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Background Report Reference

AP-42 Section Number: 11.17

Background Chapter: 4

Reference Number: 32

Title: Air Pollution Test of Woodville Lime and Chemical Company

US EPA

September 1974

File

74-LIM-3B
(REPORT NUMBER)

(32)

AIR POLLUTION EMISSION TEST

NOV 13 1974

WOODVILLE LIME AND
(PLANT NAME)

CHEMICAL COMPANY

T.P., SO_2 & NO_x
@ ESP Outlet

(19)

WOODVILLE, OHIO
(PLANT ADDRESS)

FINAL

UNUSED
TEST
REPORTS

U. S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Water Programs
Office of Air Quality Planning and Standards
Emission Standards and Engineering Division
Emission Measurement Branch
Research Triangle Park, N. C. 27711

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EMISSION TESTING REPORT
EPA REPORT 74-LIM-3-B
WOODVILLE LIME AND CHEMICAL CO.
WOODVILLE, OHIO

Contract No. 68-02-0237
Task 26

Submitted by:

PEDCo-Environmental Specialists, Inc.
13 Atkinson Square
Cincinnati, Ohio 45246

Prepared by:

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September 16, 1974

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II. INTRODUCTION

Under the Clean Air Act of 1970, as amended, the Environmental Protection Agency is charged with the establishment of performance standards for stationary sources which may contribute significantly to air pollution. A performance standard is based on the best emission reduction systems which have been shown to be technically and economically feasible.

In order to set realistic performance standards, accurate data on pollutant emissions must be gathered from the stationary source category under consideration.

Woodville Lime and Chemical Co. in Woodville, Ohio, was designated as a possible representative well-controlled stationary source in the lime production industry and therefore was selected for an emission testing program. The process under investigation in this test series was operation of the No. 1 lime kiln at the Woodville plant, from which emissions are controlled by a cyclone in series with a Buell electrostatic precipitator.

Preliminary tests were performed during the week of May 20, 1974, to ascertain composition and velocity of the gas stream and to observe visible emissions.

The emission test program was conducted from July 8 to 10, 1974, on three test runs. Sampling was done at the kiln stack to determine concentrations of filterable and total particulate,

oxides of nitrogen, and sulfur dioxide. Determinations of moisture content and dry molecular weight were performed simultaneously. Samples of the kiln feed, kiln product, kiln fuel, and effluent dust from the ESP unit were collected for calculation of a sulfur balance. In addition, visible emissions were recorded by two certified observers during this time. Because of difficulties with process operation and above-normal production rates, further tests were scheduled for August 5, 1974. In the interim between test periods the kiln was shut down, at which time the ESP was cleaned and inspected.

III. SUMMARY OF RESULTS

Data on particulate emissions from the lime kiln are summarized in Table 1. Emissions of filterable particulate, as measured by the probe and filter catch, averaged 9.77 pounds per hour at a concentration of 0.041 grain per DSCF. Total particulate emissions averaged 18.3 pounds per hour at a concentration of 0.077 grain per DSCF. Emissions of filterable particulate were higher in the first two tests than in the third. This can probably be attributed to discontinuity in process operations and to problems with control equipment, described in Section IV, "Process Operation". Because of these difficulties, the emissions data reported in this report are considered questionable with respect to being representative of a well-controlled lime-producing process.

Data on oxides of nitrogen emissions are summarized in Table 2. These data show an average concentration of 339 ppm by volume and an hourly emission rate of 67.7 pounds per hour of NO_2.

Data on sulfur dioxide emissions are summarized in Table 3. These data show an average concentration of 44.5 ppm by volume and an hourly emission rate of 12.0 pounds per

Table 1. SUMMARY OF PARTICULATE DATA

Run Number	1	3	5	Avg.
Date	7/8/74	7/9/74	7/10/74	
Volume of Gas Sampled, DSCF[a]	237.923	239.642	248.641	242.07
Average Stack Temperature, °F	621	669	674	655
Percent Moisture by Volume, %	11.3	12.1	11.4	11.6
Stack Volumetric Flow Rate, DSCFM[b]	27619	27390	28658	27889
Stack Volumetric Flow Rate, ACFM[c]	64393	67296	70330	67340
Percent Isokinetic	102.9	104.5	103.6	140
Unit Production Rate, ton/hr incorrect rate	~~32.68~~	~~32.49~~	~~32.62~~	~~32.60~~
Particulates - probe, bypass, and filter catch				
mg	781.1	718.9	417.0	639
gr/DSCF	0.051	0.046	0.026	0.041
gr/ACF	0.022	0.019	0.011	0.017
lb/hr	12.0	10.9	6.4	9.77
lb/ton	~~0.367~~	~~0.335~~	~~0.196~~	~~0.300~~
Particulates - total				
mg	1704.6	989.9	889.3	1194.6
gr/DSCF	0.111	0.064	0.055	0.077
gr/ACF	0.047	0.026	0.022	0.032
lb/hr	26.2	15.0	13.6	18.3
lb/ton	~~0.802~~	~~0.462~~	~~0.417~~	~~0.560~~

[a] Dry standard cubic feet at 70°F, 29.92 in Hg.
[b] Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.
[c] Actual cubic feet per minute.

Table 2. SUMMARY OF OXIDES OF NITROGEN DATA

NO_x Test No.	A	B	C	D	E	F	G	H	I	J	K	L	Average
Date, 1974	7/8	7/8	7/8	7/8	7/9	7/9	7/9	7/9	7/10	7/10	7/10	7/10	
Time, 24 hour clock	1748	1848	1951	2048	915	1015	1115	1215	920	1033	1130	1230	
Flow Rate, DSCFM[a]	27619	27619	27619	27619	27390	27390	27390	27390	28658	28658	28658	28658	
Sample Volume, ml	1457	1521	1519	1495	1554	1549	1487	1522	1602	1938	1616	1660	
Milligrams of NO_2	0.83	0.672	0.953	0.957	0.976	0.934	1.034	1.014	1.093	1.169	1.349	1.290	
NO_x Concentration, ppm	299	232	329	336	330	316	364	349	358	316	438	408	339.58
NO_x lb/hr	58.9	45.6	64.8	66.1	64.4	61.8	71.3	68.3	73.2	64.7	89.5	83.3	67.66
Average ppm		299				339.75				380			
lb/hr		58.85				66.45				77.67			

a) Dry standard cubic feet per minute, corrected to 70° and 29.92" Hg as obtained during particulate test runs.

Table 3. SUMMARY OF SULFUR DIOXIDE DATA

Test No.	2	4	6	Avg.
Date, 1974	7/8	7/9	7/10	
Flow rate, DSCFM[a]	27619	27390	28658	
Sample volume, DSCF[a]	166.917	165.549	166.705	
SO_2 in sample, grams	0.867	0.130	0.649	
SO_2 emissions, lb/hr	19.1	2.42	14.4	12.0
SO_2 concentration, ppm by volume	70.2	10.6	52.6	44.5

a) Dry standard cubic feet at 70°F 29.92 in. Hg.

hour of sulfur dioxide.

Visual determination of the opacity of emissions from the lime kiln exit stack was performed independently by two PEDCo personnel. Data on opacity measurements are summarized in Table 4. The average opacity was less than 5 percent in all tests. A period of high emissions occurred, however, for about 1 minute in the first test, during which opacity levels exceeded 20 percent. Failure of a field in the electrostatic precipitator caused the discontinuity, with the result that the opacity values are not considered typical of those occuring with well-controlled lime-production operations.

During sample recovery on test 1, the probe glass liner tip was found to be broken. This test was therefore not representative of true emissions. Because of the higher than expected opacity and various process problems, this test series was terminated before enough measurements were obtained to provide representative results.

Table 4. SUMMARY OF VISIBLE EMISSION DATA

Run No.	1		3		5	
Date	7/8/74		7/9/74		7/10/74	
	Obs. 1	Obs. 2	Obs. 1	Obs. 2	Obs. 1	Obs. 2
Interval of Observations[a] Start	1715	1713	840	843	820	838
End	2124	2112	1245	1235	1252	1239
Duration of Observation, min[b]	247	228	245	233	272	212.5
Total No. of Readings[c]	988	912	980	932	1088	850
No. of Readings Unobservable	0	10	0	154	0	0
No. of Readings @ 0% Opacity	986	711	914	174	1061	782
5%	2	184	34	597	21	66
10%	-	7	26	7	5	1
15%	-	-	3	-	1	1
20%	-	-	3	-	-	-
25%	-	-	-	-	-	-
30%	-	-	-	-	-	-
35%	-	-	-	-	-	-
40%	-	-	-	-	-	-
45%	-	-	-	-	-	-
50%	-	-	-	-	-	-
Percent Readings Unobservable	0	0.8	0	16.5	0	0
Percent Readings @ 0% Opacity	99.8	78.0	93.3	18.7	97.5	92.0
5%	0.2	20.2	3.5	64.1	1.9	7.8
10%	-	-	2.6	0.7	0.5	0.1
15%	-	-	0.3	-	0.1	0.1
20%	-	-	0.3	-	-	-
Percent Readings Exceeding 20%	-	-	-	-	-	-

[a] 24-hour clock start and end times

[b] Excluding the time that readings were not recorded for period of observation.

[c] Readings recorded at 15-second intervals unless otherwise noted.

Observer 1 - R. S. Amick
Observer 2 - W. G. DeWees

IV. PROCESS DESCRIPTION

Limestone consisting primarily of calcium carbonate or combinations of calcium and magnesium carbonate with varying amounts of impurities is quarried at the Woodville Plant. The limestone is calcined or burned to form lime, commonly divided into two basic products--quicklime and hydrated lime. Calcination expels carbon dioxide from the raw limestone, leaving calcium oxide (quicklime). With the addition of water, calcium hydroxide (hydrated lime) is formed.

The basic processes in production are: (1) quarrying the limestone raw material, (2) preparing the limestone for kilns by crushing and sizing, (3) calcining the limestone, and (4) optionally processing the quicklime further by additional crushing and sizing followed by hydration. The majority of lime is produced in rotary kilns which can be fired by coal, oil, or gas. Rotary kilns have the advantage of producing high production per man-hour and a more uniform product. However, they do require higher capital investment and unit fuel costs than most vertical kilns.

The Woodville Lime and Chemical plant has two rotary kilns each equipped with a Buell electrostatic precipitator. The kilns are almost identical. The feed for both is a dolomitic stone, quarried on the site and fed in sizes ranging from 1 inch to 2 1/4 inches at a rate of about 700 tons per day. There is no

preheater. Normally the kiln is fueled with a mixture of 95 percent Number 6 fuel oil and 5 percent natural gas. Both kilns have two heat transfer sections, each 20 feet long. The product, about 350 tons per day, is cooled in a Neims cooler before storage. There is no product crushing, but undersize material is separated and returned to the kiln. The majority of the product is used in the steel industry, mostly in basic oxygen furnaces; none of the product is hydrated.

The electrostatic precipitator on kiln Number 1 was put in operation in July 1971. In this kiln the main process fan is located before the ESP, with a cyclone before the fan to reduce fan blade erosion. The precipitator on kiln Number 2 was put in operation in December 1973. The main process fan is after the ESP and there is no cyclone.

In both systems the inlet gas to the precipitators is cooled to about 600°F with a combination of water injection and/or tempering air. Each precipitator has 28,800 square feet of collecting surface area, which includes one cell and two fields; design gas velocity is 1.5 feet per second and treatment time, 10.0 seconds. The plant manager reported that an earlier emission test showed exit loadings of less than 0.005 grain per dry standard cubic foot.

At present the dust collected from the precipitators is disposed of in the quarry. It is expected that in the future the

dust will be granulated and used as a component of dry mix fertilizers that are blended in another part of the complex.

At the time of the initial plant inspection (February 8, 1974) the precipitators were working satisfactorily and had been very well maintained. The plant is representative of modern design; raw materials and products are typical of those in the industry.

