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

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

AP-42 Section 11.6
Reference 10
Report Sect. 4
Reference 3

EMISSION TESTING REPORT

ETB TEST NUMBER 71-PEM-04

Emissions From
Wet Process Cement Kiln
And Finish Mill Systems
at

FINAL

FINAL

IDEAL CEMENT COMPANY
CASTLE HAYNE, NORTH CAROLINA

FINAL

FINAL

Project Officer
Clyde E. Riley

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

Source category:	Portland Cement	Date:	01/15/93
Plant name :	Ideal Cement Company	Location:	Castle Hayne, NC
Test date :	4/13 - 4/15/71	Ref. No.:	3
Process :	wet	Basis for process rate :	slurry feed rate

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor kg/Mg	Emission factor lb/ton	Volumetric flow rate, DSCFM	Concen. ppm
air separator	fabric filter	filt. PM	1	1.034	30	0.0172	0.0345		
		filt. PM	2	1.196	28.6	0.0209	0.0418		
		filt. PM	3	1.23	30.1	0.0204	0.0409		
					average	0.0195	0.0390	Rating:	B
		con. inorg. P	1	0.979	30	0.0163	0.0326		
		con. inorg. P	2	0.671	28.6	0.0117	0.0235		
		con. inorg. P	3	0.81	30.1	0.0135	0.0269		
					average	0.0138	0.0277	Rating:	B
mill grinding	fabric filter	filt. PM	1	0.421	31.1	0.0068	0.0135		
		filt. PM	2	0.408	30.7	0.0066	0.0133		
		filt. PM	3	0.424	31.7	0.0067	0.0134		
					average	0.0067	0.0134	Rating:	B
		con. inorg. P	1	0.217	31.1	0.0035	0.0070		
		con. inorg. P	2	0.261	30.7	0.0043	0.0085		
		con. inorg. P	3	0.258	31.7	0.0041	0.0081		
					average	0.0039	0.0079	Rating:	B

EMISSION TESTING REPORT

ETB TEST NUMBER 71-MM-04

Emissions From
Wet Process Cement Kiln
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IDEAL CEMENT COMPANY

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Project Officer
Clyde E. Riley

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

71-MM-04

PREFACE

The work reported herein was conducted by The Roy F. Weston Company, pursuant to a Task Order issued by the Environmental Protection Agency (EPA), under the terms of EPA Contract No. CPA 70-132 Task Order 1. Mr. Tom Cadwallader served as the Project Engineer and directed the Weston field team consisting of: Messrs. Howard Schiff, Brent Cowan, Larry Johnson, and Charles Mattocks. Mr. Schiff and Mr. Cowan performed the pollutant analyses at the Weston laboratories. Roy F. Weston submitted to EPA a draft document from which EPA personnel prepared the final report (Test No. 71-MM-04).

Approved:

Environmental Protection Agency

Gene W. Smith

Gene W. Smith
Chief, Metallurgical and Mechanical Section

March 31, 1972

FINAL

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SUMMARY

The Office of Air Programs of the Environmental Protection Agency contracted with Roy F. Weston, Inc. to conduct OAP emission sampling tests on three stacks which vent the air separators and mill grinder systems of the Castle Hayne, North Carolina plant of the Ideal Cement Company.

The sampling results demonstrated that particulate concentrations in the stacks were low. Baghouse dust collectors controlled the emissions from each stack. Particulate emissions ranged from 0.0130 to 0.0255 lb per ton of feed (taking into account the probe, cyclone and filter catches only). A summary of the particulate data is presented in Tables 1-3.

Mercury concentrations collected at the kiln stack ranged from 0.0047 to 0.0082 parts per million (ppm) by volume.

Concentrations of SO_2 and NO_x also collected at the kiln stack were between 24 and 78 ppm and 8 and 212 ppm, respectively.

Table 1

SUMMARY OF PARTICULATE DATA FOR NO. 1 MILL AIR SEPARATOR STACK A

Run Number	1	2	3
Date	4-13-71	4-14-71	4-14-71
Percent Excess Air	—	—	—
Percent Isokinetic	96.9	100.8	97.4
Stack Flow Rate - SCFM* dry	14,478	14,876	14,453
Stack Flow Rate - ACFM wet	17,554	17,636	16,677
Volume of Dry Gas Sampled - SCF*	56.931	60.857	54.777
Feed Rate - tons/hr	30.0	28.6	30.1
Particulates			
Probe, Cyclone, & Filter Catch			
mg	11.8	22.9	21.4
gr/SCF* dry	0.00319	0.00579	0.00602
gr/CF @ Stack Conditions	0.00263	0.00488	0.00521
lbs/hr.	0.391	0.729	0.737
lbs/ton feed	0.0130	0.0255	0.0245
Total Catch			
mg	24.1	34.0	35.8
gr/SCF* dry	0.00652	0.00860	0.01010
gr/CF @ Stack Conditions	0.00537	0.00725	0.00871
lbs/hr	0.796	1.086	1.243
lbs/ton feed	0.0265	0.0380	0.0413
% Impinger Catch	51.0	32.6	40.2

* 70°F, 29.92" Hg

Table 2

SUMMARY OF PARTICULATE DATA FOR NO. 1 HILL AIR SEPARATOR SERIES B

Run Number	1	2	3
Date	4-13-71	4-14-71	4-14-71
Percent Excess Air	—	—	—[1]
Percent Isokinetic	90.7	94.6	95.4
Stack Flow Rate - SCFM* dry	11,700	11,664	11,727
Stack Flow Rate - ACFM wet	13,484	13,554	13,474
Volume of Dry Gas Sampled - SCF*	74.277	77.276	75.106
Feed Rate - tons/hr	30.0	28.6	30.1
Particulates			
Probe, Cyclone, & Filter Catch			
mg	31.2	23.9	24.2
gr/SCF* dry	0.00647	0.00476	0.00496
gr/CF @ Stack Conditions	0.00561	0.00409	0.00431
lbs/hr.	0.643	0.467	0.493
lbs/ton feed	0.0214	0.0163	0.0164
Total Catch			
mg	58.8	39.3	38.9
gr/SCF* dry	0.0122	0.00783	0.00798
gr/CF @ Stack Conditions	0.0106	0.00673	0.00693
lbs/hr	1.217	0.781	0.797
lbs/ton feed	0.0406	0.0273	0.0265
% Impinger Catch	46.9	39.2	37.8

* 70°F, 29.92" Hg

Table 3
SUMMARY OF PARTICULATE DATA FOR NO. 1
MILL-GRINDER and DUST COLLECTOR

Run Number	1	2	3
Date	4-15-71	4-15-71	4-15-71
Percent Excess Air	—	—	—
Percent Isokinetic	103.5	100.1	100.8
Stack Flow Rate - SCFM* dry	5853	6087	5727
Stack Flow Rate - ACFM wet	6827	7073	6739
Volume of Dry Gas Sampled - SCF*	65.059	65.470	61.995
Feed Rate - tons/hr	31.1	30.7	31.7
Particulates			
Probe, Cyclone, & Filter Catch			
mg	35.5	33.7	34.9
gr/SCF* dry	0.00840	0.00793	0.00867
gr/CF @ Stack Conditions	0.00719	0.00681	0.00736
lbs/hr.	0.421	0.408	0.424
lbs/ton feed	0.0135	0.0133	0.0134
Total Catch			
mg	54.2	54.6	56.0
gr/SCF* dry	0.0128	0.0128	0.0139
gr/CF @ Stack Conditions	0.0110	0.0110	0.0118
lbs/hr	0.638	0.669	0.682
lbs/ton feed	0.0205	0.0218	0.0215
% Impinger Catch	34.5	38.3	37.7

* 70°F, 29.92" Hg

INTRODUCTION

Under the clean air act, as amended, the Environmental Protection Agency is charged with the establishment of performance standards for new installations or modifications of existing installations in stationary source categories which may contribute significantly to air pollution. In the cement industry, eight plants exhibiting well controlled operation were selected for the emission testing program. This report presents the emissions data for the Castle Hayne, North Carolina plant of the Ideal Cement Company.

Between April 13 and 15, 1971, Roy F. Weston, Inc. conducted source sampling at the kiln stack and finishing mill stacks of the Castle Hayne plant. The kiln calcines the raw materials (which are fed to the kiln in the form of a slurry) in this wet process operation. The finish mill grinds the coarse clinker (the main constituent of cement) and gypsum mixture, yielding finished cement. The finish mill section is controlled by baghouse units.

Roy F. Weston, Inc. conducted nitrogen oxides grab sampling at the kiln stack and particulate sampling at the finish mill stacks. In addition, Emissions Testing Branch personnel tested for gaseous mercury, sulfur dioxide and oxides of nitrogen at the kiln stack. Analysis for NO_x and SO_2 was accomplished by continuous monitoring electrochemical reaction - sensing analysers obtained from Dynasciences*, Inc. The oxides of nitrogen samples collected by Weston personnel were analyzed via wet chemical methods, providing an opportunity for comparison of the two sampling procedures.

*Mention of a specific company or product does not constitute endorsement by EPA.

PROCESS DESCRIPTION

Clay and limestone are trucked to the plant from an open pit quarry about 1/4 mile east of the plant. The limestone is relatively soft (less than 4 on the Mohs scale); size reduction is accomplished by wet grinding to form a slurry. Large sand particles are removed from the wet clay in the bottom of a classifier and the clay and fine sand slurry overflows into a launder. Both the clay and limestone slurries are pumped into large storage tanks where these materials are subsequently blended with shale and pyrite to form the kiln feed.

The blended slurry is fed into the upper end of one of two sloping (3/8 inch per foot), slowly revolving (one revolution per minute) kilns. These oil-fired kilns are 375 feet long by 12 feet inside diameter with refractory lining encased in a steel cylinder. The fuel oil (no. 6) contains approximately 2% sulfur. During passage through the kiln (about 4 hours), the raw materials are heated to a temperature of about 2600°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 kiln at temperatures exceeding 2000°F and fed immediately into 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 a storage silo.

A small amount of gypsum (4.45% by weight) is added to the clinker material and this mixture is fed into the finish mill grinding system. The mixture leaving the grinding mill is fed to an air-separator or classifier where the coarse material is returned to the mill and the finished cement (90% through 325 mesh) is pneumatically pumped to storage silos. Present plant production is approximately 3,500,000 barrels of cement per year.

The control equipment of interest in this report consists of three Norblo baghouse collectors on the No. 1 finish mill grinding system. Two of these collectors are on the air separator and the third is on the mill (see Figure 1).

The basic unit of the baghouse collector is a compartment which contains 78 cloth filters (6" dia. x 8' 3" long) for a total of 936 ft^2 of filtering area. These Dacron bags are arranged in two groups of 39 bags and each group has its own individual bag holder and shaker controlled by an electric timer with reversing air flow. Each compartment is 9' tall x 8' 6" x 5' with a 60^o hopper below. The particulate matter is collected on the inside of the cloth filter bags and falls to the hopper below where the material is removed by a screw conveyor.

The design data of these collectors is indicated in Table 4.

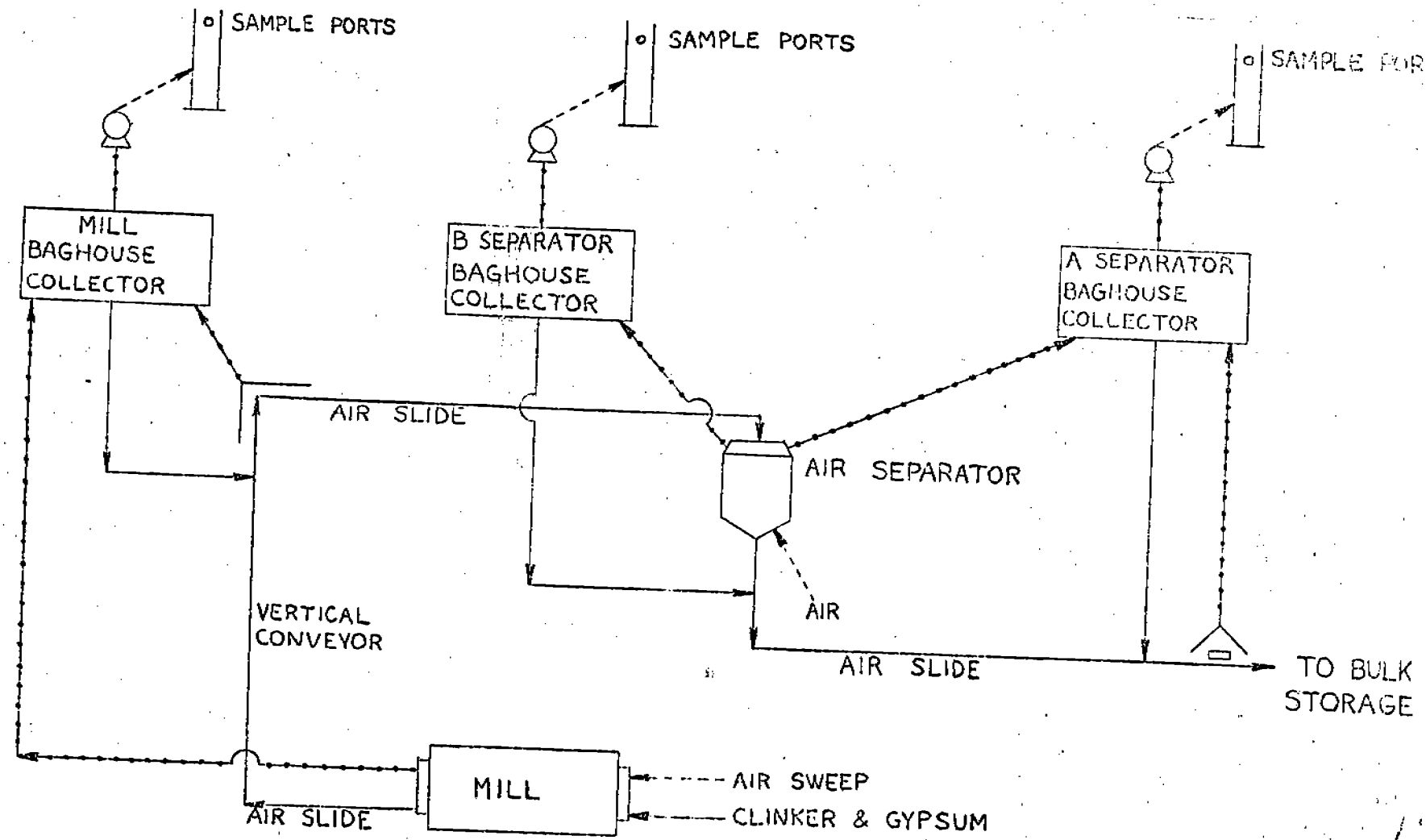


FIGURE 1 DIAGRAM OF No. 1 FINISH MILL GRINDING SYSTEM

Table 4

DESIGN DATA OF FINISH MILL GRINDING SYSTEM COLLECTORS[1]

Collector	Number of Compartments	Area (ft^2)	Gas Flow Rate (CFM)	ΔP (in V.W.G.)	Temp. (°F)	Cleaning cycle
Mill	4	3,744	9,000	10.9	150	15 sec. shake with reverse air flow every 3.5 min.
No. 1A	7	6,552	10,275	10.4	150	15 sec. shake with reverse air flow every 3.5 min.
No. 1B	7	6,552	17,500	10.6	250	15 sec. shake with reverse air flow every 2.0 min.

