EMISSION TESTING REPORT
ETB TEST NUMBER 71-MM-06

Emissions From
Wet Process Clinker Cooler
And Finish Mill Systems

at

I D E A L C E M E N T C O M P A N Y
HOUSTON, TEXAS

Project Officer
Clyde E. Riley

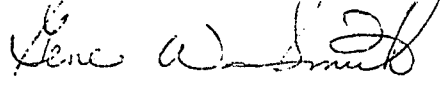
ENVIRONMENTAL PROTECTION AGENCY
Office of Air Programs
Research Triangle Park, North Carolina 27711

PREFACE

The work reported herein was conducted by The Environmental Protection Agency (EPA), Office of Air Programs, Emission Testing Branch (ETB), Metallurgical and Mechanical Section. Mr. Clyde Riley served as the Project Officer and directed the ETB field team consisting of Mr. Frederick Maerker and Mr. Gene Smith. Mr. Philip York served as Project Engineer and Mr. Howard Crist performed the pollutant analyses at the EPA laboratories.

Approved:

Environmental Protection Agency



Gene W. Smith
Chief, Metallurgical & Mechanical Section

March 29, 1972

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IV. INTRODUCTION

Source sampling was conducted at the Houston, Texas wet process plant of the Ideal Cement Company to determine particulate emissions from the baghouse stacks of the clinker cooler and the finish mill grinding system. Three particulate runs were performed at each stack (for a total of 6 runs) between 18 May and 20 May, 1971. Sampling locations are shown in Figure 1.

EPA Methods 1 and 2, Federal Register, December 23, 1971, were used to determine the number of required sampling points per stack and the stack gas velocity and volumetric flow rate. Particulate emissions were determined using EPA Method 5 of the Federal Register.

V. SUMMARY OF RESULTS

A summary of the particulate emissions data for the No. 2 clinker cooler and finish mill grinding system is presented in Tables 1 and 2. Clinker cooler emissions (based on the probe, cyclone and filter catches) ranged from 0.0253 to 0.0448 lbs/ton of feed. Emissions from the finish mill grinder baghouse were between 0.0120 and 0.0201 lb/ton of feed.

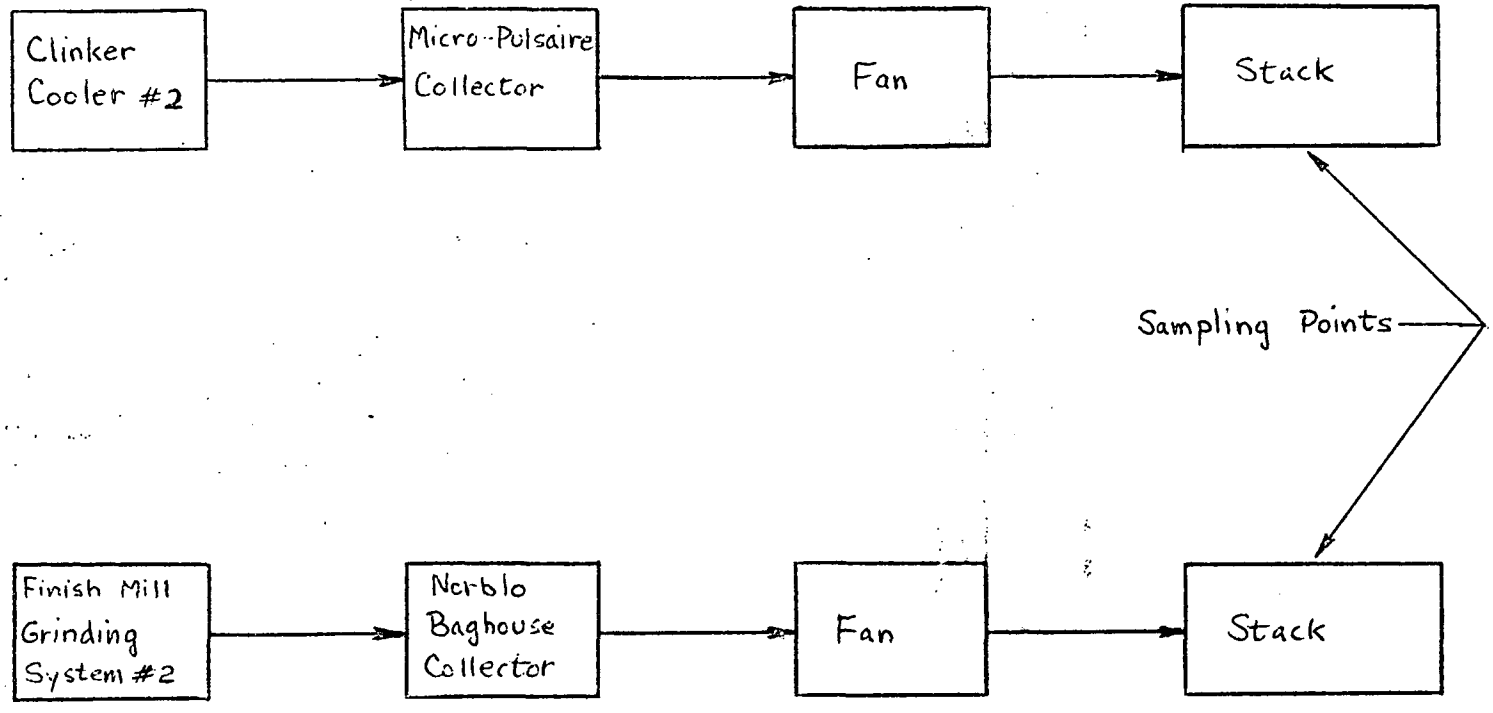


Figure 1 Sampling Locations

TABLE I

SUMMARY OF RESULTS FOR CLINKER COOLER

Run Number	1	2	3
Date	5-18-71	5-18-71	5-18-71
Percent Excess Air	NA	NA	NA
Percent Isokinetic	102.1	98.5	98.8
Stack Flow Rate - SCFM* dry	104,057	100,432	102,165
Stack Flow Rate - ACFM wet	127,032	126,664	128,672
Volume of Dry Gas Sampled - SCF	101.07	94.15	96.05
Feed Rate - tons/hr	61.8	62.7	63.7
Particulates			
Probe, Cyclone, & Filter Catch			
mg	11.8	20.5	14.2
gr/SCF* dry	0.00180	0.00335	0.00228
gr/CF @ Stack Conditions	0.00147	0.00266	0.00180
lbs/hr.	1.561	2.812	1.941
lbs/ton feed	0.0253	0.0448	0.0305
Total Catch			
mg	26.3	38.1	23.3
gr/SCF* dry	0.00401	0.00623	0.00373
gr/CF @ Stack Conditions	0.00328	0.00494	0.00296
lbs/hr	3.538	5.323	3.269
lbs/ton feed	0.0572	0.0849	0.0513
% Impinger Catch	55.1	46.2	39.1

* 70°F, 29.92" Hg

NA - Not Applicable

TABLE 2

SUMMARY OF RESULTS FOR FINISH MILL GRINDING SYSTEM

Run Number	1	2	3
Date	5-19-72	5-19-71	5-20-71
Percent Excess Air	NA	NA	NA
Percent Isokinetic	109.0	102.9	98.9
Stack Flow Rate - SCFM* dry	26,360	26,252	26,244
Stack Flow Rate - ACFM wet	35,185	35,679	35,780
Volume of Dry Gas Sampled - SCF	140.35	131.99	126.82
Feed Rate - tons/hr	34.6	33.9	37.2
Particulates			
Probe, Cyclone, & Filter Catch			
mg	22.0	26.9	17.1
gr/SCF* dry	0.00241	0.00314	0.00208
gr/CF @ Stack Conditions	0.00181	0.00231	0.00152
lbs/hr.	0.527	0.683	0.446
lbs/ton feed	0.0152	0.0201	0.0120
Total Catch			
mg	32.9	37.8	27.9
gr/SCF* dry	0.00361	0.00441	0.00339
gr/CF @ Stack Conditions	0.00270	0.00324	0.00248
lbs/hr	0.791	0.971	0.761
lbs/ton feed	0.0229	0.0287	0.0205
% Impinger Catch	33.1	28.8	38.7

* 70°F, 29.92" Hg

NA - Not Applicable

VI. PROCESS DESCRIPTION

Clay, crushed oyster shell, and silica sand are brought to the plant by barge from deposits along the Gulf of Mexico. These materials are ground and blended in two rotating ball mills to form a slurry.

The blended slurry is fed into the upper ends of two sloping, slowly revolving kilns. These kilns are gas-fired with a capacity of 5,250 bbls. per day each and are 450 ft. long and 12 ft. in diameter with refractory lining encased in a steel cylinder. Fuel consumption is 1,300,000 BTU per barrel of cement produced. During passage through the kiln, the raw materials are heated to a temperature of approximately 2800°F to produce the element hydraulic calcium silicates, known in the trade as "clinker". This marble-sized clinker material is then discharged from the lower end of the kilns at temperatures exceeding 2000°F and fed immediately into two air-quenching cooler units which reduce the temperature of the material to about 150°F. From these coolers, the newly-formed clinker material is conveyed to storage silos.

A small amount of gypsum (4.45% by weight) is added to the clinker material and this mixture is fed into two finish grinding mills with a capacity of 47 tons per hour each. The mixture leaving the grinding mills is fed to two air-separators or classifiers where the coarse material is returned to the mills and the finished cement (90% through 325 mesh screen) is pneumatically pumped to storage silos. Present plant production is approximately 4,000,000 barrels of cement per year.

The control equipment of interest in this report consists of a Mikro-Pulsaire baghouse collector on the No. 2 clinker cooler and a Norblo baghouse collector on the No. 2 finish mill grinding system.

The Mikro-Pulsaire collector consists primarily of a series of cylindrical filter elements enclosed in a dust-tight housing. The felted filter media is "Nomex" which is heat-resistant for temperatures up to 425°F and is supported on a stainless-steel wire frame. Dust-laden air is admitted to the housing and clean air withdrawn from inside the filter cylinder. As clinker dust particles accumulate on the filter elements, periodic cleaning is accomplished by introduction of a momentary jet of high-pressure air through a venturi mounted above each filter cylinder. A continuous flow of air through the collector is maintained, since only a fraction of the total filter area is cleaned at one time. The dust particles fall by gravity during the cleaning cycle to the hoppers below where the material is removed by a horizontal screw conveyor and then conveyed to the clinker storage silos.

The Mikro-Pulsaire unit is designed to handle an air volume of 145,000 ACFM at 250°F for a performance of 99.9+ percent efficiency. The effective collecting surface area is 18,720 ft^2 which gives an air-to-cloth ratio of 7.7:1. The pressure drop across the filter varies from 4 to 6 inches of water. The collector contains 2,016 bags with a minimum life expectancy of three (3) years, and each bag costs $12.00. The expected life of the baghouses is 40+ years, and the installed cost in September, 1970 was about $600,000.00 for both collectors.

The basic unit of the Norblo baghouse collectors on the finish mill grinding systems is a compartment which contains 108 cloth filter bags (6" diameter x 8' 3" long) or a total of 1,296 ft^2 of free filtering area. These bags are arranged in two groups of 54 bags. Each group has its own individual bag holder and shaker controlled by an electric timer with reversing air flow. Each compartment is 10' tall x 8' 6" x 5' above a 6' 6" tall 60° hopper. The particulate

matter is collected on the inside of the cloth filter bags (spun "Dacron") and falls by gravity during the cleaning cycle to the hopper, where the material (cement) is removed by a horizontal screw conveyor.

The Norblo baghouse collector is designed to handle an air volume of 33,000 ACFM at 180°F for a performance of 99.9+ percent efficiency. The effective collecting surface area of each baghouse which contains 12 compartments is 15,552 ft^2, giving an air-to-cloth ratio of 2.12:1. The pressure drop across the filter is approximately 3 inches of water. The collectors each contain 1,296 bags with an average life of five (5) years and each bag costs $3.65. The baghouses were installed in 1958 and the expected life is 40+ years. Neither the total installed cost nor the annual operating cost of this unit were available.

VII. LOCATION OF SAMPLING POINTS

The locations of the sampling ports are shown schematically in Figures 2 and 3. At each stack, sampling was conducted along each of two perpendicular stack diameters. The number of sampling points was dependent upon the distance of the sampling ports from disturbances in the gas flow, as described in Method 1 of the Federal Register, Vol. 36, No. 247, December 23, 1971. The number of points sampled was 22 points per diameter (for a total of 44 points) at the clinker cooler stack, and 12 points per diameter (each point sampled twice, for a total of 48 points) at the finish mill stack. The sampling time at each point throughout the testing was three minutes.