V. LOCATION OF SAMPLING POINTS

Figure 1 shows the sampling ports and sampling points used in the No. 1 lime kiln exit stack. The sampling ports were located in a 63.5-inch inside-diameter vertical stack, 4 feet (0.75 diameter) from the stack exit, and 12 feet (2.26 diameters) from the nearest downstream disturbance. In order to meet the sampling requirements of Methods 1 and 5 of the Federal Register, Vol. 36, No. 247, it was necessary to install a stack extension on the ESP exhaust outlet. Forty-eight traverse points (24 along each of two perpendicular diameters) were used as described in the Federal Register Method 1. Additional sampling points in the existing stack at a lower site were used for some of the gas sampling.

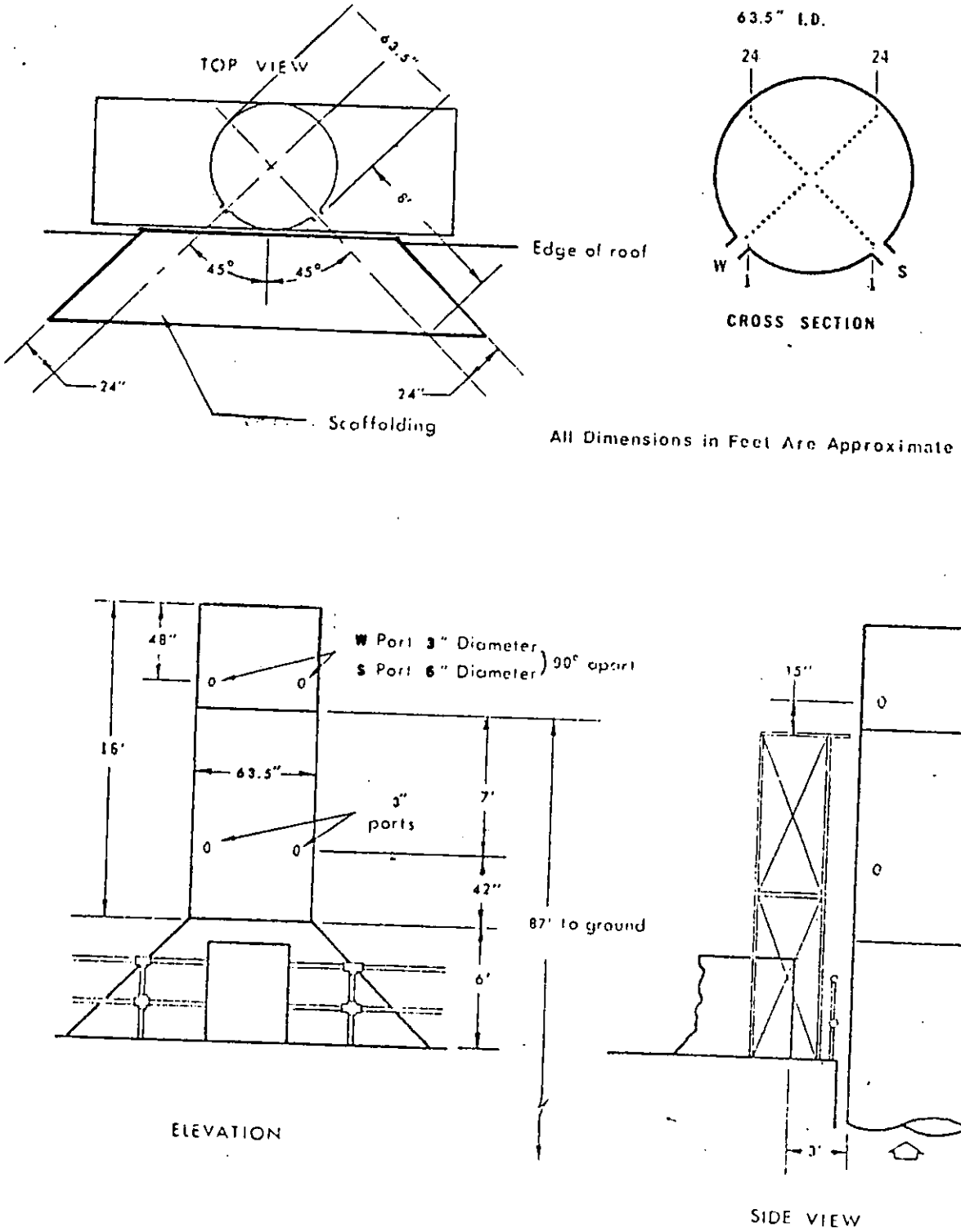

Figure 1. Test Site-No. 1 Kiln Precipitator Outlet.

VI. PROCESS OPERATION & TEST CONDITIONS

Before the test series began, EPA engineers had decided to conduct tests at the Woodville plant only during periods in which opacity of visible emissions from the kiln stack was in the range of 0 to 5 percent. This range had been described as typical of opacities during operation of the No. 1 kiln and was judged to be typical of those occurring in a well-controlled lime-producing plant.

Although plant operations appeared to be normal and preliminary readings indicated 0 to 5 percent opacity values, several problems developed during the first day of testing, July 8,1974. After about 3 hours of testing, PEDCo's team of opacity readers stopped the tests at 8:22 p.m. because opacity values were exceeding the 5 percent limit. Testing was resumed at 8:27 p.m. and continued until 9:13 p.m., when the "A" field of the kiln's electrostatic precipitator malfunctioned, probably because of overload. Sampling was resumed at 9:16 p.m., when the opacity values again dropped to the 0 to 5 percent range. The first test was completed at 9:29 p.m.

The second test was started on July 9 at 8:41 a.m. Opacities of visible emissions ranged between 0 and 5 percent

throughout the entire test sequence. The test was completed at 12:48 p.m., and because no problems were encountered in sampling or process operation the emissions were considered representative of those occurring normally.

After completion of the second test, plant operators performed a routine cleaning operation, shutting down a fan on the inlet to the ESP for removal of adhering dust. The fan was not re-started after cleaning, however, and opacity readings during the afternoon ranged between 10 and 15 percent. The third test, therefore, was not begun until the following day.

Testing was resumed at 8:24 a.m. on July 10. Operations appeared normal except for a heavy load in the kiln, as evidenced by the ampere meter on the kiln-drive motor. Opacity readings ranged from 0 to 5 percent. Sampling was hampered, however, by blockage in the silica gel impinger, which was replaced several times. As testing progressed, the opacity readers reported an increasing number of 5 percent readings, with occasional 'puffs' as high as 10 percent. Observations of the plume were difficult because of cloudy skies. Test No. 3 was completed at 12:55 p.m.

Operating variables for the three test runs are summarized in Table 5, and sulfur contents of the various process streams are shown in Table 6.

A fourth test, intended to provide values to replace those obtained in Test No. 1, was started at 3:00 p.m. July

Table 5. SUMMARY OF OPERATING VARIABLES

Date	7/8/74	7/9/74	7/10/74
Particulate Test No.	1	3	5
Stone Feed Rate, ton/hr[a]	~~32.68~~	~~32.49~~	~~32.62~~
Oil Rate, gal/hr	322	356	375
Firing Zone Temp, °F	2620-2650	2600-2650	2590-2620
Mid Kiln, Temp, °F	1460-1465	1450-1475	1470-1520
Kiln Feed End Temp, °F	1020-1040	1000-1035	1050-1080
Before ESP Temp, °F	683-700	685-700	700-725
Stack Temp, °F	660-675	660-690	670-700
ELECTROSTATIC PRECIPITATOR DATA			
"A" Field			
Primary current, amps	39-50	37-46	48-61
Primary voltage, volts	250-275	250-265	250-270
Precipitator current, amps	0.20-0.30	0.19-0.23	0.20-0.32
"B" Field			
Primary current, amps	41-55	50-54	53-61
Primary voltage, volts	240-260	240-250	240-250
Precipitator current, amps	0.27-0.35	0.28-0.30	0.32-0.37

a) Obtained by multiplying indicated tonnage by ~~0.7291666~~ (see Appendix D).

Table 6. SULFUR CONTENT OF KILN, FUEL OIL, FEED ROCK, PRODUCT AND EFFLUENT DUST.

Sample	Date	Time	Sulfur Content % by weight
#1 ESP Col. Dust	7/8/74	1830	0.9
#1 ESP Col. Dust	7/9/74	1015	1.32
#1 ESP Col. Dust	7/10/74	0800	1.28
#2 ESP Col. Dust	7/8/74	2030	0.78
#2 ESP Col. Dust	7/9/74	1255	1.16
#2 ESP Col. Dust	7/10/74	1030	1.64
#1 Stone Feed	7/8/74	1750	0.02
#1 Rock Feed	7/9/74	1100	0.07
#1 Rock Feed	7/10/74	1700	0.06
#1 Rock Feed	7/10/74	1000	0.07
#2 Stone Feed	7/8/74	2036	0.14
#2 Rock Feed	7/9/74	1230	0.04
#2 Rock Feed	7/10/74	1300	0.04
#2 Kiln Product	7/9/74	1300	0.01
#1 Lime Product	7/8/74	1720	0.07
#1 Lime Product	7/9/74	0930	0.04
#1 Lime Product	7/10/74	1000	0.02
#2 Lime Product	7/8/74	2030	0.06
#2 Lime Product	7/10/74	1230	0.07
#1 Fuel Oil	7/9/74	0930	1.75
#1 Fuel Oil	7/8/74	1900	2.26
#2 Fuel Oil	7/9/74	1230	1.7
#2 Fuel Oil	7/10/74	1230	0.875
#2 Fuel Oil	7/8/74	2030	3.22
#1 Fuel Oil	7/10/74	1100	2.26

10. Except for the heavily loaded kiln, process operations appeared normal. Because opacity readings rose to the 15 to 20 percent range, testing was stopped at 4:30 p.m. Cleanup operations later revealed that the sampling probe was broken. The values obtained in this test were therefore discarded, and further sampling was scheduled for the following day.

On the morning of July 11, however, stack opacity values were again ranging between 5 and 10 percent. Although plant personnel tried several variations in kiln operation, the high opacity readings persisted throughout the day and evening. A reading at 10:30 p.m. gave values between 20 and 25 percent.

At 6:00 a.m. on July 12, opacity readings still ranged between 5 and 10 percent. Personnel of the Woodville plant, EPA, and PEDCo agreed that the kiln should be shutdown briefly for inspection. Examination of the ESP revealed that several charge plates were covered with about 1 inch of a sticky substance, which prevented the dust particles in the effluent from receiving the positive charge and thus reduced collection efficiency. It was estimated that cleaning of the plates would require shutdown of the kiln for a week or so. A shutdown was scheduled for the week of July 15 to allow cleaning of the ESP, rebricking of certain kiln sections, and routine periodic maintenance. Further emissions testing was to be conducted shortly after resumption of kiln operation.

VII. SAMPLING AND ANALYTICAL PROCEDURES

Sampling procedures were designated by EPA. Analyses of collected samples were performed by PEDCo. Appendix H presents detailed sampling and analytical procedures.

Velocity and Gas Temperature

Gas velocities were measured with a calibrated type S pitot tube and inclined draft gage. Velocities were measured at each sampling point across the stack diameter to determine an average value according to procedures described in the Federal Register[1] - Method 2. Temperatures were measured with the use of a thermocouple.

Molecular Weight

A 4-hour integrated sample of the stack gases was collected during test 1 by pumping the gas into a Tedlar plastic bag at the rate of approximately 0.005 CFM. This bag sample was then analyzed with an Orsat analyzer for CO_2, O_2, and CO as described in the Federal Register, Method 3.

Particulates

Concentrations of particulate matter in stack gases were measured by Method 5 as described in Federal Register.[2] A rigid train consisting of a heated glass-lined probe, a 3-inch diameter

1) Federal Register, Vol. 36, No. 247, December 23, 1971.
2) Federal Register, Vol. 36, No. 159, August 17, 1971.

glass-fiber filter, and a series of Greenburg-Smith impingers was used for particulate sampling, as shown in Figure 2.

Sampling was conducted under isokinetic conditions by monitoring stack-gas velocity with a pitot tube and adjusting the sampling rate accordingly.

