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

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

Background Report Reference

AP-42 Section Number: 11.6

Background Chapter: 4

Reference Number: 48

Title: Written communication from Douglas MacIver, Southwestern Portland Cement Company, Victorville, CA, to Walter Mook, San Bernadino County Air Pollution Control District, San Bernadino, CA, August 22, 1980

Douglas MacIver

Southwestern Portland Cement Company

August 1980

Victor: coal

AP-42 Section 11.6
Reference NOx USCO
Report Sect. 4
Reference 48

SOUTHWESTERN PORTLAND CEMENT COMPANY

P. O. BOX 937
VICTORVILLE, CALIFORNIA 92392

(714) 245-1681

August 22, 1980

Mr. Walter R. Mook
Executive Officer
Air Pollution Control District
1111 E. Mill Street, Bld'g. 1
San Bernardino, CA 92415

Subject: NO_x, SO_x and CO Concentrations on Kilns No.'s 6, 7 and 9

Dear Walter:

Attached are the results of the tests on August 5, 1980, which were done by Truesdail Laboratories, Inc., of Los Angeles. These tests were observed by Oscar Hellrich of your District.

I believe that this should complete all of the requirements for the granting of an Operating Permit on the coal firing systems on these kilns.

No. 8 kiln and the Black Mountain kiln will probably be sampled in September. No. 5 kiln is down indefinitely.

Sincerely,

Douglas Y. Mac Iver

Douglas Y. Mac Iver,
Manager-Environmental Engineering

DYM/fmm

Encl.

cc: E. B. Thorn, Jr.
D. W. Heineck
M. A. Yannone
E. C. Cox

Ref 23 Wet Process
Rated as a C for NOx
by MRI
Note useable for
CO_2 as was for
single removal
(~1/2 hr run)

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH - DEVELOPMENT - TESTING

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

RECEIVED
AUG 21 1980

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

SAMPLE Kilns # 6, 7, and 9

P. O. No. 2362V

DATE August 20, 1980

RECEIVED June 3, 1980

LABORATORY NO. 32901

INVESTIGATION

Determine SO_x, NO_x, and CO concentrations.

RESULTS

On August 5, 1980 representatives of Truesdail Laboratories, Inc. conducted sulfur oxides (SO_x), nitrogen oxides (NO_x) and carbon monoxide (CO) emission tests on the flue gas from kiln numbers 6, 7, and 9 at the Southwestern Portland Cement Company facility in Victorville, California. The tests were witnessed by a representative of the South Coast Air Quality Management District.

A velocity traverse was run on each duct ahead of the induced draft fans. A special Pitot tube and a calibrated Magnehelic draft gage were used to measure the velocity head pressures, A chromel-alumel thermocouple and a Mini-Mite potentiometer were used to measure flue gas temperatures.

The SO_x sampling was conducted during a 30 minute period. The sampling train consisted of an in the stack thimble, a stainless steel probe, a set of chilled impingers, an air tight pump and a dry gas meter. The impinger set consisted of the following: the first impinger contained 100ml of 80% isopropanol, the second and third impingers contained a total of 200ml of 3% H_2O_2, the fourth impinger was dry and contained a thermometer, and a glass fiber filter was used between the first and the second impingers. NO_x and CO samples were collected in a Tedlar bag which was connected to the dry gas meter outlet. The contents were immediately transferred to four evacuated, 2-liter glass bulbs which contained absorbing solution.

This report applies only to the sample, or samples, investigated and is not necessarily indicative of the quality or condition of apparently identical or similar products. As a mutual protection to clients, the public and these Laboratories, this report is submitted and accepted for the exclusive use of the client to whom it is addressed and upon the condition that it is not to be used, in whole or in part, in any advertising or publicity matter without prior written authorization from these Laboratories.

The contents of the isopropanol impinger and the glass fiber filter were analyzed gravimetrically for SO_3 by $BaSO_4$ precipitation. The contents of the peroxide impingers were analyzed for SO_2 by titration with $BaCl_2$ to the thorin endpoint. The gaseous portion of the flasks was analyzed for O_2 and CO_2 by Orsat and for CO by gas chromatography. The liquid portion was analyzed for NO_x by the PDSA method.

The kilns were operating at steady conditions during the sampling periods and the velocity traverses; however, kiln #6 was not operating at maximum capacity.

The results are summarized in the following table.