VIII. PROCESS OPERATION

Operating conditions of this continuous process were normal throughout the testing.

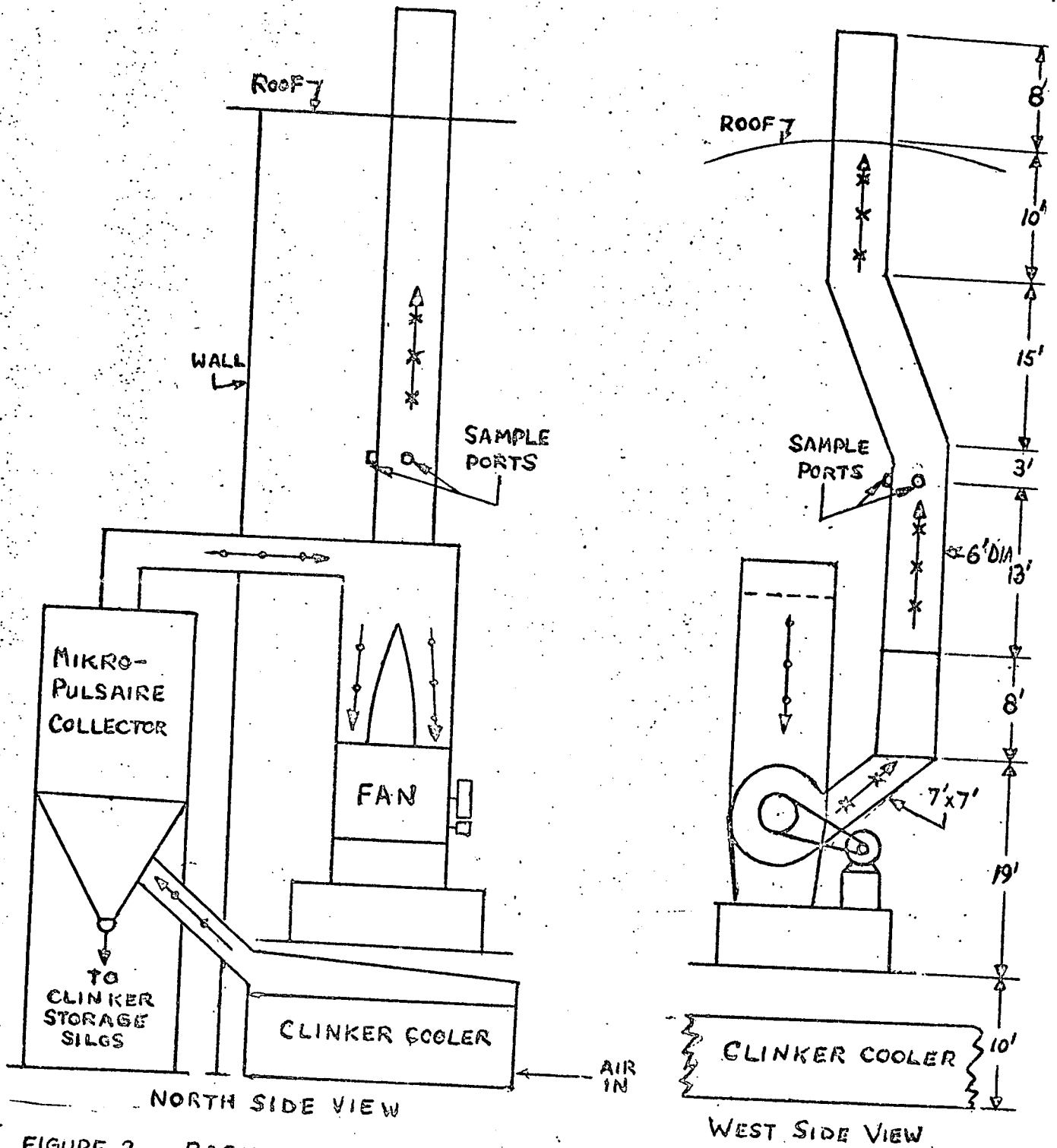


FIGURE 2 BAGHOUSE COLLECTOR ON CLINKER COOLER

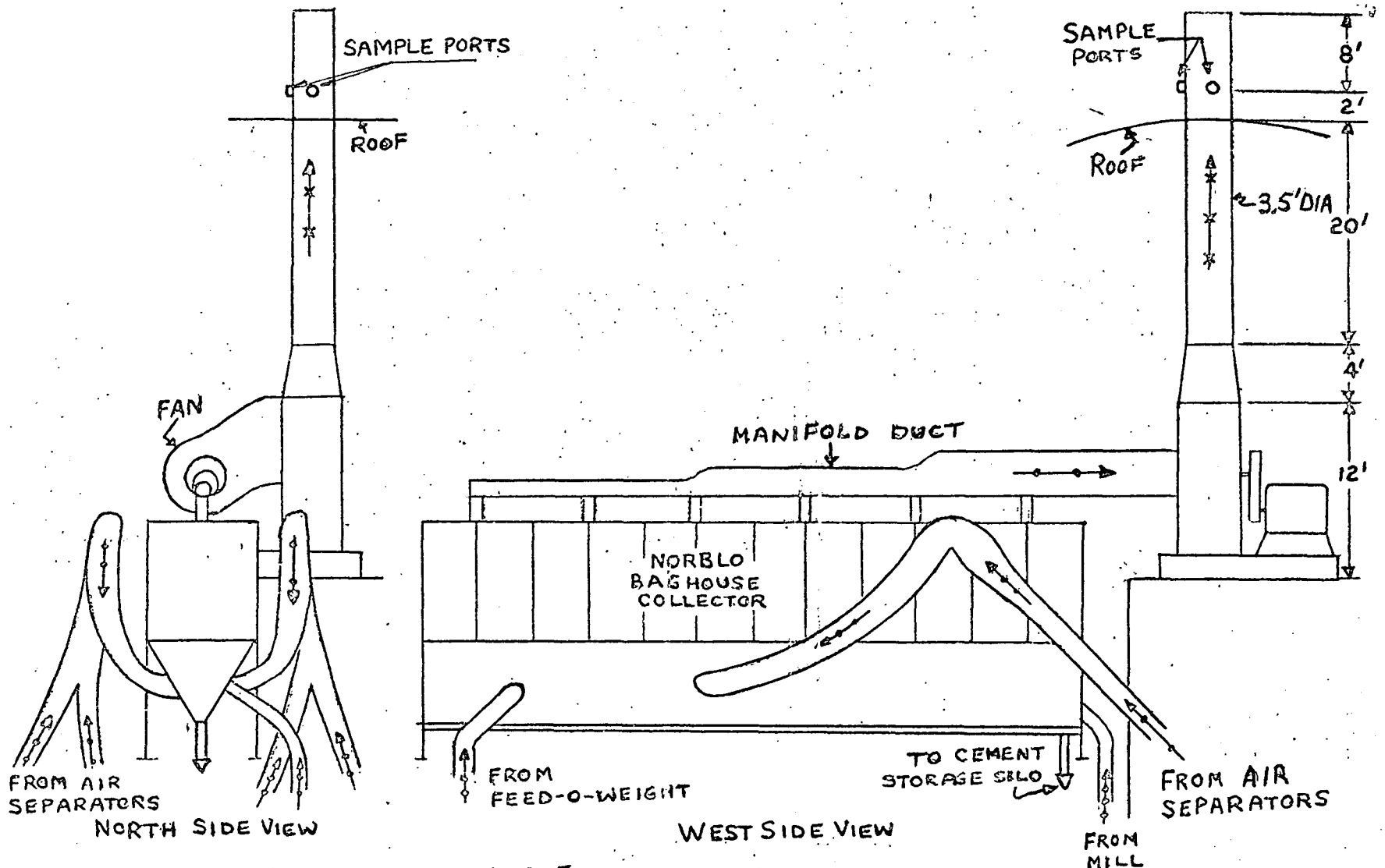


FIGURE 3 BAGHOUSE COLLECTOR ON No.2 FINISH MILL GRINDING SYSTEM

IX. SAMPLING AND ANALYTICAL PROCEDURES

Complete details of the equipment and procedures used for particulate sampling are described in Method 5, Federal Register, December 23, 1971.

The procedures for analyzing the particulates conform to Method 5 with the added exception of the impinger catch being analyzed for particulate residue including organic matter.

Quantitative analyses results of material collected on the glass fiber filter and in the residue samples are reported in Appendix C.

X. APPENDICES

APPENDIX A

PARTICULATE RESULTS AND CALCULATIONS

Complete results of the particulate sampling are presented in Tables A-1 and A-2. Example calculations using the data from run No. 1 of the clinker cooler follow the data tables.

PARTICULATE EMISSION DATA FOR CLINKER COOLER

Run No.		1	2	3
Test Date		5-18-71	5-18-71	5-18-71
D_n	Sampling nozzle diameter, in.	0.193	0.193	0.193
T_t	Net time of test, min.	132	132	132
P_b	Barometric pressure, in. Hg absolute	29.82	29.85	29.80
P_m	Average Orifice pressure drop, in. H_2O	2.28	2.06	2.15
V_m	Volume of dry gas sampled, ft^3 at meter conditions	107.40	101.95	103.79
T_m	Average gas meter temperature, °F	104	115	113
$V_{m_{std}}$	Volume of dry gas sampled at standard conditions*, SCF	101.07	94.15	96.05
V_w	Total H_2O collected in impingers and silica gel, ml	34.5	35.0	34.0
$V_{w_{gas}}$	Volume of water vapor collected at standard conditions*, SCF	1.64	1.66	1.61
% M	% Moisture in the stack gas by volume	1.59	1.73	1.65
M_d	Mole fraction of dry gas	0.984	0.983	0.983
% CO_2		< 1	< 1	< 1
% O_2		20.95	20.95	20.95
% CO		< 1	< 1	< 1
% N_2		78.0	78.0	78.0
% EA	Excess Air Percent	NA	NA	NA
MW_d	Molecular weight of stack gas, dry basis	29.00	29.00	29.00
MW	Molecular weight of stack gas, wet basis	28.82	28.81	28.82
C_p	Pitot tube coefficient	0.85	0.85	0.85
ΔP_s	Average velocity head of stack gas, in. H_2O	1.44	1.43	1.44
T_s	Average stack temperature, °F	175	196	194
N_p	Net sampling points	44	44	44
P_{st}	Static pressure of stack gas in. Hg	0.02	0.02	0.02
P_s	Stack gas pressure in. Hg absolute	29.84	29.87	29.82
V_s	Stack gas velocity at stack conditions fpm	4493	4480	4551
A_s	Stack area, $in.^2$	4072	4072	4072
Q_s	Dry stack gas volumetric flow rate at standard conditions*, SCFM	104,057	100,432	102,165
Q_a	Stack gas volumetric flow rate at stack conditions, ACFM	127,032	126,664	128,672
% I	Percent isokinetic	102.1	98.5	98.8

* 70°F, 29.92 in. Hg
NA - Not Applicable

TABLE A - 1

PARTICULATE EMISSION DATA FOR CLINKER COOLER

Run No.		1	2	3
T_c	Unit Feed Rate-Tons/hr	61.8	62.7	62.7
m_f	Particulate - probe, cyclone and filter, mg	11.8	20.5	14.2
m_t	Particulate - total, mg	26.3	38.1	23.3
I_c	% impinger catch	55.1	46.2	39.1
C_{an}	Particulate - probe, cyclone, and filter, gr/SCF*	0.00180	0.00335	0.00228
C_{ao}	Particulate - total, gr/SCF*	0.00401	0.00623	0.00373
C_{at}	Particulate - probe, cyclone, and filter, gr/cf at stack conditions	0.00147	0.00266	0.00180
C_{au}	Particulate - total, gr/cf at stack conditions	0.00328	0.00494	0.00296
C_{aw}	Particulate - probe, cyclone, and filter, lb/hr.	1.561	2.812	1.941
C_{ax}	Particulate - total, lb/hr.	3.538	5.323	3.269
P_{tf}	Particulate - probe, cyclone, and filter, lb/ton feed	0.0253	0.0448	0.0305
P_{tt}	Particulate - total, lb/ton feed	0.0572	0.0849	0.0513