[1]The overall air to filter cloth ratio is 2.18 CFM/ft^2 for the entire mill grinding system.

DISCUSSION OF TESTING AND RESULTS

Source sampling data were collected at four points at the Ideal Cement Company plant, Castle Hayne, North Carolina. A description of the test performed at the four plant locations follows:

Sampling Points	Tests Performed
1. Air Separator Stack A	3 Particulate Runs
2. Air Separator Stack B	3 Particulate Runs
3. Grinder and Elevator Dust Collector	3 Particulate Runs
4. Kiln Stack	3 gaseous mercury samples 13 NO_x samples, plus continuous monitoring of NO_x and SO_2

The first three sample locations are shown in Figures A-1 and A-2, Appendix A. The kiln stack sampling point was located approximately 150 feet up the kiln stack (see Figure A-3). Detailed dimensions of the sampling points may be found in the field notes presented in Appendix C.

A detailed description of the particulate sampling procedures and equipment may be found in Method 5 of the Federal Register (December 23, 1971), Vol. 36, No. 247.

A summary of the data collected from the air separator stacks A and B and the grinder and elevator dust collector is presented in Tables 5-7.

Equations used for particulate calculations are presented in Appendix D. Also shown are example calculations for run No. 1 of the air separator stack A.

Toward the end of Run 3 on the Air Separator Stacks A and B, the respective stack temperatures began to fall. Ninety-two minutes into the 96-minute run the draft fans were turned off for normal maintenance and both sampling trains were shut down immediately thereafter. Field representatives from Ideal Cement Company, OAP and Roy F. Weston, Inc. did not feel that the shutdown would adversely affect the results from this run. The average isokinetic ratios for the three stacks ranged from 93.5 on Stack B to 101.4 on the Grinder and Elevator Dust Collector stack. The range of isokinetics for all the runs was 90.7 to 103.5.

Gaseous mercury emissionswere determined by bubbling the kiln stack effluent through midget impingers containing an acidic solution of iodine monochloride. Sampling and analytical procedures pertaining to gaseous mercury sampling maybe found in Method 1, December 7, 1971, Federal Register (Vol. 36, No. 235). The results of the three mercury tests are presented in Table 8.

Continuous monitoring of sulfur dioxide and oxides of nitrogen were conducted at the kiln stack using electrochemical reaction sensing analyzers. Readings were taken approximately every 3-6 minutes. Sulfur dioxide and oxides of nitrogen emissions data are presented in Tables 9 and 10.

In addition to the continuous monitoring of NO_x, thirteen evacuated flask NO_x samples were collected and analyzed using the phenoldisulfonic acid method, in an attempt to compare the two analysis techniques. The results are presented in Table 10 and demonstrate fair agreement between the two methods.

TABLE 5

PARTICULATE EMISSIONS DATA FOR NO. 1 MILL AIR SEPARATOR STACK A

Run No.		1	2	3
Test Date		4-13-71	4-14-71	4-14-71
D_n	Sampling nozzle diameter, in.	0.193	0.193	0.193
T_t	Net time of test, min.	96	96	92
P_b	Barometric pressure, in. Hg absolute	29.90	29.87	29.90
P_m	Average Orifice pressure drop, in. H_2O	1.28	1.45	1.34
V_m	Volume of dry gas sampled, ft^3 at meter conditions	61.768	65.263	58.700
T_m	Average gas meter temperature, °F	116	109	109
$V_{m_{std}}$	Volume of dry gas sampled at standard conditions*, SCF	56.931	60.857	54.777
V_w	Total H_2O collected in impingers and silica gel, ml	2.3	9.0	2.0
$V_{w_{gas}}$	Volume of water vapor collected at standard conditions*, SCF	0.109	0.427	0.0948
% M	% Moisture in the stack gas by volume	0.191	0.696	0.173
M_d	Mole fraction of dry gas	0.998	0.993	0.998
% CO_2		<1	<1	<1
% O_2		20.95	20.95	20.95
% CO		<1	<1	<1
% N_2		79.0	79.0	79.0
% EA	Excess Air Percent	—	—	—
MW_d	Molecular weight of stack gas, dry basis	29.00	29.00	29.00
MW	Molecular weight of stack gas, wet basis	28.98	28.92	28.98
C_p	Pitot tube coefficient	0.85	0.85	0.85
ΔP_s	Average velocity head of stack gas, in. H_2O	0.94	0.98	0.90
T_s	Average stack temperature, °F	182	164	151
N_p	Net sampling points	16	16	16
P_{st}	Static pressure of stack gas in. Hg	0.05	0.05	0.05
P_s	Stack gas pressure in. Hg absolute	29.95	29.92	29.95
V_s	Stack gas velocity at stack conditions fpm	3643	3660	3461
A_s	Stack area, $in.^2$	694	694	694
Q_s	Dry stack gas volumetric flow rate at standard conditions*, SCFM	14,478	14,876	14,453
Q_a	Stack gas volumetric flow rate at stack conditions, ACFM	17,554	17,636	16,677
% I	Percent isokinetic	96.9	100.8	97.4

* 70°F, 29.92 in. Hg

Table 5 (concluded)

PARTICULATE EMISSIONS DATA FOR NO. 1 MILL AIR SEPARATOR STACK A

Run No.		1	2	3
T_c	Unit Feed Rate-Tons/hr	30.0	28.6	30.1
m_f	Particulate - probe, cyclone and filter, mg	11.8	22.9	21.4
m_t	Particulate - total, mg	24.1	34.0	35.8
I_c	% impinger catch	51.0	32.6	40.2
C_{an}	Particulate - probe, cyclone, and filter, gr/SCF*	0.00319	0.00579	0.00602
C_{ao}	Particulate - total, gr/SCF*	0.00652	0.00860	0.01010
C_{at}	Particulate - probe, cyclone, and filter, gr/cf at stack conditions	0.00263	0.00488	0.00521
C_{au}	Particulate - total, gr/cf at stack conditions	0.00537	0.00725	0.00871
C_{aw}	Particulate - probe, cyclone, and filter, lb/hr.	0.391	0.729	0.737
C_{ax}	Particulate - total, lb/hr.	0.796	1.086	1.243
P_{tf}	Particulate - probe, cyclone, and filter, lb/ton feed	0.0130	0.0255	0.0245
P_{tt}	Particulate - total, lb/ton feed	0.0265	0.0380	0.0413

*70°F, 29.92 in. Hg., dry basis

TABLE 6

PARTICULATE EMISSIONS DATA FOR NO. 1 MILL AIR SEPARATOR STACK B

Run No.		1	2	3
Test Date		4-13-71	4-14-71	4-14-71
D_n	Sampling nozzle diameter, in.	0.250	0.250	0.250
T_t	Net time of test, min.	96	96	92
P_b	Barometric pressure, in. Hg absolute	29.90	29.87	29.90
P_m	Average Orifice pressure drop, in. H_2O	2.39	2.55	2.62
V_m	Volume of dry gas sampled, ft^3 at meter conditions	81.345	84.391	81.502
T_m	Average gas meter temperature, °F	123	121	118
$V_{m_{std}}$	Volume of dry gas sampled at standard conditions*, SCF	74.277	77.276	75.106
V_w	Total H_2O collected in impingers and silica gel, ml	0.4	8.1	5.0
$V_{w_{gas}}$	Volume of water vapor collected at standard conditions*, SCF	0.019	0.384	0.237
% M	% Moisture in the stack gas by volume	0.026	0.494	0.315
M_d	Mole fraction of dry gas	0.999	0.995	0.997
% CO_2		<1	<1	<1
% O_2		20.95	20.95	20.95
% CO		<1	<1	<1
% N_2		79.0	79.0	79.0
% EA	Excess Air Percent	—	—	—
MW_d	Molecular weight of stack gas, dry basis	29.00	29.00	29.00
MW	Molecular weight of stack gas, wet basis	28.99	28.95	28.97
C_p	Pitot tube coefficient	0.85	0.85	0.85
ΔP_s	Average velocity head of stack gas, in. H_2O	0.62	0.62	0.62
T_s	Average stack temperature, °F	150	152	147
N_p	Net sampling points	16	16	16
P_{st}	Static pressure of stack gas in. Hg	0.01	0.01	0.01
P_s	Stack gas pressure in. Hg absolute	29.91	29.88	29.91
V_s	Stack gas velocity at stack conditions fpm	2877	2892	2875
A_s	Stack area, $in.^2$	675	675	675
Q_s	Dry stack gas volumetric flow rate at standard conditions*, SCFM	11,700	11,664	11,727
Q_a	Stack gas volumetric flow rate at stack conditions, ACFM	13,484	13,554	13,474
% I	Percent isokinetic	90.7	94.6	95.4

* 70°F, 29.92 in. Hg

Table 6 (concluded)

PARTICULATE EMISSIONS DATA FOR NO. 1 MILL AIR SEPARATOR STACK B

Run No.		1	2	3
T_c	Unit Feed Rate-Tons/hr	30.0	28.6	30.1
m_f	Particulate - probe, cyclone and filter, mg	31.2	23.9	24.2
m_t	Particulate - total, mg	58.8	39.3	38.9
I_c	% impinger catch	46.9	39.2	37.8
C_{an}	Particulate - probe, cyclone, and filter, gr/SCF*	0.00647	0.00476	0.00496
C_{ao}	Particulate - total, gr/SCF*	0.0122	0.00783	0.00798
C_{at}	Particulate - probe, cyclone, and filter, gr/cf at stack conditions	0.00561	0.00409	0.00431
C_{au}	Particulate - total, gr/cf at stack conditions	0.0106	0.00673	0.00693
C_{aw}	Particulate - probe, cyclone, and filter, lb/hr.	0.643	0.467	0.493
C_{ax}	Particulate - total, lb/hr.	1.217	0.781	0.797
P_{tf}	Particulate - probe, cyclone, and filter, lb/ton feed	0.0214	0.0163	0.0164
P_{tt}	Particulate - total, lb/ton feed	0.0406	0.0273	0.0265

*70°F, 29.92 in. Hg, dry basis

PARTICULATE EMISSIONS DATA FOR NO. 1 MILL GRINDER AND DUST COLLECTOR

Run No.		1	2	3
Test Date		4-15-71	4-15-71	4-15-71
D_n	Sampling nozzle diameter, in.	0.193	0.193	0.193
T_t	Net time of test, min.	112	112	112
P_b	Barometric pressure, in. Hg absolute	30.16	30.04	30.02
P_m	Average Orifice pressure drop, in. H_2O	1.15	1.23	1.12
V_m	Volume of dry gas sampled, ft^3 at meter conditions	67.328	68.624	65.391
T_m	Average gas meter temperature, °F	94	99	102
$V_{m_{std}}$	Volume of dry gas sampled at standard conditions*, SCF	65.059	65.470	61.995
V_w	Total H_2O collected in impingers and silica gel, ml	34.2	25.8	33.9
$V_{w_{gas}}$	Volume of water vapor collected at standard conditions*, SCF	1.62	1.22	1.61
% M	% Moisture in the stack gas by volume	2.43	1.83	2.53
M_d	Mole fraction of dry gas	0.976	0.982	0.975
% CO_2		<1	<1	<1
% O_2		20.95	20.95	20.95
% CO		<1	<1	<1
% N_2		79.0	79.0	79.0
% EA	Excess Air Percent	—	—	—
MW_d	Molecular weight of stack gas, dry basis	29.00	29.00	29.00
MW	Molecular weight of stack gas, wet basis	28.73	28.80	28.72
C_p	Pitot tube coefficient	0.85	0.85	0.85
ΔP_s	Average velocity head of stack gas, in. H_2O	0.77	0.83	0.75
T_s	Average stack temperature, °F	149	148	151
N_p	Net sampling points	14	14	14
P_{st}	Static pressure of stack gas in. Hg	0.04	0.04	0.04
P_s	Stack gas pressure in. Hg absolute	30.20	30.08	30.06
V_s	Stack gas velocity at stack conditions fpm	3213	3329	3172
A_s	Stack area, $in.^2$	306	306	306
Q_s	Dry stack gas volumetric flow rate at standard conditions*, SCFM	5853	6087	5727
Q_a	Stack gas volumetric flow rate at stack conditions, ACFM	6827	7073	6739
% I	Percent isokinetic	103.5	100.1	100.8

* 70°F, 29.92 in. Hg

Table 7 (Concluded)

PARTICULATE EMISSIONS DATA FOR NO. 1 GRINDER AND DUST COLLECTOR

Run No.		1	2	3
T_c	Unit Feed Rate-Tons/hr	31.1	30.7	31.7
m_f	Particulate - probe, cyclone and filter, mg	35.5	33.7	34.9
m_t	Particulate - total, mg	54.2	54.6	56.0
I_c	% impinger catch	34.5	38.3	37.7
C_{an}	Particulate - probe, cyclone, and filter, gr/SCF*	0.00840	0.00793	0.00867
C_{ao}	Particulate - total, gr/SCF*	0.0128	0.0128	0.0139
C_{at}	Particulate - probe, cyclone, and filter, gr/cf at stack conditions	0.00719	0.00681	0.00736
C_{au}	Particulate - total, gr/cf at stack conditions	0.0110	0.0110	0.0118
C_{aw}	Particulate - probe, cyclone, and filter, lb/hr.	0.421	0.408	0.424
C_{ax}	Particulate - total, lb/hr.	0.638	0.669	0.682
P_{tf}	Particulate - probe, cyclone, and filter, lb/ton feed	0.0135	0.0133	0.0134
P_{tt}	Particulate - total, lb/ton feed	0.0205	0.0218	0.0215

*70°F, 29.92 in. Hg, dry basis

Table 8

SUMMARY OF MERCURY TESTING

Sampling Location: Kiln Stack
Sampling Date: April 13, 1971

Sampling Time, 24 hour clock	Hg emissions, ug	Sample Volume, cu. ft.[1]	Concentration, ppMV[2]
1255-1355	4.053	2.400	0.0076
1440-1540	2.597	2.445	0.0047
1620-1720	4.559	2.467	0.0082

1. Corrected to 70°F, 29.92 in. Hg.

2. Parts per million by volume dry basis, calculated by the equation

$$ppMV\ Hg = \frac{2.399 \times 10^{-4} \times (ug\ Hg) \cdot (Tm + 460)}{Vm \times Pm}$$

Where:

ug Hg - weight of Hg in sample

Tm - Temperature of meter

Vm - Volume, cf (meter cond.)