The particulate sample was recovered by triple-rinsing the nozzle, probe, cyclone by-pass, and front half of the filter holder with acetone into a glass container. The back half of the filter holder, impingers, and connecting tubes were rinsed with distilled water and the washings placed in a glass container with the impinger contents. These components were then triple-rinsed with acetone into another glass container. The filter was placed in a separate container. Blank samples of water and acetone were also taken.

NO_x

Nitrogen oxides were collected in evacuated 2-liter flasks containing 25 ml of a dilute sulfuric acid/hydrogen peroxide absorbing solution. The sampling and analytical procedure was as described in Method 7 of the Federal Register[1] except that the final flask vacuum was read immediately after sampling.

SO_2

Sulfur dioxide sampling procedures followed those described in Method 6. However, due to the low expected concentrations,

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1) Federal Register, Vol. 36, No. 247, December 23, 1971.

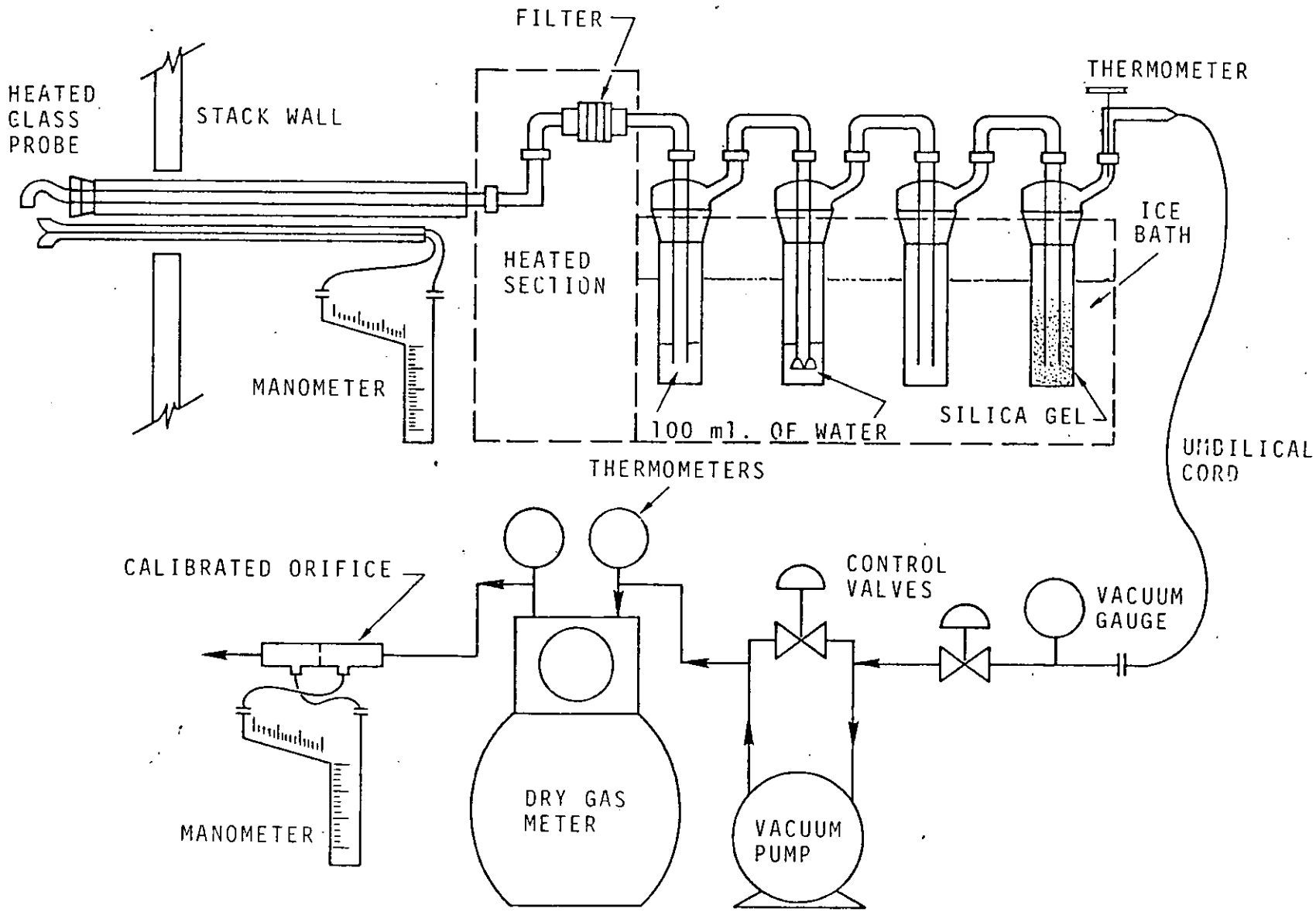

Figure 2. Particulate Sample Train

larger sampling equipment was used. Flue gas was passed through a set of Greenburg-Smith impingers at a rate of approximately 0.8 cubic foot per minute. The first impinger contained 150 ml of 80 percent isopropanol; the second and third impingers contained 100 ml each of 3 percent hydrogen peroxide/water solution. After sampling, ambient air was passed through the train for 10 to 15 minutes. The isopropanol solution was discarded, and the peroxide solution rinsed into a glass container. The hydrogen peroxide solution was titrated with barium chloride, using a Thorin indicator as described in Method 6.

Visible Emissions

Visible emissions were determined according to procedure in Method 9. Readings were difficult to determine at times due to trucks loading and unloading ESP dust and quarry rock in the vicinity of either the ESP unit or the observer and the light colored plume against an overcast and partly cloudy sky caused poor distinction. In addition, certain ESP rappers set up a visible emission condition (puffs) that read approximately 5 to 10 percent opacity for about 2 to 3 seconds every cycle.

Sulfur Analysis

Solid samples were analyzed using Standard Methods of Chemical Analysis of Limestone, Quicklime and Hydraded Lime, C25-67, A.S.T.M. Standards, Part 9, Cement; Lime; Gypsum, 1972, American Society for Testing and Materials, Philadelphia, Pa.

Fuel oil samples were analyzed using Standard Method of Test for Sulfur in Petroleum Products by the Bomb Method, D 129-64, A.S.T.M. Standards, Part 17, Petroleum Products - Fuels, Solvents, Burner Fuel Oils, Lubricating Oils, Cutting Oils, Lubricating Greases, Hydraulic Fluids, 1972, American Society for Testing Materials, Philadelphia, Pa.

APPENDIX A

PARTICULATE RESULTS AND EXAMPLE CALCULATIONS

Table A1. SUMMARY OF PARTICULATE RESULTS

Run No.		1	3	5
Test Date		7/8/74	7/9/74	7/10/74
Sampling Time, 24 hour clock		1713 2129	0841 1248	824
Sampling Location		ESP Outlet	ESP Outlet	ESP Outle
D_n	Sampling Nozzle Diameter, in.	0.375	0.375	0.375
T_t	Net Time of Test, Min.	240	240	240
P_b	Barometric Pressure, in. Hg Absolute	29.48	29.48	29.40
P_m	Average Orifice Pressure Drop, in. H_2O	3.01	3.00	3.26
V_m	Volume of Dry Gas Sampled at Meter Conditions, DCF	256.911	259.227	267.191
T_m	Average Gas Meter Temperature, °F	108.5	109.5	104.5
$V_{m_{std}}$	Volume of Dry Gas Sampled at Standard Conditions[a], DSCF	237.923	239.642	248.681
V_w	Total H_2O Collected in Impingers and Silica Gel, ml	636.7	698.5	675.0
$V_{w_{gas}}$	Volume of Water Vapor Collected at Standard Conditions[b], SCF	30.180	33.109	31.995
% M	% Moisture in Stack Gas, by Volume	11.26	12.14	11.40
M_d	Mole Fraction of Dry Gas	.8874	.8786	.8860
% CO_2	Volume % Dry	21.66	21.0	19.6
% O_2	Volume % Dry	8.0	8.67	11.4
% CO	Volume % Dry	0	0	0
% N_2	Volume % Dry	70.34	70.33	69.0
% EA	Percent Excess Air	74.7	86.4	164
MW_d	Molecular Weight of Stack Gas, Dry Basis	31.79	31.70	31.59

Table A1 (continued)

Run No.		1	3	5
MW	Molecular Weight of Stack Gas, Wet Basis	30.23	30.04	30.04
C_p	Pitot Tube Coefficient	.83	.83	.83
T_s	Average Stack Temperature, °F	621	669	674
N_p	Net Sampling Points	48	48	48
P_{st}	Static Pressure of Stack Gas, in. Hg	0.03	0.03	0.03
P_s	Stack Gas Pressure, in. Hg Absolute	29.51	29.51	29.43
V_s	Stack Gas Velocity at Stack Conditions, fpm	2928	3060	3198
A_s	Stack Area, ft^2	21.992	21.992	21.992
Q_s	Dry Stack Gas Volumetric Flow Rate at Standard Conditions,[c] DSCFM	27619	27390	28658
Q_a	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	64393	67296	70330
% I	Percent Isokinetic	102.9	104.5	103.6
% O	Percent Opacity	-	-	-
T_c	Unit Production Rate - ton/hr.	~~32.68~~	~~32.49~~	~~32.62~~
m_f	Particulate - Probe, Cyclone, and Filter, mg	781.1	718.9	417.0
m_t	Particulate - Total, mg	1704.6	989.9	889.3
I_c	% Impinger Catch	54.2	24.4	53.1
C_{an}	Particulate - Probe, Cyclone, and Filter, gr/SCF	0.051	0.046	0.026
C_{ao}	Particulate - Total, gr/SCF	0.111	0.064	0.055

Run No.	Table A1 (continued)	1	3	5
C_{at}	Particulate - Probe, Cyclone, and Filter, gr/ACF	0.022	0.019	0.11
C_{au}	Particulate - Total, gr/ACF	0.047	0.026	0.22
C_{aw}	Particulate - Probe, Cyclone, and Filter, lb/hr.	12.0	10.9	6.4
C_{ax}	Particulate - Total, lb/hr.	26.2	15.0	13.6
P_{tf}	Particulate - Probe, Cyclone and Filter, lb/ton	~~0.367~~	~~0.335~~	~~0.196~~
P_{tt}	Particulate - Total, lb/ton	~~0.802~~	~~0.402~~	~~0.417~~

[a] Dry standard cubic feet at 70°F, 29.92 in. Hg.

[b] Standard conditions at 70°F, 29.92 in. Hg.