Summary of Results

Flue Gas:	Kiln #6	Kiln #7	Kiln #9
Temperature, °F	471	498	539
Velocity, ft/sec	42.0	46.3	47.8
Static pressure, in. H_2O	-5.5	-5.5	-4.5
Duct dimensions, in.	60 x 84	60 x 84	60 x 84
Duct area, sq. ft.	35.0	35.0	35.0
Flow rate, CFM	88,200	97,300	100,500
SCFM	43,000	46,100	45,800
DSCFM	32,300	37,900	33,000
Water vapor, % by vol.	24.9	17.7	28.0
Sulfur Oxides (as SO_2), dry:			
Sulfur dioxide (SO_2), ppm	20	20	47
SO_3, ppm	1.4	0.2	0.4
Emission rate, lbs/hr.	6.9	7.7	15.7
Nitrogen Oxides, (NO_x):			
Concentration, ppm A	685	236	979
B	685	234	972
C	692	236	963
Avg:	687	235	971
Emission rate, lbs/hr. (as NO_2)	161	64.8	232
Orsat Analysis:			
O_2, %	10.1	14.0	5.9
CO_2, %	12.8	9.4	20.6
Carbon monoxide (CO), by G.C., ppm	10	4	15

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Ignas Bandziulis

Ignas Bandziulis
Supervisor, Air Pollution Testing

Clinker - Tons/hr — 17.7 — 16.0 — 15.8

Coal @ 13,283 BTU/lb

APPENDIX

TRUESDAIL LABORATORIES, INC. (A-1)

DATE: 8/5/80

Sampling Location: # before id-fan

Static Pressure, Ps: −5.5

Test No.: 1

Barometric Pressure: 26.5

1 00 pm 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
A 1	.24	465	38.9	B 1	.23	460	37.9	C 1	.23	470	38.1
2	.26	475	40.7	2	.29	480	43.1	2	.21	475	36.5
3	.20	475	35.7	3	.18	490	34.1	3	.25	465	39.7
4	.26	480	40.8	4	.35	490	47.5	4	.38	470	49.0
5	.27	480	41.5	5	.27	430	40.4	5	.39	465	49.5
		$2.9 \times .84 \times \sqrt{VH \times T_s} \times \sqrt{\frac{29.9}{26.5 + \frac{-5.5}{13.6}}} \times 1.027$									

A. AVERAGE VELOCITY (TRAVERSE) ft/sec _____

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec _____

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

D. FLUE FACTOR C/B _____

E. PITOT TUBE CORRECTION FACTOR "E" .84

F. GAS DENSITY CORRECTION FACTOR 1.027

G. CORRECTED VELOCITY, AxExF, ft/sec 42.0
or, AxDxExF, ft/sec _____

H. AREA OF FLUE, SQ. FT. 35.0

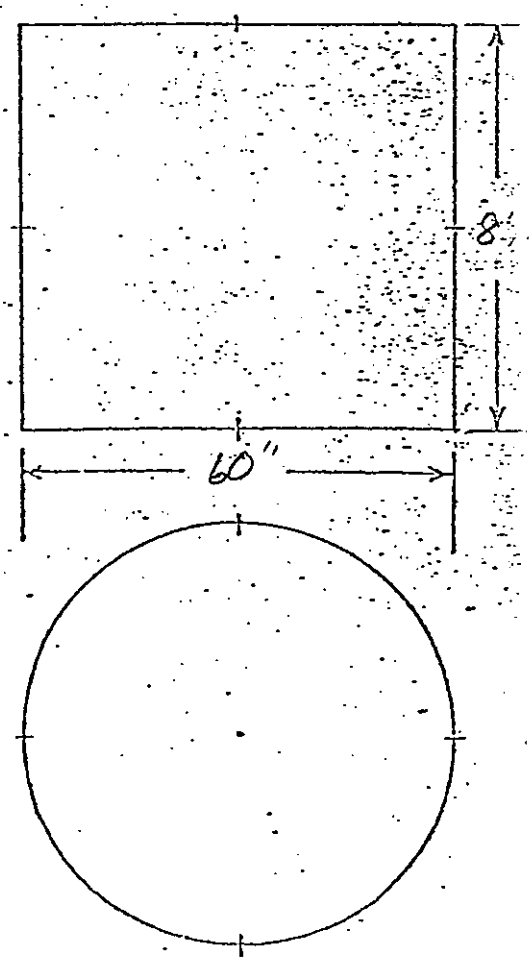
J. AVERAGE FLUE TEMPERATURE, °F 471

K. FLOW RATE, G x H x 60, CFM 88,200

L. FLOW RATE, $K \times \frac{520}{460 + J} \times \frac{BP + Ps/13.6}{29.9}$, SCFM 43,000

M. FLOW RATE, L x MOISTURE CORR., DSCFM .751 32,300

$V = f \times 2.9 \sqrt{(460 + T_s) \times VH \times \frac{29.9}{\ldots}}$



TRUESDAIL LABORATORIES, INC. (92) Date: 8/5/80

Sampling Location: SOUTHWEST PORT. CEM. KILN #6 Barometric Pressure: 26.5

Test No. 1 Nozzle Diameter: .25"

