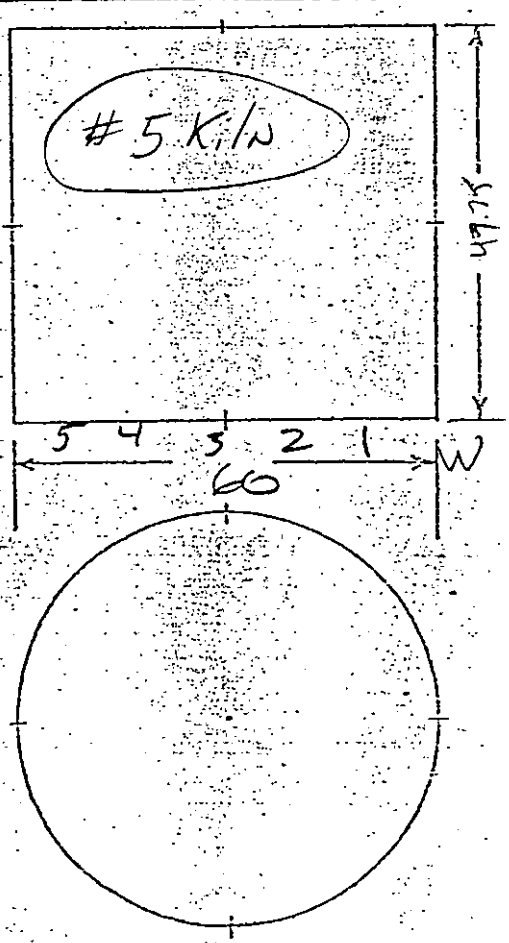
H. AREA OF FLUE, SQ. FT. 19.90

J. AVERAGE FLUE TEMPERATURE, °F 632

K. FLOW RATE, G x H x 60, CFM 76,180

L. FLOW RATE, $K \times \frac{520}{460 + J} \times \frac{BP + Ps/13.6}{29.9}$, SCFM $\frac{(26.15 - (4/13.6)}{}$ 31,400

M. FLOW RATE, L x MOISTURE CORR., DSCFM $\frac{(1 - .267)}{}$ 23,000



TRUESDAIL LABORATORIES, INC.

Date: 10-9-80

Sampling Location: Kiln #5

Barometric Pressure: 26.15

Test No. 1

Nozzle Diameter:

Time	Gas Meter 0.13 Reading cu. ft. V_m	Press. "H_2O P_m	Temp. °F IN/OUT T_m	Impinger Temp °F T_i	Sample Point	F/ **			
13:11	147.42	0.35				1376			
13:21	152.07	0.35	96/95	42		1302			
13:31	157.56	0.30	100/96	42		1409			
13:41	161.22	0.28	102/96	42					
			SO_2	Dilution, ml		500			
				aliquot, ml		10			
	Titration:		ml Ba^{++}	0.00986 N	=	19.10			
			19.10 ml	x 500/10	x 0.00986 N x	11850 µl/m eq.		= 354	ppm SO_2
				11.14 DSCF	x 28.	32 l/DSCF			
			SO_3 (as	SO_2)	Dilution, ml	250			
					aliquot, ml	25			
				ml	Ba^{++}	1.18			
					1.18 ml	x 250/25 x C =		4.4	ppm SO_2
Total	13.80					11.14 DSCF			
avg		.32	98	42					

Weight Collected, grams

H_2O_2 = 61

IPA = 24

(85) total condensate

A. Total Weight

B. Condensate Volume, ml. 85

C. Condensate Vapor Volume, $0.00267 \times \frac{450 + T_m}{B.P. - P_m/13.6} \times B$, cu. ft. 4.84

26.17

D. Total Sample Volume, $V_m + C$, cu. ft. 18.64

E. Sample Volume, $D \times \frac{520}{450 + T_m} \times \frac{B.P. - P_m/13.6}{29.9} \times$ Moisture corr., DSCF 11.14

F. Concentration, $15.43 \times A/E$, grains/DSCF

G. Stack Gas Flow Rate, DSCFM 23,030

H. Emissions, $60 \times G \times F/7000$, lbs/hr

TRUESDAIL LABORATORIES, INC.

Sampling Station Kiln #5 Date 10-9-80

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, In. Hg. (Absolute) 26.17

B. Vapor pressure of water at impinger temp., In. Hg. .268

C. Volume of metered gas, Cu. Ft. 13.80

D. Volume of water vapor metered, B X C/A, Cu. Ft. .14

E. Volume of water vapor condensed, Cu. Ft. 4.84

F. Total volume of water vapor in gas sample, D+E, Cu. Ft. 4.98

G. Total volume of gas sample, C+E, Cu. Ft. 18.64

H. Percent water vapor in sampled gas, 100 X F/G 26.72

Gas Density Correction Factor

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	.267	1.0	18.0	4.81
Carbon Dioxide	.161 Dry Basis	.733	44.0	5.19
Carbon Monoxide	Dry Basis		28.0	
Oxygen	.085 Dry Basis	.733	32.0	1.99
Nitrogen & Inerts	.754 Dry Basis	.737	28.2	15.59
			Average Molecular Weight	27.58

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.953

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.02

TRUESDAIL LABORATORIES, INC.

DATE: 10-9-80

Sampling Location: Kiln #8

Static Pressure, Ps: -5.0

Test No.: 1

Barometric Pressure: 26.15

Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec
1-1	.18	445	33.47	A-1	.24	450	38.65	1			
2	.24	445	38.65	2	.30	455	43.21	2			
3	.26	455	40.23	3	.36	465	47.33	3			
4	.24	455	38.65	4	.36	475	47.33	4			
5	.16	455	31.57	5	.32	460	44.63	5			
6	.18	455	33.47	6	.48	485	54.66	6			
7	.22	455	37.00	7	.46	475	53.51	7			
8	.32	460	44.63	8	.64	480	63.11	8			
9	.38	465	48.63	9	.46	475	53.51	9			
			2.9 x .84 x $\sqrt{.905}$			$\times\sqrt{\frac{29.0}{25+8.15}}$		$\times\sqrt{\text{V.H.}}$			
						78.89 $\times\sqrt{\text{V.H.}}$					

NOT TAKEN WAS PORT SEALED (54")

A. AVERAGE VELOCITY (TRAVERSE) ft/sec 44.0

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec

C. AVERAGE VELOCITY (REFERENCE PT.) ft/sec

D. FLUE FACTOR C/B

E. PITOT TUBE CORRECTION FACTOR .84

F. GAS DENSITY CORRECTION FACTOR 1.01

G. CORRECTED VELOCITY, AxExF, ft/sec 44.4

or, AxDxExF, ft/sec

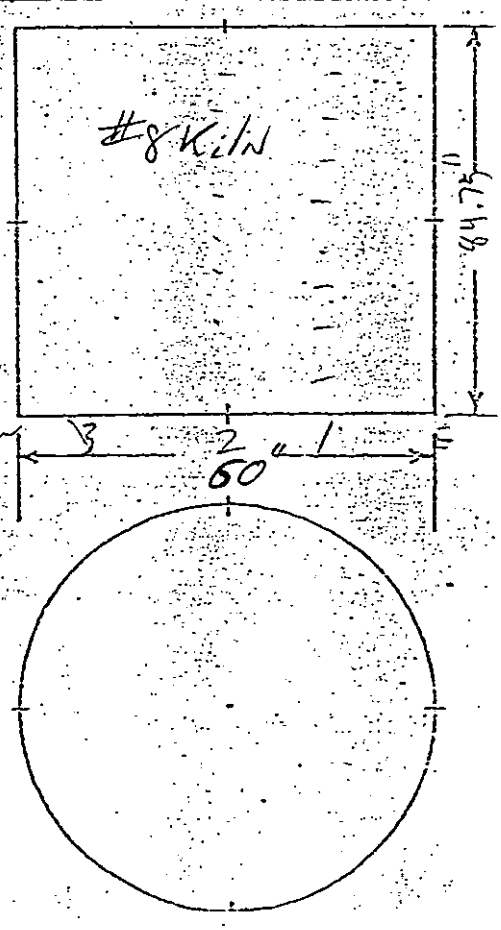
H. AREA OF FLUE, SQ. FT. 35.3

J. AVERAGE FLUE TEMPERATURE, °F 445

K. FLOW RATE, G x H x 60, CFM 94,040

L. FLOW RATE, $K \times \frac{520}{460 + J} \times \frac{BP + Ps/13.6}{29.9}$, SCFM $\frac{26.15 + (5/13.6)}{}$ 46,600

M. FLOW RATE, L x MOISTURE CORR., DSCFM (1.-.214) 36,620



TRUESDAIL LABORATORIES, INC.

Date: 10-9-80

Sampling Location: SOUTHW. PORTLAND CEMENT KILN #8

Barometric Pressure: 29.55 / 26.15

Test No. 1

Nozzle Diameter:

Time	Gas Meter Reading cu. ft. V_m	Gas Meter Press. "H_2O P_m	Gas Meter Temp. °F T_m	Impinger Temp °F T_i	Sample Point	F/#		
1432	202.84	0.32	~~—~~	~~54~~		1.400		
1442	207.26	0.26	114	54		1.373		
1452	211.02	0.23	113	64		1.317		
1502	214.60	0.23	113	56				
			SO_2, ppm		Dilution, ml		500	
					aliquot, ml		~~50~~	25
			titration, Ba^{++}		0.00986 N, ml		~~[illegible]~~	13.11
				13.11 ×	500/25 ×	0.00986N	× 11850	mg/ml =
						9.16 DSCF	× 28.32	g/DSCF
						~~[illegible]~~	~~[illegible]~~	118 ppm SO_2
			SO_3 (as SO_2)		Dilution, ml		250	
					aliquot, ml		25	
			titration, Ba^{++}		, ml		~~[illegible]~~	0.96
TOTAL	11.76				998 ×	250/25 ×	C =	~~[illegible]~~ ppm SO_3
AVG		.26	113	58		9.16 DSCF		413

Weight Collected, grams

1st Impg = 131 ml IPA
2nd = 137 ml
3rd = 82 ml
319

A. Total Weight

B. Condensate Volume, ml. 50

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + T_m}{B.P. - P_m/13.6} \times B$, cu. ft. 2.92

2617

D. Total Sample Volume, $V_m + C$, cu. ft. 14.68

E. Sample Volume, $D \times \frac{520}{460 + T_m} \times \frac{B.P. - P_m/13.6}{29.9} \times$ Moisture corr., DSCF 9.16

F. Concentration, 15.43 × A/E, grains/DSCF

G. Stack Gas Flow Rate, DSCFH

H. Emissions, 60 × C × F/7000, lbs/hr

TRUESDAIL LABORATORIES, INC.