[c] Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

FIELD DATA

PLANT	WOODVILLE LIME CHEM.,WOODVILLE,O.	DATE	07/08/74
SAMPLING LOCATION	LIME KILN #1,ESP OUTLET	RUN NUMBER	1
SAMPLE TYPE	PARTICULATE	PROBE LENGTH AND TYPE	6' PYREX GLASS
OPERATOR	EM&MB	NOZZLE I.D.	.3750
AMBIENT TEMP.(DEG.F)	120	ASSUMED MOISTURE	12
BAR.PRESS.(IN.HG)	29.48	SAMPLE BOX NUMBER	2
STATIC PRESS(IN.H2O)	.35	METER BOX NUMBER	FM3
FILTER NUMBER(S)	100108	METER HEAD DIFF.	1.36
STACK INSIDE DIM(IN)	63.500	C FACTOR	
PITOT TUBE COEFF	.83	PROBE HEATER SETTING	.800
		HEATER BOX SETTING	230
READ AND RECORD DATA EVERY 5.0 MINUTES		REFERENCE PRESS DIFF.	2.4

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1713	946.294									
S-24	005.0		949.240	.300	2.30	2.30	642	118	118	4.5	200	80
S-23	010.0		954.115	.310	2.35	2.35	639	118	118	4.5	210	77
S-22	015.0		958.716	.310	2.35	2.35	640	118	117	4.5	200	90
S-21	020.0		963.702	.350	2.65	2.65	639	120	117	4.5	198	90
S-20	025.0		968.988	.390	2.95	2.95	639	123	117	4.5	195	90
S-19	030.0		974.431	.410	3.05	3.05	641	124	117	5.0	220	90
S-18	035.0		979.972	.420	3.20	3.20	648	127	117	5.5	195	90
S-17	040.0		985.635	.440	3.30	3.30	645	129	118	5.5	215	88
S-16	045.0		991.481	.450	3.40	3.40	645	130	118	5.8	225	87
S-15	050.0		997.367	.470	3.55	3.55	642	126	118	6.0	215	83
S-14	055.0		3.358	.480	3.65	3.65	647	124	118	6.0	210	79
S-13	060.0		9.328	.480	3.65	3.65	654	122	118	6.0	215	79
S-12	065.0		15.306	.470	3.55	3.55	649	120	117	5.8	215	78
S-11	070.0		21.409	.480	3.65	3.65	649	118	117	5.5	220	78
S-10	075.0		22.235	.480	3.65	3.65	650	115	114	5.7	225	78
S-9	080.0		33.176	.480	3.65	3.65	650	114	114	5.7	230	79
S-8	085.0		38.914	.440	3.30	3.30	658	113	113	5.7	230	80
S-7	090.0		44.587	.430	3.25	3.25	649	112	112	5.6	230	77
S-6	095.0		20.070	.410	3.05	3.05	630	110	110	5.5	230	74
S-5	100.0		55.638	.430	3.25	3.25	622	108	108	5.5	200	75
S-4	105.0		61.209	.420	3.20	3.20	612	106	106	5.4	200	75
S-3	110.0		66.593	.380	3.00	3.00	590	106	106	5.5	200	75
S-2	115.0		71.426	.300	2.40	2.40	525	104	104	5.0	225	73
S-1	120.0	1913	75.500	.180	1.70	1.70	460	103	103	5.0	250	72
W-24	125.0		80.190	.310	2.40	2.40	628	100	100	5.0	210	75
W-23	130.0		85.191	.320	2.50	2.50	618	101	101	5.8	215	72
W-22	135.0		90.015	.320	2.50	2.50	617	102	101	5.8	235	74

PLANT WOODVILLE LIME CHEM.,WOODVILLE,O. DATE 07/08/74

SAMPLING LOCATION LIME KILN #1,ESP OUTLET RUN NUMBER 1

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
W-21	140.0		95.096	.340	2.65	2.65	630	102	101	6.0	230	73
W-20	145.0		100.314	.360	2.75	2.75	638	102	100	6.0	225	73
W-19	150.0		105.607	.380	2.90	2.90	639	104	100	6.0	220	72
W-18	155.0		111.093	.390	3.00	3.00	642	105	100	6.0	220	72
W-17	160.0		116.563	.420	3.20	3.20	639	106	100	6.1	215	73
W-16	165.0		122.241	.440	3.35	3.35	639	107	100	6.2	210	75
W-15	170.0		128.009	.450	3.40	3.40	637	108	99	6.3	215	74
W-14	175.0	0	133.735	.450	3.40	3.40	635	108	100	6.3	220	72
W-13	180.0		139.392	.440	3.35	3.35	640	108	101	6.2	220	70
W-12	185.0		145.186	.430	3.30	3.30	639	109	100	6.2	225	70
W-11	190.0		150.435	.410	3.10	3.10	652	104	98	5.8	225	70
W-10	195.0		155.991	.410	3.10	3.10	649	105	99	5.8	227	71
W-9	200.0		161.375	.420	3.20	3.20	660	105	98	6.0	230	72
W-8	205.0		166.811	.410	3.10	3.10	655	106	98	6.0	228	72
W-7	210.0		172.241	.390	3.00	3.00	650	106	98	5.9	225	71
W-6	215.0		177.475	.360	2.75	2.75	638	105	98	5.8	221	71
W-5	220.0		182.467	.350	2.70	2.70	625	105	97	5.8	210	71
W-4	225.0		187.551	.340	2.60	2.60	521	104	98	5.8	208	72
W-3	230.0		192.755	.330	2.75	2.75	485	103	97	5.8	205	73
W-2	235.0		198.091	.330	2.75	2.75	475	97	96	5.8	220	72
W-1	240.0	2129	203.205	.330	2.75	2.75	475	98	96	5.5	245	70
TOTALS	240.0		256.911									
AVERAGE					3.01	3.01	621	111	106	5.6	218	76

PLANT	WOODVILLE LIME CHEM.,WOODVILLE,O.	DATE	07/08/74
SAMPLING LOCATION	LIME KILN #1,ESP OUTLET	RUN NUMBER	1

DRY MOLECULAR WEIGHT DETERMINATION

GAS	VOL. PERCENT DRY BASIS
CO2	21.660
O2	8.000
CO	.000
N2	70.340
TOTAL	100.000

DRY MOLECULAR WEIGHT,LB/LB-MOLE 31.79

MOISTURE CONTENT DETERMINATION

IMPINGER MOISTURE,ML	592.0
SILICA MOISTURE,ML	44.7
TOTAL MOISTURE,ML	636.7
WATER VAPOR COLLECTED, STD. CU. FT.	30.180
GAS METER VOL.,CU.FT.	
GROSS TOTAL	256.911
LESS LEAKAGE CORR	.000
NET TOTAL	256.911
DRY GAS VOL. THROUGH METER,STD. CU. FT	237.923
MOISTURE CONTENT, VOL. FRACTION	.1126

STACK GAS VELOCITY AND VOLUME DETERMINATION

STACK AREA,SQ. FT.	21.992
PITOT TUBE COEFFICIENT	.83
STACK ABS.PRESS.,IN.HG	29.51
STACK GAS TEMPERATURE,DEG.F	621
STACK GAS MOL. WT.,WET BASIS	30.23
SQRT(VEL HD X STACK TEMP ABS)	20.5
STACK GAS VELOCITY, ACT. FPS	48.8
STACK GAS VOLUME,STD CFM,	
WET BASIS	31122.8
DRY BASIS	27619.4

ISOKINETIC VARIATION

PERCENT OF ISOKINETIC SAMPLING 102.9

EMISSION DATA

SAMPLE	WEIGHT MG.	STD. CONC. GR./SCF	ACT. CONC. GR./ACF	EMISSION RATE LB./HR.	EMISSION FACT. LB/TON.	THROUGHPUT- TON/HR.
FILTERABLE PART.	781.1000	.05066	.02173	11.994	.000	0.0000
TOTAL PART.	1704.6000	.11056	.04744	26.174	.000	0.0000

FIELD DATA

PLANT	WOODVILLE CHEM.CO., WOODVILLE,O.	DATE	07/09/74
SAMPLING LOCATION	LIME KILN #1,ESP OUTLET	RUN NUMBER	3
SAMPLE TYPE	PARTICULATE	PROBE LENGTH AND TYPE	6' GLASS
OPERATOR	EM&MB	NOZZLE I.D.	.3750
AMBIENT TEMP.(DEG.F)	88	ASSUMED MOISTURE	12
BAR.PRESS.(IN.HG)	29.48	SAMPLE BOX NUMBER	
STATIC PRESS(IN.H2O)	.35	METER BOX NUMBER	FM3
FILTER NUMBER(S)	100104	METER HEAD DIFF.	1.36
STACK INSIDE DIM(IN)	63.500	C FACTOR	.720
PITOT TUBE COEFF	.83	PROBE HEATER SETTING	80
		HEATER BOX SETTING	230
READ AND RECORD DATA EVERY 5.0 MINUTES		REFERENCE PRESS DIFF.	.250

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	0841	203.456									
S-24	005.0		208.971	.410	3.00	3.00	668	94	90	3.8	240	66
S-23	010.0		214.194	.410	3.00	3.00	670	98	91	3.8	245	64
S-22	015.0		219.621	.410	3.00	3.00	671	101	92	3.8	230	68
S-21	020.0		224.958	.430	3.11	3.11	670	104	93	4.0	225	71
S-20	025.0		230.491	.440	3.20	3.20	670	107	94	4.2	220	74
S-19	030.0		236.086	.450	3.30	3.30	669	109	95	4.4	210	81
S-18	035.0		241.766	.470	3.40	3.40	670	111	96	4.6	205	87
S-17	040.0		247.555	.480	3.50	3.50	668	113	97	4.6	212	84
S-16	045.0		253.516	.500	3.70	3.70	670	114	98	4.8	217	80
S-15	050.0		259.511	.500	3.70	3.70	663	115	100	4.9	222	76
S-14	055.0		265.290	.490	3.60	3.60	668	117	100	4.8	226	79
S-13	060.0		271.189	.490	3.60	3.60	668	117	101	5.0	227	83
S-12	065.0		277.015	.490	3.60	3.60	685	117	103	5.0	230	85
S-11	070.0		282.910	.480	3.50	3.50	691	116	103	5.0	236	81
S-10	075.0		288.974	.460	3.30	3.30	690	116	104	5.0	240	79
S-9	080.0		294.416	.460	3.30	3.30	692	114	104	5.0	245	78
S-8	085.0		299.736	.400	2.95	2.95	695	114	105	4.8	240	80
S-7	090.0		305.271	.410	3.09	3.09	698	114	105	5.0	235	79
S-6	095.0		310.664	.400	2.95	2.95	698	113	106	5.0	230	78
S-5	100.0		315.896	.380	2.75	2.75	688	114	106	4.8	235	78
S-4	105.0		321.214	.390	2.85	2.85	689	115	106	4.8	235	79
S-3	110.0		326.315	.360	2.65	2.65	670	114	106	4.8	230	80
S-2	115.0		330.886	.270	2.00	2.00	622	114	107	4.3	227	81
S-1	120.0	1041	335.034	.210	1.68	1.68	540	113	106	4.2	225	83
W-24	125.0		339.788	.330	2.41	2.41	650	110	107	4.5	240	72
W-23	130.0		344.736	.330	2.41	2.41	670	112	107	4.8	240	73
W-22	135.0		349.505	.330	2.41	2.41	670	112	107	5.0	235	73

PLANT WOODVILLE CHEM.CO., WOODVILLE,O. DATE 07/09/74

SAMPLING LOCATION LIME KILN #1,ESP OUTLET RUN NUMBER 3

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
W-21	140.0		354.467	.340	2.50	2.50	672	111	107	5.2	230	72
W-20	145.0		359.600	.370	2.70	2.70	675	113	107	5.3	225	71
W-19	150.0		365.188	.420	3.10	3.10	681	115	108	6.0	218	73
W-18	155.0		370.706	.430	3.20	3.20	683	115	108	6.0	213	75
W-17	160.0		376.507	.470	3.40	3.40	678	116	108	6.1	205	77
W-16	165.0		382.378	.480	3.50	3.50	670	117	108	6.2	210	76
W-15	170.0		388.484	.500	3.70	3.70	661	117	109	6.5	215	76
W-14	175.0		394.425	.500	3.70	3.70	660	117	109	6.5	220	75
W-13	180.0		400.476	.520	3.80	3.80	655	118	110	7.0	220	74
W-12	185.0		406.461	.490	3.65	3.65	660	119	110	7.0	225	74
W-11	190.0		412.254	.470	3.40	3.40	672	120	110	6.8	230	74
W-10	195.0		417.899	.460	3.30	3.30	680	120	111	6.8	220	73
W-9	200.0		423.588	.450	3.30	3.30	678	120	111	6.8	210	71
W-8	205.0		429.236	.420	3.10	3.10	678	120	111	6.5	200	70
W-7	210.0		434.100	.360	2.65	2.65	678	117	112	6.3	220	70
W-6	215.0		439.345	.340	2.41	2.41	670	117	111	6.0	230	69
W-5	220.0		443.927	.280	2.05	2.05	662	116	111	5.8	240	69
W-4	225.0		448.583	.300	2.20	2.20	660	116	111	5.5	235	69
W-3	230.0		453.364	.310	2.30	2.30	660	116	111	6.0	230	69
W-2	235.0		458.031	.290	2.15	2.15	655	116	111	5.8	224	68
W-1	240.0	1248	462.683	.290	2.15	2.15	651	115	111	5.8	215	68
TOTALS	240.0		259.227									
AVERAGE					3.00	3.00	669	114	105	5.3	226	75