*70°F, 29.92 in. Hg, dry basis

TABLE A - 2

PARTICULATE EMISSION DATA FOR FINISH MILL GRINDING SYSTEM

Run No.		1	2	3
Test Date		5-19-71	5-19-71	5-20-71
D_n	Sampling nozzle diameter, in.	0.250	0.250	0.250
T_t	Net time of test, min.	144	144	144
P_b	Barometric pressure, in. Hg absolute	30.00	30.00	30.10
P_m	Average Orifice pressure drop, in. H_2O	3.84	3.29	2.94
V_m	Volume of dry gas sampled, ft^3 at meter conditions	149.51	139.57	130.70
T_m	Average gas meter temperature, °F	111	106	93
$V_{m_{std}}$	Volume of dry gas sampled at standard conditions*, SCF	140.35	131.99	126.82
V_w	Total H_2O collected in impingers and silica gel, ml	90.5	81.0	72.0
$V_{w_{gas}}$	Volume of water vapor collected at standard conditions*, SCF	4.29	3.84	3.41
% M	% Moisture in the stack gas by volume	2.97	2.83	2.62
M_d	Mole fraction of dry gas	0.970	0.972	0.974
% CO_2		< 1	< 1	< 1
% O_2		20.95	20.95	20.95
% CO		< 1	< 1	< 1
% N_2		78.0	78.0	78.0
% EA	Excess Air Percent	NA	NA	NA
MW_d	Molecular weight of stack gas, dry basis	29.00	29.00	29.00
MW	Molecular weight of stack gas, wet basis	28.67	28.69	28.71
C_p	Pitot tube coefficient	0.85	0.85	0.85
ΔP_s	Average velocity head of stack gas, in. H_2O	0.81	0.81	0.81
T_s	Average stack temperature, °F	229	243	249
N_p	Net sampling points	24	24	24
P_{st}	Static pressure of stack gas in. Hg	0.04	0.04	0.04
P_s	Stack gas pressure in. Hg absolute	30.04	30.04	30.14
V_s	Stack gas velocity at stack conditions fpm	3490	3539	3549
A_s	Stack area, $in.^2$	1452	1452	1452
Q_s	Dry stack gas volumetric flow rate at standard conditions*, SCFM	26,360	26,252	26,244
Q_a	Stack gas volumetric flow rate at stack conditions, ACFM	35,185	35,679	35,780
% I	Percent isokinetic	109.0	102.9	98.9

* 70°F, 29.92 in. Hg
NA - Not Applicable

TABLE A - 2

PARTICULATE EMISSION DATA FOR FINISH MILL GRINDING SYSTEM

Run No.		1	2	3
T_c	Unit Feed Rate-Tons/hr	34.6	33.9	37.2
m_f	Particulate - probe, cyclone and filter, mg	22.0	26.9	17.1
m_t	Particulate - total, mg	32.9	37.8	27.9
I_c	% impinger catch	33.1	28.8	38.7
C_{an}	Particulate - probe, cyclone, and filter, gr/SCF*	0.00241	0.00314	0.00208
C_{ao}	Particulate - total, gr/SCF*	0.00361	0.00441	0.00339
C_{at}	Particulate - probe, cyclone, and filter, gr/cf at stack conditions	0.00181	0.00231	0.00152
C_{au}	Particulate - total, gr/cf at stack conditions	0.00270	0.00324	0.00248
C_{aw}	Particulate - probe, cyclone, and filter, lb/hr.	0.527	0.683	0.446
C_{ax}	Particulate - total, lb/hr.	0.791	0.971	0.761
P_{ct}	Particulate - probe, cyclone, and filter, lb/ton feed	0.0152	0.0201	0.0120
P_{tt}	Particulate - total, lb/ton feed	0.0229	0.0287	0.0205

*70°F, 29.92 in. Hg, dry basis

PARTICULATE CALCULATIONS

Example: Run No. 1, Clinker Cooler

1. Volume of dry gas sampled at standard conditions: 70°F, 29.92 in. Hg, SCF

$$V_{m_{std}} = \frac{17.7 \times V_m \left(P_b + \frac{P_m}{13.6}\right)}{(T_m + 460)} = \frac{17.7 \times 107.4 \left(29.82 + \frac{2.28}{13.6}\right)}{(104 + 460)} = 101.07 \text{ ft}^3$$

2. Volume of water vapor at 70°F and 29.92 in. Hg, SCF

$$V_{w_{gas}} = 0.0474 \times V_w = 0.0474 \times 34.5 = 1.64 \text{ SCF}$$

3. Percent moisture in stack gas

$$\% M = \frac{100 \times V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} = \frac{100 \times 1.64}{101.07 + 1.64} = 1.59$$

4. Mole fraction of dry gas

$$M_d = \frac{100 - \%M}{100} = \frac{100 - 1.59}{100} = 0.984$$

5. Average molecular weight of dry stack gas

$$MW_d = (\%CO_2 \times \frac{44}{100}) + (\%O_2 \times \frac{32}{100}) + \left[(\%CO + \%N_2) \times \frac{28}{100} \right] =$$

$$(0 \times \frac{44}{100}) + (20.95 \times \frac{32}{100}) + (78 \times \frac{28}{100}) = 29.00$$

6. Molecular weight of stack gas

$$MW = MW_d \times M_d + 18 (1 - M_d) = 29.00 \times 0.984 + 18 (1 - 0.984) = 28.82$$

7. Stack gas velocity at stack conditions, fpm

$$V_s = 4,360 \times \sqrt{\Delta P_s \times (T_s + 460)} \left[\frac{1}{P_s \times MW} \right]^{1/2} =$$

$$4,360 \times 30.2 \left[\frac{1}{29.84 \times 28.82} \right]^{1/2} = 4493 \text{ fpm}$$

8. Stack gas volumetric flow rate at standard conditions*, SCFM

$$Q_s = \frac{0.123 \times V_s \times A_s \times M_d \times P_s}{(T_s + 460)} = \frac{0.123 \times 4493 \times 4072 \times 0.984 \times 29.84}{(175 + 460)} = 104,057 \text{ SCFM}$$

9. Stack gas volumetric flow rate at stack conditions, ACFM

$$Q_a = \frac{.05645 \times Q_s \times (T_s + 460)}{P_s \times M_d} = \frac{.05645 \times 104,057 \times (175 + 460)}{29.84 \times 0.984} = 127,032 \text{ ACFM}$$

10. Percent isokinetic

$$\%I = \frac{1,032 \times (T_s + 460) \times V_{m_{std}}}{V_s \times T_t \times P_s \times M_d \times (D_n)^2} = \frac{1,032 \times (175 + 460) \times 101.07}{4493 \times 132 \times 29.84 \times 0.984 \times (0.193)^2} = 102.1\%$$

11. Particulate: probe, cyclone and filter, gr/SCF* Dry Basis

$$C_{an} = 0.0154 \times \frac{m_f}{V_{m_{std}}} = 0.0154 \times \frac{11.8}{101.07} = 0.00180 \text{ gr/SCF}$$

12. Particulate total, gr/SCF* Dry Basis

$$C_{ao} = 0.0154 \times \frac{m_t}{V_{m_{std}}} = 0.0154 \times \frac{26.3}{101.07} = 0.00401 \text{ gr/SCF}$$

13. Particulate: probe, cyclone and filter, gr/CF at stack conditions

$$C_{at} = \frac{17.7 \times C_{an} \times P_s \times M_d}{(T_s + 460)} = \frac{17.7 \times 0.00180 \times 29.84 \times 0.984}{(175 + 460)} = 0.00147 \text{ gr/CF}$$

14. Particulate: total, gr/CF at stack conditions

$$C_{au} = \frac{17.7 \times C_{ao} \times P_s \times M_d}{(T_s + 460)} = \frac{17.7 \times 0.00401 \times 29.84 \times 0.984}{(175 + 460)} = 0.00328 \text{ gr/CF}$$

15. Particulate: probe, cyclone, and filter, lb/hr

$$C_{aw} = 0.00857 \times C_{an} \times Q_s = 0.00857 \times 0.00180 \times 104,057 = 1.561 \text{ lb/hr}$$

16. Particulate: total, lb/hr

$$C_{ax} = 0.00857 \times C_{ao} \times Q_s = 0.00857 \times 0.00401 \times 104,057 = 3.538 \text{ lb/hr}$$

17. Particulate: probe, cyclone, and filter, lb/ton feed

$$P_{tf} = \frac{C_{aw}}{T_c} = \frac{1.561}{61.8} = 0.0253 \text{ lb/ton feed}$$

18. Particulate: total, lb/ton feed

$$P_{tt} = \frac{C_{ax}}{T_c} = \frac{3.538}{61.8} = 0.0572 \text{ lb/ton feed}$$

*70°F, 29.92 in. Hg

APPENDIX B

Field Data

PRESURVEY - PROCESS INDUSTRY & POWER PLANTS

NAME OF COMPANY Ideal Cement DATE OF PRESURVEY 4-2-71

ADDRESS P.O. Box 5 Galena Park CITY Houston STATE Texas

NAME OF CONTACT Dale Poole TITLE Production Supt PHONE 713-672-6341

PROVIDE FLOW DIAGRAM OF EACH PROCESS TO BE SAMPLED, INCLUDING FEED COMPOSITIONS AND RATES, OPERATING TEMPERATURES AND PRESSURES, PRODUCT RATES, AND PROPOSED SAMPLING SITES:

Clinker Cooler

1. danger control - automatic
2. Water sprays - cut in around 300°F
3. Number of Baghouses - 2 (1 per each kiln).
4. Temperature range - 150 - 300°
5. Cooling air from plant area.
6. Flow - 200,000 CFM (200 H.P. motor)
7. dce supply - stories near-by
8. Clinker bed - depth changes during time intervals
9. Product mostly Type I
10. Kiln - 2 natural gas fired
11. Baghouses installed in Jan. 1971 & Feb 1971
12. Wet Process

COMMENTS:

M. D. Poole
Ideal Cement Co.
P.O. Box 5
Galena Park, Texas 77547

SCAFFOLDING OR OTHER MEANS OF SUPPORT PRESENT?

☐ YES

☒ NO, WHO WILL PROVIDE IT? plant

SOURCE OF ELECTRICITY AVAILABLE? ☒ YES, MAXIMUM AMPERAGE PER CIRCUIT 20

☐ NO

DISTANCE 100 ft WHO WILL PROVIDE EXTENSION CORDS? Plant & OAP ~~Pace~~ people

LOCATION OF FUSE BOX

PARKING FACILITIES AVAILABLE FOR TRAILER OR VAN? yes

SIGNATURE REQUIRED ON PASSES? yes WAIVERS? yes

NEARBY RESTAURANTS AND MOTELS Holiday Inn 6752711 (5 miles)
Drive thru near plant for lunch
Vending machines on plant site!

LIST ANY SPECIAL SAFETY EQUIPMENT OR RULES
Hard hats + safety glasses

SURVEY BY C.E.R.

COMMENTS:

It is possible to sample the finish mill and air separator baghouse also. These units are combined into 1 separate baghouse.

Clean-up area — Can use part of the control room. Room is clean, dust free, and cool!

PRELIMINARY FIELD DATA

Stack Geometry

Plant Ideal Cement – Houston

Test No.

Location Houston, Texas (Klinker cooler - part A)

Date 5/17/71

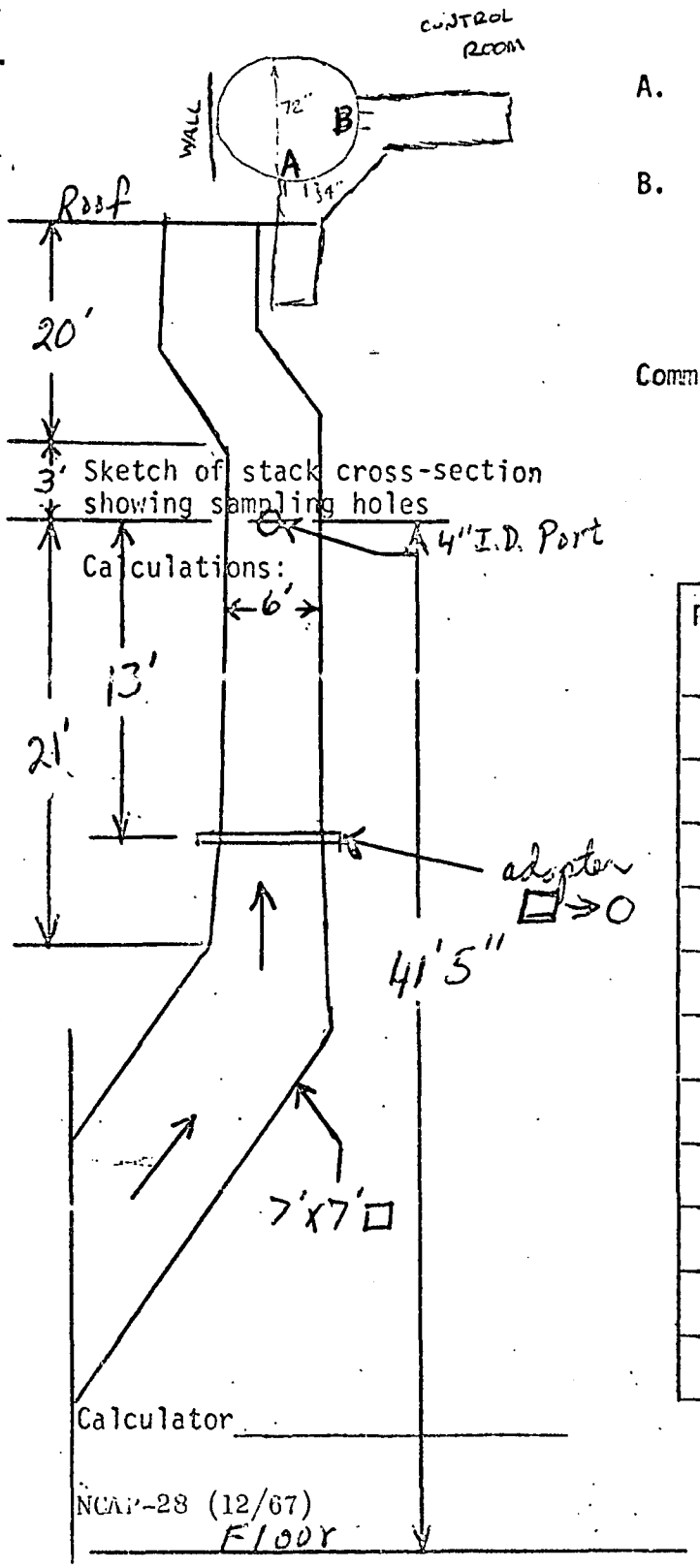
A. Dist. from inside of far wall to outside of near wall, in., = 76