Time	Gas Meter 008 Reading cu. ft. V_m	Press. "H_2O P_m	Temp. °F T_m	Impinger Temp °F T_i	Sample Point	FL#			
13:17	68.36	—	—	—		1500			
13:27	73.48	0.33	99	52		1444			
13:37	78.72		101	52		1194			
13:47	83.84		102	54		1107			
30 min	15.48	.33	101	53					

Weight Collected, grams

A. Total Weight

B. Condensate Volume, ml. 85

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + T_m}{B.P. + P_m/13.6} \times B$, cu. ft. 4.80

D. Total Sample Volume, $V_m + C$, cu. ft. 20.28

E. Sample Volume, $D \times \frac{520}{460 + T_m} \times \frac{B.P. + P_m/13.6}{29.9} \times$ Moisture corr., DSCF .751 12.51

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

G. Stack Gas Flow Rate, DSCFM

H. Emissions, 60 x G x F/7000, lbs/hr

TRUESDAIL LABORATORIES, INC.

(A3)

Sampling Station Kiln #6 Date 8/5/80

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, In. Hg. (Absolute) 26.5

B. Vapor pressure of water at impinger temp., In. Hg. .405

C. Volume of metered gas, Cu. Ft. 15.48

D. Volume of water vapor metered, B X C/A, Cu. Ft. .24

E. Volume of water vapor condensed, Cu. Ft. 4.80

F. Total volume of water vapor in gas sample, D+E, Cu. Ft. 5.04

G. Total volume of gas sample, C+E, Cu. Ft. 20.28

H. Percent water vapor in sampled gas, 100 X F/G 24.9

Gas Density Correction Factor

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	.249	1.0	18.0	4.48
Carbon Dioxide	.128 Dry Basis	.751	44.0	4.23
Carbon Monoxide	— Dry Basis	.751	28.0	—
Oxygen	.101 Dry Basis	.751	32.0	2.43
Nitrogen & Inerts	.771 Dry Basis	.751	28.2	16.33
			Average Molecular Weight	27.47

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.949

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.027

TRUESDAIL LABORATORIES, INC. (14)

DATE: 8/5/80

Sampling Location: # before i.d. fan

Static Pressure, Ps: -5.5

Test No.: 1

Barometric Pressure: 26.5

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	.19	455	34.2	1	.24	480	39.0	1	.22	470	37.1
2	.24	505	39.5	2	.26	505	41.1	2	.28	500	42.6
3	.21	505	37.0	3	.23	510	38.8	3	.40	505	51.0
4	.35	505	47.7	4	.32	510	45.8	4	.51	510	57.8
5	.52	505	58.2	5	.45	510	54.3	5	.56	500	60.2

$2.9 \times .84 \times \sqrt{V_H} \times \sqrt{T_s} \times \sqrt{\frac{29.9}{26.5 + \frac{-5.5}{13.6}}} \times 1.016$