Sampling Station Kiln #8 Date 10-9-80

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, In. Hg. (Absolute) 26.17 ~~29~~

B. Vapor pressure of water at impinger temp., In. Hg. .486

C. Volume of metered gas, Cu. Ft. 11.76

D. Volume of water vapor metered, B X C/A, Cu. Ft. .22

E. Volume of water vapor condensed, Cu. Ft. 2.92

F. Total volume of water vapor in gas sample, D+E, Cu. Ft. 3.14

G. Total volume of gas sample, C+E, Cu. Ft. 14.68

H. Percent water vapor in sampled gas, 100 X F/G 21.39

Gas Density Correction Factor

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wet Basis (Wt./Mole)
Water	.214	1.0	18.0	3.85
Carbon Dioxide	.155 Dry Basis	.786	44.0	5.36
Carbon Monoxide	Dry Basis		28.0	
Oxygen	.045 Dry Basis	.786	32.0	2.39
Nitrogen & Inerts	.750 Dry Basis	.786	28.2	16.62
			Average Molecular Weight	28.22

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = .975

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.01

Flue gas flow rate calculations

Stoichiometric combustion: 1/100 lbs coal:

	%	Mol wt	Moles	Req'd Moles O_2	Product	Moles	SCF
H_2O	3.83	18.02	0.213		H_2O	0.213	80.7
C	73.92	12.01	6.155	6.155	CO_2	6.155	2332.7
H_2	5.17	2.016	2.564	1.282	H_2O	2.564	971.9
N_2	1.58	28.016	0.056	—	N_2	0.056	21.4
S	0.63	32.07	0.020	0.020	SO_2	0.020	7.4
Ash	5.97	—	—	—	—	—	—
O_2	8.90	32.00	0.278	(−) 0.278	—	—	—
Total	100.0	—	—	7.179			3494.1

N_2 = 7.179 mols O_2 × 379 SCF/Mol × 79/21 = 9,103.5

Total combustion products: dry = 12,597.0

wet = 13,649.6

% CO_2 in Stoichiometric combustion (dry)

$\frac{2332.7 \times 100}{12,597} = 18.52\%$

O_2 by Orsat

% CO_2 in flue gas (at 9% O_2) $16.9 \times 21/21 - 9.8 = 31.69$

O_2 by Orsat

DSCF of CO_2 from reaction products:

$\frac{(2332.7 + x) \times 100}{12,597 + x} = 31.69$

$\therefore x = 2429.1$ DSCF

TOTAL DSCF / 100 lbs coal = (12,597.0 + 2429.1) = 15,026.1

COAL RATE = 11.8 tons/hour or 23,600 lbs/hour

Flue gas O_2, % = 9.8

Flue gas flow rate, DSCFH at 9.8% O_2

23,600 lbs/hour (coal) × 15,026.1 DSCF/100 lbs (coal) × 21/21 − 9.8 =

$= 6.65 \times 10^6$ DSCFH

= 110,833 DSCFM

TRUESDAIL LABORATORIES, INC.

Date: 2

Sampling Location: Black Mountain

Barometric Pressure: 25.55

Test No. 1

Nozzle Diameter: 10-9-80

Time	Gas Meter 014: Reading cu. ft. V_m	Press. "H_2O P_m	Temp. °F T_m	Impinger Temp °F T_i	Sample Point	Fl #			
9:31	186.16	0.32				1001			
9:41	191.04	0.33	85	46		1250			
9:51	195.88	0.33	87	47		1182			
10:01	200.76	0.35	89	47					
					SO_2:	Dilution, ml		500	
						aliquot, ml		25	
			Titration		0.00986N	$BaCl_2$, ml		9.60	
					ppm SO_2 =	9.60 ml × 500/25	× 0.00986 N × 11850		
						11.69 DSCF × 28.32			
Total	14.60								
Avg			87	47			= 68	ppm SO_2	

Weight Collected, grams

SO_3 (as SO_2) Dilution, ml = 250

aliquot, ml 25

Ba^{++} Titration, ml 0.91

fuel cons @ 11.8 Tons/Hr.

$$\frac{0.91 \text{ ml} \times 250/25 \times 0.00986 \times 11850}{11.69 \times 28.32} = 3.2 \text{ ppm } SO_3$$

A. Total Weight

B. Condensate Volume, ml. 39

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + T_m}{B.P. - P_m/13.6} \times B$, cu. ft. .51

25.59

D. Total Sample Volume, $V_m + C$, cu. ft. 15.11

E. Sample Volume, $D \times \frac{520}{460 + T_m} \times \frac{B.P. - P_m/13.6}{29.9} \times$ Moisture corr., DSCF 11.69

F. Concentration, 15.43 × A/E, grains/DSCF

G. Stack Gas Flow Rate, DSCFH

TRUESDAIL LABORATORIES, INC.

Sampling Station Black Mountain Date 10-9-80

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, In. Hg. (Absolute) 25.57 ~~29.55~~

B. Vapor pressure of water at impinger temp., In. Hg. .324

C. Volume of metered gas, Cu. Ft. 14.60

D. Volume of water vapor metered, B X C/A, Cu. Ft. .18

E. Volume of water vapor condensed, Cu. Ft. .51

F. Total volume of water vapor in gas sample, D+E, Cu. Ft. .69

G. Total volume of gas sample, C+E, Cu. Ft. ~~15.10~~ 15.11

H. Percent water vapor in sampled gas, 100 X F/G ~~4.63~~ 4.57 ≈ 4.6

Gas Density Correction Factor

Component	Volume Percent/100 x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	~~.0463~~ .046	1.0	18.0	.83
Carbon Dioxide	.169 Dry Basis	.954	44.0	7.09
Carbon Monoxide	Dry Basis		28.0	
Oxygen	.098 Dry Basis	.954	32.0	2.99
Nitrogen & Inerts	.733 Dry Basis	.954	28.2	19.72
			Average Molecular Weight	30.63

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 1.058

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = .972

Flue gas flow rate calculations

Stoichiometric combustion of 100 lbs coal:

	%	Mol wt	Moles	Req'd Moles O_2	Combustion products	Moles	SCF
H_2O	3.83	18.02	0.213	—	H_2O	0.213	80.7
C	73.92	12.01	6.155	6.155	CO_2	6.155	2332.7
H_2	5.17	2.016	2.564	1.282	H_2O	2.564	971.9
N_2	1.58	28.016	0.056	—	N_2	0.056	21.4
S	0.63	32.07	0.020	0.020	SO_2	0.020	7.4
Ash	5.97	—	—	—	—	—	—
O_2	8.90	32.00	0.278	(−) 0.278	—	—	—
Total	100.0	—	—	7.179			

N_2 = 7.179 moles O_2 × 379 SCF/Mole × 79/21 = 10,235.5

Total combustion products: dry 12,597.0

wet 13,649.6

% CO_2 in Stoichiometric combustion (dry):

$$\frac{2332.7 \times 100}{12,597} = 18.52\%$$

% CO_2 in flue gas (at 9% O_2):

$$\frac{18.9 \times 21}{21 - 9.8} = 31.69$$

DSCF of CO_2 from reaction products:

$$\frac{(2332.7 + x) \times 100}{12,597 + x} = 31.69$$

$$\therefore x = 2429.1 \text{ DSCF}$$

TOTAL DSCF / 100 lbs coal = (12,597.0 + 2429.1) = 15,026.1

COAL RATE = 11.8 Tons/hour or 23,600 lbs/hour

Flue gas O_2, % = 9.8

Flue gas flow rate, DSCFH at 9.8% O_2

$$23,600 \text{ lbs/hour (coal)} \times 15,026.1 \text{ DSCF/100 lbs (coal)} \times \frac{21}{21 - 9.8} =$$

$$= 6.65 \times 10^6 \text{ DSCFH}$$

$$= 110,833 \text{ DSCFM}$$

DATE 2/17/82 Southwestern Portland Cem[illegible] Co.

ACCT. CODE OR W/O NO. #11

BY D4M

SHEET NO. ____ of ____

SUBJECT Source Test Emissions - From Coal Mill Tests 1980 — Summary sheet.

REFERENCE ____

$\#/hour = (1.58 \times 10^{-7})(PPM_v \text{ Pollutant})(MW)(SDCFM)$

MW	Factor
SO_2 = 64	10.1
NO_2 = 46	7.27
CO = 28	4.42

Kiln	Clinker T/hr	SDCFM	SO_2 PPMv	SO_2 #/hr	SO_2 #/TCl	NO_x as NO_2 PPMv	NO_x as NO_2 #/hr	NO_x as NO_2 #/TCl	CO PPMv	CO #/hr	CO #/TCl
5	10.4	23000	358	83.4 ([illegible])	8.01 (~~0.80~~)	1077	180	17.3	10	1.02	0.10
6	17.7	32300	21.4	6.9	0.39	687	161	9.1	10	1.43	0.08
7	16.0	37,900	20.02	7.7 / 97.8	0.48	235	64.8	4.1	4	0.67	0.04
8	16.7	36,620	122	45.3	2.71	690	184	11.0	<10	<1.62	<.096
9	15.8	33,000	47.4	15.7 / 158.8	0.99	971	232	14.7	15	2.19	0.14
1Q	84.5	110,830	71	79.7 / 238.5	0.94	770	621	7.35	150	73.5	0.87