PLANT WOODVILLE CHEM.CO., WOODVILLE,O.
SAMPLING LOCATION LIME KILN #1,ESP OUTLET

DATE 07/09/74
RUN NUMBER 3

DRY MOLECULAR WEIGHT DETERMINATION

GAS	VOL. PERCENT DRY BASIS
CO2	21.000
O2	8.670
CO	.000
N2	70.330
TOTAL	100.000

DRY MOLECULAR WEIGHT,LB/LB-MOLE 31.71

MOISTURE CONTENT DETERMINATION

IMPINGER MOISTURE,ML	600.0
SILICA MOISTURE,ML	98.5
TOTAL MOISTURE,ML	698.5
WATER VAPOR COLLECTED, STD. CU. FT.	33.109
GAS METER VOL.,CU.FT.	
GROSS TOTAL	259.227
LESS LEAKAGE CORR	.000
NET TOTAL	259.227
DRY GAS VOL. THROUGH METER,STD. CU. FT	239.642
MOISTURE CONTENT, VOL. FRACTION	.1214

STACK GAS VELOCITY AND VOLUME DETERMINATION

STACK AREA,SQ. FT.	21.992
PITOT TUBE COEFFICIENT	.83
STACK ABS.PRESS.,IN.HG	29.51
STACK GAS TEMPERATURE,DEG.F	669
STACK GAS MOL. WT.,WET BASIS	30.04
SQRT(VEL HD X STACK TEMP ABS)	21.4
STACK GAS VELOCITY, ACT. FPS	51.0
STACK GAS VOLUME,STD CFM,	
WET BASIS	31173.8
DRY BASIS	27389.6

ISOKINETIC VARIATION

PERCENT OF ISOKINETIC SAMPLING 104.5

EMISSION DATA

SAMPLE	WEIGHT MG.	STD. CONC. GR./SCF	ACT. CONC. GR./ACF	EMISSION RATE LB./HR.	EMISSION FACT. LB/TON.	THROUGHPUT TON/HR.
FILTERABLE PART.	718.9000	.04629	.01883	10.868	.000	0.0000
TOTAL PART.	989.9000	.06374	.02592	14.965	.000	0.0000

FIELD DATA

PLANT	WOODVILLE CHEMICAL CO.	DATE	07/10/74
SAMPLING LOCATION	LIME LILN #1.ESP OUTLET	RUN NUMBER	5
SAMPLE TYPE	PARTICULATE	PROBE LENGTH AND TYPE	6'GLASS W/ 3*SS TIP
OPERATOR	EM&MB	NOZZLE I.D.	.3750
AMBIENT TEMP.(DEG.F)	90	ASSUMED MOISTURE	12
BAR.PRESS.(IN.HG)	29.40	SAMPLE BOX NUMBER	2
STATIC PRESS(IN.H2O)	.35	METER BOX NUMBER	FM3
FILTER NUMBER(S)	100115	METER HEAD DIFF.	1.36
STACK INSIDE DIM(IN)	63.500	C FACTOR	.72
PITOT TUBE COEFF	.83	PROBE HEATER SETTING	.80
		HEATER BOX SETTING	230
READ AND RECORD DATA EVERY 5.0 MINUTES		REFERENCE PRESS DIFF.	2.5

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	824	462.872									
W-24	005.0		467.485	.300	2.20	2.20	690	90	87	7.0	235	67
W-23	010.0		472.035	.300	2.20	2.20	695	93	87	7.0	240	68
W-22	015.0	839	976.800	.340	2.40	2.40	688	99	87	7.8	232	72
W-21	020.0		481.954	.400	2.95	2.95	680	101	90	9.5	228	76
W-20	025.0		487.238	.410	3.00	3.00	671	104	91	10.0	220	78
W-19	030.0	0857	492.713	.440	3.20	3.20	672	108	92	11.0	200	64
W-18	035.0	0913	499.216	.510	3.75	3.75	690	108	95	16.5	215	60
W-17	040.0	0922	505.051	.480	3.50	3.50	690	108	96	16.5	210	66
W-16	045.0		511.973	.530	3.90	3.90	688	106	96	4.2	220	69
W-15	050.0		518.016	.550	4.00	4.00	685	110	98	4.5	225	72
W-14	055.0		524.173	.550	4.00	4.00	680	111	98	4.5	230	73
W-13	060.0		530.315	.540	3.95	3.95	675	111	99	4.6	235	74
W-12	065.0		536.462	.540	3.95	3.95	681	111	100	4.6	240	75
W-11	070.0		542.446	.510	3.71	3.71	690	110	100	4.6	240	74
W-10	075.0		548.492	.520	3.80	3.80	697	110	100	4.6	230	74
W-9	080.0		554.425	.500	3.70	3.70	690	110	100	4.5	220	75
W-8	085.0		560.365	.470	3.50	3.50	695	111	101	4.5	250	75
W-7	090.0		565.936	.450	3.30	3.30	691	112	101	4.6	240	74
W-6	095.0		571.370	.410	3.00	3.00	690	112	101	4.4	230	73
W-5	100.0		576.820	.410	3.00	3.00	695	111	101	4.2	225	72
W-4	105.0		582.086	.370	2.75	2.75	695	111	102	4.1	233	71
W-3	110.0		587.082	.350	2.55	2.55	675	110	101	4.0	240	71
W-2	115.0		591.981	.310	2.28	2.28	625	110	101	3.8	225	71
W-1	120.0	1049	596.376	.270	1.95	1.95	580	108	101	3.8	215	72
S-24	125.0		601.625	.340	2.50	2.50	665	102	100	4.2	245	81
S-23	130.0		606.207	.340	2.50	2.50	650	104	100	4.2	250	80
S-22	135.0		611.631	.420	3.10	3.10	652	106	100	5.0	225	78

PLANT WOODVILLE CHEMICAL CO. DATE 07/10/74

SAMPLING LOCATION LIME LICN #1,ESP OUTLET RUN NUMBER 5

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
S-21	140.0		617.195	.440	3.20	3.20	655	106	98	5.0	215	76
S-20	145.0		622.885	.470	3.45	3.45	662	107	99	5.4	218	73
S-19	150.0		628.803	.500	3.70	3.70	662	108	99	5.4	220	70
S-18	155.0		634.817	.510	3.71	3.71	668	110	99	5.5	245	70
S-17	160.0		640.879	.530	3.90	3.90	665	113	100	5.5	243	72
S-16	165.0		646.970	.530	3.90	3.90	660	116	100	5.6	240	74
S-15	170.0		653.096	.540	3.95	3.95	662	117	100	5.7	245	74
S-14	175.0		659.275	.530	3.90	3.90	665	116	101	5.7	255	75
S-13	180.0		665.359	.530	3.90	3.90	665	116	102	5.7	265	76
S-12	185.0		671.513	.540	3.95	3.95	663	116	102	5.7	210	71
S-11	190.0		677.648	.530	3.90	3.90	670	115	103	6.0	245	75
S-10	195.0		683.613	.510	3.71	3.71	672	113	102	5.8	235	75
S-9	200.0		689.585	.500	3.70	3.70	688	114	102	5.8	236	75
S-8	205.0		695.298	.450	3.30	3.30	698	113	102	5.7	240	76
S-7	210.0		700.875	.430	3.15	3.15	695	112	102	5.5	245	74
S-6	215.0		706.407	.430	3.15	3.15	690	111	103	5.5	250	71
S-5	220.0		711.915	.410	3.05	3.05	688	115	102	5.3	215	69
S-4	225.0		717.435	.430	3.15	3.15	695	115	102	5.3	230	71
S-3	230.0		722.951	.420	3.10	3.10	685	114	103	5.3	245	73
S-2	235.0		727.825	.320	2.38	2.38	645	115	104	5.0	230	75
S-1	240.0	1255	732.105	.240	1.78	1.78	610	114	105	4.5	220	78
TOTALS	240.0		269.233									
AVERAGE					3.26	3.26	674	110	99	5.9	232	73

PLANT WOODVILLE CHEMICAL CO.
SAMPLING LOCATION LIME LILN #1,ESP OUTLET

DATE 07/10/74
RUN NUMBER 5

DRY MOLECULAR WEIGHT DETERMINATION

GAS	VOL. PERCENT DRY BASIS
CO2	19.600
O2	11.400
CO	.000
N2	69.000
TOTAL	100.000

DRY MOLECULAR WEIGHT,LB/LB-MOLE 31.59

MOISTURE CONTENT DETERMINATION

IMPINGER MOISTURE,ML	600.0
SILICA MOISTURE,ML	75.0
TOTAL MOISTURE,ML	675.0
WATER VAPOR COLLECTED, STD. CU. FT.	31.995
GAS METER VOL.,CU.FT.	
GROSS TOTAL	269.233
LESS LEAKAGE CORR	2.042
NET TOTAL	267.191
DRY GAS VOL. THROUGH METER,STD. CU. FT	248.681
MOISTURE CONTENT, VOL. FRACTION	.1140

STACK GAS VELOCITY AND VOLUME DETERMINATION

STACK AREA,SQ. FT.	21.992
PITOT TUBE COEFFICIENT	.83
STACK ABS.PRESS.,IN.HG	29.43
STACK GAS TEMPERATURE,DEG.F	674
STACK GAS MOL. WT.,WET BASIS	30.04
SQRT(VEL HD X STACK TEMP ABS)	22.4
STACK GAS VELOCITY, ACT. FPS	53.3
STACK GAS VOLUME,STD CFM.	
WET BASIS	32345.1
DRY BASIS	28658.0

ISOKINETIC VARIATION

PERCENT OF ISOKINETIC SAMPLING 103.6

EMISSION DATA

SAMPLE	WEIGHT MG.	STD. CONC. GR./SCF	ACT. CONC. GR./ACF	EMISSION RATE LB./HR.	EMISSION FACT. LB/TON.	THROUGHPUT- TON/HR.
FILTERABLE PART.	417.0000	.02587	.01053	6.356	.000	0.0000
TOTAL PART.	889.3000	.05518	.02247	13.556	.000	0.0000

CALCULATIONS

1. Volume of dry gas sampled at standard conditions - 70°F, 29.92" Hg. ft^3.

$$V_{m_{std}} = \frac{17.71 \times V_m \left(P_B + \frac{P_m}{13.6}\right)}{(T_m + 460)} = \frac{17.71 \times 256.911 \left(29.48 + \frac{3.01}{13.6}\right)}{(108.5 + 460)}$$

$$= 237.710$$

2. Volume of water vapor at 70°F & 29.92" Hg, $Ft.^3$

$$V_{w_{gas}} = 0.0474 \times V_w = Ft.^3 = (0.0474)(636.7) = 30.180$$

3. % moisture in stack gas

$$\%M = \frac{100 \times V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} = \frac{100 \times 30.180}{237.710 + 30.180} = 11.27$$

4. Mole fraction of dry gas

$$M_d = \frac{100 - \%M}{100} = \frac{100 - 11.27}{100} = .8873$$

5. Average molecular weight of dry stack gas

$$M\,W_d = (\%CO_2 \times \frac{44}{100}) + (\%O_2 \times \frac{32}{100}) + (\%N_2 \times \frac{28}{100})$$

$$= (21.66 \times .44) + (8 \times .32) + (70.34 \times .28)$$

$$= 31.79$$

6. Molecular weight of stack gas

$$M\,W = M\,W_d \times M_d + 18\,(1 - M_d)$$

$$(31.79)(.8873) + (18)(1-.8873) = 30.23$$

7. Stack velocity @ stack conditions, fpm

$$V_s = 1062.6 C_p \times \sqrt{\Delta P \times (T_s + 460)} \left[\frac{1}{P_s \times M\,W}\right]^{1/2} =$$

$$= (1062.6)(.83)\ (.389)(621+460) \left[\frac{1}{(29.51)(30.23)}\right]^{1/2} = 2923$$

8. Stack gas volume @ standard conditions, SCFM

$$Q_s = \frac{17.71 \times V_s \times A_s \times M_d \times P_s}{(T_s + 460)} = \frac{(17.71)(2923)(21.992)(.8873)(29.5}{(621 + 460)}$$

$$= 27576$$

9. Per cent isokinetic

$$\%I = \frac{1032 \times (T_s + 460) \times V_{m_{std}}}{V_s \times T_t \times P_s \times M_d \times (D_n)^2} = \frac{(1032)(621+460)(237.710)}{(2923)(240)(29.51)(.8873)(.375)^2}$$

$$= 102.7$$

10. Particulate - probe, cyclone, & filter, gr/SCF

$$C_{an} = 0.0154 \times \frac{M_f}{V_{m\ std}} = \frac{(0.0154)(781.1)}{237.710} = 0.051$$