Pm - Pressure of meter

TABLE 9

SUMMARY OF SULFUR DIOXIDE DATA RECORDED FROM THE DYNASCIENCE INSTRUMENT

Sampling Location: Kiln Stack

Date	Time	Reading [1, 2, 3]
4-14-71	14:35	68
4-14-71	14:40	76
4-14-71	14:45	70
4-14-71	14:55	74
4-14-71	15:05	78
4-14-71	15:15	68
4-14-71	15:30	54
——— Removed glass fiber filter from sampling line ———		
4-14-71	15:50	30
4-14-71	16:00	24
4-14-71	16:10	46
4-14-71	16:15	46
4-14-71	16:20	46

1. Dynascience readings recorded at 60°F, 30.02 in. Hg
2. All values are in ppm SO_2, dry basis.
3. Sample was drawn through a stainless steel tube.

TABLE 10

NITROGEN OXIDE DATA COMPARING THE PDS[1] METHOD vs. THE DYNASCIENCE INSTRUMENT [2, 3]

Sampling Location: Kiln Stack

Date	Time	PDS Method	Dynascience
4-15-71	14:30	—	85
4-15-71	14:40	—	96
4-15-71	14:50	8	96
4-15-71	14:56	164	—
4-15-71	15:00	180	107
4-15-71	15:03	186	—
4-15-71	15:10	—	107
4-15-71	15:20	129	117
4-15-71	15:25	98	—
4-15-71	15:28	118	—
4-15-71	15:30	—	75
4-15-71	15:40	—	75
4-15-71	15:45	115	—
4-15-71	15:48	100	—
4-15-71	15:50	—	64
4-15-71	15:52	131	—
4-15-71	16:00	—	64
4-15-71	16:10	—	75
4-15-71	16:24	199	—
4-15-71	16:27	208	—
4-15-71	16:30	—	117

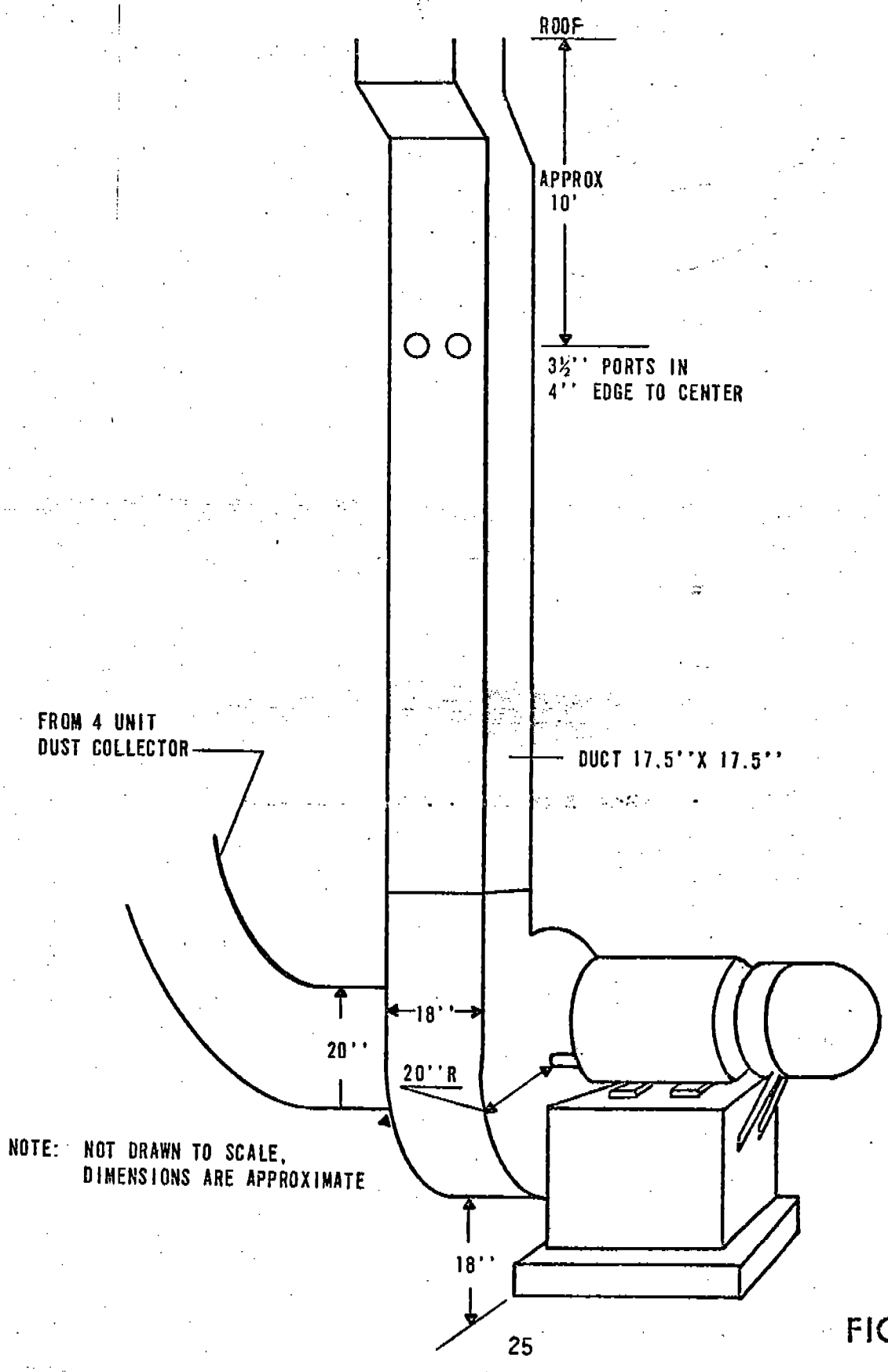
1. PDS = Phenoldisulfonic Acid
2. Dynascience readings recorded at 60°F, 30.02 in. Hg; all values are in ppm NO_x dry basis.
3. Concentration of O_2 during sampling ranged from 0.4% to 1.5%.

APPENDIX A

SCHEMATICS OF TEST LOCATIONS

IDEAL CEMENT COMPANY
CASTLE HAYNE, NORTH CAROLINA

SAMPLING LOCATION FOR NO. 1 MILL GRINDER AND ELEVATOR DUST COLLECTOR



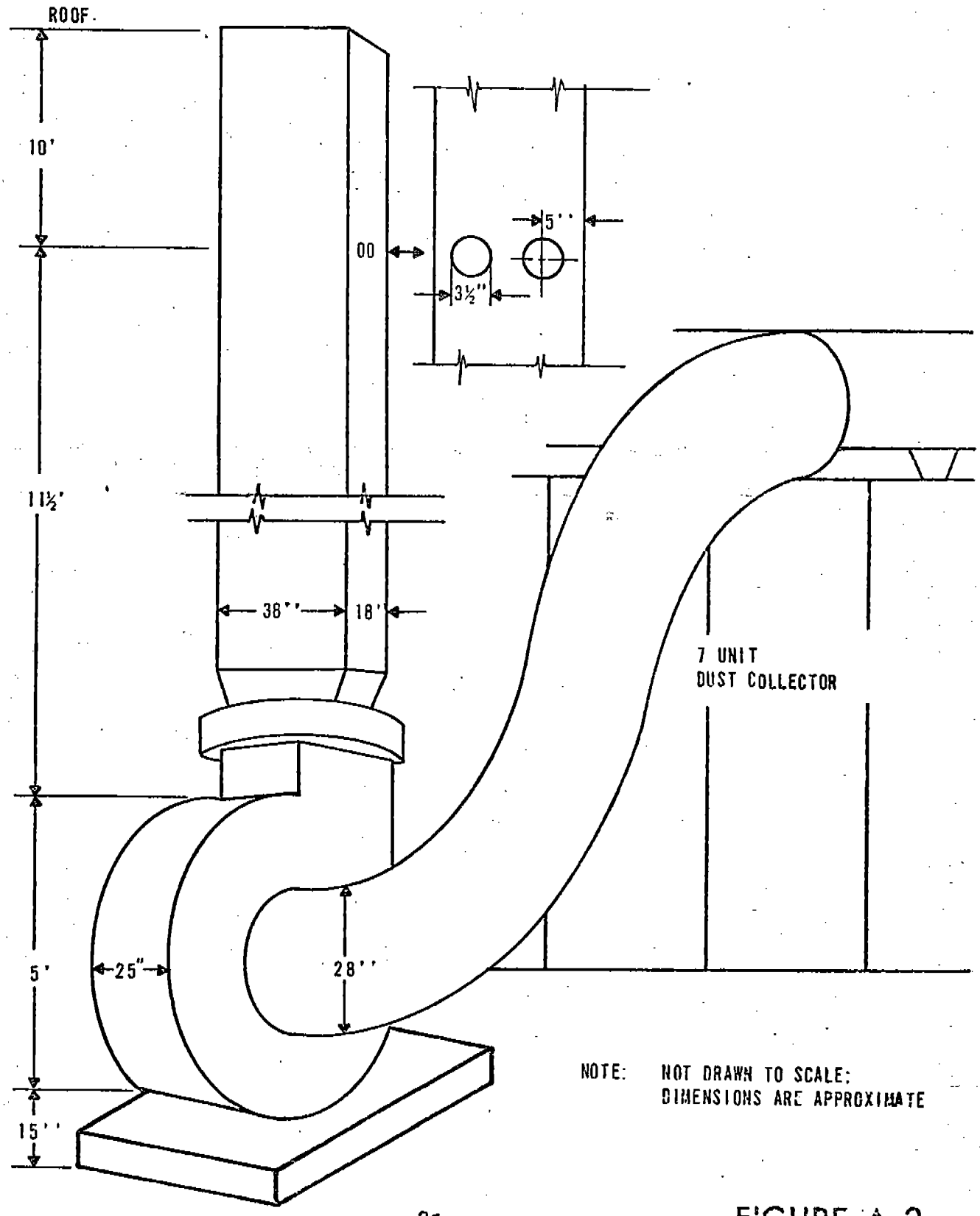
NOTE: NOT DRAWN TO SCALE, DIMENSIONS ARE APPROXIMATE

FIGURE A-1

IDEAL CEMENT COMPANY

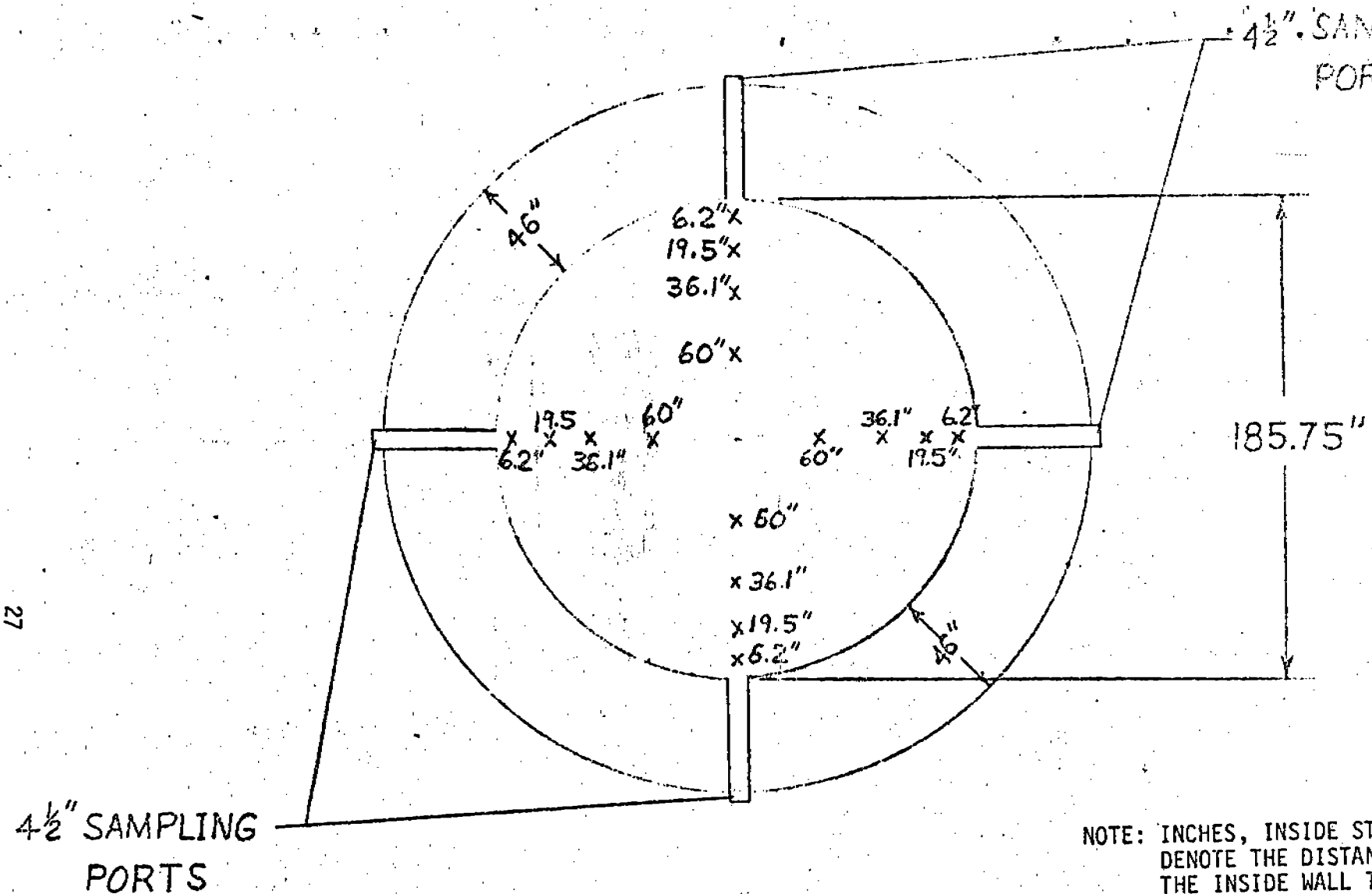
CASTLE HAYNE, NORTH CAROLINA

SAMPLING LOCATIONS FOR AIR SEPARATOR STACKS A AND B



NOTE: NOT DRAWN TO SCALE;
DIMENSIONS ARE APPROXIMATE

FIGURE A-2



NOTE: INCHES, INSIDE STACK, DENOTE THE DISTANCE FROM THE INSIDE WALL TO THE SAMPLING POINT.

FIGURE A-3
IDEAL CEMENT COMPANY
CASTLE HAYNE, NORTH CAROLINA
SCHEMATIC OF KILN STACK CROSS-SECTION

APPENDIX C

FIELD DATA AND NOTES

FTS- 919 763 9971

PRESURVEY - PROCESS INDUSTRY & POWER PLANTS

NAME OF COMPANY Ideal Cement DATE OF PRESURVEY 1-18-71

ADDRESS CITY Castle Hayne STATE N.C.