B.M. #1

1936 LA SC

#6 Kiln

2 - 3.25

O_2 - 2-3%

BZT = 2780

FKF - steady

SKK ~~ARH~~ - steady

Coal @ 4.0 Tph

16.7 TC/hr

#5 Kiln

~~Lift Zone~~

12.5 - 2

2520 ~~2500~~

O_2 - 2-3%

10.54 TC/hr

10/9/80

Truesdale Lab

11

S.WPC Data

DYM

10/9/80

Coal @ 11.8 T/Hr - 8:20
130 T/Hr Feed rate

QUARRY PLAFT PRODUCTION REPORT

TIME 10/09/80 08:11

	SHIFT	TODAY
ROCK ANVENTORY M TON		-23996.240
ROCK TO STORAGE, TON	297.512	4384.880
RAW MILLING, TONS		
BLACC LIMESTONE	.000	3172.251
WHITE LIMESTONE	.000	
ALVIC	.000	292.883
QUARTZITE	.000	24.602
CLAY	.000	89.021
IRON	.000	42.419
TOTAL	.000	3621.177
TONS/HOUR	.000	182.580
MILL HOURS	.000	19.833
EALL DRIVE, KWH	.000	20738.562
, HP	.000	2804.409
KF INVENTORY, TON		23433.833
X-RAY ANALYSES		
SI02	.000	22.846
AL203	.000	4.080
FE203	.000	2.949
CAO	.000	66.059
MGO	.000	4.363
C3S	.000	63.680
C3A	.000	5.826
X-RAY HRS	.000	18.416
TARGETS		
C3S	.000	64.188
AD203	.000	4.050
FE203	.000	2.950
KILN		
HOURS	1.166	24.000
CLINKER, TON	104.574	1944.992
FEED, TONS	151.547	2942.505
, TON/HR	129.897 ←	122.604
COAD,TON	13.768	280.732
,TON/HR	11.801 ←	11.697
BTU/TON, CLINKER	.000	
OXYGEN,%	1.231	1.383
FEED HOUSE,F	1067.873	1076.397
SECONDARY AIR,F	853.184	833.089
CLINKER TEMP,F	508.030	259.738
COOLER EXHAUST,F	541.478	498.786
CDANKER		
TO STORAGE,TON	97.253	1808.828
TO RAIL SCALE TON	.000	496.485
INVENTORY, E TON		356.702

QUARRY PLANT PRODUCTION REPORT

TIME 10/09/80 09:32

	SHIFT	TODAY
ROCK INVENTORY E TON		-23996.240
ROCK TO STORAGE TON	1031.410	4384.880
RAW FEADLING, TONS		
BLACK DIMESTONE	.000	3172.251
WHITE LIMESTONE	.000	
ADVIC	.000	292.883
QUARTZITE	.000	2.602
CLAY	.000	89.021
IRON	.000	42.419
TOTAL	.000	3621.177
TONS/HOUR	.000	182.580
MILL HOURS	.000	19.833
MILL DRIVE, KWH	.000	20738.562
, HP	.000	2804.409
KF INVENTORY, TON		23433.833
X-RAY ANALYSES		
SIO2	.000	22.846
AL203	.000	4.080
FE203	.000	2.949
CAG	.000	66.059
EGO	.000	4.363
C3	.000	63.680
C3A	.000	5.826
X-RAY HRS	.000	18.416
TARGETS		
C3S	.000	64.188
AL203	.000	4.050
FE203	.000	2.950
KILN		
HOURS	2.500	24.000
CLINKER, TON	225.299	1944.992
FEED, TONS	324.870	2942.505
, TON/HR	129.948 ←	122.604
COAL, TON	30.483	280.732
,TON/HR	11.800 ←	11.697
BTU/TON, CLINKER	.000	
OXYGEF,%	1.192	1.383
FEED HOUSE,F	1068.801	1076.397
SECONDARY AIR,F	868.190	833.089
CLINKER TEMP,F	192.208	259.738
COOLER EXHAUST,F	538.237	498.786
CLINKER		
TO STORAGE,TON	209.527	1808.828
TO RAIL SCALE TON	.000	496.485
INVENTORY, E TON		356.702

QUARRY PLANT PRODUCTION REPORT

TIME 10/09/80 10:15

	SHIFT	TODAY
ROCK INVENTORY E TON		-23996.240
ROCK TO STORAGE, TON	1412.377	4384.880
RAW EILLING, TONS		
BLACK LIMESTONE	.000	3172.251
WHITE LIMESTONE	.000	
ALVIC	.000	292.883
QUARTZITE	.000	24.602
CLAY	.000	89.021
IRON	.000	42.419
TOTAD	.000	3621.177
TONS/HOUR	.000	182.580
MILL @OURS	.000	19.833
MILL DRIVE, KWH	.000	20738.562
, HP	.000	2804.409
KF INVENTORY, TON		23433.833
X-RAY AFADYSES		
SI02	.000	22.846
AL203	.000	4.080
FE203	.000	2.949
CAG	.000	66.059
MGO	.000	4.363
C3S	.000	63.680
C3A	.000	5.826
X-RAY HRS	&000	18.416
TARGETS		
C3S	.000	64.188
AL203	.000	4.050
FE203	.000	2.950
KILN		
HOURS	3.250	24.000
CLINKER, TON	294.953	1944.992
FEED, TONS	422.316	2942.505
, TON/HR	129.943	122.604
COAL.TON	38.348	280.732
,TON/HR	11.799	11.697
BTU/TON, CLINKER	.000	
GXYGEN,%	1.188	1.383
FEED HOUSE,F	1068.826	1076.397
SECONDARY AIR,F	869.813	833.089
CLINKER TEMP,F	7.852	259.738
COOLER EXHAUST,F	537.463	498.786
CLINKER		
TO STORAGE,TON	274.304	1808.828
TO RAAL SCALE TON	.000	496.485
VENTORY, M TON		356.702

130 T/hr KF
≈ 85.0 T/hr

QUARRY PLANT PRODUCTION REPORT

TIME 10/10/80 07:00

For 10-9-80 T 1/11 mch

Silo = 9'

Gas Used = 0

	SHIFT	TODAY
ROCK INVENTORY M TON		-23996.240
ROCK TO STORAGE, TON	.000	2513.211
RAW MILLING, TONS		
BLACK LIMESTONE	1289.947	2704.788
WHITE LIMESTONE	11.117	11.117
ALVIC	118.803	247.913
QUARTZITE	.000	3.223
CLAY	36.432	70.211
IRON	16.055	35.270
TOTAL	1472.356	3072.523
TONS/HOUR	184.044	182.526
MILL HOURS	8.000	16.833
MILL DRIVE, KWH	16720.050	17624.160
, HP	2802.697	2807.999
KF INVENTORY, TON		23433.833
X-RAY ANALYSES		
SIO2	22.478	22.493
AL203	4.112	4.049
FE203	3.004	2.998
CAG	65.186	65.308
EGO	5.517	5.449
C3S	62.630	63.447
C3A	5.817	5.659
X-RAY HRS	7.083	15.083
TARGETS		
C3S	63.999	63.999
AD203	4.099	4.056
FE203	3.000	2.999
KILN		
HOURS	8.000	24.000
CLINKER, TON	696.947	2043.441
FEED, TONS	1020.101	3015.757
, TON/HR	127.512	125.656
COAL,TON	94.174	282.349
,TON/HR	11.771	11.764
BTU/TON, CLINKER	.000	
OXYGEN,%	1.197	1.251
FEED HOUSE,F	1076.257	1080.652
SECONDARY AIR,F	880.357	831.981
CLINKER TEEP,F	537.031	299.241
COOLER EXHAUST,F	514.589	510.765
CLINKER		
TO STORAGE,TON	648.155	1900.385
TO RAAL SCALE TON	161.403	161.403
INVENTORY, M TON		358.441

QUARRY PLANT PRODUCTION REPORT

TIME 10/09/80 15:00

	SHIFT	TODAY
ROCK INVENTORY M TON		-23996.240
ROCK TO STORAGE, TON	2513.211	2513.211
RAW BILLING, TONS		
BLACK LIMESTONE	125.371	125.371
WHITE LIMESTONE	.000	
ALVIC	10.793	10.793
QUARTZITE	1.729	1.729
CDAY	1.574	1.574
IRON	1.676	1.676
TOTAL	141.145	141.145
TONS/HOUR	169.375	169.375
MILL HOURS	.833	.833
MILL DRIVE, CWH	1824.168	1824.168
, HP	2935.452	2935.451
KF INVENTORY, TON		23433.833
X-RAY ANALYSES		
SIO2	22.451	22.451
AL203	3.697	3.697
FE203	2.722	2.722
CAG	66.463	66.463
MGG	4.964	4.964
C3S	71.225	71.225
C3A	5.194	5.194
X-RAY HRS	.666	.666
TARGETS		
C3S	63.999	63.999
AL203	3.999	3.999
FE203	3.000	2.999
KILN		
HOURS	8.000	8.000
CLINKER, TON	695.222	695.222
FEED, TONS	1039.889	1039.889
, TON/HR	129.986	129.986
COAL,TON	94.797	94.797
,TON/HR	11.849	11.849
BTU/TON, CLINKER	.000	
OXYGEN,%	1.203	1.203
FEED HOUSE,F	1074.191	1074.191
SECONDARY AIR,F	837.856	837.856
CLINKER TEEP,F	118.613	118.613
COOLER EXHAUST,F	517.815	517.815
CLINKER		
TO STORAGE,TON	646.551	646.551
TO RAAL SCAL TON	.000	
INVENTORY, M TON		357.348