B. Wall thickness, in., = 4

Inside diameter of stack = A-B 72

Stack Area = ~~4070~~ in.^{2} 4072

Comments:



Sketch of stack cross-section showing sampling holes

Calculations:

Point	% Dia. for circular stack	Dist. from outside of sample port, in.
	(See 2nd sheet)	

Calculator

NCAP-28 (12/67)

Alcock Comet.
Houston, Texas
7-17-71

22"

Point	%			
1	1.1	~~0.797~~ ~~0.8~~ 0.75	+ 4" =	4 3/4"
2	3.5	2.5	=	6 1/2"
3	6.0	4.25	=	8 1/4
4	8.7	6.25		10 1/4
5	11.6	8.375		12 3/8
6	14.6	10.5		~~16~~ 14 1/2
7	18.0	13.0		17.0
8	21.8	15.75		19 3/4
9	26.2	18.875		22 7/8
10	31.5	22.625		26 5/8
11	39.3	28.25		32 1/4
12	60.7	43.75		47 3/4
13	68.5	49.25		53 1/4
14	73.8	53.125		57 1/8
15	78.2	56.25		60 1/4
16	82.0	59.0		63.0
17	85.4	61.375		65 3/8
18	88.4	63.5		67 1/2
19	91.3	65.625		69 5/8
20	94.0	67.625		71 5/8
21	96.5	69.375		73 3/8
22	98.9	71.125		75 1/8

VELOCITY TRAVERSE FIELD DATA

Plant Ideal Cement - Houston

Test

Location Klinker Cooler – Port A B

Date 5/17/71

Operator Maerker, Smith, Riley

Meter ΔH 2.01

P_{static} ranges from 0.1 to 0.6 in. H_2O

Clock Time	Point	(1) ΔP, in. H_2O	(1) $\sqrt{\Delta P}$, in. H_2O	Point	(2) ΔP, in. H_2O	(2) $\sqrt{\Delta P}$, in. H_2O	Stack Tempt. °F (1)	Stack Tempt. °F (2)
	1	1.2		14	1.6		195	205
	2	1.4		15	1.6		205	205
	3	1.4		16	1.5		205	195
	4	1.4		17	1.5		200	200
	5	1.4		18	1.5		210	200
	6	1.4		19	1.5		205	200
	7	1.4		20	1.5		210	200
	8	1.4		21	1.5		210	200
	9	1.4		22	1.1		220	200
	10	1.5					200	
	11	1.6					210	
	12	1.7					205	
	13	1.6					205	

(1) ΔP, in. H_2O Average 1.45

(2) ΔP, in. H_2O Average

Comments:

VELOCITY TRAVERSE FIELD DATA

Plant Ideal Cement

Test

Location Klinker Cooler – Port ~~B~~ A

Date 5/17/71

Operator Maerker, Smith, Riley

Meter ΔH 2.01

Clock Time	Point	(1) ΔP, in. H_2O	(1) $\sqrt{\Delta P}$, in. H_2O	(2) ΔP, in. H_2O		(2) $\sqrt{\Delta P}$, in. H_2O	Stack Tempt. °F (1)	Stack Tempt. °F (2)
	1	1.1		14	1.5		165	178
	2	1.4		15	1.6		167	170
	3	1.5		16	1.6		168	170
	4	1.6		17	1.6		178	173
	5	1.6		18	1.6		172	173
	6	1.6		19	1.5		172	165
	7	1.6		20	1.5		172	165
	8	1.7		21	1.3		175	170
	9	1.6		22	1.2		178	165
	10	1.6					185	
	11	1.5					170	
	12	1.5					180	
	13	1.6					180	

(1) ΔP, in. H_2O Average .15

(2) ΔP, in. H_2O Average

$$22\overline{)3.33}\ .15$$

22
113
110
3

Comments:

Plant Alical Cement Houston Date 5-17-71

Sampling location Clinker Cooler A + B port

STACK DATA FOR NOMOGRAPH:

1. Meter ΔH 2.01 in H_2O

2. Avg. meter tempt (ambient (110) + 20° 130 °F

3. Moisture (volume) ~2.0 %

4. Avg. static press. ± 0.3 in. H_2O X .073 = ±0.022 in. Hg.

5. Bar. press sampling point 29.89 in.Hg ± 0.02 (static press in.Hg) = 29.91 in. Hg.

6. Bar press of meter 29.89 in. Hg.

7. P_s/P_m = $\frac{5.\ 29.91 \text{ in. Hg}}{6.\ 29.89 \text{ in. Hg}}$ = 1.0

8. Avg. stack temperature 200 °F.

9. Avg. stack velocity (ΔP) ~1.5 in H_2O.

C factor (1) 13 (2) 1.25

/

PARTICULATE FIELD DATA

Plant: Ideal Cement (Houston)

Run No. 1

Location Clinker Cooler Dust Collector

Date 5-18-71

Operator Maerker, Smith

Sample Box No. 1 - blue (NC-1)

Meter Box No. NC-1

Meter ΔH 2.01

C Factor 1.3

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

start time 8:25 A.M.

Completion 10:40 A.M.

Readings every 3 MIN

Ambient Temp °F 90°

Bar. Press. "Hg 29.82

Assumed Moisture % 2

Heater Box Setting, °F 250

Probe Tip Dia., In. .193

Probe Length 6½ ft

Probe Heater Setting 90

Avg. ΔP _____ Avg. ΔH _____

Point	Clock Time	Dry Gas Meter Reading, Cu. Ft.	Pitot In. H_2O ΔP	Orifice ΔH In. H_2O Desired	Orifice ΔH In. H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press In. Hg	Stack Temp °F
A 1	0	845.00 844.50	1.1	1.7	1.7	100	100	2.5	220	65		170
2	3	847.09	1.3	2.0	2.0	100	98	3.5	240	62		175
3	6	849.23	1.4	2.25	2.25	100	98	4.0	–	–		180
4	9	851.65	1.5	2.4	2.4	102	98	4.6	215	62		188
5	12	854.13	1.6	2.6	2.6	102	98	4.4	220	64		193
6	15	856.70	1.6	2.6	2.6	102	98	4.5	230	65		194
7	18	859.30	1.6	2.6	2.6	103	98	4.5	—	—		195
8	21	861.99	1.65	2.45	2.45	104	100	4.3	200	65		198
9	24.5	864.98	1.65	2.45	2.45	105	99	4.3	–	–		198
10	27	867.97	1.65	2.45	2.45	105	100	4.3	230	66		198
11	30	869.50	1.6	2.4	2.4	105	100	4.3	225	67		194
12	33	872.12	1.6	2.4	2.4	105	101	4.3	245	70		190
13	36	874.535	1.65	2.45	2.45	105	101	4.3	250	75		186
14	39	877.06	1.6	2.5	2.5	105	101	4.4	220	70		185
15	42	879.61	1.6	2.5	2.5	105	101	4.4	220	72		179
16	45	882.155	1.65	2.7	2.7	105	101	4.8	245	72		176

22 sampling points per port
2 ports (A & B)

points 21 & 22 taken at point 20 — probe too short

Run 1

Comments	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
9:13 a.m.	48	884.79	1.65	2.65	2.65	106	102	4.8				170
18	51	887.42	1.65	2.65	2.65	107	102	4.8	215	71		165
19	54	890.07	1.6	2.55	2.55	107	102	4.8	235	72		160
22	57	892.69	1.55	2.5	2.5	107	102	4.6	210	72		157
* 21	60	895.27	1.55	2.55	2.55	107	103	4.5	220	70		151
22	63	897.86	1.55	2.55	2.55	107	103	4.5	225	70		149
	66	900.42	.90	1.5	1.5	107	103	2.8	215	68		145
B1	69	902.40	1.1	1.8	1.8	107	103	3.2	240	65		148
2	72	904.55	1.2	1.9	1.9	107	103	3.5	238	65		151
3	75	906.875	1.25	2.05	2.05	107	103	3.7	230	65		159
4	78	909.07	1.25	2.05	2.05	107	103	3.8	230	64		159
5	81	911.41	1.3	2.1	2.1	107	103	3.8	245	64		161
6	84	913.78	1.3	2.1	2.1	108	103	3.8	252	62		163
7	87	916.135	1.3	2.1	2.1	108	103	3.9	230	62		165
8	90	918.50	1.35	2.15	2.15	108	103	3.9	235	62		160
9	93	920.87	1.35	2.15	2.15	108	103	3.9	240	62		160
10	96	923.26	1.45	2.3	2.3	109	104	4.0	220	63		160
11	99	925.725	1.5	2.4	2.4	110	105	4.1	220	64		160
12	102	928.23	1.5	2.4	2.4	110	105	4.1	250	65		162
13	105	930.765	1.45	2.3	2.3	110	105	4.1	240	65		165
14	108	933.28	1.45	2.3	2.3	110	105	4.1	255	70		175
15	111	935.76	1.35	2.1	2.1	111	105	4.0	250	74		179
16	114	938.17	1.4	2.15	2.15	111	105	4.0	215	77		184
17	117	940.59	1.4	2.15	2.15	111	107	4.0	210	80		190
18	120	943.00	1.35	2.1	2.1	111	106	3.9	225	80		195
19	123	945.36	1.35	2.1	2.1	111	106		215	78		206
20	126	947.95	1.35	2.0	2.0	111	106	3.9	195	75		210
* 21	129	950.07	1.35	2.0	2.0	111	106	3.9	215	78		211
22	132	952.40										
	132	107.40	1.44		44 / 100.10	106.7 ~~107~~	102.2					175
					~~2.275~~ 2.28	~~106~~ 104						

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PARTICULATE FIELD DATA

Plant Ideal Cement (Houston)

Run No. 2

Location Clinker Cooler Dust Collector

Date 5/18/71

Operator Maerker, Smith

Sample Box No. 1 - brown

Meter Box No. NC-1

Meter Δ H 2.01

C Factor ~~1.3~~ 1.25

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

start time 11:10 A.M.

completion 1:24 P.M.

Readings every 3 minutes

Ambient Temp °F 90°

Bar. Press. "Hg 29.85

Assumed Moisture % ~2.0

Heater Box Setting, °F 250

Probe Tip Dia., In. 0.193

Probe Length 6½ ft.

Probe Heater Setting 90

Avg. Δ P _____ Avg. ΔH _____

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
A 1	0	952.90	1.0	1.5	1.5	110	119	2.5	250	70		205
2	3	954.93	1.15	1.7	1.7	110	118	3.0	240	64		205
3	6	957.04	1.25	1.9	1.9	110	118	3.2	245	64		205
4	9	959.24	1.35	2.0	2.0	111	118	3.2	250	66		211
5	12	961.51	1.4	2.1	2.1	111	118	3.5	250	66		220
6	15	963.845	1.45	2.15	2.15	111	118	3.8	250	67		220
7	18	966.20	1.45	2.05	2.05	111	118	3.7	245	68		220-
8	21	968.545	1.45	2.05	2.05	111	118	3.5	250	69		217
9	24	970.86	1.5	2.1	2.1	111	118	3.6	250	69		215
10	27	973.20	1.5	2.1	2.1	111	118	3.6	250	68		210
11	30	975.56	1.5	2.1	2.1	111	118	3.6				206
12	33	977.92	1.5	2.25	2.25	111	118	3.8	250	70		206-
13	36	980.35	1.5	2.25	2.25	111	117	3.8	250	68		203
14	39	982.79	1.55	2.3	2.3	111	117	3.9	255	68		199
15	42	985.25	1.55	2.3	2.3	111	117	3.9	255	67		198
16	45	987.72	1.55	2.3	2.3	111	117	3.9	250	69		192

Comments: 22 sampling points per port — 2 ports (A & B)

NCAP-37 (12/57) # points 20, 21, 22 taken at point 19 — probe too short.