11. Particulate total, gr/SCF

$$C_{ao} = 0.01543 \times \frac{M_t}{V_{m_{std}}} = \frac{(0.0154)(1704.6)}{237.710} = 0.11$$

12. Particulate - probe, cyclone & filter, gr/CF at stack conditions

$$C_{at} = \frac{17.71 \times C_{an} \times P_s \times M_d}{(T_s + 460)} = \frac{(17.71)(0.051)(29.51)(.8873)}{(621 + 460)} = 0.022$$

13. Particulate - total, gr/CF @ stack conditions

$$C_{au} = \frac{17.71 \times C_{ao} \times P_s \times M_d}{(T_s + 460)} = \frac{(17.71)(0.11)(29.51)(.8873)}{(621 + 460)} = 0.047$$

14. Particulate - probe, cyclone, & filter, lb/hr.

$$C_{aw} = 0.00857 \times C_{an} \times Q_s = (.00857)(.051)(27576) = 12.05$$

15. Particulate - total, lb/hr.

$$C_{ax} = 0.00857 \times C_{ao} \times Q_s = (.00857)(0.11)(27576) = 26.0$$

APPENDIX B

GASEOUS RESULTS AND EXAMPLE CALCULATIONS

NO_2 CALCULATIONS

TEST A

1. Sample Volume

$$V_s = (17.71)(V_o - 25ml)\left(\frac{P_f}{T_f} - \frac{P_i}{T_i}\right)$$

where: V_s = Sample volume at std. cond., dry basis, ml.
V_o = Volume of flask and valve, ml.
P_f = Final absolute pressure of flask, in.Hg.
P_i = Initial absolute pressure of flask, in. Hg.
T_f = Final absolute temperature of flask, °R.
T_i = Initial absolute temperature of flask, R.

$$V_s = (17.71)(2073 - 25ml)\left(\frac{26.68}{564} - \frac{4.03}{565}\right)$$

V_s = 1457 ml.

2. PPM NO_2

$$C = \frac{(.5245)(M)}{V_s} \times 10^6$$

where: C = Concentration of NO_2, PPM. (dry basis)
M = Mass of NO_2 in gas sample, mg.
V_s = Gas sample volume @ 70°F and 29.92" Hg.

$$C = \frac{(.5245)(0.830)}{1457} \times 10^6$$

C = 298.8 PPM

3. LBS/HR NO_2

$$ER = (PPM)(Q_s)\left(60\,\frac{min}{hr}\right) \times \left(\frac{M.W.\,(lbs/lb\text{-}mole)}{387\ ft^3/lb\text{-}mole}\right) \times 10^{-6}$$

where: ER = Emission Rate in lbs/hr.

PPM= Parts per million NO_2 (dry basis)

MW = Molecular weight of NO_2, 46.01

$$ER = (7.133)(PPM)(Q_s) \times 10^{-6}$$

$$ER = (7.133)(\ 298.8)(\ 27619\ ) \times 10^{-6}$$

ER = 58.9 LBS/HR

TEST NO.A DATE 07-08-74 LOCATION WOODVILLE LIME CO.

TYPE OF OPERATION LIME KILN NO.1

SAMPLING FLASK NO. 22 FLASK VOLUME 2073.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM. LEG 1 12.45
LEG 2 13.00
TOTAL 25.45 PI=PB-TOTAL LEG1+LEG2= 4.03

FINAL FLASK VACUUM. LEG 1 1.30
LEG 2 1.50
TOTAL 2.80 PF=PB-TOTAL LEG1+LEG2= 26.68

INITIAL FLASK TEMPERATURE. TI= 105. F+460= 565.R
FINAL FLASK TEMPERATURE. TF= 104. F+460= 564.R

BAROMETRIC PRESSURE.PB= 29.480 IN. HG

MILLIGRAMS OF NO2 0.830

CLOCK TIME 1748 DRY STACK VOL. FLOW RATE 27619.00 DSCFM

OUTPUT CALCULATIONS

VS= 1457.04 ML
C= 298.77 PPM NO2
ER= 58.86 LBS/HR NO2

TEST NO.8 DATE 07-08-74 LOCATION WOODVILLE LIME CO

TYPE OF OPERATION LIME KILN NO.1 ESP OUTLET

SAMPLING FLASK NO. 8 FLASK VOLUME 2086.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM, LEG 1 12.70
LEG 2 13.30
TOTAL 26.00 PI=PB-TOTAL LEG1+LEG2= 3.48

FINAL FLASK VACUUM, LEG 1 1.20
LEG 2 1.30
TOTAL 2.50 PF=PB-TOTAL LEG1+LEG2= 26.98

INITIAL FLASK TEMPERATURE, TI= 105. F+460= 565.R
FINAL FLASK TEMPERATURE, TF= 104. F+460= 564.R

BAROMETRIC PRESSURE,PB= 29.480 IN. HG

MILLIGRAMS OF NO2 0.672

CLOCK TIME 1848 DRY STACK VOL. FLOW RATE 27619.00 DSCFM

OUTPUT CALCULATIONS

VS= 1521.24 ML
C= 231.69 PPM NO2
ER= 45.64 LBS/HR NO2

TEST NO.C DATE 07-08-74 LOCATION WOODVILLE LIME CO

TYPE OF OPERATION LIME KILN ESP OUTLET

SAMPLING FLASK NO. 19 FLASK VOLUME 2074.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM, LEG 1 12.85
LEG 2 12.65
TOTAL 25.50 PI=PB-TOTAL LEG1+LEG2= 3.98

FINAL FLASK VACUUM, LEG 1 0.90
LEG 2 1.10
TOTAL 2.00 PF=PB-TOTAL LEG1+LEG2= 27.48

INITIAL FLASK TEMPERATURE, TI= 106. F+460= 566.R
FINAL FLASK TEMPERATURE, TF= 102. F+460= 562.R

BAROMETRIC PRESSURE,PB= 29.480 IN. HG

MILLIGRAMS OF NO2 0.953

CLOCK TIME 1951 DRY STACK VOL. FLOW RATE 27619.00 DSCFM

OUTPUT CALCULATIONS

VS= 1519.18 ML
C= 329.02 PPM NO2
ER= 64.81 LBS/HR NO2

TEST NO.D DATE 07-08-74 LOCATION WOODVILLE LIME CO

TYPE OF OPERATION LIME KILN NO.1 ESP OUTLET

SAMPLING FLASK NO. 20 FLASK VOLUME 2070.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM, LEG 1 13.00
LEG 2 12.30
TOTAL 25.30 PI=PB-TOTAL LEG1+LEG2= 4.17

FINAL FLASK VACUUM, LEG 1 1.00
LEG 2 1.20
TOTAL 2.20 PF=PB-TOTAL LEG1+LEG2= 27.28

INITIAL FLASK TEMPERATURE, TI= 103. F+460= 563.R
FINAL FLASK TEMPERATURE, TF= 100. F+460= 560.R

BAROMETRIC PRESSURE,PB= 29.480 IN. HG

MILLIGRAMS OF NO2 0.957

CLOCK TIME 2048 DRY STACK VOL. FLOW RATE 27619.00 DSCFM

OUTPUT CALCULATIONS

VS= 1495.38 ML
C= 335.66 PPM NO2
ER= 66.12 LBS/HR NO2

TEST NO.E DATE 07-09-74 LOCATION WOODVILLE LIME CO

TYPE OF OPERATION LIME KILN NO. 1 ESP OUTLET

SAMPLING FLASK NO. 4 FLASK VOLUME 2044.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM, LEG 1 12.70
LEG 2 13.30
TOTAL 26.00 PI=PB-TOTAL LEG1+LEG2= 3.48

FINAL FLASK VACUUM, LEG 1 1.00
LEG 2 1.10
TOTAL 2.10 PF=PB-TOTAL LEG1+LEG2= 27.38

INITIAL FLASK TEMPERATURE, TI= 90. F+460= 550.R
FINAL FLASK TEMPERATURE, TF= 90. F+460= 550.R

BAROMETRIC PRESSURE,PB= 29.480 IN. HG

MILLIGRAMS OF NO2 0.976

CLOCK TIME 0915 DRY STACK VOL. FLOW RATE 27390.00 DSCFM

OUTPUT CALCULATIONS

VS= 1553.78 ML
C= 329.46 PPM NO2
ER= 64.36 LBS/HR NO2

TEST NO.F DATE 07-09-74 LOCATION WOODVILLE LIME CO

TYPE OF OPERATION LIME KILN NO.1 ESP OUTLET

SAMPLING FLASK NO. 5 FLASK VOLUME 2086.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM, LEG 1 12.50
LEG 2 13.10
TOTAL 25.60 PI=PB-TOTAL LEG1+LEG2= 3.87

FINAL FLASK VACUUM, LEG 1 1.00
LEG 2 1.15
TOTAL 2.15 PF=PB-TOTAL LEG1+LEG2= 27.33

INITIAL FLASK TEMPERATURE, TI= 95. F+460= 555.R
FINAL FLASK TEMPERATURE, TF= 93. F+460= 553.R

BAROMETRIC PRESSURE,PB= 29.480 IN. HG

MILLIGRAMS OF NO2 0.934

CLOCK TIME 1015 DRY STACK VOL. FLOW RATE 27390.00 DSCFM

OUTPUT CALCULATIONS

VS= 1548.72 ML
C= 316.31 PPM NO2
ER= 61.79 LBS/HR NO2

TEST NO.G DATE 07-09-74 LOCATION WOODVILLE LIME CO

TYPE OF OPERATION LIME KILN NO.1 ESP OUTLET

SAMPLING FLASK NO. 11 FLASK VOLUME 2062.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM. LEG 1 12.95
LEG 2 12.35
TOTAL 25.29 PI=PB-TOTAL LEG1+LEG2= 4.18

FINAL FLASK VACUUM. LEG 1 1.00
LEG 2 1.10
TOTAL 2.10 PF=PB-TOTAL LEG1+LEG2= 27.38

INITIAL FLASK TEMPERATURE. TI= 104. F+460= 564.R
FINAL FLASK TEMPERATURE. TF= 103. F+460= 563.R

BAROMETRIC PRESSURE.PB= 29.480 IN. HG

MILLIGRAMS OF NO2 1.034

CLOCK TIME 1115 DRY STACK VOL. FLOW RATE 27390.00 DSCFM

OUTPUT CALCULATIONS

VS= 1487.05 ML
C= 364.70 PPM NO2
ER= 71.25 LBS/HR NO2

TEST NO.H DATE 07-09-74 LOCATION WOODVILLE LIME CO

TYPE OF OPERATION LIME KILN NO.1 ESP OUTLET

SAMPLING FLASK NO. 6 FLASK VOLUME 2091.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM, LEG 1 12.50
LEG 2 13.10
TOTAL 25.60 PI=PB-TOTAL LEG1+LEG2= 3.87

FINAL FLASK VACUUM, LEG 1 1.00
LEG 2 1.15
TOTAL 2.15 PF=PB-TOTAL LEG1+LEG2= 27.33

INITIAL FLASK TEMPERATURE, TI= 99. F+460= 559.R
FINAL FLASK TEMPERATURE, TF= 103. F+460= 563.R

BAROMETRIC PRESSURE,PB= 29.480 IN. HG

MILLIGRAMS OF NO2 1.014

CLOCK TIME 1215 DRY STACK VOL. FLOW RATE 27390.00 DSCFM

OUTPUT CALCULATIONS

VS= 1522.18 ML
C= 349.39 PPM NO2
ER= 68.26 LBS/HR NO2

TEST NO.1 DATE 07-10-74 LOCATION WOODVILLE LIME CO

TYPE OF OPERATION LIME KILN NO.1 ESP OUTLET

SAMPLING FLASK NO. 15 FLASK VOLUME 2083.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM, LEG 1 12.75
LEG 2 13.30
TOTAL 26.05 PI=PB-TOTAL LEG1+LEG2= 3.34