#5 TYPE I-II					#6 TYPE 2.5					#7 TYPE 6.5					#8 TYPE 6.5					#9 TYPE Clay Co.				
FKF	SKN	TFH	CXO	FNG FFO	FKF	SKN	TFH	CXO	FNG FFO	FKF	SKN	TFH	CXO	FNG FFO	FKF	SKN	TFH	CXO	FNG FFO	FKF	SKN	TFH	CXO	FNG FFO
175	105	680	2.5	3.3	340	123	440	1.5	4.0	405	112	410	3.5	4.1	370	122	570	1.0	4.1	380	110	560	3.5	3.5
175	105	680	2.5	3.3	340	123	630	1.0	3.7	385	108	510	3.0	4.5	370	122	600	1.5	4.1	390	110	560	3.7	3.5
175	105	700	2.0	3.3	350	127	610	1.0	3.8	385	108	560	1.5	4.5	360	114	630	1.5	4.1	410	118	580	4.0	3.8
175	105	700	1.0	3.3	350	127	580	1.0	3.8	385	108	560	1.5	4.7	360	114	640	2.0	4.1	410	118	580	4.0	3.8
11.0	110	720	1.0	3.2	340	125	550	3.0	3.6	385	107	560	2.0	4.6	370	115	580	2.0	4.0	360	113	600	5.0	3.0
155	110	720	2.5	2.8	350	127	540	2.5	3.4						370	115	600	2.0	4.0	400	118	600	2.0	3.8
155	110	720	2.0	2.8	350	127	540	2.0	3.6	5.1	0.4	520	3.5	4.0	370	115	600	1.5	4.0	400	118	550	2.5	3.8
155	110	800	2.5	2.8	350	127	550	2.0	3.6	280	108	600	2.5	4.1	370	115	600	1.5	4.0	400	118	560	2.5	4.0
170	110	710	1.5	3.5	350	127	560	2.5	3.6	360	102	550	1.5	4.1	360	114	570	2.5	4.1	420	121	530	0.5	4.0
170	110	680	1.5	3.5	350	127	560	3.0	3.8	360	102	550	2.5	4.1	370	119	560	2.5	4.1	420	121	550	0.8	4.0
170	110	680	1.0	3.5	350	127	560	2.0	3.8	360	102	550	4.5	4.2	370	119	500	2.5	4.1	420	121	560	0.8	4.0
170		680	1.0	3.5	350	127	560	1.5	3.8	360	slow 102	550	2.5	4.5	370	119	550	1.5	4.1	420	121	560	0.8	4.0
170	110	680	1.0	3.5	350	127	560	1.5	3.8	360	slow 102	520	2.5	4.2	370	119	550	1.5	4.1	420	121	560	0.8	4.0
170	110	690	2.0	3.0	350	127	550	2.0	3.8	360	102	520	2.5	4.4	370	119	530	1.5	4.1	450	121	560	0.8	4.1
170	110	690	2.0	3.0	350	127	550	2.0	3.8	360	103	600	1.5	4.5	370	119	600	1.5	4.1	420	121	560	1.5	4.1
170	110	690	2.0	3.0	350	157	550	2.0	3.8	360	102	590	2.0	4.5	370	119	570	1.5	4.1	400	101	570	1.5	4.1
170	110	680	2.0	3.0	350	127	550	4.0	3.3	360	102	550	1.5	4.5	370	119	560	1.5	4.1	385	110	610	1.5	4.2
170	110	680	2.5	3.0	350	127	580	2.0	3.8	360	102	550	1.0	4.6	370	119	560	1.5	4.1	385	110	610	1.0	4.2
170	110	690	3.5	3.0	350	127	540	1.5	3.8	360	102	560	2.0	4.6	360	112	600	1.5	4.1	395	114	630	1.0	4.2
170	110	690	3.5	3.0	350	127	570	1.5	3.8	360	102	570	2.0	4.6	360	112	490	1.0	4.1	395	114	630	.7	4.2
170	110	680	3.5	3.0	350	127	530	1.0	3.9	360	102	670	.5	4.6	360	112	710	2.5	4.1	395	114	610	3.5	3.9
170	110	680	3.5	3.0	350	127	500	2.0	3.7	360	103	560	.5	4.6	350	112	650	2.5	3.9	395	114	610	1.3	4.1
170	110	[illegible]	2.0	3.0	330	123	530	1.5	4.0	360	102	550	.5	4.6	360	110	620	3.0	4.0	390	115	630	1.5	3.8
170	110	700	2.0	3.0	340	125	580	.5	3.9	360	102	550	1.0	4.6	360	110	600	3.0	3.9	410	130	580	2.5	3.8

	0700	1500	2300	0700	DIFF.	%	TOTALS
5 FNG							
5 FFO	0332 101	0356 733	0380 102	0404 526	72425		72.42
5 SFW	13289	14126	15588	16744	3472		253
6 FNG							
6 FFO	7799 220	7833 553	7865 432	7901 017	101817		101817
6 SFW	04095	05894	07704	09400	5305		383
7 FNG							
7 FFO	9422 576	9457 257	9494 610	9537 251	114675		114675
7 SFW	12214	13757	16437	17176	5460		394
8 FNG							
8 FFO	6078 172	6114 188	6146 765	6185 939	107767		107767
8 SFW	13914	15841	17233	19470	5556	40	401
9 FNG							16.7
9 FFO	7437 854	7472 740	7511 912	7557 166	113312		113312
9 SFW	84165	86284	88510	90110	5645	40	407
KILN	5	6	7	8	9		1138
START							
STOP							
START							
STOP							
START							
STOP							
HOURS RUN							
FEED FROM							
CLINKER TO							
DENSITY SHIFT #1							
DENSITY SHIFT #2							
DENSITY SHIFT #3							

#1 SHIFT BURNER Lee Crazy

S. on 6-7-8-9 at 8:00 AM

Tank #8 D4350 #2 Clinker bin

#7-12515 Clean Coal bin

#8-14220

#9-84747

#2 SHIFT BURNER Rip

#3 SHIFT BURNER McLaury

Started wasting dust on #8 at 11:00pm 8D screw is broken.

DAILY PRODUCTION REPORT

DATE 10-9-80

TIME	PBI	SID	TID	CXO	TFH	TCI	TPH	TCZ	FHS CTRL	FFO KWD	DUST SHP	TSA	FCA	FCB	FCZ	PUA	PUB	PUZ	TCX	FCS	STACK POS	SP/SPD	-200	A/A
0700	6.7	597	637	1.2	1070	1422	1716	2049	11.8	240	1.0	875	8.0	8.0	18.0	14.7	14.2	9.6	530	86.3	#9			
0800	6.7	596	638	1.2	1066	1417	1748	2047	11.8	240	0.2	849	8.0	8.0	18.0	14.5	13.9	9.3	510	89.8				
0900	6.8	590	641	1.1	[illegible]	[illegible]	[illegible]	2033	11.8	235	1.6	[illegible]	8.0	8.0	18.0	11.9	11.2	9.6	536	92.0				
1000	6.5	590	639	1.1	[illegible]	[illegible]	[illegible]	2010	11.8	227	1.9	873	8.0	8.0	18.0	14.7	14.1	9.6	536	91.4				
1100	6.5	578	637	0.9	[illegible]	[illegible]	[illegible]	2005	11.8	226	2.7	880	8.0	8.0	18.0	14.0	13.4	9.3	516	89.8	#11	OK LA		
1200	6.5	590	637	1.0	1071	1431	1772	1919	12.0	222	4.3	846	8.0	8.0	18.0	14.4	13.8	9.5	523	86.1				
1300	6.7	604	644	1.2	1081	1435	1780	2001	12.0	222	4.4	799	8.0	8.0	18.0	14.0	13.5	9.2	495	83.4				
1400	6.9	610	644	1.2	1083	1441	1786	2009	11.8	225	6.0	795	8.0	8.0	18.0	13.1	12.6	8.4	489	80.6		144/720		
1500	6.9	613	629	1.5	1066	1420	1773	[illegible]	11.2	242	4.2	[illegible]	8.0	8.0	18.0	14.3	13.6	7.0	[illegible]	76.0				
1600	6.7	609	627	1.3	1055	1355	[illegible]	[illegible]	12.0	240	2.3	775	8.0	8.0	18.0	13.6	13.3	9.9	523	86.7				78.8
1700	6.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11.7	157	7.4	[illegible]	8.0	8.0	18.0	12.6	12.2	7.2	405	62.0		[illegible]	83.4	78.9
1800	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12.0	240	6.7	[illegible]	8.0	8.0	18.0	14.6	14.1	9.9	545	72.3				78.8
1900	6.5	[illegible]	625	1.1	[illegible]	[illegible]	[illegible]	[illegible]	13.0	243	3.8	[illegible]	8.0	8.0	18.0	13.8	13.4	7.0	503	77.2	#9		76.0	77.2
2000	7.0	611	631	1.5	[illegible]	[illegible]	[illegible]	[illegible]	13.0	130	4.1	[illegible]	8.0	8.0	18.0	14.9	14.4	8.0	561	72.4		Coal		72.8
2100	5.6	559	626	1.4	1134	1317	[illegible]	1961	11.3	252	2.1	646	8.0	8.0	18.0	6.5	8.7	4.4	406	73.2			46.8	78.4
2200	6.3	526	620	1.7	1166	1325	1760	2041	11.6	263	3.6	746	8.0	8.0	18.0	13.6	13.2	8.5	457	52.4			75.3	78.0
2300	6.0	569	625	1.2	1089	1430	1806	2108	11.6	237	0.6	872	8.0	8.0	18.0	12.7	12.4	9.0	518	95.1				
2400	6.6	598	631	1.0	1088	1422	1772	2050	11.7	240	0.5	863	8.0	8.0	18.0	14.2	13.8	9.6	504	85.6				77.5
0100	6.6	600	633	1.2	1080	1426	1772	2028	11.7	241	0.4	873	8.0	8.0	18.0	14.5	14.0	9.6	517	89.3			COAL 82.8	77.9
0200	6.6	600	630	1.6	1090	1417	[illegible]	2086	11.8	237	0.5	860	8.0	8.0	18.0	14.3	13.8	9.4	508	86.2				78.0
0300	6.8	600	627	1.2	1082	1401	1779	2032	11.9	229	0.1	870	8.0	8.0	18.0	14.5	14.0	9.5	517	86.7	#5			78.4
0400	7.0	600	626	0.9	1070	1430	1782	2016	11.8	221	0.1	891	8.0	8.0	18.0	14.2	13.6	9.1	513	87.4				78.3
0500	6.9	600	629	1.2	1070	1439	1795	2009	11.8	221	0.1	876	8.0	8.0	18.0	14.4	13.8	9.2	521	86.8			COAL 82.4	78.1
0600	6.9	600	628	1.2	1070	1442	1802	2004	11.8	219	0.1	874	8.0	8.0	18.0	14.1	13.6	9.2	520	89.5				78.0
AVG.																								