Comments	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
17	48	990.19	1.55	2.3	2.3	111	117	3.9	240	70		192
18	51	992.65	1.5	2.25	2.25	111	117	3.9	255	71		192
19	54	995.10	1.5	2.25	2.25	111	117	3.9	235	78		190
20	57	997.55	1.5	2.25	2.25	111	117	3.9	245	74		190
21	60	1000.00	1.5	2.25	2.25	111	117	3.8	245	75		190
22	63	2.445	1.5	2.25	2.25	111	117	3.9	245	76		188
	66	4.845										
12:18 P.M. Point #1	66	4.845	0.87	1.35	1.35	111	117	2.4	245	74		182
2	69	6.685	1.05	1.65	1.60	111	117	3.0	245	70		182
3	72	8.78	1.1	1.7	1.7	111	117	3.0	230	70		182
4	75	10.835	1.15	~~2.0~~ 1.8	~~2.0~~ 1.8	111	117	3.1	230	70		184
5	78	13.00	1.2	1.85	1.86	111	117	3.1	245	68		184
6	81	15.21	1.25	1.9	1.9	111	117	3.2	225	68		184
7	84	17.46	1.3	2.0	2.0	111	117	3.3	225	69		188
8	87	19.72	1.35	2.05	2.05	111	117	3.5	235	68		189
9	90	22.00	1.35	2.05	2.05	112	118	3.5	225	69		190
10	93	24.31	1.4	2.1	2.1	112	118	3.5	235	70		200
11	96	26.64	1.45	2.1	2.1	112	118	3.5	230	70		200
12	99	28.95	1.65	2.4	2.4	112	118	4.0	245	71		200
13	102	31.40	1.6	2.35	2.35	112	118	4.0	245	68		200
14	105	33.80	1.5	2.2	2.2	113	117	3.8	240	66		200
15	108	36.33	1.45	2.1	2.1	113	117	3.5	240	66		200
16	~~H9~~ 111	38.695	1.45	2.1	2.1	113	117	3.5	235	66		200
17	~~H3~~ 114	41.045	1.4	2.0	2.0	113	118	3.5	230	67		197
18	~~H6~~ 117	43.33	1.35	2.0	2.0	113	118	3.4	230	67		190
19	~~H9~~ 120	45.61	1.35	2.05	2.05	113	118	3.4				182
20	~~L2~~ 123	47.925	1.4	2.1	2.1	113	118	3.4				178
21	126	50.23	1.4	2.1	2.1	113	118	3.4	245	68		172
22	129	52.51	1.4	2.1	2.1	113	118	3.4	240	69		172
	132	54.85	~~1.47~~	~~2.1~~	~~2.1~~	~~113~~	~~118~~	~~3.4~~	~~240~~	~~68~~		~~172~~
1:24 P.M.												
	132	101.95	~~1.47~~ 1.53		~~2.04~~ 2.06	111.5 ~~112~~ (115)	117.5					196

PARTICULATE FIELD DATA

Plant Ideal Cement (Houston)

Run No. 3

Location Clinker Cooler Dust Collector

Date 5-18-71

Operator Maerker, Smith

Sample Box No. 1 - Blue

Meter Box No. NC-1

Meter Δ H 2.01

C Factor 1.25

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

start time 2:24 P.M.

Completion 4:48 P.M.

readings every 3 min

Ambient Temp °F 95°

Bar. Press. "Hg 29.80

Assumed Moisture % 2

Heater Box Setting, °F 250

Probe Tip Dia., In. .193

Probe Length 6 ft

Probe Heater Setting 90

Avg. Δ P _____ Avg. Δ H _____

32 Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
A 1	0	55.20	0.95	1.4	1.4	112	112	2.5	220	74		205
2	3	57.15	1.15	1.7	1.7	112	112	3.0	260	65		205
3	6	59.23	1.25	1.85	1.85	112	112	3.1	235	65		201
4	9	61.42	1.35	2.0	2.0	112	110	3.4	225	66		199
5	12	63.685	1.45	2.1	2.1	113	110	3.6	255	77		194
6	15	66.025	1.45	2.1	2.1	114	110	3.6	215	66		192
7	18	68.34	1.45	2.1	2.1	114	110	3.6	250	66		195
8	21	70.625	1.5	2.2	2.2	113	111	3.6	235	67		195
9	24	73.995	1.5	2.2	2.2	114	110	3.6	215	68		180
10	27	75.415	1.5	2.3	2.3	114	110	3.8				180
11	30	77.88	1.55	2.4	2.4	115	110	4.0	220	67		185
12	33	80.365	1.55	2.4	2.4	115	110	4.0				185
13	36	82.85	1.55	2.4	2.4	115	110	4.0	240	69		193
14	39	85.33	1.5	2.2	2.2	115	110	3.8	215	70		193
15	42	87.75	1.5	2.2	2.2	115	110	3.8				196
16	45	90.18	1.55	2.3	2.3	115	111	3.8	220	72		196

Comments:

NCAP-37 (12/67) * Points 21 & 22 taken at point 20

Comments	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in Hg	Stack Temp °F
3:11 P.M.	17 48	92.625	1.6	2.4	2.4	115	111	4.0				196
	19 51	95.125	1.55	2.3	2.3	115	111	4.0				196
	19 54	97.60	1.6	2.4	2.4	115	111	4.0	210	77		196
	20 57	100.68	1.55	2.3	2.3	116	112	3.9				196
*	21 60	102.525	1.55	2.3	2.3	116	112	3.9				196
	22 63	104.98	1.55	2.3	2.3	116	112	3 9	230	79		196
	66	107.405										
3:35 P.m.	B1 69	107.405	0.80	1.25	1.25	114	112	2.1	235	77		187
	2 72	109.20	1.1	1.7	1.7	114	112	2.9	225	71		187
	3 75	111.25	1.2	1.8	1.8	115	111	3.0	245	69		187
	4 78	113.43	1.3	2.0	2.0	115	111	3.1	210	69		187
	5 81	115.673	1.35	2.1	2.1	115	111	3.3	235	68		187
	6 84	118.99	1.45	2.2	2.2	115	111	3.6	250	68		190
	7 87	120.39	1.45	2.2	2.2	115	111	3.7	215	67		190
	8 90	122.82	1.45	2.2	2.2	115	111	3.7				190
	9 93	125.195	1.35	2.1	2.1	115	111	3.5	250	68		210
	10 96	127.52	1.35	2.0	2.0	116	111	3 5	215	68		214
	11 99	129.81	1.35	2.0	2.0	116	111					214
	12 102	132.10	1.5	2.2	2.2	116	111	3.5	235	70		214
	13 105	134.475	1.45	2.1	2.1	115	111	3.5	215	70		209
	14 108	136.82	1.45	2.1	2.1	115	111	3.5	245	68		206
	15 111	139.14	1.5	2.2	2.2	115	111	3.5				202
	16 114	141.53	1.55	2.25	2.25	115	111	3.7	230	67		193
	17 117	143.95	1.55	2.3	2.3	115	111	3.8				190
	18 120	146.43	1.6	2.4	2.4	115	111	4.0	210	67		181
*	19 123	148.93	1.6	2.4	2.4	115	111	4.0	240	67		181
	20 126	151.44	1.6	2.4	2.4	115	111	4.0				181
4:41 P.M.	21 129	153.96	1.6	2.4	2.4	115	111	4.0	220	68		181
	22 132	156.47	1.6	2.4	2.4	116	112	4.0				188
		158.985										
						114.7	111.0					~~199~~
	132	103.285	1.44		2.15							
						(113)						194

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PARTICULATE CLEANUP SHEET

Date: 5-18-71 Plant: Ideal Cement (Houston)

Run number: 1 Location of sample port: Center Location

Operator: C.E.R. Barometric pressure: 29.80

Sample box number: 1 Blue Ambient temperature: 90°

Impinger H_2O

Volume after sampling 218 ml Container No. 1A Ether-chloroform extraction of impinger water — 0 mg

Impinger prefilled with 204 ml Extra No. ____

Volume collected 14 ml Impinger water residue 14.5 mg

Impingers and back half of filter, acetone wash: Container No. 1B

Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. ____

Extra No. ____ Weight results ____ mg

Probe, cyclone, flask, and front half of filter, acetone wash: Container No. 1C

Extra No. ____ Weight results 11.8 mg

Filter Papers and Dry Filter Particulate

Filter number	Container no.	Filter number	Container no.
12412	1D		

Filter particulate weight 0 mg

Total particulate weight 26.3 mg

Silica Gel

	1.	2.	3.	4.
Weight after test:	220.5	____	____	____
Weight before test:	200	____	____	____
Moisture weight collected:	20.5	____	____	____
Container number:				

20.5
14
34.5

Moisture total 34.5 gm

Sample number: 1 Analyze for: Mass particulate

Method determination: ____

Comments: ____

PARTICULATE CLEANUP SHEET

Date: 5-18-81
Plant: Ideal Cement Houston
Run number: 2
Location of sample port: Clinker Cooler
Operator: CEB
Barometric pressure: 29.32
Sample box number: 1 Ken
Ambient temperature: 90°

Impinger H_2O

Volume after sampling 218 ml
Container No. 2A
Ether-chloroform extraction of impinger water 0 mg
Impinger prefilled with 204 ml
Extra No. ____
Volume collected 14 ml
Impinger water residue 17.6 mg

Impingers and back half of filter, acetone wash:
Container No. 2B
Extra No. ____
Weight results ✓ mg

Dry probe and cyclone catch:
Container No. ____
Extra No. ____
Weight results ____ mg

Probe, cyclone, flask, and front half of filter, acetone wash:
Container No. 2C
Extra No. ____
Weight results 19.4 mg

Filter Papers and Dry Filter Particulate

Filter number	Container no.	Filter number	Container no.
F2414	2D		

Filter particulate weight 1.1 mg

Total particulate weight 38.1 mg

Silica Gel

	1	2	3	4
Weight after test:	221.0			
Weight before test:	200			
Moisture weight collected:	21.0			
Container number:	1.	2.	3.	4.

21.0
14
35.0

Moisture total 35.0 gm

Sample number: 2
Analyze for: Mass particulate
Method determination: ____
Comments: ____

PARTICULATE CLEANUP SHEET

Date: 5-18-71 Plant: Alcoa Conant (Houston)

Run number: 3 Location of sample port: Clinker Cooler

Operator: C.E.B. Barometric pressure: 29.85

Sample box number: 1 Blue Ambient temperature: 90°

Impinger H_2O

Volume after sampling 216 ml Container No. 3A Ether-chloroform extraction of impinger water 0 mg

Impinger prefilled with 200 ml Extra No. ____

Volume collected 10 ml Impinger water residue 9.1 mg

Impingers and back half of filter, acetone wash: Container No. 3B

Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. ____

Extra No. ____ Weight results ____ mg

Probe, cyclone, flask, and front half of filter, acetone wash: Container No. 3C

Extra No. ____ Weight results 13.4 mg

Filter Papers and Dry Filter Particulate

Filter number	Container no.	Filter number	Container no.
12411	3D		

Filter particulate weight 0.8 mg

Total particulate weight 23.3 mg

Silica Gel

Weight after test:	224	____	____	____	24.0
Weight before test:	200	____	____	____	10.0
Moisture weight collected:	24	____	____	____	34
Container number:	1. ____	2. ____	3. ____	4. ____	

Moisture total 34.0 gm

Sample number: 3 Analyze for: Mass particulate

Method determination: ____

Comments: ____

SAMPLING SUMMARY SHEETS

PLANT Ideal Cement LOCATION Houston, Texas

SAMPLED SOURCE Clinker Cooler Stack

Train Data

Run No.	Date	Nozzle dia. in.	Net time min.	Bar. pres. "Hg.	Orifice diff. ΔH "H_2O	Volume sampled meter cond. cu. ft.	Meter temp. °F	Volume sampled standard cond. cu. ft.
1	5-18-71	.193	132	29.82	2.28	107.40	104	101.07
2	5-18-71	.193	132	29.85	2.06	101.95	115	94.15
3	5-18-71	.193	132	29.80	2.15	103.785	113	96.04