NAME OF CONTACT Mr. R.T. Nelson TITLE Plant mgr. PHONE 919-675-2264

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

Mr. Dee Good (asst plant mgr)
Mr. John Yocum

Wet process
kiln - oil fired
Cap - 3,500,000
kilns - 2
ESP unit - 99.3% efficient
ice - no ice on plant site
Tel space available if needed
Lunch - vending machines

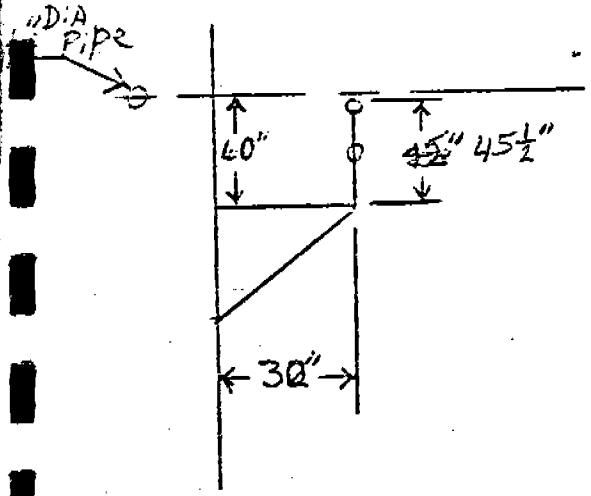
COMMENTS:
clinker coolers controlled by multi cyclone!
with dampers

PROVIDE DIAGRAM OF EACH SAMPLING SITE. INCLUDE THE FOLLOWING INFORMATION:

DIMENSIONS TO NEAREST OBSTRUCTION IN ALL DIRECTIONS FROM SAMPLING PORT.

COMPLETE DESCRIPTION OF ALL PORTS INCLUDING ALL DIMENSIONS. DESCRIPTION OF ANY UNUSUAL FEATURES ABOUT ENVIRONMENT; HEIGHT, ODORS, TOXIC CONDITIONS, TEMPERATURE, DUST, ETC.

Kiln stack platform

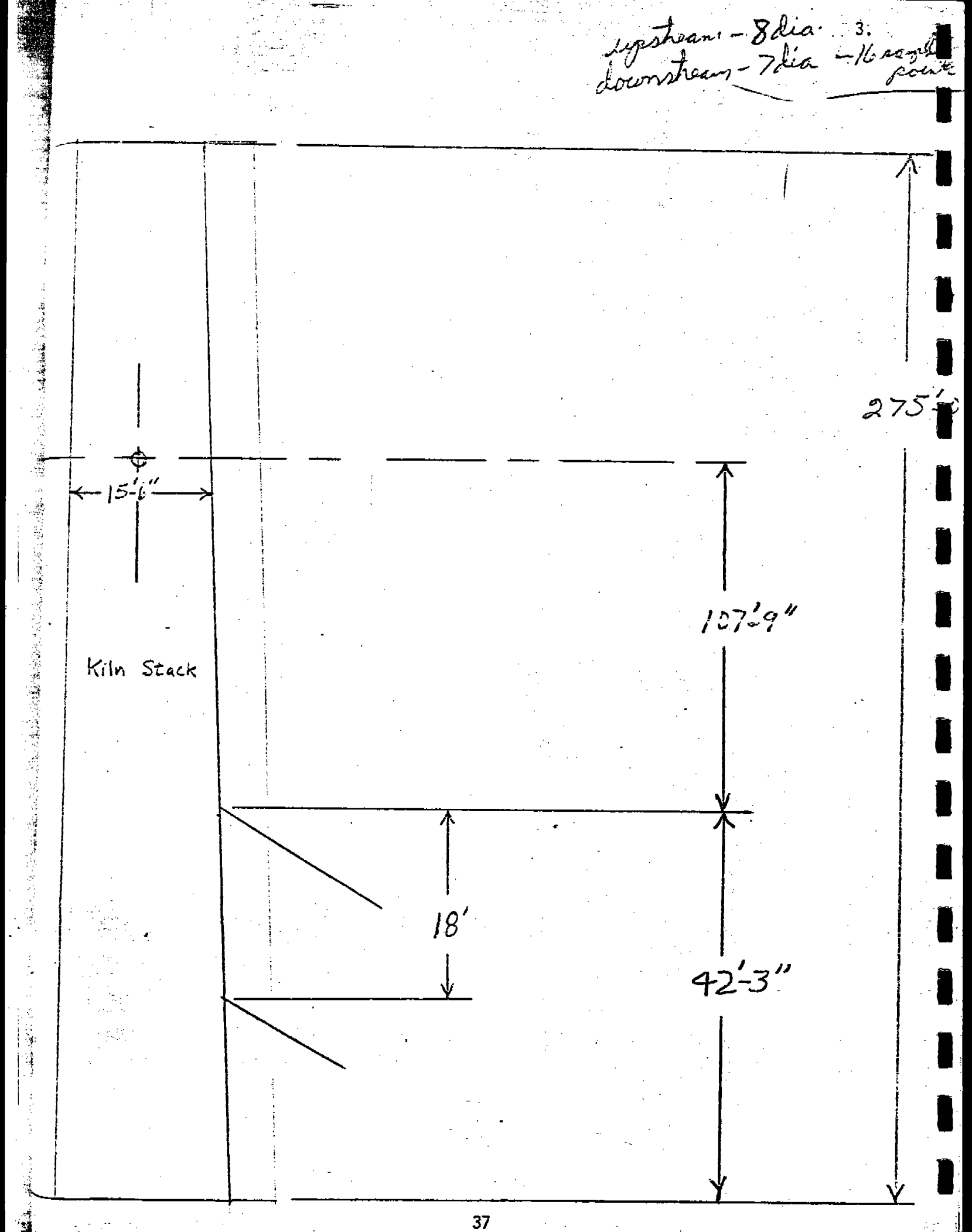


WALL Thickness – from outside of stack to outside of inner wall @ 36". Estimate inside wall to be @ 12" (36+12 = 48" wall total)

Note – Pulley and 2 electric circuits will be provided at base of stack.

upstream - 8 dia
downstream - 7 dia

3.
16 equally spaced



SCAFFOLDING OR OTHER MEANS OF SUPPORT PRESENT?

☑ YES

☐ NO, WHO WILL PROVIDE IT? plant

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

Large stock @ 20°/ft ☐ NO

DISTANCE _____ WHO WILL PROVIDE EXTENSION CORDS? Testing personnel

LOCATION OF FUSE BOX in control room

PARKING FACILITIES AVAILABLE FOR TRAILER OR VAN? yes

SIGNATURE REQUIRED ON PASSES? no yes WAIVERS? _____

NEARBY RESTAURANTS AND MOTELS Rainbow End motel (675-2741) @ 3 miles from plant (very good + clean) S-6.00 D-7.50 No restaurant on plant site (no ice) Also Holiday Inn at Wilmington

LIST ANY SPECIAL SAFETY EQUIPMENT OR RULES Glasses and hard hats

SURVEY BY C. E. Riley

COMMENTS:

Ideal Cement Castle Hayne N.C.
4-12-71 — 4-16-71

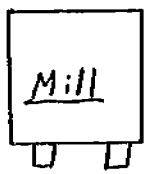
Phil York

PRODUCTION RATES

Ideal Cement Co.
Castle Hayne, N.C.
4/15/71

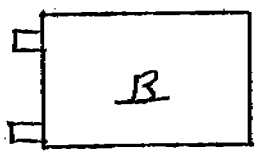
Sampling Area — No. 1 Finish Mill (5th floor)

FINISH MILL No.1



Stack from dust collector on grinder & elevator.

Stack from dust collector on Air Separator "A".



Stack from dust collector on Air Separator "B".

DATE	TIME	T/HR
4/13	15:60	30.0
	18:06	
4/14	9:59	20.6
	11:41	
	14:58	30.1
	15:44	
4/15	10:32	31.1
	12:30	
	13:57	30.1
	15:53	
	16:20	31.7
	18:17	

KILN: 9 10 11 12 1 2 3 4 5
4/15 (TIME) 127.1 127.9 127.9 127.9 127.9 125.5 127.9 129.5

Storm Elevator

39

Ideal Cement Castle Hayne N.C.
4-12-71 — 4-16-71

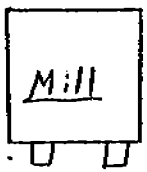
Phil York

PRODUCTION RATES

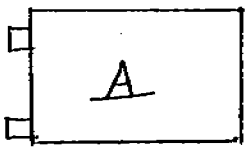
Ideal Cement Co.
Castle Hayne, N.C.
4/16/71

Sampling Area — No. 1 Finish Mill (5th floor)

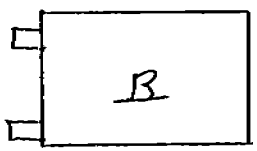
FINISH MILL No. 1



Stack from dust collector on grinder & elevator.



Stack from dust collector on Air Separator "A".



Stack from dust collector on Air Separator "B".

DATE	TIME	T/HR
4/13	15:50	30.0
	18:06	
4/14	9:59	28.6
	11:41	
	14:58	30.1
	16:44	
4/15	10:32	31.1
	12:30	
	13:57	30.1
	15:53	
	16:20	31.7
	18:17	

KILN:	9	10	11	12	1	2	3	4	6
4/15 (TIME)	127.1	127.9	127.9	127.9	127.9	125.5	127.9	129.6	

Screw Elevator

40

"A" Ideal Cement Castle Hayne 4-13-71
"A" Air Separator Dust Collector, Mill No. 1

Sampling Data

Run	DAY	PBR	TAM	Vac	Tcj	Pcf	Vcb
① 1	.193	29.90	96	61.768	116	1.28	56.931
② 2	.193	29.87	96	65.263	109	1.45	60.857
③ 3	.193	29.90	92	58.700	109	1.34	54.777

Moisture + Gas

Run	Vcc	Vcf	Vcg	Mch	Mbj	Mcz
1	2.3	.11	.19	.998	29.08	28.98
2	9.0	.43	.70	.993	29.00	28.92
3	2.0	.09	.16	.998	29.00	28.98

Velocity and Calculation Data

Run	Sdd	Pd	Tdf	Sdc	Vdh	Vdb	TAX
1	738	29.95	182	24.62	3635	15,362	97.1
2	738	29.92	164	24.70	3653	15,788	106.0
3	738	29.95	151	23.39	3454	15,338	97.6

Static press = .05

VELOCITY TRAVERSE FIELD DATA

Plant Ideal Cement Castle Hayne
Test
Location Air Separator A
Date 4-13-71
Operator
Meter ΔH 1.86

y / x — parallel

Point	ΔP, in. H2O	(1) √ΔP	(2) ΔP, in. H2O	(2) √ΔP
X1	1.2		Y1	.84
2	1.1		2	.92
3	1.1		3	.90
4	1.0		4	.86
5	.96		5	.86
6	.85		6	.83
7	.75		7	.79
8	.63		8	.72

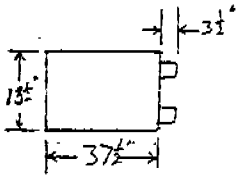
(1) ΔP, in. H2O Average .894
(2) ΔP, in. H2O Average

Comments: Static press .64 in H2O

PRELIMINARY FIELD DATA

Stack Geometry

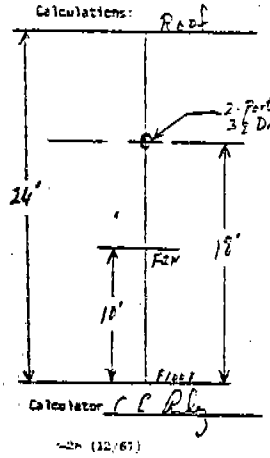
Test No. Castle Hayne
Location Air Separator A
Date 4-13-71



A. Dist. from inside of far wall to outside of near wall, in., = 41
B. Wall thickness, in. = 3½
Inside diameter of stack = A-B 37½
Stack Area = 738 6pf

Comments:

Sketch of stack cross-section showing sampling holes



Point	Dist. for stack	Dist. from outside of sample port, in.
1	2¼ + 3½	= 5¾
2	7 "	= 10½
3	11¾ "	= 15¼
4	16½ "	= 20
5	21¼ "	= 24¾
6	26 "	= 29½
7	30¾ "	= 34¼
8	35½ "	= 39

Plant Ideal Cement Date 4-13-71
Sampling location Air Separator A No. 1 Mill

STACK DATA FOR NOMOGRAPH:

1. Meter ΔH 1.84 in H_2O
2. Avg. meter temp (ambient + 20°) 100 °F
3. Moisture (volume) 2 %
4. Avg. static press. ⓒ .64 in. H_2O X.073 = + .05 in. Hg.
5. Bar. press sampling point 29.90 in. Hg ± _____ (static press in. Hg) = _____ in. Hg.
6. Bar press of meter 29.90 in. Hg.
7. P_s/P_m = S. _____ in. Hg / B. _____ in. Hg = 1.00
8. Avg. stack temperature 160 °F.
9. Avg. stack velocity (ΔP) .894 in H_2O.

C factor (1) 1.1 (2) _____

1.03

Plant Castle Hayne

Run No. A-1

Location Fireplace stack

Date 4/15/71

Operator [illegible]

Sample Box No. A

Meter Box No. 1204

Meter ΔH 1.84

C Factor 1.12

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

Ambient Temp °F

Bar. Press. "Hg 29.90

Assumed Moisture %

Heater Box Setting, °F 500

Probe Tip Dia., In. 0.193

Probe Length 4'

Probe Heater Setting 55

Avg. ΔH 1.6 Avg. √ΔP 1.3

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	0800	298.105	1.10	1.48	1.47	100	100	3.3	220	65	.05	150	39.0
A-1	08[illegible]	300.[illegible]	1.10	1.48	1.47	104	100	3	220	65		150	39.0
A-2	08[illegible]	302.[illegible]	1.30	1.48	1.47	110	102	3	220	70		150	39.2
A-2	08[illegible]	304.[illegible]	1.30	1.48	1.47	114	102	3	230	70		150	39.2
A-3	08[illegible]	306.[illegible]	1.20	1.48	1.47	117	104	3	230	75		150	39.5
A-3	08[illegible]	309.[illegible]	1.20	1.48	1.47	119	104	3	230	75		150	39.5
A-4	08[illegible]	311.[illegible]	1.10	1.48	1.47	121	104	3	230	80		150	39.5
A-4	08[illegible]	313.[illegible]	1.10	1.48	1.47	123	104	3	230	80		150	39.7
A-5	08[illegible]	315.[illegible]	1.05	1.48	1.47	124	106	3	240	80		150	39.7
A-5	08[illegible]	317.[illegible]	1.05	1.48	1.47	125	106	3	240	80		150	39.7
A-6	08[illegible]	319.[illegible]	1.00	1.48	1.47	126	106	3	240	80		150	39.8
A-6	08[illegible]	321.[illegible]	1.00	1.48	1.47	127	106	3	240	80		150	39.8
A-7	08[illegible]	323.[illegible]	0.95	1.48	1.47	128	107	3.5	240	80		150	40.0
A-7	08[illegible]	325.[illegible]	0.95	1.48	1.47	129	107	3.5	240	80		150	40.0
A-8	08[illegible]	327.[illegible]	0.90	1.48	1.47	130	108	3.5	240	80		150	40.2
A-8	08[illegible]	329.[illegible]	0.90	1.48	1.47	130	108	3.5	240	80		150	40.2
A-9	08[illegible]	331.[illegible]	0.85	1.48	1.47	130	108	3.5	240	80		150	40.2
A-9	08[illegible]	333.[illegible]	0.85	1.48	1.47	130	108	3.5	240	80		150	40.2
A-10	08[illegible]	335.[illegible]	0.80	1.48	1.47	130	108	3.5	240	80		150	40.2
A-10	08[illegible]	337.[illegible]	0.80	1.48	1.47	130	108	3.5	240	80		150	40.2
A-11	08[illegible]	339.[illegible]	0.75	1.48	1.47	130	108	3.5	240	80		150	40.2
A-11	08[illegible]	341.[illegible]	0.75	1.48	1.47	130	108	3.5	240	80		150	40.2
A-12	08[illegible]	343.[illegible]	0.70	1.48	1.47	130	108	3.5	240	80		150	40.2
A-12	08[illegible]	345.[illegible]	0.70	1.48	1.47	130	108	3.5	240	80		150	40.2