	0700	1500	2300	0700	DIFF.	%	TC
WMLS	418299	[illegible]	448299	448389	90	.1	9.
BMLS	951920	[illegible]	953341	954651	2731	1.0	27.3
AL	401819	[illegible]	406167	407339	2440	.1	24
QUART.	54266	[illegible]	54306	54307	41	.1	4
CAL		—		—		.1	—
FE	781481	[illegible]	783291	784794	3310	.01	33
CLAY	114479	[illegible]	114802	115157	678	.1	67
DROSS	—	—		—		.01	—
FFC COAL	—	7620	19328	29075	TOTAL MIX		30
25-BC1	—	11675	19758	279947	2995	.01	295
FNG	182758	[illegible]	184476	185334	2576	1	257
35-BC1	—	[illegible]	134286	204240	2042	.01	20
35-BC4	95310	95310	95340	95395	55	1	5
35-BC5	1809959	[illegible]	1809959	1810083	124	1	12
19-BC1	243787	[illegible]	246648	246648	2864	1	286

	START	STOP	TONS		KILN	MIL
WMLS				START		
BMLS				STOP		06:0
ALVIC				START		14:0
QUART.				STOP		
CAL				START		
CLAY				STOP		
FE				HOURS RUN	24	17
DROSS				OPER. SHIFT-1	OPER. SHIFT-2	OPER. SHIFT-3
TOTAL			2864	[illegible]		Corder

	O	REMARKS #1 SHIFT	HI	LO	REMARKS #2 SHIFT	HI	LO	REMARKS #3 SHIFT
1								
2								
3								
4								

SHIFT	PPA	FPA	TPA	TFO	PFOA	PFOC	PFOT	PGA	PGC	MTPH	SILO FT	STD -200	ST A
1											06:00		
2											9'0		77
3											06:00		

TIME	WMLS	CLAY	CAL	DROSS	Al_2O_3	Fe_2O_3	C_3S	BY	REMARKS
07:20	1-3 4-6	1.25	—	—	4.1	3.0	63.0		#9 ok'ed
09:40	"	"	—	—	4.0	"	64.0	J.S.	#11 ok'ed
	1-2				4.1				#9 ok'ed

3 Tests stapled #8

#1 Black Mtn coal - coke ← Long Dry

STATE OF CALIFORNIA

GEORGE DEUKMEJIAN, Governor

AIR RESOURCES BOARD
1102 Q STREET
P.O. BOX 2815
SACRAMENTO, CA 95812

Copies to T. Knosley
W. R. McCormick
G. W. Ogle
ERMR 9/17/84

RECEIVED
SEP 4 1984

August 29, 1984

Black Mtn Kiln #1

Mr. Douglas Y. MacIver, Manager
Environmental Engineering
Southwestern Portland Cement Company
P. O. Box 937
Victorville, CA 92392

Dear Mr. MacIver:

Source Test Results

On July 25, 1984, staff of the Compliance Division of the California Air Resources Board conducted a source test of the your Victorville kiln emissions. Enclosed is a summary of the test results.

If you have any questions regarding these results, please feel free to contact Gary Zimmerman at (916) 322-2886.

Sincerely,

Robert Jenne
for

James J. Morgester, Chief
Compliance Division

Enclosure

Ref No 8-11
Dry process kilns

TABLE 1

Ref # 9
Dry Process Kiln
One run only - not useable

California Air Resources E
COMPLIANCE DIVISIO
SUMMARY OF SOURCE TEST F

SOURCE INFORMATION

VES

SOURCE NAME AND ADDRESS	SOURCE REP	NICIANS
Southwestern Portland Cement Company P. O. Box 937 Victorville, CA 92392	Douglas Y. Mgr. - Env PHONE NO.(	ker ishahn
	DEVICE TES Cement Kiln Baghouse Inlet	

OPERATING PARAMETERS:
Fuel Rate (tons/hr) - 11.6 @ 14,120 BTU/lb. - See Timesdale report 8/10/84
Fuel Coke (% wt.) - 40
Fuel Coal (% wt.) - 60
Kiln Feed Rate (tons/hr) - 125
Clinker Rate (tons/hr) - 81

PARAMETER MEASURED	TEST RESULT	REGULATORY LIMIT
Flowrate (SDCFM)*	106,430	
Oxygen (%, dry)	8.0	
Carbon Dioxide (%, dry)	21.0	
Carbon Monoxide (ppm, dry)	negligible	2,000
Sulfur Dioxide		
(ppm, dry)	0	500
(lb./hr.)	0	
Oxides of Nitrogen		3.56 #NOx/TKF
(ppm, dry)	575	
(lb./hr.)	446 - 5.5 #NOx/T CO	
		1.36 #NOx/MMBTU

*Calculated from fuel analysis and kiln feed analysis using a carbon dioxide balance.

Gary L. Zimmerman DATE 8/30/84	Fuit DATE 8/29/84	DATE
SECTION MANAGER	ENGINEER IN CHARGE	ENGINEER

BM NOX Test — 7/25/3c

w/ Truesdale - Bob Breaker - Brian McCready -

Truesdale & ARB - 10:52 ARB Time

start 1st Run 11:03 AM - BH Comp #1 -

ARB & Truesdale probes on same pitot tube - 10' above test ports

bags = Truesdale to take 30 min SO_2 - & 3 NO_x flasks

taken @ 10 min - 20 - 30 mins - ARB Continuous Monitors in

		NO_x ppm	SO_2	CO	CO_2	O_2
12:21 = 12:26 (my time)	@ 11:12 -	392	38	Negligible	14.0	11%
NOx Samples taken @	NB 08					
	11:18					
	11:31					

2nd Run - Cell # 8 - S. Side of BH.

Start @ 12:24 PM (my watch) = 420 —

@ 1237 -	400 -	45±	Neg.	17	9.5±
@ 12:52 -	466 - 433 = 482				
Last Test Flask @ 12:55 -					
@ 1:00 PM	469 - 482 = 427	63±	" - 16		9.7

3rd Run - Cell # 4 - ARB Id Line @ 1:30 - Truesdale @ 1:33 PM

	NO_x	SO_2			
To ARB - 1:35 -	323 = 287 -	36	Neg	- 16.8	9.7
Last F →					
1:37 -	373 -	37			
13 min NO_x Grab 1:45 -	420 - 460 -				

ARB - In stack - After ID fan Before BH

	NO_x - range	SO_2	CO	CO_2 -	O_2
2:55 -	560 - 710				
	600 Avg	52	Negl.	20.5 -	5.25
	537 - 664				

#1 Black Mtn coal-coke Long Dry

#9

SOUTHWESTERN PORTLAND CEMENT COMPANY

P.O. BOX 937
VICTORVILLE, CALIFORNIA 92392-0623

INTER-OFFICE CORRESPONDENCE

RECEIVED
JUL 23 1984

(619) 245-1681

To: G. W. Ogle

From: T. F. Knisley TFK

Subject: NOx Test - June 13, 1984

Date: July 20, 1984

Attached is the final report issued by Truesdail Laboratories, Inc., on the tests they ran on June 13, 1984, on the Black Mountain Kiln #1 to determine the emissions of NOx, SOx, and CO.

Briefly, these results show a substantial reduction in both NOx and SOx emissions over the similar test run on October 9, 1980. SOx emissions dropped from 79.7 Lbs/Hour (as SO_2) to 17.8 Lbs/Hour (as SO_2), and NOx emissions dropped form 621 Lbs/Hour (as NO_2) to 398 Lbs/Hour (as NO_2). This new NOx number represents a 35.9% reduction and equates to 5.17 Lbs/Ton of clinker. @ 77 T/hr clinker

Another test is currently scheduled for Wednesday, July 25, 1984, by Truesdail, using the EPA-recommended procedure (procedures in the previous test were APCD-recommended). The local APCD will observe this test, and it is my understanding that the State Air Resources Board will be present and will run concurrent tests for their own information.

I will keep you informed of further developments.

@ 125 T/hr KF: $\frac{398\ \#NO_x}{125} = 3.184\ \#NO_x/TKF$

$= 4.89\ \#NO_x/TCO$

TFK:lm
Att-
cc: D. W. Heineck
W. R. McCormick
D. Y. MacIver

125 T/hr KF @ 34.91 L.O.I = 81.36 TCO/hr
= 81.4

$\#NO_x/MMBTU = \frac{398\ \#NO_x/hr}{11.8 \times 28.2^*} = 1.20\ \#NO_x/MMBTU$

*Note! Coal-Coke BTU assumed to be 14,100 BTU/lb from 7/25/84 test.
= 28.2 mm BTU/T

Ref No 10
Dry Process(?) - listed as wet earlier
No useable data
Single run only

#1 Black Mtn coal-coke Long Dry #9

TERN PORTLAND CEMENT COMPANY

P.O. BOX 937
VICTORVILLE, CALIFORNIA 92392-0623

(619) 245-1681

RECEIVED
JUL 23 1984

From: T. F. Knisley TFK

Subject: NOx Test - June 13, 1984

Date: July 20, 1984

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$= 4.89\ \#NO_x/TCQ$

TFK:lm
Att-
cc: D. W. Heineck
W. R. McCormick
D. Y. MacIver

125 T/hr_{KF} @ 34.91 L.O.I = 81.36 TCQ/hr
= 81.4

$\#NO_x/MMBTU = \frac{398\ \#N_x/hr}{11.2 \times 28.2^*} = 1.20\ \#NO_x/MMBTU$

* Note: Coal-Coke BTU assumed to be 14,100 BTU/lb from 7/25/84 test,
= 282 mm BTU/T

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH - DEVELOPMENT - TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Southwestern Portland Cement Company
Post Office Box 937
Victorville, California 92352
Attention: Tim Knisley

DATE July 12, 1984

RECEIVED June 6, 1984

LABORATORY NO. 00258

SAMPLE Kiln Exhaust at Black Mountain

P.O. No. 8262 V

INVESTIGATION SO_x, NO_x, CO Emissions

RESULTS

On June 13, 1984 representatives of Truesdail Laboratories, Inc. conducted tests to determine the nitrogen oxides (NO_x), sulfur oxides (SO_x), and carbon monoxide (CO) emissions of the Black Mountain kiln baghouse exhaust at Southwestern Portland Cement Company in Victorville, California.