A. AVERAGE VELOCITY (TRAVERSE) ft/sec _____

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec _____

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

D. FLUE FACTOR C/B _____

E. PITOT TUBE CORRECTION FACTOR "E" .84

F. GAS DENSITY CORRECTION FACTOR 1.016

G. CORRECTED VELOCITY, AxExF, ft/sec 46.3
or, AxDxExF, ft/sec _____

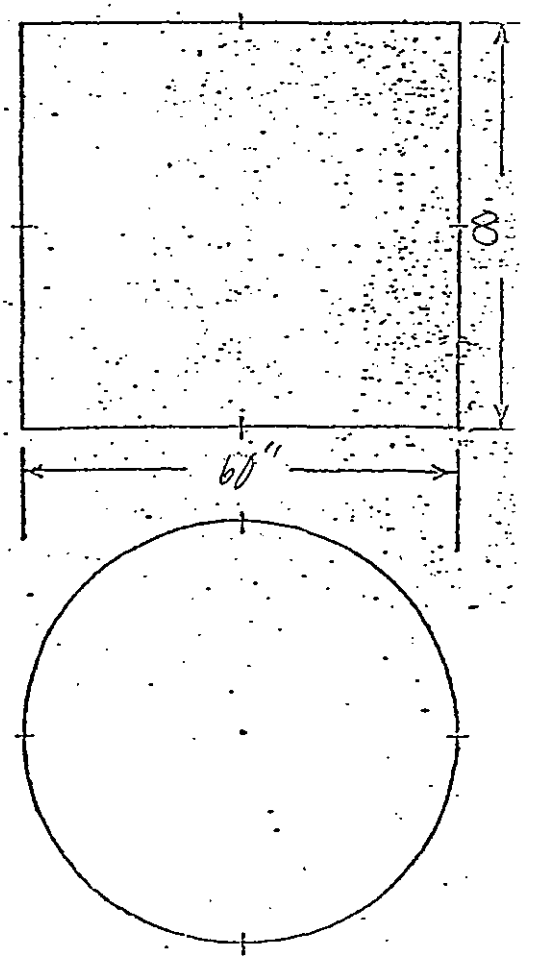
H. AREA OF FLUE, SQ. FT. 35.0

J. AVERAGE FLUE TEMPERATURE, °F 498

K. FLOW RATE, G x H x 60, CFM 97,300

L. FLOW RATE, K x $\frac{520}{460 + J}$ x $\frac{BP + Ps/13.6}{29.9}$, SCFM 46,100

M. FLOW RATE, L x MOISTURE CORR. (.823), DSCFM 37,900



$V = f \times 2.9 \sqrt{(460 + T_s) \times V_H \times \frac{29.9}{P_s + P_{bar}}}$

TRUESDAIL LABORATORIES, INC. (15)

Date: 8/5/80

Sampling Location: 7 before i.d. fan

Barometric Pressure: 26.5

Test No. 1

Nozzle Diameter: .25"

Time	Gas Meter 008 Reading cu. ft. V_m	Press. "H_2O P_m	Temp. °F T_m	Impinger Temp °F T_i	Sample Point	CFM	FL #		
							97		
10:41	45.78	0.33				0.5	1479		
10:51	51.12	0.33	95	44		0.5	1336		
11:01	56.46	0.33	95	45			739		
11:11	61.82	0.33	94	46					
30min	16.04	.33	95	45					

Weight Collected, grams

A. Total Weight _____

B. Condensate Volume, ml. 58.1

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + T_m}{B.P. + P_m/13.6} \times B$, cu. ft. 3.24

D. Total Sample Volume, $V_m + C$, cu. ft. 19.28

E. Sample Volume, $D \times \frac{520}{460 + T_m} \times \frac{B.P. + P_m/13.6}{29.9} \times$ Moisture corr. .823, DSCF 13.18

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

(16)

TRUESDAIL LABORATORIES, INC.

Sampling Station Kiln #7 Date 8/5/80

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, In. Hg. (Absolute) 26.5

B. Vapor pressure of water at impinger temp., In. Hg. .300

C. Volume of metered gas, Cu. Ft. 16.04

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

E. Volume of water vapor condensed, Cu. Ft. 3.24

F. Total volume of water vapor in gas sample, D+E, Cu. Ft. 3.42

G. Total volume of gas sample, C+E, Cu. Ft. 19.28

H. Percent water vapor in sampled gas, 100 X F/G 17.7

Gas Density Correction Factor

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	.177	1.0	18.0	3.19
Carbon Dioxide	.094 Dry Basis	.823	44.0	3.40
Carbon Monoxide	– Dry Basis		28.0	—
Oxygen	.140 Dry Basis	—"—	32.0	3.69
Nitrogen & Inerts	.766 Dry Basis	—"—	28.2	17.78
			Average Molecular Weight	28.06

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.969

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.016

TRUESDAIL LABORATORIES, INC. (A7)

DATE: 8/5/80

Sampling Location: # 1 before i.d. fan

Static Pressure, Ps: -4.5

Test No.:

Barometric Pressure: 26.5

10:10 am 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
8.4 A 1	.25	500	40.3	B 1	.22	500	37.8	C 1	.23	525	39.2
25.2 2	.32	535	46.5	2	.31	540	45.8	2	.27	555	43.1
42.0 3	.24	545	40.4	3	.21	560	38.1	3	.24	550	40.5
58.8 4	.45	550	55.5	4	.47	550	56.7	4	.45	540	55.2
75.6 5	.57	550	62.5	5	.45	545	55.4	5	.32	535	46.5
		$2.9 \times .84 \times \sqrt{V.H.} \times \sqrt{T_s} \times \sqrt{\frac{29.9}{26.5 + \frac{-4.5}{13.6}}}$ 1.14257					$\times 1.02$				
		$2.6039 \times \sqrt{VH} \times \sqrt{T_s}$									