FINAL FLASK VACUUM, LEG 1 1.00
LEG 2 1.10
TOTAL 2.10 PF=PB-TOTAL LEG1+LEG2= 27.30

INITIAL FLASK TEMPERATURE, TI= 85. F+460= 545.R
FINAL FLASK TEMPERATURE, TF= 85. F+460= 545.R

BAROMETRIC PRESSURE,PB= 29.400 IN. HG

MILLIGRAMS OF NO2 1.093

CLOCK TIME 0920 DRY STACK VOL. FLOW RATE 28658.00 DSCFM

OUTPUT CALCULATIONS

VS= 1601.66 ML
C= 357.92 PPM NO2
ER= 73.16 LBS/HR NO2

TEST NO.J DATE 07-10-74 LOCATION WOODVILLE LIME CO

TYPE OF OPERATION LIME KILN NO.1 ESP OUTLET

SAMPLING FLASK NO. 18 FLASK VOLUME 2074.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM, LEG 1 12.75
LEG 2 13.35
TOTAL 26.10 PI=PB-TOTAL LEG1+LEG2= 3.29

FINAL FLASK VACUUM, LEG 1 1.00
LEG 2 1.10
TOTAL 2.10 PF=PB-TOTAL LEG1+LEG2= 27.30

INITIAL FLASK TEMPERATURE, TI= 95. F+460= 555.R
FINAL FLASK TEMPERATURE, TF= 0. F+460= 460.R

BAROMETRIC PRESSURE,PB= 29.400 IN. HG

MILLIGRAMS OF NO2 1.169

CLOCK TIME 1033 DRY STACK VOL. FLOW RATE 28658.00 DSCFM

OUTPUT CALCULATIONS

VS= 1937.83 ML
C= 316.40 PPM NO2
ER= 64.67 LBS/HR NO2

TEST NO.K DATE 07-10-74 LOCATION WOODVILLE LIME CO

TYPE OF OPERATION LIME KILN NO.1 ESP OUTLET

SAMPLING FLASK NO. 1 FLASK VOLUME 2007.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM, LEG 1 13.25
LEG 2 13.85
TOTAL 27.10 PI=PB-TOTAL LEG1+LEG2= 2.29

FINAL FLASK VACUUM, LEG 1 1.00
LEG 2 1.10
TOTAL 2.10 PF=PB-TOTAL LEG1+LEG2= 27.30

INITIAL FLASK TEMPERATURE, TI= 81. F+460= 541.R
FINAL FLASK TEMPERATURE, TF= 83. F+460= 543.R

BAROMETRIC PRESSURE,PB= 29.400 IN. HG

MILLIGRAMS OF NO2 1.349

CLOCK TIME 1130 DRY STACK VOL. FLOW RATE 28658.00 DSCFM

OUTPUT CALCULATIONS

VS= 1615.52 ML
C= 437.96 PPM NO2
ER= 89.52 LBS/HR NO2

TEST NO.L DATE 07-10-74 LOCATION WOODVILLE LIME CO

TYPE OF OPERATION LIME KILN NO.1 ESP OUTLET

SAMPLING FLASK NO. 7 FLASK VOLUME 2074.0 ML

VOLUME OF REAGENT 25.0 ML TYPE OF REAGENT H202

INITIAL FLASK VACUUM, LEG 1 13.25
LEG 2 13.85
TOTAL 27.10 PI=PB-TOTAL LEG1+LEG2= 2.29

FINAL FLASK VACUUM, LEG 1 1.05
LEG 2 1.15
TOTAL 2.20 PF=PB-TOTAL LEG1+LEG2= 27.20

INITIAL FLASK TEMPERATURE, TI= 80. F+460= 540.R
FINAL FLASK TEMPERATURE, TF= 84. F+460= 544.R

BAROMETRIC PRESSURE,PB= 29.400 IN. HG

MILLIGRAMS OF NO2 1.290

CLOCK TIME 1230 DRY STACK VOL. FLOW RATE 28658.00 DSCFM

OUTPUT CALCULATIONS

VS= 1659.83 ML
C= 407.63 PPM NO2
ER= 83.32 LBS/HR NO2

SO_2 CALCULATIONS (Test 2)

$$Vmstd = Vm \frac{(Tstd)}{(Tm)} \frac{(Pbar + \frac{\Delta H}{13.6}}{(Pstd)}$$

$$Vmstd = \frac{(180.062)(530)(29.48 + \frac{1.90}{13.6}}{(566)(29.92)}$$

Vmstd = 166.917 std cu. ft.

$$PPMSO_2 = \frac{(Vt-Vtb)}{(64)} \frac{(N)}{(28.316)} \frac{(Vsoln)}{(Va)} \frac{(.032)}{(Vmstd)} \frac{(24.5)}{} \frac{(10^6)}{}$$

$$PPMSO_2 = \frac{(28.52)(0.0188)(510)(.032)(24.5)(10^6)}{(64)(28.316)(10)(166.917)}$$

$PPMSO_2$ = 70.8 ppm by volume

$$CSO_2 = \frac{(7.05x10^{-5})(Vt-Vth)(H)(Vsoln)}{(Vmstd)(Va)}$$

$$CSO_2 = \frac{(7.05x10^{-5})(28.52)(0.0188)(510)}{(166.917)(10)}$$

$CSO_2 = 1.155x10^{-5}$ lb/std cu. ft.

Emission rate - $(CSO_2)(Qsstd)(60)$

Emission rate = $(1.155x10^{-5})(27619)(60)$

Emission rate = 19.1 lb/hr.

SO_2 CALCULATIONS (Test 4)

$$Vmstd = Vm \frac{(Tstd)}{(Tm)} \frac{(Pbar + \frac{\Delta H}{13.6})}{(Pstd)}$$

$$Vmstd = \frac{(181.11)(530)(29.48 + \frac{}{13.6})}{(574)(29.92)}$$

Vmstd = 165.549 std cu. ft.

$$PPMSO_2 = \frac{(Vt-Vtb)}{(64)} \frac{(N)}{(28.316)} \frac{(Vsoln)}{(Va)} \frac{(.032)}{(Vmstd)} (24.5)(10^6)$$

$$PPMSO_2 = \frac{(3.12)(0.0188)(650)(.032)(24.5)(10^6)}{(64)(28.316)(10)(165.549)}$$

$PPMSO_2$ = 10.0 ppm by volume

$$CSO_2 = \frac{(7.05x10^{-5})(Vt-Vth)(H)(Vsoln)}{(Vmstd)(Va)}$$

$$CSO_2 = \frac{(7.05x10^{-5})(3.12)(0.0188)(650)}{(165.549)(10)}$$

$CSO_2 = 1.624x10^{-6}$ lb/std cu. ft.

Emission rate - $(CSO_2)(Qsstd)(60)$

Emission rate = $(1.624x10^{-6})(27390)(60)$

Emission rate = 2.67 lb/hr.

SO_2 CALCULATIONS (TEST NO. 6)

$$Vmstd = Vm \frac{(Tstd)}{(Tm)} \frac{(Pbar + \frac{\Delta H}{13.6})}{(Pstd)}$$

$$Vmstd = \frac{(180.024)(530)(29.40 + \frac{1.85}{13.6})}{(565)(29.92)}$$

Vmstd = 166.705 std cu. ft.

$$PPMSO_2 = \frac{(Vt-Vtb)}{(64)} \frac{(N)}{(28.316)} \frac{(Vsoln)}{(Va)} \frac{(.032)}{(Vmstd)} (24.5) (10^6)$$

$$PPMSO_2 = \frac{(17.90)(0.0188)(590)(.032)(24.5)(10^6)}{(64)(28.316)(10)(166.705)}$$

$PPMSO_2$ = 51.5 ppm by volume

$$CSO_2 = \frac{(7.05x10^{-5})(Vt-Vth)(H)(Vsoln)}{(Vmstd)(Va)}$$

$$CSO_2 = \frac{(7.05x10^{-5})(17.90)(0.0188)(590)}{(166.705)(10)}$$

$CSO_2 = 8.398x10^{-6}$ lb/std cu. ft.

Emission rate - $(CSO_2)(Qsstd)(60)$

Emission rate = $(8.397x10^{-6})(28658)(60)$

Emission rate = 14.4 lb/hr.

APPENDIX D

OPERATING RESULTS

SAMPLING TASK LOG

Plant Woodville Lime & Chemical
Date 7-8-78 to 7-12-74

Plant Location Woodville, Ohio
Recorded by C. E. Riley 10-3-74

Comments	Run	Sampling location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
7-8-74							
Contractor arrived at plant and setup his equipment				1300	1530		
Due to time restraints it was not possible to have a process engineer from EPA at the plant site during the testing. Therefore the project officer was responsible for monitoring the process as well as the NSPS testing. A flight delay caused me to arrive at the plant at				1675			
Upon arrival I'd noticed the stack opacity was showing between 0 and 5 percent. I checked in with Mr. Virgil Tadson, the plant vice president and also visited the ~~the~~ control room. Mr. Tadson ~~and also the~~ along with the control room operator stated that the process was operating satisfactorily with normal process conditions prevailing.							
Since test data were available from the May 20, 1974 test all preliminary work was by-passed.							
Kiln fuel is approximately 65 % oil and 35 % Nat. gas							
Started test	1	South	Particulate	1713	1913	120	
Switched ports				1913	1917		
Continued sampling	1	West	Part.	1917	~~2022~~ 2023	65	
Opacity exceeding 5 %; shut down test —				~~2022~~ 2022	2027		
Continued sampling	1	West	Part.	2027	2113	46	

SAMPLING TASK LOG

Plant Woodville Lime & Chemical
Date 7-8-74 & 7-9-74

Plant Location Lime Kiln; Woodville Ohio
Recorded by C. E. Riley

Comments	Run	Sampling location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
"A" field of ESP went out, due to breaker overload				2113	2116		
Particulate train was operated for about 1 min during				2113			
this time; Opacity up to 30-35 percent							
Allowed process to become stable through ESP				2116	2120		
Continued sampling	1	West	Part.	2120	2129	9	
Completed part. test	1		Part.	2129		240 min total	
Considered this test invalid due to the 1 min segment collected at 2112 to 2113							
This minute segment of 30 to 35 % opacity exceeded our desired sampling							
parameters, which were to performed the NSPS tests at the normal							
opacity range for the No. 1 kiln controlled emissions. This opacity range was determined							
to fall between 0 and 5 percent opacity.							
Started SO_2 test	1	West	SO_2	1713	1913	120	
Switched ports.				1913	1917		
Continued sampling	1	South	SO_2	1917	2022	65	
High opacity shut-down				2022	2027		
Continued sampling	1	South	SO_2	2027	2114	47	
Completed SO_2 test	1		SO_2	2114		232 min total	
Started NO_x test	1A	Bottom West	NO_x	1748		1	
	1B	" "	"	1848		1	
	1C	" "	"	1951		1	
Completed NO_x test	1D	" "	"	2048		1	
Started carrier gases test	1	Bottom West	CO_2, O_2, CO	1720	1915	115	

SAMPLING TASK LOG

Plant Woodville Lime & Chemical
Date 7-8-74 & 7-9-74

Plant Location Lime Kiln No.1 Woodville, Ohio
Recorded by C. E. Riley

Comments	Run	Sampling location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
Continued sampling (carrier gases)	1	Bottom West	CO_2, O_2, CO	1920	2115	115	
Completed carrier gaseous test	1		CO_2, O_2, CO	2115		230 min total	
Carried out cleaning and sample recovery				2130	2330		
During washing of probe glass liner, found nozzle end to be broken and several pieces of glass were noticed in the bottom of the sample container. These were to be removed by PEDCo personnel during the lab analysis.							
7-9-74							
0730 Arrived plant; opacity is between 0 and 5 %							
Started part test	2	South	Part.	0841	1041	120	
Opacity observers recorded several 10 % readings during this time, but these only lasted for ~~test~~ less than 15 seconds.							
Switched ports				1041	1045		
Continued sampling	2	West	Part.	1045	1100	15	
Stopped to exchange silica gel impinger				1100	1103		
Continued sampling	2	West	Part	1103	1248	105	
Completed part test	2		Part.	1248		240 min total	
Opacity observers reported that during the West port testing that the opacity had increased, ~~and~~ with readings as high as 20 percent for short intervals of time							
Started SO_2 test	2	West	SO_2	0842	1037	115	
Switched ports (leaked check train)				1037	1046		
Continued sampling	2	South	SO_2	1046	1246	120	