Comments: Filter # 162

Silicagel 200.5

Dry 12 - 103 wash

RCAP-37 (12/67)

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	Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press. In. Hg	Stack Temp °F	
B-1	0800	347.[illegible]	1.10	1.48	1.47	115	104	5.0	230	75	.05	150	39.0
B-1	08[illegible]	349.[illegible]	1.10	1.48	1.47	116	104	5.5	230	75		150	39.0
B-2	08[illegible]	351.[illegible]	1.00	1.48	1.47	120	106	5.0	240	75		150	39.2
B-2	08[illegible]	353.[illegible]	1.00	1.48	1.47	122	107	5.5	240	75		150	39.2
B-3	08[illegible]	355.[illegible]	0.95	1.48	1.47	124	107	5.5	240	75		150	39.5
B-3	08[illegible]	357.[illegible]	0.95	1.48	1.47	126	107	5.5	240	75		150	39.5
B-4	08[illegible]	359.[illegible]	0.90	1.48	1.47	127	108	5.0	240	80		150	39.7
B-4	08[illegible]	361.[illegible]	0.90	1.48	1.47	128	108	5.0	240	80		150	39.7
B-5	08[illegible]	363.[illegible]	0.85	1.48	1.47	129	108	5.0	240	80		150	39.7
B-5	08[illegible]	365.[illegible]	0.85	1.48	1.47	129	108	5.0	240	80		150	39.7
B-6	08[illegible]	367.[illegible]	0.80	1.48	1.47	129	108	5.0	240	80		150	39.7
B-6	08[illegible]	369.[illegible]	0.80	1.48	1.47	129	108	5.0	240	80		150	39.7
B-7	08[illegible]	371.[illegible]	0.75	1.48	1.47	129	108	5.0	240	80		150	39.7
B-7	08[illegible]	373.[illegible]	0.75	1.48	1.47	129	108	5.0	240	80		150	39.7
B-8	08[illegible]	375.[illegible]	0.70	1.48	1.47	129	108	5.0	240	80		150	39.7
B-8	08[illegible]	377.[illegible]	0.70	1.48	1.47	129	108	5.0	240	80		150	39.7
B-9	08[illegible]	379.[illegible]	0.65	1.48	1.47	129	108	5.0	240	80		150	39.7
B-9	08[illegible]	381.[illegible]	0.65	1.48	1.47	129	108	5.0	240	80		150	39.7

PARTICULATE CLEANUP SHEET

Date: 4/15/71

Run number: A-1

Operator:

Sample box number: A

Plant: Castle Hayne Inlet

Location of sample port: Fireplace stack A

Barometric pressure: 29.95

Ambient temperature:

Impinger H_2O

Volume after sampling 191 ml

Impinger prefilled with 206 ml

Volume collected -15 ml

Containers and back half of filter, acetone wash:

Container No. 106

Extra No.

Container No. 1504

Weight results 852.2 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. 101

Extra No. 1508

Weight results 8.3 mg

Ether-chloroform extraction of impinger water mg

Impinger water residue 24.1 mg

Filter Papers and Dry Filter Particulate

Filter number	Container no.	Filter number	Container no.	
F-162	F-162			

Total particulate weight 24.1 mg

Filter particulate weight 8.5 mg

Moisture total 243 gm

Silica Gel 2168 2188

Weight after test: 2205

Weight before test: 2005

Moisture weight collected: 200

Container number: 1. 163 2. 3. 4.

Sample number:

Method determination:

Comments:

Analyze for:

Plant: Todd Cold Upper

Run No. A-2

Location Air preheater A

Date 4/14/71

Operator [illegible]

Sample Box No. A

Meter Box No. 1204

Meter ΔH 1.44

C Factor 1.15

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

Move every 3 min

Ambient Temp °F 96-98

Bar. Press. "Hg 29.27

Assumed Moisture % 2

Heater Box Setting, °F

Probe Tip Dia., In. C 193

Probe Length 4'

Probe Heater Setting 55

Avg. √ΔP 1.10 Avg. ΔH 1.0

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	Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press In. Hg	Stack Temp °F	
A-2	1000	555.855											D-57
A-6	06	60.6											57
A-7	10	65.5											57
A-7	15	70.4											60
A-6	20	75.3											60
A-5	25	80.2											60
A-5	30	85.1											60
A-4	35	90.0											60
A-4	40	94.9											60
A-3	45	99.8											60
A-3	50	104.7											60
A-2	55	109.6											60
A-2	1100	114.5											60
A-1	05	119.4											60
A-1	10	124.3											60

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	Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press In. Hg	Stack Temp °F	
4-27 Comments													D-57
A-2	1047	564.855											
A-6	1052	569.6											57
A-7	1057	574.5											57
A-7	1102	579.4											60
A-6	1107	584.3											60
A-5	1112	589.2											60
A-5	1117	594.1											60
A-4	1122	599.0											60
A-4	1127	603.9											60
A-3	1132	608.8											60
A-3	1137	613.7											60
A-2	1142	618.6											60
A-2	1147	623.5											60
A-1	1152	628.4											60
A-1	1157	633.3											60

PARTICULATE CLEANUP SHEET

Plant: Todd Upper

Date:

Run number: A-2

Location of sample port: Air Htr A

Operator:

Barometric pressure:

Sample box number: A

Ambient temperature:

Impinger H_2O

Volume after sampling 194 ml — Container No. 1/1 — Ether-chloroform extraction of impinger water

Impinger prefilled with 200ml — Container No. 1514 — Impinger water residue

Volume collected ~12 ml

Impingers and back half of filter, acetone wash: Container No. 1/2 — Weight results 6.8 mg

Dry probe and cyclone catch: Container No. 1 — Weight results mg

Probe, cyclone, flask, and front half of filter, acetone wash: Container No. 61 — Weight results 169 mg

Filter Papers and Dry Filter Particulate

Filter number: 1559 — Container no. Todd 1515 — Filter number — Container no.

Filter particulate weight 34.0 mg

Total particulate weight mg

Silica Gel

	1.	2.	3.	4.
Weight after test:	2206			
Weight before test:	2005			
Moisture weight collected:	201			
Container number:				

201 / 2 / 8.1

Moisture total 8.1 gm

Sample number: Analyze for:

Method determination:

Comments:

PARTICULATE FIELD DATA

Plant: Ideal Castle Hayne
Run No.: A-3
Location: Girsperton A
Date: 4/14/71
Operator:
Sample Box No.: #4
Meter Box No.: 1204
Meter ΔH: 1.94
C Factor:

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 3 minutes. Move every 6 min

Ambient Temp °F:
Bar. Press. "Hg: 29.98
Assumed Moisture %: 2
Heater Box Setting, °F:
Probe Tip Dia., In.: 0.193
Probe Length: 41
Probe Heater Setting: 55
Avg. √ΔP:
Avg. ΔH:

Point	Clock Time	Dry Gas Meter, Cf	Pitot in. H2O ΔP	Orifice ΔH in. H2O Meter	Orifice ΔH in. H2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Vacuum mm Hg Gauge	Box °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
A-1	0000	426.10	.52	.51	.51	90	82	4	250	50	.05	160
A-1	0200	428.19	.52	.51	.51	96	84	4	250	50		160
A-2	0400	430.31	.52	.51	.51	99	91	4	250	50		161
A-2	0600	432.41	.52	.51	.51	100	93	4	250	50		162
A-3	0800	434.52	.52	.51	.51	106	94	4	250	50		163
A-3	1000	436.63	.52	.51	.51	108	96	4	250	50		164
A-4	1200	438.71	.52	.51	.51	117	97	4	250	50		165
A-4	1400	440.82	.52	.51	.51	117	98	4	250	50		165
A-5	1600	442.92	.52	.51	.51	118	98	4	250	50		165
A-5	1800	445.01	.52	.51	.51	118	98	4	250	50		165
A-6	2000	447.11	.52	.51	.51	120	100	4	250	50		166
A-6	2200	449.21	.52	.51	.51	121	101	4	250	50		166
A-7	2400	451.31	.52	.51	.51	121	101	4	250	50		166
A-7	0200	453.41	.52	.51	.51	122	102	4	250	50		166
A-8	0400	455.51	.52	.51	.51	122	102	4	250	50		166
A-8	0600	457.61	.52	.51	.51	122	102	4	250	50	.05	166
Comments	Clock Time	Dry Gas Meter, Cf	Pitot in. H2O ΔP	Orifice ΔH in. H2O Meter	Orifice ΔH in. H2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Vacuum mm Hg Gauge	Box °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
B-1	0800	460.8	.52	.51	.51	122	102	4	250	50	.05	166
B-1	1000	462.9	.52	.51	.51	122	102	4	250	50		166
B-2	1200	465.0	.52	.51	.51	122	102	4	250	50		166
B-2	1400	467.1	.52	.51	.51	122	102	4	250	50		166
B-3	1600	469.2	.52	.51	.51	122	102	4	250	50		166
B-3	1800	471.3	.52	.51	.51	122	102	4	250	50		166
B-4	2000	473.4	.52	.51	.51	122	102	4	250	50		166
B-4	2200	475.5	.52	.51	.51	122	102	4	250	50		166
B-5	2400	477.6	.52	.51	.51	122	102	4	250	50		166
B-5	0200	479.7	.52	.51	.51	122	102	4	250	50		166
B-6	0400	481.8	.52	.51	.51	122	102	4	250	50		166
B-6	0600	483.9	.52	.51	.51	122	102	4	250	50		166
B-7	0800	486.0	.52	.51	.51	122	102	4	250	50		166
B-7	1000	488.1	.52	.51	.51	122	102	4	250	50		166
B-8	1200	490.2	.52	.51	.51	122	102	4	250	50		166
B-8	1400	492.3	.52	.51	.51	122	102	4	250	50		166
		494.4										

PARTICULATE CLEANUP SHEET

Plant: Castle Hayne
Date: 4/14/71
Run number: A-3
Location of sample port: Airsperton A
Operators:
Barometric pressure:
Sample box number: 4
Ambient temperature:

Impinger H2O
Volume after sampling: 199 ml
Impinger prefilled with 200 ml
Volume collected: 42 ml

Container No. 1578
Ether-chloroform extraction
of impinger water: 1578
Impinger water residue: 45 mg

Implingers and back half of filter, acetone wash: Container No. 304 / 1577 — Weight results: 99 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. 113 / 1576 — Weight results: 124 mg

Filter Papers and Dry Filter Particulate

Filter number	Container no.	Filter number	Container no.	Filter particulate weight
F 160	Blank 1579			20 mg
				358 mg
				mg
		Total particulate weight		mg

Silica Gel

Weight after test:	214	___	___	___
Weight before test:	200.0	___	___	___
Moisture weight collected:	14.	___	___	___
Container number:	1. ___	2. ___	3. ___	4. ___

Moisture total 2 gm

Sample number:
Method determination:
Comments:
Analyze for:

Ideal Cement Castle Hayne 4-13-71

"B" Air Separator Dust Collector, Mill No. 1

Sampling Data

Run	Dav	Pbe	Taw	Vsc	Tsi	Psf	Vsb
1	.250	29.90	96	81.345	123	2.39	74.277
2	.250	29.87	96	84.391	121	2.55	77.276
3	.252	29.90	92	81.502	118	2.62	75.106

Moisture + Gas

Run	Vcc	Vaf	Vcg	Mch	Mbj	Mcc
1	.4	.02	.63	.999	29.01	28.92
2	8.1	.38	.49	.995	29.00	28.95
3	5.0	.24	.32	.997	29.00	28.97

Velocity and Calculation Data

Run	Isd	Pdi	Tdf	Sdc	Vdh	Vwb	Tax
1	720	29.91	150	19.44	2872	12,459	90.8
2	720	29.88	152	19.51	2886	12,416	94.8
3	720	29.91	147	19.41	2868	12,478	95.7

Pitot assumed = .01

VELOCITY TRAVERSE FIELD DATA

Plant Ideal Cement (Castle Hayne)

Test 1

Location Air Separator B

Date 4-13-71

Operator

Meter ΔH 1.86

18" — Y / X — capped

←45"→

right 3½ length

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	Temp. °F (1)	Temp. °F (2)
X 1	.57		Y 1 .50		155	
2	.52		2 .52			
3	.48		3 .48			
4	.47		4 .43			
5	.47		5 .40			
6	.50		6 .43			
7	.55		7 .50			
8	.58		8 .50		155	

(1) ΔP, in. H_2O Average .494

(2) ΔP, in. H_2O Average

Comments:

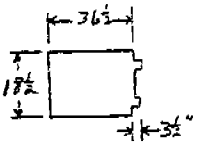
PRELIMINARY FIELD DATA

Stack Geometry

Test No. Ideal Cement Castle

Location Air Separator B

Date 4-13-71



A. Dist. from inside of far wall to outside of near wall, in., = 40

B. Wall thickness, in., = 3½

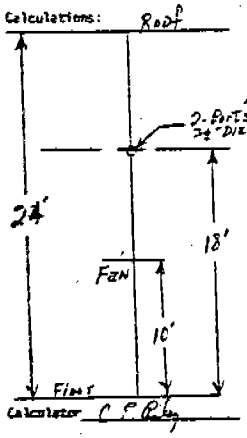
Inside diameter of stack = A-B 36½

Stack Area = (720) 675

Comments:

Sketch of stack cross-section showing sampling holes

Calculations: Roof



Calculator C P Ruby

Point	Dist. for circular stack	Dist. from outside of sample port, in.
1	7½ + 3½	= 5¾
2	7 + "	= 10⅜
3	11⅜ "	= 15½
4	16½ "	= 20
5	21¼ "	= 24¾
6	26 "	= 29½
7	30¾ "	= 34½
8	35⅜ "	= 39.0

X+Y

EPA-2F (12/67)

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Plant Ideal Cement Date 4-13-71

Sampling location Air Separator B No. 1 Mill

STACK DATA FOR NOMOGRAPH:

1. Meter ΔH 1.84 in H_2O

2. Avg. meter temp (ambient + 20° 120 °F

3. Moisture (volume) 2 %

4. Avg. static press. ± .20 in. H_2O X .073 = ± .01 in. Hg.

5. Bar. press sampling point 29.90 in. Hg (A) .01 (static press in. Hc) = 29.91 in. Hg.

6. Bar press of meter 29.90 in. Hg.

7. P_s/P_m = 5. ____ in. Hg / 6. ____ in. Hg = 1.00

8. Avg. stack temperature 155 °F.

9. Avg. stack velocity (ΔP) .494 in H_2O.

C factor (1) 1.1 (2)

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Plant: Castle Hayne
Run No. B1
Location Air Sep Stack
Date 4/13/71
Operator
Sample Box No. B
Meter Box No. Small Cone
Meter ΔH 1.54
C Factor 1.10

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

Make reading 6

Ambient Temp °F
Bar. Press. "Hg 29.98
Assumed Moisture % 2.0
Heater Box Setting, °F
Probe Tip Dia., In. 0.25
Probe Length
Probe Heater Setting 60
Avg. ΔP Avg. ΔH

Traverse 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	DGM
A-1	1600	592.60	.76	3.6	3.0	102	98	11.5	330			155	39.0
A-2	1605	595.12	.77	3.6	3.0	106	99	11.0				155	39.0
A-3	1610	597.70	.76	3.6	3.0	110	102	11.0			.01	155	39.2
A-4	1615	600.65	.70	3.6	3.0	117	105	11.0				155	39.2
A-5	1620	603.25	.68	3.6	3.0	123	108	11.0				150	39.2
A-6	1625	605.9	.68	3.6	3.0	128	110	11.0	330	100		150	39.5
A-7	1630	608.6	.68	3.6	3.0	132	104	11.2				150	39.5
A-8	1635	611.3	.68	3.6	3.0	134	103	11.0				150	39.7
B-8	1640	614.0	.68	3.6	3.0	134	105	11.0		115		150	39.7
B-7	1645	616.7	.68	3.6	3.0	136	107	11.0				150	39.8
B-6	1650	619.3	.68	3.6	3.0	137	109	11.0	330	115		150	39.8
B-5	1655	621.90	.68	3.6	3.0	139	110	11.0				150	39.8
B-4	1700	624.6	.68	3.6	3.0	140	110	10.8				150	39.8
B-3	1705	627.3	.68	3.6	3.0	141	111	10.8				150	39.8
B-2	1710	630.0	.68	3.6	3.0	143	112	10.7				150	39.8
B-1	1715	632.6	.68	3.6	3.0	143	113	10.7	330	110		150	39.8

Comments: Filter 161
Silica Gel 201.2
Impinger Vol 103 each

NCAP-37 (12/67)

Traverse 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	Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press. in. Hg	Stack Temp °F	DGM
B-1	1600	635.73	.68	3.6	3.0	113	113	10.5			.01	150	39.0
B-2	1605	638.40	.68	3.6	3.0	113	113	10			.01	150	39.0
B-3	1610	641.10	.68	3.6	3.0	113	113	9.5	330	96		150	39.2
B-4	1615	643.80	.68	3.6	3.0	112	113	9				150	39.2
B-5	1620	646.50	.68	3.6	3.0	112	113	9				150	39.5
B-6	1625	649.20	.68	3.6	3.0	112	113	9	330	98		150	39.5
B-7	1630	651.90	.68	3.6	3.0	112	113	9				150	39.7
B-8	1635	654.60	.68	3.6	3.0	112	113	9				150	39.7
B-8	1640	657.30	.68	3.6	3.0	112	113	9				150	39.8
B-7	1645	660.00	.68	3.6	3.0	112	113	9				150	39.8
B-6	1650	662.70	.68	3.6	3.0	112	113	9	330	100		150	39.8
B-5	1655	665.40	.68	3.6	3.0	112	113	9				150	39.8
B-4	1700	668.10	.68	3.6	3.0	112	113	9				150	39.8
B-3	1705	670.80	.68	3.6	3.0	112	113	9				150	39.8
B-2	1710	673.50	.68	3.6	3.0	112	113	9				150	39.8
B-1	1715	676.20	.68	3.6	3.0	112	113	9	330	100		150	39.8

PARTICULATE CLEANUP SHEET

Plant: Castle Hayne
Date: 4/13/71
Run number: B1
Location of sample port: Air Sep B
Operator:
Barometric pressure:
Sample box number: B
Ambient temperature:

Impinger H2O
Volume after sampling 620ml
Impinger prefilled with 200ml
Volume collected ~420ml

Container No. 119 Weight results 1522 gm
Extra No.
Ether-chloroform extraction of impinger water
Impinger water residue 764.6 mg

Implingers and back half of filters, acetone wash:
Container No. 117
Extra No. 1539 Weight results 1144 mg

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

Probe, cyclone, flask, and front half of filter, acetone wash:
Container No. 118
Extra No. 1534 Weight results 244 mg

Filter Papers and Dry Filter Particulate

Filter number: F161
Container No.: Blank 1533
Filter particulate weight: 68 mg
Total particulate weight: 58.8 mg

Silica Gel
Weight after test: 1276
Weight before test: 201.2
Moisture weight collected: 244
Container number: 1. 2. 3. 4.
Moisture total .4 gm

Sample number:
Analyze for:
Method determination:
Comments:

Plant Ideal - Cecil & Hayne

Run No. B-2

Location Air Sparta B

Date 4/14/71

Operator Ernie & Tom

Sample Box No. B

Meter Box No. 1205

Meter ΔH 1.84

C Factor 1.15

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

Mode. Every 3 Min

Start 10:

Ambient Temp °F

Bar. Press. "Hg 24.99

Assumed Moisture % 2

Heater Box Setting, °F

Probe Tip Dia., In. 0.250

Probe Length 4'

Probe Heater Setting 650

Avg. Δ P 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	Vacuum in. Hg	Box Temp °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F	
B-8	4000	674.30	2.60	2.45	2.45	104	94	9.5	330	65	.01	150	57.7
A-8	000 3	676.765	.62	2.50	2.50	110	96	10.0				150	57.7
A-7	000 6	679.37	.57	2.35	2.35	114	96	10.0				150	60.5
A-7	000 9	681.96	.58	2.40	2.40	125	97	10.0	340	70		150	60.5
A-6	00 12	684.36	.52	2.15	2.15	130	98	9.0				150	65.2
A-6	00 15	686.78	.52	2.20	2.20	133	100	9.0				150	65.2
A-5	00 18	689.15	.50	2.60	2.60	135	102	9.0	330	65		150	70.0
A-5	00 21	691.55	.50	2.60	2.60	134	102	9.0				150	70.0
A-4	00 24	693.93	.50	2.30	2.30	136	104	9.5				150	74.7
A-4	00 27	696.37	.51	2.15	2.15	137	105	9.0	330	60		150	74.7
A-3	00 30	698.76	.51	2.20	2.20	138	106	9.5				150	74.5
A-3	00 33	701.21	.54	2.20	2.20	138	106	9.5				150	74.5
A-2	00 36	703.87	.54	2.50	2.50	139	107	10.0	330	65		150	74.3
A-2	00 39	706.34	.46	2.45	2.45	140	108	10.0				150	74.2
A-1	00 42	708.80	.53	2.60	2.60	142	109	10.0				150	74.0
A-1	00 45	711.[illegible]	.53	2.65	2.65	144	110	10.0	330		.01	150	74.0

Comments:

Start 2

NCAP-37 (12/67)

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	Vacuum in. Hg	Box Temp °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F	
B-8	4000	714.61	.46	2.60	2.60	132	110	10.5	320	55	.01	150	57.7
A-8	000 3	717.23	.46	2.70	2.70	134	110	11.0				150	57.7
A-7	000 6	719.64	.42	2.50	2.50	136	109	11.0				150	60.5
A-7	000 9	722.05	.43	2.35	2.35	139	109	11.0	330	55		150	60.5
A-6	00 12	724.45	.42	2.40	2.40	139	109	11.0				150	65.2
A-6	00 15	726.85	.42	2.35	2.35	139	109	11.0				150	65.2
A-5	00 18	729.26	.42	2.60	2.60	139	109	11.0	330	55		150	70.0
A-5	00 21	731.67	.42	2.60	2.60	139	109	11.0				150	70.0
A-4	00 24	734.06	.42	2.30	2.30	140	110	11.0				150	74.7
A-4	00 27	736.46	.42	2.30	2.30	140	110	11.0	330	55		150	74.7
A-3	00 30	738.86	.42	2.30	2.30	140	110	11.0				150	74.5
A-3	00 33	741.26	.42	2.30	2.30	140	110	11.0				150	74.5
A-2	00 36	743.66	.42	2.70	2.70	140	110	11.0	330	55		150	74.3
A-2	00 39	746.06	.42	2.70	2.70	140	110	11.0				150	74.2
A-1	00 42	748.46	.42	2.70	2.70	140	110	11.0				150	74.0
A-1	00 45	750.86	.42	2.70	2.70	140	110	11.0	330	50	.01	150	74.0

PARTICULATE CLEANUP SHEET

Plant: Cecil Hayne

Location of sample port: Air Sparta Stack

Barometric pressure:

Ambient temperature:

Date: 4/14/71

Run number: B-2

Operator:

Sample box number: B

Impinger H2O

Volume after sampling 190 ml

Impinger prefilled with 206 ml

Volume collected -16 ml

Container No. 116 Ether-chloroform extraction

Sample No. 1526 of impinger water: 710 mg

Impinger water residue: 3.0 mg

Impingers and back half of filter, acetone wash:

Container No. 121 Weight results 124 mg

Extra No. 1534

Dry acetone and cyclone catch:

Container No. 121 Weight results

Extra No.

Probe, cyclone, flask, and front half of filter, acetone wash:

Container No. 120 Weight results 182 mg

Sample No. 1524

Filter Papers and Dry Filter Particulate

Filter number Container no.

Filter particulate weight 52 mg

Total particulate weight 39.1 mg

Silica Gel

Weight after test: 2246.5

Weight before test: 2015

Moisture weight collected: 15.0

Container number: 1. 2. 3. 4.

Moisture total 9 g

Sample number: Analyze for:

Method determination:

Comments:

Plant: Ideal Cas. Hayne

Run No.: B-3

Location: Cir Scrn. for B

Date: 4/14/71

Operator: _____

Sample Box No.: ~~3~~ 2

Meter Box No.: _____

Meter ΔH: _____

C Factor: _____

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every ~~5~~ 3 minutes.

Mod. every 6 Min.

Ambient Temp °F: _____

Bar. Press. "Hg: 29.98

Assumed Moisture %: 2

Heater Box Setting, °F: _____

Probe Tip Dia., In.: 0.250

Probe Length: 4'

Probe Heater Setting: 55

Avg. ΔP: _____ Avg. ΔH: _____

Traverse 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	1108	761.415	.65	2.70	2.70	90	92	4"	290	60	.01	150	39.0
A-2	1112	763.9	.66	2.75	2.75	100	92	4"	290	60		150	39.0
A-3	1116	766.0	.67	2.78	2.78	100	92	4"	290	60		150	39.2
A-4	1120	768.6	.68	2.81	2.81	104	94	4"	292	60		150	39.2
A-5	1124	771.2	.65	2.70	2.70	104	94	4"	292	60		150	39.5
B-1	1130	773.175	.65	2.70	2.70	104	96	4"	290	60		145	39.5
B-2	1134	775.75	.66	2.75	2.75	101	97	3.5"	290	60		145	39.7
B-3	1138	778	.66	2.75	2.75	106	98	3.5"	290	60		145	39.7
B-4	1142	780.57	.60	2.50	2.50	106	98	3.5"	290	60		145	39.8
B-5	1146	783.37	.62	2.59	2.59	104	101	3.5"	290	70		145	39.8
C-1	1150	786.2	.65	2.70	2.70	106	102	4.0"	290	70		145	39.8
C-2	1154	788.9	.65	2.70	2.70	104	104	4.0"	290	70		145	39.8
C-3	1158	791.64	.72	2.85	2.85	110	106	4.0"	290	70		145	39.5
C-4	1202	794.45	.72	2.85	2.80	111	106	4.0"	290	70		145	39.5
C-5	1206	797.4	.75	2.95	2.95	110	108	4.0"	290	70		145	39.5
A-1	1210	800.52	.78	3.08	3.01	110	109	4.0"	290	70	.01	145	39.7

Traverse 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	Vacuum In. Hg Gauge	Box Temp °F	Impinger Temp °F	Stack Press. in. Hg	Stack Temp °F	
Comments:													
B-1	1214	806.22	.65	2.60	2.60	114	108	4.0"	290	70	.01	145	39.0
B-2	1218	808.62	.65	2.60	2.60	114	108	4.0"	290	70		145	39.0
B-3	1222	811.10	.60	2.50	2.50	112	108	4.0"	290	70		145	39.2
B-4	1226	813.44	.60	2.50	2.50	112	109	4.0"	290	70		145	39.2
B-5	1230	815.98	.64	2.70	2.70	112	110	4.0"	290	70		145	39.5
C-1	1234	818.82	.64	2.70	2.70	112	110	4.0"	290	70		145	39.5
C-2	1238	821.45	.64	2.70	2.70	112	110	4.0"	290	70		145	39.5
C-3	1242	824.16	.68	2.80	2.80	112	110	4.0"	290	70		145	39.7
C-4	1246	826.96	.68	2.80	2.80	112	110	4.0"	290	70		145	39.7
C-5	1250	829.82	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	1254	832.78	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	1258	835.76	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	1302	838.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	1306	841.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	1310	844.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	1314	847.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	1318	850.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	1322	853.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	1326	856.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	1330	859.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	1334	862.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	1338	865.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	1342	868.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	1346	871.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	1350	874.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	1354	877.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	1358	880.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	1402	883.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	1406	886.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	1410	889.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	1414	892.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	1418	895.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	1422	898.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	1426	901.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	1430	904.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	1434	907.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	1438	910.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	1442	913.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	1446	916.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	1450	919.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	1454	922.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	1458	925.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	1502	928.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	1506	931.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	1510	934.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	1514	937.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	1518	940.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	1522	943.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	1526	946.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	1530	949.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	1534	952.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	1538	955.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	1542	958.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	1546	961.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	1550	964.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	1554	967.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	1558	970.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	1602	973.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	1606	976.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	1610	979.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	1614	982.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	1618	985.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	1622	988.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	1626	991.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	1630	994.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	1634	997.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	1638	1000.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	1642	1003.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	1646	1006.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	1650	1009.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	1654	1012.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	1658	1015.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	1702	1018.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	1706	1021.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	1710	1024.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	1714	1027.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	1718	1030.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	1722	1033.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	1726	1036.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	1730	1039.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	1734	1042.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	1738	1045.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	1742	1048.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	1746	1051.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	1750	1054.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	1754	1057.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	1758	1060.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	1802	1063.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	1806	1066.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	1810	1069.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	1814	1072.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	1818	1075.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	1822	1078.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	1826	1081.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	1830	1084.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	1834	1087.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	1838	1090.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	1842	1093.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	1846	1096.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	1850	1099.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	1854	1102.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	1858	1105.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	1902	1108.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	1906	1111.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	1910	1114.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	1914	1117.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	1918	1120.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	1922	1123.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	1926	1126.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	1930	1129.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	1934	1132.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	1938	1135.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	1942	1138.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	1946	1141.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	1950	1144.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	1954	1147.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	1958	1150.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	2002	1153.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	2006	1156.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	2010	1159.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	2014	1162.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	2018	1165.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	2022	1168.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	2026	1171.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	2030	1174.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	2034	1177.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	2038	1180.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	2042	1183.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	2046	1186.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	2050	1189.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	2054	1192.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	2058	1195.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	2102	1198.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	2106	1201.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	2110	1204.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	2114	1207.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	2118	1210.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	2122	1213.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	2126	1216.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	2130	1219.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	2134	1222.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	2138	1225.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	2142	1228.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	2146	1231.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	2150	1234.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	2154	1237.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	2158	1240.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	2202	1243.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	2206	1246.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	2210	1249.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	2214	1252.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	2218	1255.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	2222	1258.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	2226	1261.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	2230	1264.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	2234	1267.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	2238	1270.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	2242	1273.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	2246	1276.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	2250	1279.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	2254	1282.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	2258	1285.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	2302	1288.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	2306	1291.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	2310	1294.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	2314	1297.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	2318	1300.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	2322	1303.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	2326	1306.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	2330	1309.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	2334	1312.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	2338	1315.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	2342	1318.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	2346	1321.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	2350	1324.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	2354	1327.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	2358	1330.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	0002	1333.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	0006	1336.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	0010	1339.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	0014	1342.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	0018	1345.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	0022	1348.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	0026	1351.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	0030	1354.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	0034	1357.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	0038	1360.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	0042	1363.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	0046	1366.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	0050	1369.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	0054	1372.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	0058	1375.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	0102	1378.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	0106	1381.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	0110	1384.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-1	0114	1387.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-2	0118	1390.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-3	0122	1393.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-4	0126	1396.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
B-5	0130	1399.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-1	0134	1402.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-2	0138	1405.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-3	0142	1408.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-4	0146	1411.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
C-5	0150	1414.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-1	0154	1417.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-2	0158	1420.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-3	0202	1423.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-4	0206	1426.73	.69	2.84	2.84	112	110	4.0"	290	70		145	39.8
A-5	0210	1429.73	.69	2.84