A. AVERAGE VELOCITY (TRAVERSE) ft/sec _____

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec _____

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

D. FLUE FACTOR C/B _____

E. PITOT TUBE CORRECTION FACTOR "F" .84

F. GAS DENSITY CORRECTION FACTOR 1.020

G. CORRECTED VELOCITY, AxExF, ft/sec 47.8
or, AxDxExF, ft/sec _____

H. AREA OF FLUE, SQ. FT. 35.0

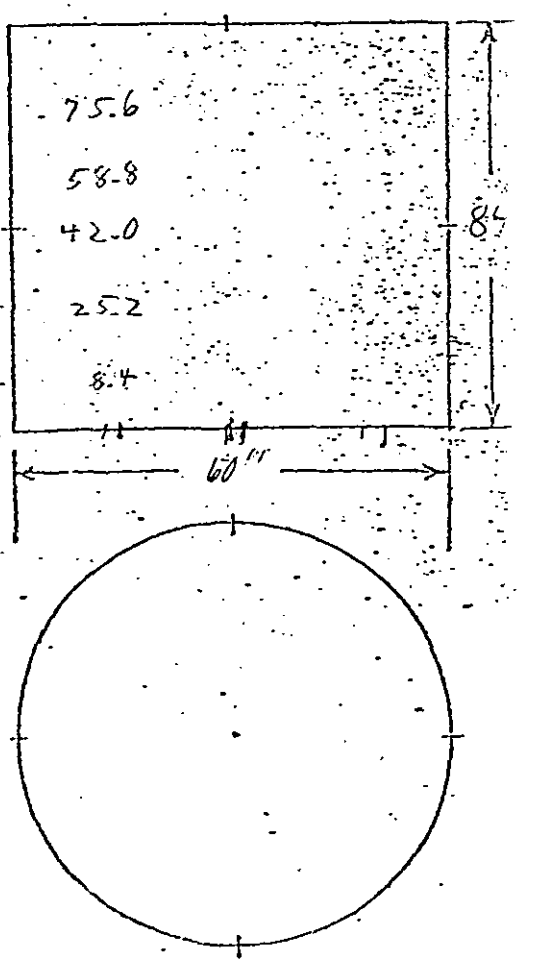
J. AVERAGE FLUE TEMPERATURE, °F 539

K. FLOW RATE, G x H x 60, CFM 100,500

L. FLOW RATE, $K \times \frac{520}{460 + J} \times \frac{BP + Ps/13.6}{29.9}$, SCFM 45,800

M. FLOW RATE, L x MOISTURE CORR., DSCFM 33,000

.720



$V = \sqrt{T_s} \cdot 2.9 \cdot \sqrt{VH(460 + T_s)} \times VH \times \frac{29.9}{\ldots}$

TRUESDAIL LABORATORIES, INC. (#8)

Date: 8/5/80

Sampling Location: #9 before i.d. fan

Barometric Pressure: 26.5

Test No. 1

Nozzle Diameter: .25"

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		Integrated NO_x		
10:39	28.41	—	—	—	—		1334	broken	
10:49	33.16	.32	100	49			1383		
10:59	37.94	.31	101	50			1345		
11:09	42.62	.31	103	51			1477		
30 min	14.21	.31	101	50					

Weight Collected, grams

A. Total Weight _____

B. Condensate Volume, ml. 93

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + T_m}{B.P. + P_m/13.6} \times B$, cu. ft. 5.26

D. Total Sample Volume, $V_m + C$, cu. ft. 19.47

E. Sample Volume, $D \times \frac{520}{460 + T_m} \times \frac{B.P. + P_m/13.6}{29.9} \times$ Moisture corr. (.720), DSCF 11.52

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

(49)

TRUESDAIL LABORATORIES, INC.

Sampling Station Kiln #9 Date 8/5/80

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, In. Hg. (Absolute) 26.5

B. Vapor pressure of water at impinger temp., In. Hg. .363

C. Volume of metered gas, Cu. Ft. 14.21

D. Volume of water vapor metered, B X C/A, Cu. Ft. .19

E. Volume of water vapor condensed, Cu. Ft. 5.26

F. Total volume of water vapor in gas sample, D+E, Cu. Ft. 5.45

G. Total volume of gas sample, C+E, Cu. Ft. 19.47

H. Percent water vapor in sampled gas, 100 X F/G 28.0

Gas Density Correction Factor

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	.280	1.0	18.0	5.04
Carbon Dioxide	.206 Dry Basis	.720	44.0	6.53
Carbon Monoxide	— Dry Basis		28.0	—
Oxygen	.05 Dry Basis		32.0	1.36
Nitrogen & Inerts	.735 Dry Basis		28.2	14.92
			Average Molecular Weight	27.85

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.962

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.020