A single 60-minute sample of the baghouse exhaust (open type) was collected at a single point above the bags of a cell in the baghouse. The sampling train consisted of an in-stack glass fiber filter mounted to a stainless steel sampling probe and connected with Teflon tubing to a set of impingers containing 200 mls. of 3% hydrogen peroxide solution. The sampling probe was kept heated by the baghouse exhaust temperature (above 500°F). During the test period, three 2-liter grab samples of the flue gas were collected at the sample point, 20 minutes apart, with evacuated glass bulbs containing an NO_x absorbing solution.

Flue gas grab samples were also collected at the kiln exhaust (O_2 monitor tap), at the baghouse inlet, and at the dilution air inlets to the baghouse fan.

A sample of the coal/coke feed was subjected to ultimate analysis by ASTM methods and the results used to calculate the flue gas flow rate. The amount of dilution air and the amount of CO_2 off gas from the product were included in the calculations by using the CO_2 and O_2 values found in the baghouse exhaust samples.

Sulfur dioxide (SO_2) was determined by titration of the hydrogen peroxide collection with barium chloride solution to a thorin endpoint. Neutral sulfate was determined by titration of the filter collection in the same manner.

The grab samples were analyzed for NO_x by the phenoldisulfonic acid (PDSA) method and for carbon dioxide (CO_2) and oxygen (O_2) by Orsat. The single sample taken at the kiln exhaust was also analyzed for carbon monoxide (CO) by gas chromatography followed by methanization and flame ionization detection.

The results were as follows:

Test Results from ~~June 5, 84~~ Test. June 13 Test

Black Mountain

Production Data

Fuel Rate, tons/hr	11.8
Fuel Coal, %	60
Fuel Coke, %	40
Kiln Feed Rate, tons/hr	125
Klinker Rate, tons/hr	~~70~~ 81.4
Oxygen, %	1
Combustibles, %	0.002
I.D. Fan Damper, % open	10
I.D. Fan Speed, RPM	640
Temperatures, °F	
KILN Feed Housing	1130
Secondary Air	1300
Inlet	673

From calculation Rate of raw coal & Fuel Rate

Should be 77 T/H ~~81.4~~

Baghouse Exhaust

Flue Gas

Temperature, °F	537
Flow Rate, DSCFM*	120,600
Moisture, % by Vol.	4.8

Sulfur oxides

Neutral Sulfate, ppm	0.3
Sulfur Dioxide, ppm	14.3
Total	14.7
Emission Rate, LBS/hr (as SO_2)	17.8 →

Nitrogen oxides

Time	CO_2, %	O_2, %	NO_x, ppm dry
11:33	15.3	10.7	471
11:53	14.4	11.4	437
12:13	15.8	10.7	452
Avg.	15.2	10.9	453
Emission Rate, Lbs/hr NO_2			398

* Calculated from fuel analysis.

Baghouse Inlet

Time	CO_2, %	O_2, %	NO_x, ppm dry
10:06	19.9	8.1	516
10:07	19.6	8.6	615
10:08	18.5	8.8	533

Oxygen Monitor

Time	CO_2, %	O_2, %	NO_x, ppm dry	CO, ppm
13:25	26.2	3.4	747	9

Dilution Air Fan

	Time	CO_2, %	O_2, %	NO_x, ppm dry
Left Inlet	12:43	0.0	20.9	3
Right Inlet	12:44	0.0	21.0	3

Coal/Coke Analysis	% by Weight (dry)
Carbon	80.74
Hydrogen	5.13
Nitrogen	2.04
Sulfur	0.81
Ash	4.39
Moisture	2.34
Oxygen (by difference)	6.89

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

S. Hugh Brown

S. Hugh Brown, Supervisor
Air Pollution Testing

DATE 6-13-84 — **Southwestern Portland Cement Co.** — ACCT. CODE OR W/O NO. _____

BY TFK — SHEET NO. _____ of _____

SUBJECT TRUESDALE NO_x TEST - QUARRY KILN #1 — REFERENCE _____

1. SAMPLED DUCT BETWEEN I.D FAN & BAGHOUSE AT ~10:00 AM → NO_x, CO (3 FLASKS)
2. SAMPLED ABOVE NO. 7 COMPARTMENT OF BAGHOUSE → SO_x; NO_x, CO
   START : 11:15 AM (3 FLASKS FOR NO_x/CO)
   STOP : 12:15 PM

KILN FEED RATE	:	125 TPH
FUEL RATE	:	11.8 TPH — 60% Sunnyside Coal — 40% Pet. Coke
CLINKER RATE	:	~~~70 TPH~~ 82 T/Hr
% O_2	:	~1 %
% COMBUSTIBLES	:	~0.002 %
ID FAN DAMPER	:	10 %
ID FAN TEMP	:	673° F
KILN FEED HOUSING	:	1130° F
SECOND. AIR TEMP	:	1300° F
ID FAN SPEED	:	640 RPM
BAGHOUSE OUTLET TEMP	:	530° F

RECEIVED
JUN 15 1984

3. SAMPLED OUTSIDE AIR AT ID FAN DAMPER INLET AT ~ 12:45 PM → NO_x, CO (2 FLASKS)
4. SAMPLED PURGE LINE ABOVE O_2 ANALYSER AT ~ 1:00 PM → NO_x, CO
   NOTE : SAMPLE COLLECTED THROUGH PUMP AT O_2 ANALYSER INSTRUMENTATION CABINET. (2 FLASKS)
5. SAMPLED AT O_2 ANALYSER PROBE INLET (O_2 PROBE REMOVED) AT ~ 1:20 PM → NO_x, CO (1 FLASK)

NO_x SAMPLES COLLECTED IN EVACUATED FLASKS. COLLECTION TIME PER FLASK WAS APPROXIMATELY 15-20 SECONDS.

#1 Black mtn
Coal-coke Long Dry
Copies To: W.R. McCormick
T.F. Knisley
E. B. Thorin Jr

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Southwestern Portland Cement Co.
P. O. Box 937
Victorville, California 92532
ATTENTION: Tim Knisley

DATE August 10, 1984

RECEIVED August 2, 1984

LABORATORY NO. 00283

SAMPLE Baghouse Exhaust At Black Mountain Kiln #1

P. O. No. 8787 V

INVESTIGATION Sulfur Oxides And Nitr

#11 long Dry kiln.
CO_2 concentrations for 3 runs but flow rate and clinker rate only for avg. Hence 0 rating

RECEIVED
AUG 16 1984

On July 25, 1984 representat
conducted tests to determine the
oxides (NO_x) emissions of the bagh
facility of Southwestern Portland
California. The baghouse was of t
conducted on each of three differe samples were collected from the middle of the cell just above the bags.

Sulfur dioxide was determined with an EPA Method 8 sampling train. Each sample was collected for 30 minutes during which time three 2-liter grab samples of the flue gas were collected with evacuated glass bulbs containing an NO_x absorbing solution. The Method 8 train consisted of a heated stainless steel sampling probe connected to a heated glass fiber filter in a glass holder. The filter was followed by an impinger set, a diaphragm vacuum pump and a dry gas meter. The impinger set contained 200 ml of 80% isopropanol in the first bubbler, 100 ml of 3% hydrogen peroxide solution in each of the second and third bubblers, and the fourth bubbler was empty except for a mercury thermometer.

The peroxide solutions were analyzed for SO_2, in duplicate, by titration with barium chloride solution to a thorin indicator endpoint.

The grab samples were analyzed for NO_x by the phenoldisulfonic acid method, and for carbon dioxide (CO_2) and oxygen (O_2) by Orsat.

A sample of the coal/coke feed was subjected to ultimate analysis by ASTM methods and the results used to calculate the flue gas flow rate of the baghouse exhaust. The amount of dilution air and the amount of CO_2 off gas from the product were included in the calculations by using the CO_2 and O_2 values found in the grab samples.

#1 Black mtn
Coal-coke Long Dry
Copies To: W.R. McCormick
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REPORT

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CHEMISTS - MICROBIOLOGISTS - ENGINEERS
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DATE August 10, 1984

RECEIVED August 2, 1984

LABORATORY NO. 00283

SAMPLE Baghouse Exhaust At Black Mountain Kiln #1

P. O. No. 8787 V

INVESTIGATION Sulfur Oxides And Nitrogen Oxides

RECEIVED
AUG 16 1984

RESULTS

On July 25, 1984 representatives of Truesdail Laboratories, Inc. conducted tests to determine the sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions of the baghouse exhaust at the Black Mountain facility of Southwestern Portland Cement Company in Victorville, California. The baghouse was of the open type and the tests were conducted on each of three different cells. The samples were collected from the middle of the cell just above the bags.

Sulfur dioxide was determined with an EPA Method 8 sampling train. Each sample was collected for 30 minutes during which time three 2-liter grab samples of the flue gas were collected with evacuated glass bulbs containing an NO_x absorbing solution. The Method 8 train consisted of a heated stainless steel sampling probe connected to a heated glass fiber filter in a glass holder. The filter was followed by an impinger set, a diaphragm vacuum pump and a dry gas meter. The impinger set contained 200 ml of 80% isopropanol in the first bubbler, 100 ml of 3% hydrogen peroxide solution in each of the second and third bubblers, and the fourth bubbler was empty except for a mercury thermometer.

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A sample of the coal/coke feed was subjected to ultimate analysis by ASTM methods and the results used to calculate the flue gas flow rate of the baghouse exhaust. The amount of dilution air and the amount of CO_2 off gas from the product were included in the calculations by using the CO_2 and O_2 values found in the grab samples.

#11 Long Dry Kiln.