Moisture and Gas Data

Run No.	Total moisture ml.	Moisture std. cond. cu. ft.	% Moisture by volume	Mole fraction dry gas	Molecular wt. of dry stack gas	Molecular wt. of moist. stack gas
1	34.5	1.64	1.60	.98	29.00	28.78
2	35.0	1.66	1.73	.98	29.00	28.78
3	34.0	1.61	1.65	.98	29.00	28.78

tack Data

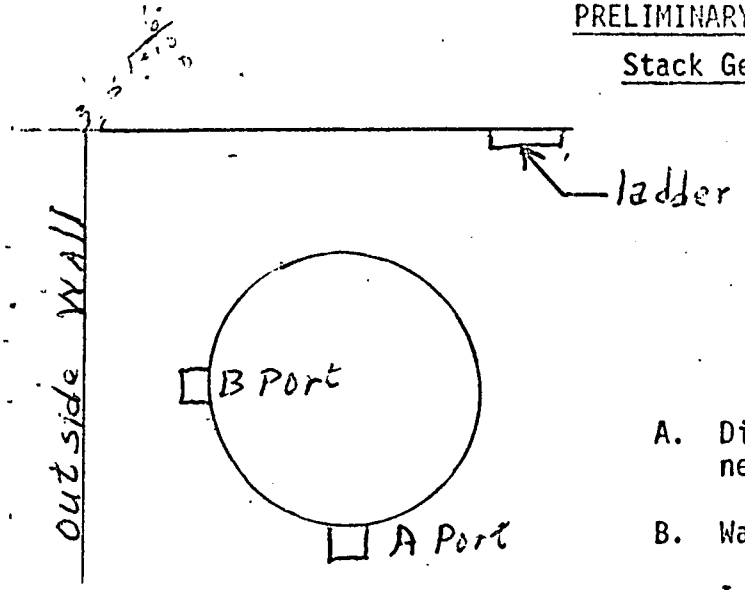
Run No.	Stack area in^2	Velocity head "H_2O	Static press. "Hg.	Stack press. "Hg. Abs.	Stack temp. °F
1	4072	1.44	.02	29.84	175
2	4072	1.43	.02	29.87	196
3	4072	1.44	.02	29.82	194

elocity and Calculation Data

Run No.	Average $\sqrt{\text{Velocity} \times \text{temperature } ^\circ R}$	Stack velocity fpm stack cond.	Stack gas volume scfm	Percent isokinetic
1	30.23	4487	103,495	102.7
2	30.14	4472	99,948	99.0
3	30.61	4545	101,719	99.3

PRELIMINARY FIELD DATA

Stack Geometry



Plant Ideal Cement Houston

Test No. 1

Location Mill + Air Separator Stack

Date 5-19-71

A. Dist. from inside of far wall to outside of near wall, in., = 47"

B. Wall thickness, in., = 4"

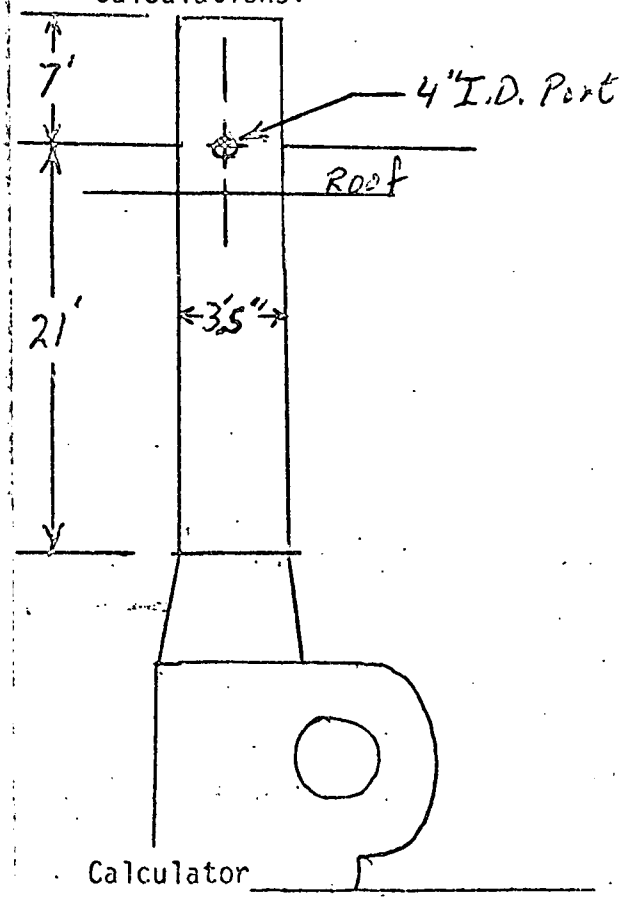
Inside diameter of stack = A-B 43"

.7854d² Stack Area = ~~1400~~ 1452.

Comments:

Sketch of stack cross-section showing sampling holes

Calculations:



24 sampling points

Point	% Dia. for circular stack	Dist. from outside of sample port, in.
1	2.1	0.85 + 4 = 5"
2	6.7	2.88 = 6 7/8
3	11.8	5.07 = 9"
4	17.7	7.60 = 11 5/8
5	25.0	10.72 = 14 3/4
6	35.5	15.3 = 19 3/8
7	64.5	27.7 = 31 3/4
8	75.0	32.2 = 36 1/4
9	82.3	35.4 = 39 3/8
10	88.2	38.0 = 42
11	93.3	40.2 = 44 1/2
12	97.9	42.2 = 46 1/8

VELOCITY TRAVERSE FIELD DATA

Plant Ideal Cement Houston

Test 1

Location Mill + Air Separator Stack

Date 5-19-71

Operator Maerker, Smith, York, Riley

P_{static} = 0.6 in H_2O

Port A

P_{abs} = 30.0 + $\frac{0.6}{13.6}$ = 30.0

T_{stack} = 190°F

BAGHOUSE EFFLUENT STACK FROM FINISH MILL GRINDING CIRCUIT

Meter ΔH ~~2.0~~ 2.01

Clock Time	Point	(1) ΔP, in. H_2O	(1) $\sqrt{\Delta P}$, in. H_2O	Point	(2) ΔP, in. H_2O	(2) $\sqrt{\Delta P}$, in. H_2O	Stack Tempt. °F (1)	Stack Tempt. °F (2)
	A 1	0.52		B 1	0.49		190	200
	2	0.65		2	0.68		200	230
	3	0.77		3	0.74		200	230
	4	0.74		4	0.77		220	"
	5	0.75		5	0.78		230	"
	6	0.72		6	0.74		230	"
	7	0.69		7	0.73		"	"
	8	0.68		8	0.67		"	"
	9	0.68		9	0.71		"	"
	10	0.69		10	0.67		"	"
	11	0.65		11	0.62		"	"
	12	0.58		12	0.56		230	"
					6.81			

(1) ΔP, in. H_2O Average 0.65 = 0.68

(2) ΔP, in. H_2O Average 0.70

24 | 16.28

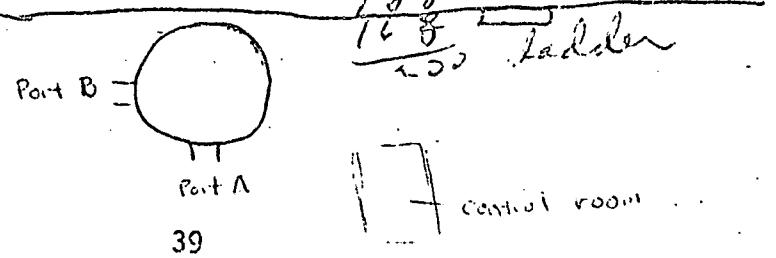
144

188

168

20 ladder

Comments:



NCAP-29 (12/67)

Plant Alad Cement (Houston) Date 5-19-71

Sampling location Mill & Air Separator Stack

STACK DATA FOR NOMOGRAPH:

1. Meter ΔH ~~2.02~~ 2.01 in H_2O

2. Avg. meter tempt (ambient + 20° 85) 105 °F

3. Moisture (volume) 2 %

4. Avg. static press. ⊖ .6 in. H_2O X.073 = ⊖ .04 in. Hg.

5. Bar. press sampling point 30.00 in.Hg ± .04 (static press in.Hg) = 30.04 in. Hg.

6. Bar press of meter 30.00 in. Hg.

7. P_s/P_m = 5. _____ in. Hg / 6. _____ in. Hg = 1.0

8. Avg. stack temperature 190 °F.

9. Avg. stack velocity (ΔP) .65 in H_2O.

C factor (1) 1.25 (2) 1.20

PARTICULATE FIELD DATA

Plant Alcoa Cement (Houston)

Run No. 1

Location Mill Air Separator Stack

Date 5-19-71

Operator Maerker, Smith

Sample Box No. 1-brown

Meter Box No. NC-1

Meter ΔH@ 2.01

C Factor 1.25

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.
do each point twice
PATHOLOGICAL INCINERATORS-
read and record every 5 minutes.

start time 10:41 AM

Completion time 1:06 pm

Ambient Temp °F 90°

Bar. Press. "Hg 30.20

Assumed Moisture % 2

Heater Box Setting, °F 250

Probe Tip Dia., In. 0.25

Probe Length 5 ft

Probe Heater Setting 60-70

Avg. ΔP Avg. ΔH

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H2O ΔP	Orifice ΔH in H2O Desired	Orifice ΔH in H2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
A-1-1	10:41 0	167.000	0.52	2.15	2.15	98	95	5	250	63°	5	190
A-1-2	3	Meter 1693-	0.52	2.15	2.15	99	96	5				200
-3	6	171.79	0.76	3.1	3.1	101	96	6	235	68		192
4	9	174.50	0.81	3.23	3.23	104	97	6	240	69		235
5	12	177.41	0.83	3.26	3.26	104	98	6	235	69		230
		-	0.87	4.20	4.20	-	-	8	-	-		240
6	15	180.20	0.90	4.3	4.3	107	99	8	245	68		240
		-	0.88	4.2	4.2	-	-	8	-	-		240
7	18	183.51	0.90	4.3	4.3	109	100	8	240	68		232
		-	0.87	4.2	4.2	-	-	8	-	-		232
8	21	186.765	0.88	4.25	4.25	111	102	8	235	68		231
9	24	190.03	0.88	4.25	4.25	113	103	8	250	67		235
10	27	193.40	0.87	4.2	4.2	114	103	8	250	67		235
		-	0.84	4.0	4.0	-	-	8	-	-		235
11	30	196.53	0.87	4.2	4.2	115	105	8	245	68		230
		-	0.84	4.0	4.0	-	-	8	-	-		230

1st time at point (2 times total at each point)

A-1-1

port

location on probe

(3/67)

Run 1 Mill

Comments	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
A-1-12	33	199.15	0.76	3.7	3.7	116	105	7.5	235	70		230
		—	0.74	3.6	3.6	—	—	7	—	—		230
A-2-12	36	202.82	0.74	3.6	3.6	116	106	7	235	71		230
		—	0.77	3.7	3.7	—	—	7	—	—		230
		—	0.74	3.6	3.6	—	—	7	—	—		230
11	39	205.85	0.86	4.15	4.15	116	107	8	230	71		230
		—	0.82	3.95	3.95	—	—	8	—	—		230
10	42	209.03	0.89	4.25	4.25	117	107	8	225	70		232
			0.87	4.2	4.2	—	—	8	—	—		232
9	45	212.28	0.88	4.2	4.2	117	108	8	230	71		233
8	48	215.54	0.89	4.25	4.25	118	108	8	235	70		233
7	51	218.82	0.91	4.35	4.35	118	108	8.5	225	72		227
		—	0.88	4.2	4.2	—	—	8.5	—	—		227
6	54	222.11	0.90	4.25	4.25	119	109	8.5	230	74		225
5	57	225.41	0.87	4.2	4.2	119	109	8.5	245	73		225
4	60	228.69	0.84	4.0	4.0	119	110	8	230	73		225
3	63	231.92	0.78	3.75	3.75	119	110	7.5	230	73		225
2	66	235.06	0.67	3.25	3.25	118	110	6.5	230	73		225
		—	0.69	3.3	3.3	—	—	6.5	—	—		225
A-2-1	69	238.03	0.51	2.45	3.45 (possibly run at 3.45 instead of 2.45)	119	110	6.5	230	72		210
	72	240.95										
B-1-1	72	240.95	0.52	2.55	2.55	117	110	5	220	72		212
2	75	243.65	0.68	3.3	3.3	117	109	6	230	72		224
		—	0.70	3.35	3.35	—	—	6	—	—		224
3	78	246.51	0.77	3.75	3.75	118	109	7	220	71		226
4	81	249.59	0.81	3.9	3.9	118	110	7	230	70		226
5	84	252.75	0.84	4.0	4.0	118	110	7.5	230	70		228
6	87	255.95	0.86	4.15	4.15	118	110	7.5	230	71		231
7	90	259.20	0.89	4.25	4.25	119	111	8	240	70		231
8	93	262.51	0.87	4.2	4.2	119	110	8	230	70		231
9	96	265.79	0.87	4.2	4.2	119	111	7.5	230	68		231
		—	0.84	4.0	4.0	—	—	7.5	—	—		231
10	99	269.04	0.85	4.1	4.1	119	111	7.5	240	68		234
11	102	272.25	0.84	4.0	4.0	119	110	7.5	240	68		233
		—	0.82	3.95	3.95	—	—	7.5	—	—		233
B-1-12	105	275.50	0.74	3.6	3.6	119	110	7	240	68		233
B-2-12	108	278.60	0.74	3.6	3.6	119	111	7	240	69		233
11	111	281.63	0.82	3.95	3.95	119	110	7	230	68		233
10	114	284.80	0.88	4.2	4.2	119	110	7.5	230	68		233
9	117	288.05	0.89	4.25	4.25	119	110	8	235	68		233
		—	0.87	4.2	4.2	—	—	8	—	—		233