Ideal Cement Castle Hayes 4-15-71

Mill grinder & Elevator Dust Collector

Sampling Data

Run	Tav	Pss	Taw	Vsc	Tsi	Psd	Vsh
1	.193	30.16	112	67.328	94	1.15	65.059
2	.193	30.04	112	68.624	99	1.23	65.470
3	.193	30.02	112	65.391	102	1.12	61.994

Moisture + Gas

Run	Vcc	Vaf	Vcg	Mcf	Mbj	Msg
1	34.2	1.62	2.43	.976	29.00	28.74
2	25.8	1.22	1.83	.982	29.00	28.80
3	33.9	1.61	2.53	.974	29.0	28.71

Velocity and Calculation Data

Run	Sdd	Fdi	Tdf	Sdc	Vdh	Vdb	Tsx
1	306	30.20	149	21.71	3206	5840	103.7
2	306	30.08	148	22.48	3322	6074	100.3
3	306	30.06	151	21.38	3166	5710	101.1

Pressure = .04 in Hg

Plant Ideal Cement Castle Hayes Date 4-15-71

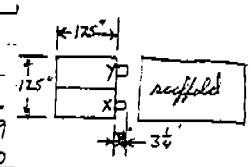
Sampling location Mill Grinder No. 1 mill

STACK DATA FOR NOMOGRAPH:

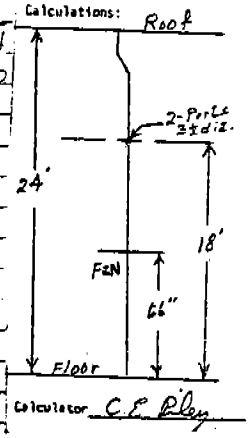
1. Meter ΔH 1.88 in H_2O
2. Avg. meter temp (ambient + 20°) 100 °F
3. Moisture (volume) 1 %
4. Avg. static press (+) .57 in. H_2O (.073 = (+) .04 in. Hg.
5. Bar. press sampling point 30.16 in.Hg (+) .04 (static press in.Hg) = 30.20 in. Hg.
6. Bar press of meter 30.16 in. Hg.
7. P_s/P_a = 5. 30.20 in. Hg / 6. 30.16 in. Hg = 1.00
8. Avg. stack temperature 145 °F.
9. Avg. stack velocity (ΔP) .97 in H_2O.

C factor (1) .115 (2)

.193 Dp



Sketch of stack cross-section showing sampling holes



Calculations: Roof

Calculator C E Riley

PRELIMINARY FIELD DATA

Stack Geometry

Location Ideal Cement Castle Hayes

Location 3rd Mill No. 1 Mill grinder

Date 4-15-71

A. Dist. from inside of far wall to outside of near wall, in., = 21 3/4

B. Wall thickness, in., = 2 1/2

Inside diameter of stack = A-B 17 1/2

Stack Area = 306

Comments:

Point	~~Dist.~~ for circular stack	Dist. from outside of sample port, in.
1	1 1/4 + 3 1/2	= 4 1/2
2	3 3/4	= 7
3	6 1/4	= 9 1/2
4	8 3/4	= 12
5	11 1/4	= 14 1/2
6	13 3/4	= 17
7	16 1/4	= 19 1/2

VELOCITY TRAVERSE FIELD DATA

Plant Ideal Cement Castle Hayes

Test Run 1

Location Mill Grinder

Date 4-15-71

Operator E

Meter ΔH 1.88

Point	(1) ΔP, in. H_2O	(1)' ΔP Equiv.	(2) in. H_2O	(2)'	Tsc Tsp °F
1	.57		1- 0.86		145 145
2	.85		2- 0.89		
3	.94		3- 1.20		
4	.94		4- 1.10		
5	1.00		5- 1.20		
6	.95		6- .93		
7	.90		7- 1.00		145 145

(1) ΔP, in. H_2O Average .97

(2) ΔP, in. H_2O Average

Comments: T_s = 145.

0.57" + stock pressure

NCAP-20 (12/67)

Plant Lehigh Cement

Run No. 1

Location Mill (Kiln)

Date 4/15/71

Operator Larry - Charlie

Sample Box No. B

Meter Box No. 1205

Meter ΔH 1.88

C Factor 1.15

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

Ambient Temp °F 75

Bar. Press. "Hg 30.16

Assumed Moisture % 1

Heater Box Setting, °F

Probe Tip Dia., in. .193

Probe Length 4ft

Probe Heater Setting

Avg. ΔP Avg. ΔH

PIST

Traverse 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	1400	560.917	.57	.54	.54	77	75	5.0	190	60	.04	155	19.5
A-1	1404	561.[illegible]	.[illegible]	.77	.77	81	76	4.5				156	19.5
A-1	1408	562.[illegible]	.[illegible]	.96	.96	85	76	5.0				158	17.0
A-1	1412	563.[illegible]	.65	.90	.92	87	76	5.5	220	60		159	17.0
A-2	1416	564.[illegible]	.70	1.05	1.05	94	88	6.0				160	14.5
A-2	1420	565.[illegible]	.67	.97	.96	96	86	5.4				160	14.5
A-2	1424	566.[illegible]	.76	1.15	1.12	98	92	6.5	250	80	.04	160	13.0

Traverse 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	Vacuum In Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F	
B-1	1000	565.581	.57	.74	.76	92	82	4.5			.04	155	19.5
B-1	1004	566.[illegible]	.[illegible]	.73	.74	90	96	4.5	230	75		157	19.5
B-1	1008	567.[illegible]	.60	.95	.95	96	87	5.3				165	17.0
B-1	1012	568.[illegible]	.60	.95	.95	99	87	5.3				155	17.0
B-1	1016	569.[illegible]	.[illegible]	1.10	1.10	101	92	5.9	240	75		150	14.5
B-2	1020	570.74	.75	1.45	1.45	109	99	5.5				150	14.5
B-2	1024	571.[illegible]	.[illegible]	1.35	1.38	103	91	6.2				153	12.0
B-2	1028	572.[illegible]	.67	1.40	1.40	108	93	6.2	250	80		150	12.0
B-2	1032	573.[illegible]	.69	1.45	1.45	110	94	6.5				150	9.5
B-2	1036	574.[illegible]	.[illegible]	1.45	1.45	110	95	6.5				150	9.5
B-2	1040	575.[illegible]	.[illegible]	1.50	1.50	110	96	6.5	245	80		140	7.0
B-2	1044	576.[illegible]	.[illegible]	1.45	1.45	110	96	6.5				140	7.0
B-2	1048	577.[illegible]	.[illegible]	1.45	1.45	112	96	6.5	245	85		140	4.5
B-2	1052	578.[illegible]	.[illegible]	1.45	1.45	112	96	6.5				150	4.5
A-2	1056	579.[illegible]	.[illegible]	.58	.61	92	94	5.5				155	12.0
A-2	1100	580.[illegible]	.[illegible]	1.15	1.15	109	96	6.5				150	9.5
A-2	1104	581.[illegible]	.[illegible]	1.25	1.25	108	98	6.5	230	80		155	9.5
A-2	1108	582.[illegible]	.[illegible]	1.25	1.25	106	96	6.0				150	7.0
A-2	1112	583.[illegible]	.[illegible]	1.20	1.20	106	96	6.0				150	7.0
A-2	1116	584.[illegible]	.[illegible]	1.25	1.25	105	96	6.0	235	80		145	4.5
A-2	1120	585.[illegible]	.[illegible]	1.05	1.05	101	96	5.5			.04	145	4.5

Final 589.338

Comments: After finishing half of run at Sample pt x; half of run at pt Y was made, then the second half run at pt x was then continued!

NCAP-37 (12/67)

PARTICULATE CLEANUP SHEET

Date: 4/15/71 Plant: Lehigh Cement Co. Mill #1

Run number: Mill 2 run 1 Location of sample port: Mill #1

Operator: Barometric pressure:

Sample box number: B Ambient temperature:

Impinger H_2O

Volume after sampling 218 ml Container No. 127 Ether-chloroform extraction of impinger water 39 mg

Impinger prefilled with 206 ml Extra No. 1535 Impinger water residue 3.2 mg

Volume collected 12 ml

Impingers and back half of filter, acetone wash: Container No. 121 Extra No. 1533 Weight results 148 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. 124 Extra No. 1534 Weight results 285 mg

Filter Papers and Dry Filter Particulate

Filter number: K-163 Container no.: 8 GWH 1535

Filter number Container no. Filter particulate weight 60 mg

Total particulate weight 54.2 mg

Silica Gel

Weight after test: 227.2 g

Weight before test: 200.0 g

Moisture weight collected: 27.2 g

Container number: 1. 2. 3. 4.

Moisture total 34.2 g

11.0 / 23.2 / 34.2

Sample number: Analyst for:

Method determination:

Comments:

MS-2

PARTICULATE FIELD DATA

Plant: Ideal Cement Mill NC

Run No. 2

Location Mill St. Lab (Grinder)

Date 4/15/71

Operator Tom & Jerry Howell

Sample Box No. A

Meter Box No. 1205

Meter ΔH 1.88

C Factor 1.15

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 @ 1:57pm

Leak test passed

Ambient Temp °F 80

Bar. Press. "Hg 30.04

Assumed Moisture % 1

Heater Box Setting, °F

Probe Tip Dia., in. 0.193

Probe Length 4

Probe Heater Setting 250

Avg. ΔP 1 Avg. 1.42

Traverse 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	Plant Vacuum in. Hg Gauge	Box Temp °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F	D_{st}
X-1	1677	910.50	.45	.46	.46	79	82	4.5	240	75	.04	149	9.5
A-1	0004	912.35	.50	.72	.72	84	82	4.5	230	75		149	9.5
A-2	0009	914.22	.71	1.05	1.05	89	82	5.0	220	75		149	7.0
A-2	0013	916.50	.49	.69	.66	95	83	5.0	240	75		149	7.0
A-3	0016	918.35	.35	1.15	.9	100	85	5.5	230	75		149	9.5
A-3	0020	921.04	.76	1.16	1.16	103	85	5.5	230	75		149	9.5
A-4	0024	923.23	.64	1.25	1.25	107	88	5.5	230	75		149	11.0
A-4	0028	925.32	.81	1.40	1.40	109	88	5.5	230	75		149	11.0
A-5	0032	928.28	.67	1.36	1.36	110	90	6.0	240	75		149	13.5
A-5	0036	930.70	.56	1.25	1.25	111	92	5.5	230	75		150	13.5
A-4	0040	933.16	.61	1.39	1.35	113	93	6.0	240	75		149	11.0
A-4	0044	935.32	.56	1.39	1.35	114	94	6.0	240	75		149	11.0
A-3	0048	938.27	.83	1.26	1.26	113	95	5.5	230	75		149	13.5
A-2	0052	940.71	.56	1.12	1.12	113	96	5.5	240	75	.04	149	13.5

Comments: No Cyclone Flask

Traverse 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	Vacuum in. Hg Gauge	Box Temp °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F	D_{st}
B-1	1700	943.145	.63	.91	.91	104	94	5.0	250	75	.04	150	9.5
B-1	0004	945.25	.69	1.01	1.01	101	96	5.0	240	76		150	9.5
B-2	0008	947.51	.73	1.09	1.09	104	97	5.0	230	75		150	7.0
B-2	0013	949.55	.50	1.17	1.17	106	97	5.5	250	75		150	7.0
B-3	0017	952.24	.98	1.51	1.51	107	97	5.5	230	77		150	9.5
B-3	0020	954.79	.95	1.30	1.30	108	98	6.0	220	77		150	9.5
B-4	0024	957.41	1.15	1.60	1.60	109	98	6.0	240	77		150	13.0
B-4	0028	960.14	1.20	1.67	1.67	111	99	6.0	230	77		150	13.0
B-3	0032	962.75	1.20	1.67	1.67	111	99	6.0	240	77		150	14.5
B-3	0036	965.80	1.30	1.81	1.81	111	99	6.3	230	77		150	14.5
B-2	0040	968.70	1.05	1.47	1.47	112	99	6.3	220	77		150	17.0
B-2	0044	971.51	1.00	1.47	1.47	112	99	6.3	230	77		150	17.0
B-1	0048	974.21	1.00	1.47	1.47	112	100	6.3	220	77	.04	150	14.5
	1889	979.154											

PARTICULATE CLEANUP SHEET

Plant: Ideal Cement Co. Pacific Mountain Mill, N.C.