CO_2 concentration for 3 runs but flow rate and clinker rate only for avg. Hence D rating

The results were as follows:

BLACK MOUNTAIN

Process Parameters

Fuel Rate, Tons/Hr	11.6
Fuel Coke, % By Wt.	40
Fuel Coal, % By Wt.	60
Kiln Feed Rate, Tons/Hr	125
Clinker Rate, Tons/Hr	81
Oxygen, %	1.4
Combustibles, %	0
I. D. Fan, % Open	22
Fan Speed, RPM	622
Temperatures, °F	
Kiln Feed Housing	1,017
Secondary Air	1,500
I. D. Inlet	650

Baghouse Exhaust

Flue Gas	Test 1	Test 2	Test 3	Avg 3
Sample Location	Cell #1	Cell #8	Cell #4	
Temperature, °F	548	579	542	
Moisture, % By Vol.	6.2	6.1	5.2	
Sulfur Dioxide				
Concentration, PPM Dry	1.1	1.8	2.4	
Emissions, Lbs/Hr	1.5	2.5	3.3	2.43
Sample Volume, DSCF	8.47	7.99	11.51	
Flow Rate, DSCFM*		137,100		

*Calculated From Fuel Analysis

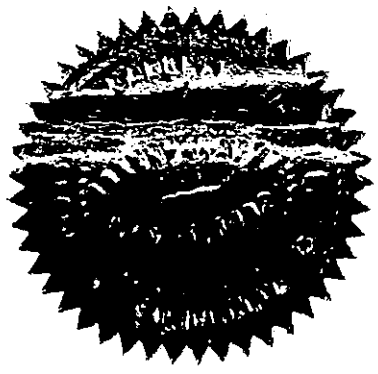
TRUESDAIL LABORATORIES, INC.

Laboratory No. 00283

Coal/Coke Ultimate Analysis:	% By Wt (Dry)
Carbon	80.47
Hydrogen	5.21
Nitrogen	2.03
Sulfur	0.71
Ash	4.79
Oxygen (by difference)	6.79
Moisture	2.51
BTU/Lb	14,120

Nitrogen Oxides

Sample Location	Time	CO_2, %	O_2, %	Nitrogen Oxides PPM Dry	Nitrogen Oxides Lbs/Hr
Cell #1	11:08	13.1	14.3	338	
	11:18	13.3	12.1	434	
	11:31	-	-	585	
Average		13.2	13.2	452	451.
Cell #8	12:30	12.6	12.5	361	
	12:39	16.5	10.1	484	
	12:51	13.8	12.1	461	
Average		14.3	11.6	435	434.
Cell #4	13:39	13.9	12.3	345	
	13:52	11.0	13.9	310	
	14:01	14.8	11.2	453	
Average		13.2	12.5	369	368.
Average all tests		13.6	12.4	419	417.67 #/hr NO_x



Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

S. Hugh Brown

S. Hugh Brown, Supervisor
Air Pollution Testing

$\frac{417.67\ \#NO_x/hr}{81\ T\ Clinker/hr} = 5.156\ \#NO_x/T\ cl$

$\frac{417.67\ \#NO_x/hr}{125\ T/hr\ KF} = 3.34\ \#NO_x/T\ KF$

$\frac{417.67\ \#NO_x/hr}{11.6 \times 28.2 mm\ BTU/T} = 1.31\ \#NO_x/mmBTU$

APPENDIX

FLOW RATE CALCULATION

6-13-84 TEST

	MOL WT.	LBS/100 LBS FUEL	LB-MOLES	LB-MOLES O_2	COMBUSTION PRODUCT	MOLES	SCF
C	12.01	80.74	6.723	6.723	CO_2	6.723	2548
H_2	2.016	5.13	5.089	1.272	H_2O	2.544	964
N_2	28.016	2.04	0.146	–	N_2	0.073	28
S	32.06	0.81	0.025	0.025	SO_2	0.025	9
ASH	–	4.39	–	–	–	–	–
O_2	32.00	6.89	0.215	−0.215	–	–	–
				8.030			

N_2: $8.030 \times 379 \times 79/21 =$ 11,449 SCF →

TOTAL 14034

O_2: 10.9% $14034 \times 21/21-10.9 =$ 29,180 SCF/100#

$\%\ CO_2 = .2548/29,180 = 8.7\%$

PRODUCT $\%\ CO_2 = 15.2 - 8.7 = 6.5\%$

$29,180 \times 100-15.2+6.5/100-15.2 =$ 31,406 SCF

H_2O corr.: $31,406 \times \frac{100-2.34}{100} =$ 30,671

$30,671 \times 11.8\ T/HR \times 2000/60 =$ 120,639 DSCFM

STOICHIOMETRIC COMBUSTION OF 100 LBS OF FUEL (DRY)

	Mol. Wt.	lbs/100 lbs Fuel	lb.-moles/100 lbs Fuel	O_2, lb.-moles used for combustion	Combustion Products: Product	Moles	SCF
C	12.01	80.47	6.700	6.700	CO_2	6.700	2539.
H_2	2.016	5.21	2.584	1.292	H_2O	2.584	979.
N_2	28.016	2.03	0.072	—	N_2	0.072	27
S	32.06	0.71	0.022	0.022	SO_2	0.022	8
Ash	—	4.79	—	—		—	
O_2	32.00	6.79	0.212	(−) 0.212		—	
				Total O_2	7.802		

N_2 (from comb. air) 7.802 moles × 79/21 × 379 scf/lbmole = 11,124

Total comb. products, SCF = 14,677

Total comb. products, DSCF = 13,698

Assumption: lb. mole = 379 scf (60°F @ 29.92" H_2 BP)

ORSAT ANALYSIS, DRY (avg.) CO_2, % 13.6

O_2, % 12.4

COMBUSTION PRODUCTS OF 100 lbs FUEL AT 12.4% O_2 DRY, 60°F 29.92" Hg B.P.

13,698 DSCF × 21% O_2 / (21 − 12.4% O_2) = 33,450 DSCF

% CO_2 FROM FUEL = 2539 × 100 / 33,450 = 7.6 %

% CO_2 FROM PRODUCT = 13.6 − 7.6 = 6.0 %

∴ THE TOTAL COMB. PRODUCTS / 100 lbs FUEL

33,450 DSCF × (100 + 6)% / (100) = 35,450 DSCF

TOTAL FLOWRATE, DSCF / HOUR

FUEL 11.6 TONS/HR × 2,000 lbs/ton × 35,460 DSCF / 100 lbs = 8.23×10^6 DSCF/H

DSCFM = 137,100

WRITE IT—DON'T SAY IT! #7

INTERCOMMUNICATING MEMORANDUM

RECEIVED

TO DOUG DATE AUG 16 1984

FROM HUGH BROWN

Enclosed you will find the amended copies of our report # 00283. Keep the original appendix.

Hugh

KEEP THIS SHEET FOR FUTURE REFERENCE

FORM 9 S.C.

#1 Black Mtn Coal-coke Long Dry

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Southwestern Portland Cement Co.
P. O. Box 937
Victorville, California 92532
ATTENTION: Tim Knisley

DATE August 10, 1984

RECEIVED August 2, 1984

LABORATORY NO. 00283

SAMPLE Baghouse Exhaust At Black Mountain - Kiln #1

P. O. No. 8787 V

INVESTIGATION Sulfur Oxides And Nitrogen Oxides

RECEIVED
AUG 13 1984

Copy of Flow data & Emission rates to APCD & WRM 9/15/84 along w/ my Calc. Spread sheet DYM.

RESULTS

On July 25, 1984 representatives of Truesdail Laboratories, Inc. conducted tests to determine the sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions of the baghouse exhaust at the Black Mountain facility of Southwestern Portland Cement Company in Victorville, California. The baghouse was of the open type and the tests were conducted on each of three different cells. The samples were collected from the middle of the cell just above the bags.

Sulfur dioxide was determined with an EPA Method 8 sampling train. Each sample was collected for 30 minutes during which time three 2-liter grab samples of the flue gas were collected with evacuated glass bulbs containing an NO_x absorbing solution. The Method 8 train consisted of a heated stainless steel sampling probe connected to a heated glass fiber filter in a glass holder. The filter was followed by an impinger set, a diaphragm vacuum pump and a dry gas meter. The impinger set contained 200 ml of 80% isopropanol in the first bubbler, 100 ml of 3% hydrogen peroxide solution in each of the second and third bubblers, and the fourth bubbler was empty except for a mercury thermometer.

The peroxide solutions were analyzed for SO_2, in duplicate, by titration with barium chloride solution to a thorin indicator endpoint.

The grab samples were analyzed for NO_x by the phenoldisulfonic acid method, and for carbon dioxide (CO_2) and oxygen (O_2) by Orsat.

A sample of the coal/coke feed was subjected to ultimate analysis by ASTM methods and the results used to calculate the flue gas flow rate of the baghouse exhaust. The amount of dilution air and the amount of CO_2 off gas from the product were included in the calculations by using the CO_2 and O_2 values found in the grab samples.

The results were as follows:

BLACK MOUNTAIN

Process Parameters

Fuel Rate, Tons/Hr	11.6
Fuel Coke, % By Wt.	40
Fuel Coal, % By Wt.	60
Kiln Feed Rate, Tons/Hr	125 ~ 35.2 LOI factor = Cl = 1.5032
Clinker Rate, Tons/Hr	81
Oxygen, %	1.4
Combustibles, %	0
I. D. Fan, % Open	22
Fan Speed, RPM	622
Temperatures, °F	
Kiln Feed Housing	~~1,017~~ 1107
Secondary Air	1,500
I. D. Inlet	650

Baghouse Exhaust

Flue Gas	Test 1	Test 2	Test 3
Sample Location	Cell #1	Cell #8	Cell #4
Temperature, °F	548	579	542
Moisture, % By Vol.	6.2	6.1	5.2
Sulfur Dioxide			
Concentration, PPM Dry	1.1 #/	1.8	2.4
Emissions, Lbs/Hr	1.5 #/hr	2.5	3.3
Sample Volume, DSCF	8.47	7.99	11.51

FLOW RATES FORTHCOMING.

Flow Rate DSCFM = 137,100 - ← Results from Hugh Brown via phone 8/14/84 ~ 3:30 pm

60°F - 29.92" H_2

Nitrogen Oxides

Sample Location	Time	CO_2, %	O_2, %	Nitrogen Oxides PPM Dry	Nitrogen Oxides Lbs/Hr
Cell #1	11:08	13.1	14.3	338	
	11:18	13.3	12.1	434	
	11:31	-	-	585	
Average		13.2	13.2	452	451 #/hr
Cell #8	12:30	12.6	12.5	361	
	12:39	16.5	10.1	484	
	12:51	13.8	12.1	461	
Average		14.3	11.6	435	434 #/hr
Cell #4	13:39	13.9	12.3	345	
	13:52	11.0	13.9	310	
	14:01	14.8	11.2	453	
Average		13.2	12.5	369	368 #/hr
Avg all tests -		13.6	12.4	419	417.67

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

S. Hugh Brown

S. Hugh Brown, Supervisor
Air Pollution Testing

$$\frac{417.67\ \#NO_x/hr}{81\ TC/hr} = 5.156\ \#NO_x/TC$$

APPENDIX

TRUESDAIL LABORATORIES, INC.