Comments	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
B-2-8	120	291.32	0.86	4.15	4.15	118	110	7.5	220	68		235
7	023	294.61	0.89	4.25	4.25	119	110	8	225	68		235
6	126	297.89	0.91	4.35	4.35	119	110	8	225	67		235
5	129	301.21	0.86	4.15	4.15	118	110	7.5	225	67		235
4	132	304.50	0.84	4.0	4.0	118	109	7.5	225	68		235
3	135	307.73	0.75	3.6	3.6	118	109	6.5	230	69		235
2	138	310.80	0.70	3.35	3.35	118	109	6.5	235	69		235
1	141	313.78	0.54	2.6	2.6	118	109	5	240	72		235
	144	316.51	(64)		(64)							
						115.5	106.8					
(144)		149.51	.805		3.81	~~116~~	~~107~~					234
						~~113~~ (111)						

PARTICULATE FIELD DATA

Plant Ideal Cement - Houston

Run No. 2

Location Mill & Air Separator Stack

Date 5/10/71

Operator Smith - Maerker

Sample Box No. 1 - blue

Meter Box No. NC-1

Meter ΔH@ 2.01

C Factor 1.25

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS - read and record every 5 minutes.

Start time 2:58 p.m.
Completion 5:25 PM

Ambient Temp °F 90°F

Bar. Press. "Hg 30.00

Assumed Moisture % 2

Heater Box Setting, °F 250

Probe Tip Dia., In. 0.25

Probe Length 5 ft

Probe Heater Setting 65

Avg. Δ P _____ Avg. ΔH _____

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
A-1-1	2:58pm Start 0	317.00	0.57	2.75	2.75	100	96	5	210	69		213
2	3	319.55	0.72	3.45	3.45	101	96	6	195	63		230
3	6	322.41	0.78	3.75	3.75	102	96	6	255	71		230
4	9	325.45	0.84	4.0	4.0	104	96	7	220	75		236
5	12	328.98	0.88	4.2	4.2	105	97	7.5	235	74		236
6	15	331.79	0.92	4.4	4.4	106	98	7.5	245	74		235
7	18	335.09	0.91	4.35	4.35	106	98	7.5	240	73		235
8	21	338.39	0.91	4.35	4.35	108	99	7.5	255	72		235
9	24	341.70	0.91	4.35	4.35	109	100	7.5	240	73		240
		—	0.89	3.55	3.45	108	100	—	—	—		240
10	27	345.00	0.89	3.45	3.45	110	102	6	220	74		240
11	30	348.03	0.86	3.35	3.35	110	102	6	240	75		240
1-12	33	351.00	0.78	3.05	3.05	110	102	5.5	210	72		245
2-12	36	353.82	0.78	3.05	3.05	110	102	5.5	215	72		245
13	39	356.64	0.85	3.3	3.3	110	102	6	250	72		245
14	42	359.555	0.87	3.35	3.35	110	104	6	260	72		246

Run 2 — mill + Air Lpt

Comments	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
A-2-9	~~A-2 45~~	362.49	0.88	3.4	3.4	110	104	6	205	71		246
A-2-8	48	365.455	0.89	3.4	3.4	110	104	6	230	72		246
-7	51	368.42	0.89	3.4	3.4	110	105	6	240	73		246
-6	54	371.39	0.91	3.5	3.5	110	104	6	230	72		246
-5	57	374.39	0.87	3.3	3.3	110	104	6	270	73		246
-4	60	377.34	0.91	3.5	3.5	110	104	5.5	210	73		246
-3	63	380.22	0.72	2.8	2.8	110	104	5	215	73		245
2	66	382.97	0.71	2.75	2.75	110	105	5	245	72		245
A-2-1	69	—	0.52	2.05	2.05	110	105	4	220	71		240
B-1-1	72	388.125	0.50	1.95	1.95	110	105	4	280	73		225
2	75	390.42	0.71	2.75	2.75	108	104	5	215	68		245
3	78	393.05	0.76	2.95	2.95	108	105	5	210	67		245
4	81	395.80	0.84	3.25	3.25	108	105	5.5	210	67		245
5	84	398.69	0.86	3.3	3.3	108	105	5.5	255	67		245
6	87	401.59	0.84	3.25	3.25	108	105	5.5	250	67		250
7	90	404.42	0.90	3.45	3.45	109	105	6	285	67		250
8	93	407.46	0.91	3.5	3.5	110	105	6	215	67		250
9	96	410.51	0.89	3.4	3.4	110	105	6	240	68		250
10	99	413.43	0.86	3.3	3.3	110	105	6	210	69		250
11	102	416.40	0.84	3.2	3.2	110	106	5.5	240	69		250
B-1-12	105	419.30	0.76	2.95	2.95	110	106	5.5	190	68		250
B-2-12	108	422.20	0.72	2.8	2.8	110	106	5.5	235	69		250
B-2-11	111	424.90	0.85	3.3	3.3	111	106	6.0	210	70		247
10	114	427.80	0.87	3.4	3.4	111	106	6.0	250	70		250
9	117	430.73	0.87	3.4	3.4	111	106	6.0	215	72		250
8	120	433.74	0.88	3.5	3.5	112	107	6.0	245	72		242
7	123	436.75	0.89	3.5	3.5	113	107	6.0	200	73		250
6	126	439.78	0.88	3.45	3.45	112	107	6.0	250	71		250
5	129	442.80	0.85	3.35	3.35	112	107	6.0	210	70		250
4	132	445.75	0.80	3.15	3.15	112	107	6.0	245	69		242
3	135	448.65	0.75	2.95	2.95	113	107	6.0	190	68		242
2	138	451.47	.68	2.70	2.70	113	107	5.0	245	67		242
1	141	454.13	.52	2.00	2.00	113	107	4.0	195	68		216
0	144	456.574										
			(.79)									
							103.5					
	144	139.574	.81	3.29	3.29	109.2	~~104~~					243
							~~107~~ 106					

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PARTICULATE FIELD DATA

Plant Ideal Cement - Houston

Run No. 3 -

Location Mill & Air Separator

Date 5/20/71

Operator Smith - Maerker

Sample Box No. 1-brown

Meter Box No. NC-1

Meter ΔH@ 2.01

C Factor 1.20

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

start 9:17 a.m.
finish 11:42

Ambient Temp °F 76

Bar. Press. "Hg 30.10

Assumed Moisture % 2

Heater Box Setting, °F 250

Probe Tip Dia., In. 0.25

Probe Length 5ft

Probe Heater Setting 65

Avg. ΔP ____ Avg. ΔH ____

Point	Clock Time	Dry Gas Meter, CF	Pitot In. H2O ΔP	Orifice ΔH in H2O Desired	Orifice ΔH in H2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
A-1-1	0	457.80	0.49	1.9	1.9	76	76	3.5	280	60		223
2	3	459.91	0.72	2.8	2.8	76	76	5	270	52		242
3	6	462.56	0.83	3.2	3.2	79	77	5.5	250	56		242
4	9	465.22	0.88	3.4	3.4	82	78	5.5	255	64		245
5	12	468.09	0.93	3.35	3.35	84	79	5.5	245	65		250
6	15	471.00	0.95	3.45	3.45	85	81	5.5	255	65		250
7	18	473.90	0.92	3.35	3.35	88	82	5.5	255	64		250
8	21	476.72	0.92	3.35	3.35	89	84	5.5	260	64		250
9	24	479.66	0.88	3.15	3.15	91	85	5.5	300	63		250
10	27	482.49	0.88	3.15	3.15	93	87	5.5	225	64		250
11	30	485.29	0.83	3.0	3.0	93	87	5	270	64		250
A-1-12	33	488.07	0.74	2.65	2.65	94	88	4.5	250	64		250
A-2-12	36	490.89	0.77	2.8	2.8	94	88	5	250	64		250
11	39	493.33	0.81	2.9	2.9	94	89	5	240	64		250
10	42	496.05	0.86	3.1	3.1	94	89	5	225	65		250
9	45	498.93	0.86	3.1	3.1	95	89	5	230	65		250

Changed K factor @ point A-1-5

Comments:

NCAP-37 (12/67)

Run 3 — mill + air dept

Comments	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
A-2-8	48	501.72	0.85	3.05	3.05	95	90	5	230	65		250
7	51	504.42	0.90	3.2	3.2	96	91	5.5	210	65		250
6	54	507.25	0.92	3.25	3.25	97	91	5.5	210	65		250
5	57	510.12	0.90	3.2	3.2	96	92	5.5	200	65		250
4	60	512.98	0.89	3.15	3.15	97	92	5.5	200	66		250
3	63	515.80	0.80	2.9	2.9	97	93	5	240	65		250
2	66	518.54	0.72	2.6	2.6	97	93	5	240	65		250
A-2-1	69	521.18	0.52	1.9	1.9	97	93	5	235	64		250
B-1-1	72	523.51	0.61	2.2	2.2	94	91	4	230	68		250
2	75	525.87	0.69	2.5	2.5	95	92	4.5	205	67		250
3	78	528.38	0.80	2.85	2.85	96	91	5	210	69		250
4	81	531.04	0.83	3.0	3.0	97	91	5	210	69		250
5	84	533.80	0.88	3.15	3.15	97	91	5.5	210	70		250
6	87	536.61	0.88	3.15	3.15	97	91	5.5	220	70		250
7	90	539.44	0.90	3.2	3.2	98	93	5.5	210	70		250
8	93	542.30	0.88	3.15	3.15	99	94	5.5	230	69		250
9	96	545.12	0.89	3.15	3.15	101	94	5.5	200	69		250
10	99	547.96	0.83	3.0	3.0	101	95	5	210	67		250
11	102	550.73	0.78	2.8	2.8	102	95	5	215	65		250
B-1-12	105	553.43	0.69	2.5	2.5	102	96	4.5	215	64		250
B-2-12	108	556.00	0.69	2.5	2.5	101	95	4.5	205	65		230
11	111	558.54	0.78	2.8	2.8	100	95	5	260	65		250
10	114	561.20	0.82	2.95	2.95	100	95	5	240	65		250
9	117	–	0.88	3.15	3.15	101	96	5	260	65		250
8	120	566.73	0.88	3.15	3.15	101	96	5	220	65		250
7	123	569.57	0.88	3.15	3.15	101	96	5	230	65		250
6	126	572.30	0.86	3.1	3.1	101	95	5	205	66		250
5	129	575.20	0.84	3.1	3.1	100	95	5	210	65		250
4	132	578.00	0.82	2.95	2.95	100	95	5	230	65		250
3	135	580.77	0.74	2.75	2.75	101	95	5	220	66		250
2	138	583.44	0.71	2.6	2.6	101	95	5	220	68		250
1	141	586.10	0.62	2.25	2.25	101	95		220	68		250
	144	588.50										
												249
	144	130.78	.81	2.94	2.94	95.1	90.1					
						~~94~~ 93						

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PARTICULATE CLEANUP SHEET

Date: 5-17-71 Plant: Ideal Cement (Houston)

Run number: 1 Location of sample port: Mill & Air Sep.