Date: 4/15/71

Run number: # 2

Location of sample port: Mill Stack

Operator: Tom Howell & Jerry Howell

Barometric pressure:

Sample box number: A

Ambient temperature: 80

Impinger H_2O

Volume after sampling 210 ml

Impinger prefilled with 200 ml

Volume collected 7 ml

Container No. 131 Ether-chloroform extraction 339 mg

Extra No. 1538 of impinger water

Impinger water residue 8.0 mg

Impingers and back half of filter, acetone wash:

Container No. 130 Weight results 129 mg

Extra No. 1537

Dry probe and cyclone catch:

Container No. Weight results

Extra No.

Probe, cyclone, flask, and front half of filters, acetone wash:

Container No. 129 Weight results 255 mg

Extra No. 2536

Filter Papers and Dry Filter Particulate

Filter number	Container no.	Filter number	Container no.	Filter particulate weight
E 1537	2319			78 mg
	6041559			
				54.6 mg

Total particulate weight

Silica Gel

Weight after test: 216 g

Weight before test: 201.2 g

Moisture weight collected: 14.8 g

Moisture total 25.8 g

Container numbers: 1. 2. 3. 4.

Sample number: Analyze for:

Method determination:

Comments:

Plant: Universal Cement

Run No.: 3

Location: Mill 1 (Grinder)

Date: 4/15/71

Operator:

Sample Box No.: B

Meter Box No.: 1205

Meter ΔH: @1.88

C Factor: .115

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS - read and record every 0 minutes.

Ambient Temp °F:

Bar. Press. "Hg:

Assumed Moisture %: 1

Heater Box Setting, °F:

Probe Tip Dia., In.: .193

Probe Length: 4ft

Probe Heater Setting: 200

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	Vacuum In. Hg Gauge	Box Temp °F	Impinger °F	Stack Press In. Hg	Stack Temp °F	Comments
1-1	0900	679.64	.68	1.47	1.47	85	96	4	210	70	.04	150	4.5
1-2	0910	683.0	.68	1.47	1.47	90	96	4		70		150	4.5
1-3	0920	686.5	.68	1.47	1.47	90	96	4		70		150	7.0
1-4	0930	690.0	.68	1.47	1.47	90	96	4	220	70		150	7.5
1-5	0940	693.5	.68	1.47	1.47	90	96	4		70		150	7.5
2-1	0950	697.0	.68	1.47	1.47	90	96	4		70		150	13.0
2-2	1000	700.5	.68	1.47	1.47	90	96	4		80		150	13.0
2-3	1010	704.0	.68	1.47	1.47	90	96	4		80		150	19.5
2-4	1020	707.5	.68	1.47	1.47	90	96	4		80		150	19.5
2-5	1030	711.0	.68	1.47	1.47	90	96	4		80		150	17.0
3-1	1040	714.5	.68	1.47	1.47	90	96	4		80		150	17.0
3-2	1050	718.0	.68	1.47	1.47	90	96	4		80		150	19.5
3-3	1100	721.5	.68	1.47	1.47	90	96	4		80	.04	150	19.5
3-4	1110	725.0	.68	1.47	1.47	90	96	4		80		150	19.5
3-5	1120	728.5	.68	1.47	1.47	90	96	4		80		150	19.5

Comments:

NCAP-37 (12/67) No Cyclone or Flask

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	Vacuum In. Hg Gauge	Box Temp °F	Impinger °F	Stack Press In. Hg	Stack Temp °F	Comments
1-1	1240	731.50	.68	1.47	1.47	100	99	4	220	70	.04	150	4.5
1-2	1250	735.0	.68	1.47	1.47	100	99	4		70		150	4.5
1-3	1300	738.5	.68	1.47	1.47	100	99	4		70		150	7.0
1-4	1310	742.0	.68	1.47	1.47	100	99	4	220	70		150	7.5
1-5	1320	745.5	.68	1.47	1.47	100	99	4		70		150	7.5
2-1	1330	749.0	.68	1.47	1.47	100	99	4		70		150	13.0
2-2	1340	752.5	.68	1.47	1.47	100	99	4		70		150	13.0
2-3	1350	756.0	.68	1.47	1.47	100	99	4		70		150	19.5
2-4	1400	759.5	.68	1.47	1.47	100	99	4	220	70		150	19.5
2-5	1410	763.0	.68	1.47	1.47	100	99	4		70		150	17.0
3-1	1420	766.5	.68	1.47	1.47	100	99	4		70		150	17.0
3-2	1430	770.0	.68	1.47	1.47	100	99	4		70		150	19.5
3-3	1440	773.5	.68	1.47	1.47	100	99	4		70	.04	150	19.5
3-4	1450	777.0	.68	1.47	1.47	100	99	4		70		150	19.5
3-5	1500	780.5	.68	1.47	1.47	100	99	4		70	.04	150	19.5

PARTICULATE CLEANUP SHEET

Plant: Castle Haynie

Date: 4/15/71

Location of sample port: Mill #1 Grinder

Run number: 3

Barometric pressure:

Operator:

Ambient temperature:

Sample box number: B

Meter box number:

Meter ΔH:

Factor:

Impinger H2O

Volume after sampling: 721ml

Impinger prefilled with: 200ml

Volume collected: 521ml

Ether-chloroform extraction of impinger water: 7mg

Impinger water residue: 7.3 mg

Impingers and back half of filter, acetone wash: Container No. 1S1 Extra No. 1S1 Weight results 13.3 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. 1S2 Extra No. 1S2 Weight results 274.8 mg

Filter Papers and Dry Filter Particulate

Filter number: 1S5 F 10 Container no.: 1S5 F 10 Container no.

Filter particulate weight: 58.0 mg

Total particulate weight: 58.0 mg

Silica Gel

Weight after test: 218.3 g

Weight before test: 200.4 g

Moisture weight collected: 17.9 g

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

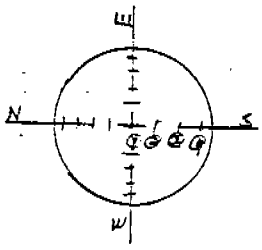
Moisture total 33.9 g

Sample number: ____ Analyze for: ____

Method determination: ____

Comments: ____

PRELIMINARY FIELD DATA



Sketch of stack cross-section showing sampling holes

Calculations:

Calculator _____

Stack Geometry

Test No. Allied Concord Castle Hayne

Location Kiln Stack

Date 4-13-71

A. Dist. from inside of far wall to outside of near wall, in., = 231.75

B. Wall thickness, in., = 46

Inside diameter of stack = A-B 185.75

Stack Area = 27085

Comments:

16 points

Point	% Dia. for circular stack	Dist. from outside of sample port, in.
1	3.3	6.2 + 46 = 52¼
2	14.5	19.5 " = 65⅝
3	19.4	36.1 " = 82⅜
4	32.3	60 " = 106

OXIDES OF NITROGEN FIELD DATA

Date 4/15/71

Plant Allied Concord Castle Hayne

Sample Collected By Crew

Run No. _____

Power Stat Setting _____

Field Data

Clock time	2.50	2.56	3.00	5.03	5.20
Flask number	1	2	3	4	11
Volume of flask [redacted]	2077	2100	2111	2076	2094
Pressure before sampling in Hg.	27.4	27.4	27.4	27.4	27.2
Pressure after sampling in Hg. Minus +	.07	.07	.07	.07	.07
Flask temperature, °F Initial	66	66	66	65	64
Final	67	67	67	66	64

Remarks:

Substract 5 min from above

Stack pressure = 0.07" Hg

from Harvard Exit Area

VELOCITY TRAVERSE FIELD DATA

Plant Allied Concord Castle Hayne

Test _____

Location Kiln Stack

Date 4-14-71

Operator Allen Riley

Meter no 185

Clock Time	Point	(1) ΔP, in. H₂O	(1) √ΔP, √in. H₂O	(2) ΔP, in. H₂O	(2) √ΔP, √in. H₂O	Stack Temp. °F (1)	Stack Temp. °F (2)
12:30	1	.41		.39		490	
	2	.41		.41			
	3	.42		.40			
	4	.37		.35			
	1	.32		.28		495	
	2	.30		.28			
	3	.30		.28			
	4	.30		.29		500	

(1) ΔP, in. H₂O Average .344

(2) ΔP, in. H₂O Average _____

Sde = 18.17 Mcf = .70

Pdi = 27.90 Tdf = 500°

Mcz = 26.50

Vdh = 2808 — 2600 F/M

Vdb = 203,950.

Comments: Static press 1. — 1.1
2. — .85
3. — .88
4. — 1.0

OXIDES OF NITROGEN FIELD DATA

Date 4/15/71

Plant Allied Concord Castle Hayne

Sample Collected By Crew

Run No. _____

Power Stat Setting _____

Field Data

Clock time	3:25	3:28	3:45	3:45	5:48
Flask number	12	9	5	6	7
Volume of flask [redacted]	2070	2068	2073	2082	2105
Pressure before sampling in Hg.	27.2	27.2	27.4	27.2	27.4
Pressure after sampling in Hg. +	.07	.07	.07	.07	.07
Flask temperature, °F Initial	65	64	64	64	64
Final	66	65	65	66	64

Remarks: Stack pressure = +0.07" Hg

Substract 5 min from above

ground

Plant Tunnel Exit

2 liters

IS (12/67)

OXIDES OF NITROGEN FIELD DATA

Date 4/15/71

Plant Ideal Cement CH NC

Sample Collected By [illegible]

Run No. _____

Power Stat Setting _____

Field Data

Clock time	~~3.52~~	4.24	4.27		
Flask number	8	14	15		
Volume of flask ~~less correction/factor~~	2112	2095	2100		
Pressure before sampling in Hg.	27.4	27.4	27.4		
Pressure after sampling in Hg.		.07	.07		
Flask temperature, °F (In / Out)	65 / 65	66 / 67	63 / 64		

Remarks:

Subtract 2" Hg

Stack Pressure $= \frac{Vc}{} = +0.07$ " Hg

NCAP-35 (12/67)

PARTICULATE CALCULATIONS

Example: Run No. 1 on No. 1 Mill Air Separator Stack A (For Data, see Table 5)

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

$$V_{m_{std}} = \frac{17.7 \times V_m \left(P_b + \frac{P_m}{13.6}\right)}{(T_m + 460)} = \frac{17.7 \times 61.768 \left(29.90 + \frac{1.28}{13.6}\right)}{(116 + 460)} = 56.931 \text{ ft}^3$$

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

$$V_{w_{gas}} = 0.0474 \times V_w = 0.0474 \times 2.3 = 0.109 \text{ SCF}$$

3. Percent moisture in stack gas

$$\%M = \frac{100 \times V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} = \frac{100 \times 0.109}{56.931 + 0.109} = 0.191$$

4. Mole fraction of dry gas

$$M_d = \frac{100 - \%M}{100} = \frac{100 - 0.191}{100} = 0.998$$

5. Average molecular weight of dry stack gas

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

$$(0 \times \tfrac{44}{100}) + (20.95 \times \tfrac{32}{100}) + (79 \times \tfrac{28}{100}) = 29.0$$

6. Molecular weight of stack gas

$$MW = MW_d \times M_d + 18 (1 - M_d) = 29.0 \times 0.998 + 18 (1 - 0.998) = 28.98$$

7. Stack gas velocity at stack conditions, fpm

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

$$4{,}360 \times 24.6 \left[\frac{1}{29.95 \times 28.98}\right]^{1/2} = 3643 \text{ fpm}$$

PARTICULATE CALCULATIONS, Run No. 1, No. 1 Mill Air Separator Stack A (continued)

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

$$Q_s = \frac{0.123 \times V_s \times A_s \times M_d \times P_s}{(T_s + 460)} = \frac{0.123 \times 3643 \times 694 \times 0.998 \times 29.95}{(182 + 460)} = 14,478 \text{ SCFM}$$

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

$$Q_a = \frac{.05565 \times Q_s \times (T_s + 460)}{P_s \times M_d} = \frac{.05565 \times 14,478 \times (182 + 460)}{29.95 \times 0.998} = 17,554 \text{ ACFM}$$

10. Percent isokinetic

$$\%I = \frac{1,032 \times (T_s + 460) \times V_{m_{std}}}{V_s \times T_t \times P_s \times M_d \times (D_n)^2} = \frac{1,032 \times (182 + 460) \times 56.931}{3643 \times 96 \times 29.95 \times 0.998 \times (0.193)^2} = 96.9\%$$

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

$$C_{an} = 0.0154 \times \frac{m_f}{V_{m_{std}}} = 0.0154 \times \frac{11.8}{56.931} = 0.00319 \text{ gr/SCF}$$

12. Particulate total, gr/SCF* Dry Basis

$$C_{ao} = 0.0154 \times \frac{m_t}{V_{m_{std}}} = 0.0154 \times \frac{24.1}{56.931} = 0.00652 \text{ gr/SCF}$$

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

$$C_{at} = \frac{17.7 \times C_{an} \times P_s \times M_d}{(T_s + 460)} = \frac{17.7 \times 0.00319 \times 29.95 \times 0.998}{(182 + 460)} = 0.00263 \text{ gr/CF}$$

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

$$C_{au} = \frac{17.7 \times C_{ao} \times P_s \times M_d}{(T_s + 460)} = \frac{17.7 \times 0.00652 \times 29.95 \times 0.998}{(182 + 460)} = 0.00537 \text{ gr/CF}$$

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

$$C_{aw} = 0.00857 \times C_{an} \times Q_s = 0.00857 \times 0.00319 \times 14,478 = 0.391 \text{ lb/hr}$$

16. Particulate: total, lb/hr

$$C_{ax} = 0.00857 \times C_{ao} \times Q_s = 0.00857 \times 0.00652 \times 14,478 = 0.796 \text{ lb/hr}$$

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

$$P_{tf} = \frac{C_{aw}}{T_c} = \frac{0.391}{30.0} = 0.0130 = \text{lb/ton feed}$$

18. Particulate: total, lb/ton feed

$$P_{tt} = \frac{C_{ax}}{T_c} = \frac{0.796}{30.0} = 0.0265 = \text{lb/ton feed}$$

* 70°F, 29.92 in. Hg

APPENDIX E

TEST LOG

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

Table E-1

SAMPLING LOG

(No. 1 Mill Air Separator Stack A)

Run	Date	Sampling Port	Began	Ended	Elapsed Time (min)
1	4-13-71	A	15:50	16:38	48
		B	17:17	8:05	48
2	4-14-71	A	09:59	10:47	48
		B	10:53	11:41	48
3	4-14-71	A	14:58	15:46	48
		B	16:00	16:44	44
		(No. 1 Mill Air Separator Stack B)			
1	4-13-71	A	15:50	16:38	48
		B	17:17	18:05	48
2	4-14-71	A	09:59	10:47	48
		B	10:53	11:41	48
3	4-14-71	A	14:58	15:46	48
		B	16:00	16:44	44
		(No. 1 Mill Grinder and Dust Collector)			
1	4-15-71	A	10:32	11:28	56
		B	11:34	12:30	56
2	4-15-71	A	13:57	14:53	56
		B	14:57	15:53	56
3	4-15-71	B	16:20	17:16	56
		A	17:21	18:17	56