Lab. No. _____

EPA FIELD TEST DATA

Plant S.W. Portland

Sampling Station Engine's Outlet

Date 7-25-94

Flue Dimensions _____

Test No. 1 North Side Cell #1

Amb. Temp., °F _____

Bar. Pressure, In. Hg 26.28

Stack Pressure, In. H_2O _____

Sampling Nozzle Diam., In. .5

Sampling Apparatus No.: D, A

Trav. Point No.	Sampling Time	Sample Volume, Cu. Ft.	Vel. Head $\sqrt{Ps}$	Orifice ΔH In.H_2O	TEMPERATURE, °F Stack	Probe	Oven	Impinger Inlet	Impinger Outlet	Gas Meter
	10:58	45.40		0.15	552		238			91/88
	11:08	48.95		0.15	549		240		65	99/91
	11:18	52.50		0.10	543		245		55	104/93
	11:25	55.92					261		55	107/98
	pump tmin ✓									
									SH	tmin
									1212	11:08
									3300	11:18
									1377	11:31
	IPA	H_2O_2	H_2O_2				pretest leak ✓ at 13" H_2 2.02 CFM			
				NET			post test leak ✓ at 15" H_2 .02 CFM			
tot	637.4	584.0	551.0							
tmin	644.3	572.4	547.2							
Diff	-6.9	11.6	3.8	8.5 ml						
TOTAL		13.52								
AVG.				0.13	548				58	97

Operator(s) _____

CFM = .5

$8.5 ml \times .0027 \times \frac{557}{26.29} = 0.48$ CF H_2O

TRUESDAIL LABORATORIES, INC.

Lab. No.__________

EPA FIELD TEST DATA

Plant S.W. Portland

Sampling Station Baghaus outlet

Date 7-25-84

Flue Dimensions __________

Test No. 2 South Side Middle of Baghaus Cell #8

Amb. Temp., °F __________

Bar. Pressure, In. Hg 26.88

Stack Pressure, In. H_2O __________

Sampling Nozzle Diam., In. .5

Sampling Apparatus No.: D, B

Trav. Point No.	Sampling Time	Sample Volume, Cu. Ft.	Vel. Head $\sqrt{Ps}$	Orifice ΔH In.H_2O	TEMPERATURE, °F Stack	Probe	Oven	Impinger Inlet	Impinger Outlet	Gas Meter
	12:19	57.87		.15	570				65	135/120
	12:29	60.90		.15	573	250	270		63	143/126
	12:39	64.65		.15	586	239	249		62	146/129
	12:49	68.51		.15	586	267	265			148/132
	purge train									
									Fl#	time
									1259	12:30
									1369	12:39
									3473	12:51
							pre test leak ✓ @ 13" = 0 CFM			
	IPA	H_2O_2	H_2O_2				post test leak ✓ @ 4" = <.01 CFM			
				NET						
total	620.9	583.3	536.3							
tare	631.4	570.0	531.7							
net	-10.5	13.3	4.6	7.4 ml						
TOTAL										
AVG.		10.64		.15	579				63	135

Operator(s) __________

$$7.4 \times .00267 \times \frac{595}{26.29} = 0.45 \text{ CF } H_2O$$

TRUESDAIL LABORATORIES, INC.

Lab. No._____

EPA FIELD TEST DATA

Plant S.W. Portland

Sampling Station Baghouse Out. Cell #4

Date 7-25-84

Flue Dimensions_____

Test No. 3

Cell #4

Amb. Temp., °F_____

Bar. Pressure, In. Hg 26.28

Stack Pressure, In. H_2O_____

Sampling Nozzle Diam., In. .25"

Sampling Apparatus No.:_____

Trav. Point No.	Sampling Time	Sample Volume, Cu. Ft.	Vel. Head $\sqrt{Ps}$	Orifice ΔH In. H_2O	TEMPERATURE, °F Stack	Probe	Oven	Impinger Inlet	Impinger Outlet	Gas Meter
	13:28	70.15		.25	540	251	247		60	134/128
	13:38	74.95		.25	547	272	271		53	134/126
	13:48	79.96		.24	542	271	266		54	141/130
	13:58	85.11		.24	540	272	253		53	142/133
									FIF	time
									1171	13:39
									1437	13:52
									615	14:01
	IPA	H2O	H2O							
init	615.5	584.9	560.1							
fin	628.4	567.0	555.8							
net	-12.9	17.9	4.3	9.3 ml						
TOTAL		14.15								
AVG.				.25	542				55	134

pre-test leak √ at 15" H, .02 CFM
post-test leak √ at 14" H, < .02 CFM

Operator(s)

2:06

$9.3 \text{ ml} \times .00267 \times \frac{594}{26.30} = 0.56$

SAMPLE VOLUMES:

1) $(10.52 - 0.20) \times \frac{520}{557} \times \frac{26.29}{29.92} = 8.47$ DSCF

2) $(10.64 - 0.23) \times \frac{520}{595} \times \frac{26.29}{29.92} = 7.99$ DSCF

3) $(14.96 - 0.25) \times \frac{520}{594} \times \frac{26.30}{29.92} = 11.51$ DSCF

SO_2 ANALYSIS:

	MLS SAMPLE	ALIQUOT	ML $BaCl_2$ R_1	R_2	AVG
STD	(H_2SO_4)	5	4.78	4.79	4.785
1)	500	20	0.08	0.10	0.09
2)	500	20	0.15	0.13	0.14
3)	500	20	0.25	0.27	0.26

N $BaCl_2$ = $5 \times .009562 / 4.785 = .00999$ N

1) $\frac{0.09 \times 0.00999 \times 11850 \times 500/20}{28.3 \times 8.47} = 1.1$ PPM SO_2

2) $\frac{0.14 \times 0.00999 \times 11850 \times 500/20}{28.3 \times 7.99} = 1.8$ PPM SO_2

3) $\frac{0.26 \times 0.00999 \times 11850 \times 500/20}{28.3 \times 11.51} = 2.4$ PPM SO_2

TRUESDAIL LABORATORIES, INC.

Sampling Station SWPC SCRUBBER OUTLET Date 7-25-84

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

		1	2	3
A.	Gas pressure at meter, In. Hg. (Absolute)	26.29	26.29	26.30
B.	Vapor pressure of water at impinger temp., In. Hg.	0.49	0.58	0.44
C.	Volume of metered gas, Cu. Ft.	10.52	10.64	14.96
D.	Volume of water vapor metered, B X C/A, Cu. Ft.	0.20	0.23	0.25
E.	Volume of water vapor condensed, Cu. Ft.	0.48	0.45	0.56
F.	Total volume of water vapor in gas sample, D+E, Cu. Ft.	0.68	0.68	0.81
G.	Total volume of gas sample, C+E, Cu. Ft.	11.00	11.09	15.52
H.	Percent water vapor in sampled gas, 100 X F/G	6.2	6.1	5.2
	AVG		5.8	

Gas Density Correction Factor

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water		1.0	18.0	
Carbon Dioxide	Dry Basis		44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	Dry Basis		32.0	
Nitrogen & Inerts	Dry Basis		28.2	

Average Molecular Weight _____

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = _____

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = _____

DATE PRINTED: 07/23

INTER-LABORATORY STUDY RESULTS

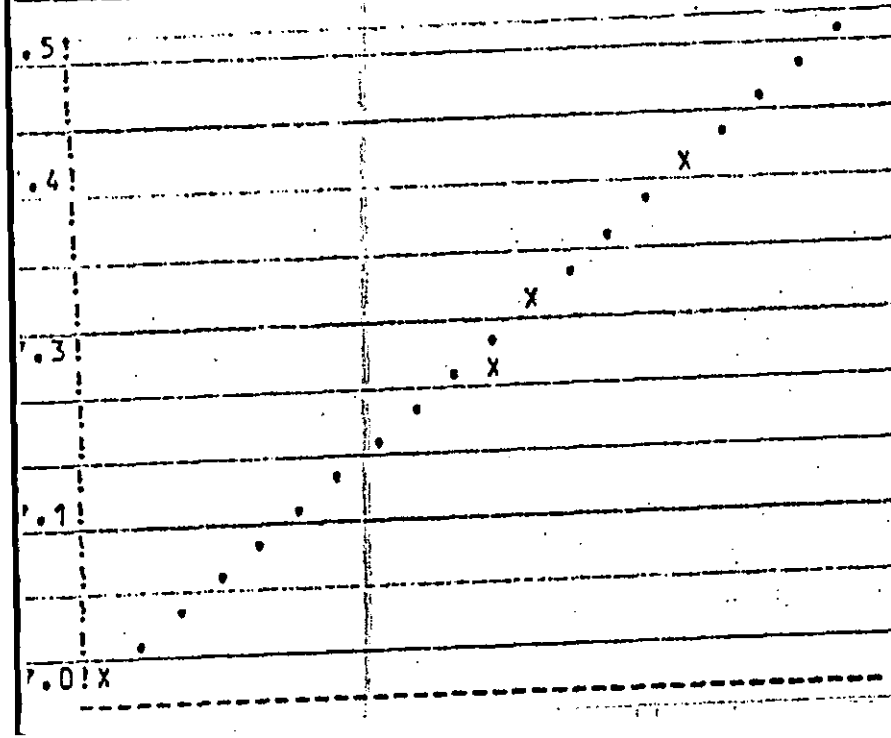
(MAY 1984)

POLLUTANT - SO2

C45010
MR. IGNAS BANDZIULIS
TRUESDAIL LABORATORIES, INC.
14201 FRANKLIN AVENUE
TUSTIN, CA 92680

UNITS - MILLIGRAMS PER DRY STD CUBI

SAMPLE NUMBER	REPORTED VALUE	EPA VALUE	PERCENT DIFFERENCE
2567	296.0	297.4	-.4
3366	278.0	282.2	-1.49
5012	951.0	968.5	-1.81
7538	881.0	899.9	-2.10
9232	1180.0	1197.3	-1.44



Received 6/2/84
EPA AUDIT