Operator: C.E.R. Barometric pressure: 30.00

Sample box number: 1 tan Ambient temperature: 90°

Impinger H_2O

Volume after sampling 258 ml Container No. 4A Ether-chloroform extraction of impinger water 0 mg

Impinger prefilled with 204 ml Extra No. ____

Volume collected 54 ml Impinger water residue 10.9 mg

Impingers and back half of filter, acetone wash: Container No. 4B

Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. ____

Extra No. ____ Weight results ____ mg

Probe, cyclone, flask, and front half of filter, acetone wash: Container No. 4C

Extra No. ____ Weight results 19.2 mg

Filter Papers and Dry Filter Particulate

Filter number	Container no.	Filter number	Container no.
012200	4D		

Filter particulate weight 2.8 mg

Total particulate weight 32.9 mg

Silica Gel

Weight after test:	236.5	____	____	____
Weight before test:	200	____	____	____
Moisture weight collected:	36.5	____	____	____
Container number:	1. ____	2. ____	3. ____	4. ____

54.0
36.0
90.5

Moisture total 90.5 gm

Sample number: 4 Analyze for: ____

Method determination: ____

Comments: ____

PARTICULATE CLEANUP SHEET

Date: 5-19-71 Plant: Ideal Cement Houston

Run number: 2 Location of sample port: Mill + Air Sept.

Operator: _____ Barometric pressure: 30.00

Sample box number: 1 Blue Ambient temperature: 90°

Impinger H_2O

Volume after sampling 252 ml Container No. 5A Ether-chloroform extraction of impinger water 0 mg

Impinger prefilled with 264 ml Extra No. _____

Volume collected 48 ml 250 + 2 Impinger water residue 10.9 mg

Impingers and back half of filter, acetone wash: Container No. 5B

Extra No. _____ Weight results _____ mg

Dry probe and cyclone catch: Container No. _____

Extra No. _____ Weight results _____ mg

Probe, cyclone, flask, and front half of filter, acetone wash: Container No. 5C

Extra No. _____ Weight results 20.2 mg

Filter Papers and Dry Filter Particulate

Filter number	Container no.	Filter number	Container no.
12413	5D		

Filter particulate weight 6.7 mg

Total particulate weight 37.8 mg

Silica Gel

33.0 + 480 = 81.0

Weight after test:	233.0			
Weight before test:	200.0			
Moisture weight collected:	33.0			

Moisture total 81.0 gm

Container number: 1. _____ 2. _____ 3. _____ 4. _____

Sample number: _____ Analyze for: _____

Method determination: _____

Comments: _____

PARTICULATE CLEANUP SHEET

Date: 5-20-71 Plant: Ideal Cement Houston

Run number: 3 Location of sample port: Mill & dia Separator

Operator: C.E.R. Barometric pressure: 30.10

Sample box number: 1 Ten Ambient temperature: 75°

Impinger H_2O

Volume after sampling 242 ml Container No. 6A Ether-chloroform extraction of impinger water 0 mg

Impinger prefilled with 204 ml Extra No. ____

Volume collected 38 ml Impinger water residue 10.8 mg

Impingers and back half of filter, acetone wash: Container No. 6B

Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. ____

Extra No. ____ Weight results ____ mg

Probe, cyclone, flask, and front half of filter, acetone wash: Container No. 6C

Extra No. ____ Weight results 14.1 mg

Filter Papers and Dry Filter Particulate

Filter number	Container no.	Filter number	Container no.
012198	6D		

Filter particulate weight 3.2 mg

Total particulate weight 27.9 mg

Silica Gel

Weight after test:	234	____	____	____	38
Weight before test:	200	____	____	____	34
Moisture weight collected:	34	____	____	____	72
Container number:	1. ____	2. ____	3. ____	4. ____	

Moisture total 72 gm

Sample number: 1 6 Analyze for: Mass particulate

Method determination: ____

Comments: ____

SAMPLING SUMMARY SHEETS

PLANT Ideal Cement LOCATION Houston, Texas

SAMPLED SOURCE Finish Mill & Air Separator Stack

Train Data

Run No.	Date	Nozzle dia. in.	Net time min.	Bar. pres. "Hg.	Orifice diff. ΔH "H_2O	Volume sampled meter cond. cu. ft.	Meter temp. °F	Volume sampled standard cond. cu. ft.
1	5-19-71	.250	144	30.00	3.84	149.51	111	140.34
2	5-19-71	.250	144	30.00	3.29	139.574	106	132.00
3	5-20-71	.250	144	30.00	2.94	130.70	93	126.82

Moisture and Gas Data

Run No.	Total moisture ml.	Moisture std. cond. cu. ft.	% Moisture by volume	Mole fraction dry gas	Molecular wt. of dry stack gas	Molecular wt. of moist. stack gas
1	90.5	4.29	2.97	.97	29.00	28.67
2	81.0	3.84	2.83	.97	29.00	28.67
3	72.0	3.41	2.62	.97	29.00	28.67

Stack Data

Run No.	Stack area in^2	Velocity head "H_2O	Static press. "Hg.	Stack press. "Hg. Abs.	Stack temp. °F
1	1452	0.81	.04	30.04	229
2	1452	.81	.04	30.04	143
3	1452	.81	.04	30.04	249

Velocity and Calculation Data

Run No.	Average $\sqrt{\text{Velocity} \times \text{temperature } ^\circ R}$	Stack velocity fpm stack cond.	Stack gas volume scfm	Percent isokinetic
1	23.50	3483	26,307	109.2
2	23.83	3532	26,146	103.4
3	23.95	3544	26,100	99.5

APPENDIX C

LABORATORY RESULTS

Tables C - 1 and C - 2 present a summary of the particulate cleanup and analysis data. Table C - 3 (C - 4) presents the results of a metals analysis conducted on the samples from runs no. 3 of the clinker cooler and finish mill stacks.

TABLE C - 1

PARTICULATE RESULTS, CLINKER COOLER (1)

		run 1	run 2	run 3
impinger water	sample no.	(1 A)	(2 A)	(3 A)
	wt., mg	14.5	17.6	9.1
probe, cyclone	sample no.	(1 B)	(2 B)	(3 B)
	wt., mg	11.8	19.4	13.4
filter	sample no.	(1 C)	(2 C)	(3 C)
	wt., mg	0.0	1.1	0.8
Total particulates, mg		26.3	38.1	23.3

Note: water blank: 1.4 mg/500 ml
acetone blank: 1.1 mg/500 ml

TABLE C - 2

PARTICULATE RESULTS, FINISH MILL GRINDING SYSTEM (1)

		run 1	run 2	run 3
impinger water	sample no.	(4 A)	(5 A*)	(6A)
	wt., mg	10.9	10.9	10.8
probe, cyclone	sample no.	(4 B)	(5 B)	(6B)
	wt., mg	19.2	20.2	14.1
filter	sample no.	(4 C)	(5 C)	(6C)
	wt., mg	2.8	6.7	3.0
Total Particulates, mg		32.9	37.8	27.9

* Several particles of silica gel found in impinger water; removed before analysis

Note: water blank: 1.4 mg/500 ml
acetone blank: 1.1 mg/500 ml

(1) Blank values have been substracted from sample results.

TABLE C - 3

RESULTS OF METALS ANALYSIS[a]

Sample: run number 3, clinker cooler

Types of Analyses - Spark Source Mass Spectrograph (SSMS)
Optical Emission Spectrography (OES)

Analysis Sample No. wt., mg	SSMS 3A+3B 22.5	OES 3A+3B 22.5	SSMS 3C 0.8	OES 3C 0.8	Analysis Sample No. wt., mg	SSMS 3A+3B 22.5	OES 3A+3B 22.5	SSMS 3C 0.8	OES 3C 0.8
Element					Element				
Hg	0.01	<0.03	<0.05	<0.6	B	10.	20.	(c)	(c)
Be	<0.005	<0.02	<0.005	<2.	F	<0.03	(b)	(c)	(b)
Cd	2.	<2.	<0.4	<60.	Li	0.2	<3.	3.	<15.
As	0.3	<2.	<0.4	<3.	Ag	4.	2.	<0.1	< 2.
V	0.3	1.	<10.	<30.	Sn	30.	40.	7.	10.
Mn	5.	10.	<5.	< 6.	Fe	200.	400.	<500.	<600.
Ni	100.	200.	<7.	<6.	Sr	3.	8.	30.	<60.
Sb	0.1	<1.	0.03	<15.	Na	High	10,000.	(c)	(c)
Cr	40.	80.	<10.	<30.	K	High	10,000	(c)	(c)
Zn	20.	<10.	<4.	<30.	Ca	High	50,000.	(c)	(c)
Cu	15.	10.	<0.5	<3.	Si	High	1,500.	(c)	(c)
Pb	20.	12.	<1.	<15.	Mg	High	60.	(c)	(c)
Se	2.	(b)	<0.3	(b)					

(a) All results given in total micrograms per sample.

(b) Not detectable by OES.

(c) Useful determination is precluded by high contribution from blank.

* Glass filters - values given are impurity levels above glass background.

Comments - (1) Estimates of precision are ±25% and ±100% for SSMS.

(2) Where discrepancies in results occur between OES and SSMS, take the average as being most correct. If greater accuracy is demanded, the concentrations can be determined by AA, other classical chemical techniques and/or better standardization of the OES and SSMS.

(3) High in the SSMS column is given where concentrations are found generally greater than 500 ppm. The latitude of the photographic emulsion prevents obtaining detections to 0.1 ppm and up to 500 ppm. This would not be a problem with electrical detection.

TABLE C - 4

RESULTS OF METALS ANALYSIS[a]

Sample: run number 3, finish mill air separator

Types of Analyses - Spark Source Mass Spectrograph (SSMS)
Optical Emission Spectrography (OES)

Analysis Sample No. wt.,mg	SSMS 6A+6B 24.9	OES 6A+6B 24.9	SSMS 6C 3.0	OES 6C 3.0	Analysis Sample No. wt.,mg	SSMS 6A+6B☆ 24.9	OES 6A+6B 3.0	SSMS 6C 3.0	OES 6C 3.0
Element					Element				
Hg	0.02	<0.02	0.04	<0.6	B	40.	40.	(c)	(c)
Be	<0.02	<0.02	<0.005	<2.	F	<0.1	(b)	(c)	(b)
Cd	2.	<2.	<0.4	<60.	Li	0.1	<3.	3.	<15.
As	1.	<2.	≤0.4	<30.	Ag	2.	2.	<0.4	<2.
V	1.	2.	≤5.	<30.	Sn	60.	40.	20.	<20
Mn	4.	6.	≤5.	<6.	Fe	200.	400.	<500.	<600.
Ni	300.	400.	<15.	<6.	Sr	10.	16.	50.	< 60.
Sb	0.3	<1.	0.03	<15.	Na	High	10,000.	(c)	(c)
Cr	20.	40.	10.	<30.	K	High	10,000.	(c)	(c)
Zn	10.	<10.	<4.	<30.	Ca	High	50,000.	(c)	(c)
Cu	10.	10.	<0.5	<3.	Si	High	1,500.	(c)	(c)
Pb	4.	6.	2.	<15.	Mg	High	100.	(c)	(c)
Se	1.	(b)	<0.3	(b)					

(a) All results given in total micrograms per sample.

(b) Not detectable by OES.

(c) Useful determination is precluded by high contribution from blank.

☆ Glass filters - values given are impurity levels above glass background.

Comments - (1) Estimates of precision are ±25% and ±100% for SSMS.

(2) Where discrepancies in results occur between OES and SSMS, take the average as being most correct. If greater accuracy is demanded, the concentrations can be determined by AA, other classical chemical techniques and/or better standardization of the OES and SSMS.

(3) High in the SSMS column is given where concentrations are found generally greater than 500 ppm. The latitude of the photographic emulsion prevents obtaining detections to 0.1 ppm and up to 500 ppm. This would not be a problem with electrical detection.

APPENDIX D

Test Log

Table D - 1 presents the actual time during which sampling was conducted.

Table D - 1

Sampling Log

(Clinker Cooler)

Run	Date	Sampling Port	Began	Ended	Elapsed Time(min)
1	5-18-71	A	08:25	09:31	66
		B	09:34	10:40	66
2	5-18-71	A	11:10	12:16	66
		B	12:18	13:24	66
3	5-18-71	A	14:24	15:30	66
		B	15:35	16:41	66

(Finish Mill Grinding System)

Run	Date	Sampling Port	Began	Ended	Elapsed Time(min)
1	5-19-71	A	10:41	11:53	72
		B	11:54	13:06	72
2	5-19-71	A	14:58	16:10	72
		B	16:13	17:25	72
3	5-20-71	A	09:17	10:29	72
		B	10:30	11:42	72

APPENDIX E

PROJECT PARTICIPANTS AND TITLES

Name	Title
Joe Bazes	Chemical Engineer, ETB
Howard Crist	Analytical Chemist, ETB
Frederick Maerker	Chemical Engineer, ETB
Clyde Riley	Technician, ETB
Gene Smith	Chemical Engineer, ETB
Philip York	Chemical Engineer, ETB