SAMPLING TASK LOG

Plant Woodville Lime & Chemical
Date 7-9-74 to 7-10-74

Plant Location No. 2 lime kiln, Woodville Ohio
Recorded by C. E. Riley

7-9-74 Comments	Run	Sampling location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
Completed sampling SO_2	2		SO_2	1246		235 min total	
Started NO_x test	2A	Bottom West	NO_x	0915		1	
	2B	" "	NO_x	1015		1	
	2C	" "	NO_x	1115		1	
	2D	" "	NO_x	1215		1	
Completed NO_x test				1215			
Started carrier gases test	2	Bottom West	CO_2, O_2, CO	0845	1030	105	
Continued sampling (carrier gases	2	" "	CO_2, O_2, CO	1050	1240	110	
Completed carrier gases sampling	2		CO_2, O_2, CO	1240		915 min total	
Carried out cleanup and sample recovery				1300	1630		
Plant personnel washed down the fan on the No. 1 unit				1330			
Power to fan was mistakenly left off until around 1600 (4-12 shift)							
Prepared to start 3rd series of test at 1730, but stack opacity was							
exceeding the 5% desired limit. readings observed were between 5 + 15%.							
Decided to delay 3rd test til 7-10-74; due to kiln operation being							
unstable because of the fan shut down and the high opacity readings.							
7-10-74							
0700 Arrived plant; Observed opacity to be between 0 and 5%							
Started part test	3	South	Part.	0824	0839	15	
Shut down to install thermocouple on stack probe				0839	0843		
Continued sampling	3	South	Part.	0843	0857	14	
Shut down again (high vacuum problem)				0857	0900		

SAMPLING TASK LOG

Plant Woodville Lime & Chemical
Date 7-10-74 to 7-11-74

Plant Location Woodville Ohio
Recorded by C. E. Riley

7-10-74 Comments	Run	Sampling location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
Continued sampling	3	South	Part.	0900	0902	2	
Shut down again (high vacuum problem				0902	0913		
Found silica gel in umbilical hose; removed particles							
also performed leak check on train					0913		
Continued sampling	3	South	Part.	0913	0922	9	
Shut down to replace silica gel imps				0922	0939		
Continued sampling	3	South	Part.	0929	1049	80	
Switched ports	3			1049	1055		
Continued sampling	3	West	Part.	1055	1255	120	
Completed part. test	3		Part.	1255		240 min total	
Visible emission reader read several 10% opacities for short periods; mostly 0.5%							
Started SO_2 test	3	West	SO_2	0824	1050*	120	
Continued sampling	3	South	SO_2	1055	1250	115	
Completed SO_2 sampling	3		SO_2	1250		235 min total	
Started NO_x test	3A	Bottom West	NO_x	0920		1	
	3B	" "	"	1033		1	
	3C	" "	"	1130		1	
Completed NO_x test	3D	" "	"	1230		1	
Started carrier gases test	3	Bottom West	CO_2, O_2, CO	0830	1030	120	
Continued test	3	" "	CO_2, O_2, CO	1100	1245	105	
Completed test	3		CO_2, O_2, CO	1245		225 min total	
Carried out cleanup and sample recovery				1300	1430		

* See down times for particulate run 3 South port!

SAMPLING TASK LOG

Plant Woodville Lime & Chemical
Date 7-10-74 to 7-11-74

Plant Location Woodville, Ohio
Recorded by C. E. Riley

7-10-74 Comments	Run	Sampling location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
Prepared to collect another sample to replace the No. 1 voided test							
Started Part. test	4	South	Part	1500	1630		
Shut down test; Opacity increased 15 to 20 %					1630		
Opacity still high 10 to 15 %; Decided to discard sample and restart test on 7-11-74.					1800		
While cleaning the particulate train the glass liner was found to be broken. This along with the excessive high opacity voided the test!							
7-11-74							
0730 Arrived plant. opacity was between 5 and 10 %							
Plant personnel started to check for causes of the high opacity readings							
Increased fuel oil to kiln; 90% oil – 10% Nat. gas					1000		
This supposedly would create a higher SO_2 concentration and therefore increase the collection efficiency; after ½ hour no change was noticed in the stack opacity.							
Increased total fuel feed to kiln. This would establish a true combustible condition; almost immediately the kiln temperature dropped.					1100		
Increased excess air supply to increase oxygen ~~to~~ in firing zone					1400		
Temperature to ESP is 600 / somewhat lower than normal							
Increased ESP inlet temperature and slowly started to reduce load in kiln. Kiln drive motor amps are above normal run mark; this is an indication that the kiln has increased in material load. Decided to let process run and possibly stabilize overnite; Decision to test or go home will be made in the morning.							

SAMPLING TASK LOG

Plant Woodville Lime & Chemical
Date 7-10-74 to 7-12-74

Plant Location Woodville, Ohio
Recorded by C. E. Riley

7-11-74	Comments	Run	Sampling location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
2230	Checked stack opacity; against black background the opacity was observed to be between 20 and 25 %.							
7-12-74								
0600	Checked stack opacity; still reading between 5 and 10 % values							
1000	Plant personnel inspected plates inside the ESP unit; found plates to be coated with about 1 inch of sticky material. Mr. Tadson stated that this was the problem and that the kiln would have to be shut down several days to clean out the ESP. He stated he would plan a scheduled shut-down for the week of July 15, 1974. During which the plant would rebrick certain sections of the kiln; perform routine maintance on and clean out the ESP unit. Hopefully he stated he would be back in operation by the week of July 29. He suggested that future tests should be planned for the week of August 5, 1974 if he was able to meet his intended schedule. He further suggested I call him the latter part of July to check on the planned schedule. 1100 Departed plant site for duty station.							
7-23-74	I called Mr. Tadson. He relayed that the No. 1 kiln was down and that they were presently rebricking the kiln and cleaning, repairing the ESP unit. I told him I would call the next week and check on his start-up schedule.							
7-29-74	I ~~A~~ called Mr. Tadson again; he said the was back in operation and the stack was ~~observed~~ observed to be clear. ~~on stack~~. He further stated that when they cleaned out the ESP they found several passage blocked.							

SAMPLING TASK LOG

Plant Woodville Lime & Chemical
Date 10-3-74

Plant Location Woodville Ohio
Recorded by C. E. Riley

7-29-74 Comments	Run	Sampling location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
We estimated these areas to represent up to about ½ of the total area. These blocked areas caused an increase in air flow ~~through~~ the remaining portion of the ESP. This in turn ~~resulted in~~ allowed higher than normal velocity air stream to pass through the unit's fields. Mr. Tadson quoted the air flow to be as much as 10 to 12 ft^3/second. This would naturally reduce the collection efficiency of the ESP unit.							
Mr. Tadson said that perforated plates situated at the ESP inlet to direct air streams were found to be partially blocked; as stated above. He further stated that these plates distributed the air flow equally to the different sections of the ESP. In addition to the plate blocking, an ½" sticky film was found on the collection plates along with a 1 to 2 foot dust buildup at the bottom of the ESP. This dust buildup surrounded a moveable dust removal device, causing it to become stationary; hence, the collected dust was not being removed from the bottom of the collector. During the kiln shut down, all of the above mentioned conditions were corrected.							
See Appendix F for date and times kiln fuel oil, rock feed, product, and ESP dust samples were collected!							

Company: Woodville Lime | Location: Woodville, Ohio

Facility: Lime Kiln | Unit No. 1

Operators: | Date 7-8-74

Data Set No. | Page 1

	Time (24-hour clock)							
1700	Units	1800	1900	2000	2100		Avg	
Stone Totalizer 742959	N.A.	747444	751924	756405	760889			
Stone Rate	Tons/hr.	44.85	44.80	44.71	44.84		44.8	avg.
Oil Totalizer 671425	Gals.	671767	672081	672407	672884			
Oil Rate	Gals/hr.	342	314	316	317		32.2	
~~Gas Totalizer~~ Corrected Stone Rate T/hr	~~Ft³~~						~~3268~~	
Gas Rate	Ft^3/hr							
% Oil to % Gas	% Oil / % Gas							
Firing Zone Tempt	°F	2640	2650	2620	2640		2638	
Middle Kiln Tempt	°F	1460	1460	1465	1460		1462	
Feed End Kiln Tempt	°F	1020	1030	1040	1040		1033	
ESP Inlet Tempt	°F	683	690	700	700		693	
ESP Outlet Tempt	°F	660	660	675	675		668	
ESP "A" Field								
Primary Current	amps	46	39	47	50		46	
Primary Voltage	volts	255	256	275	275		264	
Precipitator Current	amps	.23	.20	.26	.30		.25	
ESP "B" Field								
Primary Current	amps	50	41	55	55		50	
Primary Voltage	volts	245	240	260	255		250	
Precipitator Current	amps	.27	.28	.35	.33		.31	
Mode of Operation A/B	Auto / Manual	A/A	A/A	A/A	A/A		A/A	

COMMENTS: 2113 HRS "A" FIELD WENT OUT FOR APPROX 2 MINUTES

Company WOODVILLE LIME | Location WOODVILLE, OHIO

Facility LIME KILN | Unit No. 1

Operators BOB BROSSIA | Date 7-9-74

Data Set No. | Page 2

	Time (24-hour clock)								
0842	Units	0900	1000	1100	1200	1300		Avg	
Stone Totalizer 813406	N.A.	817757	819235	823712	828148	832579			
Stone Rate	Tons/hr.	44.29	44.78	44.77	44.36	44.31		~~44.6~~ 44.56 avg	
Oil Totalizer 676831	Gals.	676988	677300	677663	678020	678375			
Oil Rate	Gals/hr.	363	362	363	357	335		356	
~~Gas Totalizer~~ Corrected Stone Rate T/hr	~~ft³~~							~~32.49~~	
Gas Rate	ft^3/hr								
% Oil to % Gas	% Oil / % Gas								
Firing Zone Tempt	°F	2635	2600	2640	2650	2645		2634	
Middle Kiln Tempt	°F	1470	1475	1460	1450	1450		1461	
Feed End Kiln Tempt	°F	1035	1010	1000	1000	1000		1009	
ESP Inlet Tempt	°F	700	690	690	685	685		690	
ESP Outlet Tempt	°F	690	680	670	670	660		682	
ESP "A" Field									
Primary Current	amps	37	41	46	45	45		43	
Primary Voltage	volts	255	255	245	250	250		255	
Precipitator Current	amps	.22	.19	.22	.20	.23		.21	
ESP "B" Field									
Primary Current	amps	52	54	54	50	51		52	
Primary Voltage	volts	250	250	240	245	240		245	
Precipitator Current	amps	.30	.30	.30	.28	.30		.30	
Mode of Operation A/B	Auto / Manual	A/A	A/A	A/A	A/A	A/A		A/A	

COMMENTS: START TIME APPX 0842 - HEAVY LOAD ABOUT 175 AMPS

Company WOODVILLE LIME | Location WOODVILLE, OHIO

Facility LIME KILN | Unit No.

Operators BOB BROSSIA | Date 7-10-74

Data Set No. | Page 3

		Time (24-hour clock)							
0700	Units	0800	0900	1000	1100	1200	1300		Avg.
Stone Totalizer 912977	N.A.	916766	921244	925726	930172	934653	939132		
Stone Rate	Tons/hr.	44.89	44.78	44.82	44.46	44.81	44.79		44.7
Oil Totalizer 685002	Gals.	685382	685764	686142	686516	686887	687253		
Oil Rate	Gals/hr.	380	382	378	374	371	366		375
Corrected Stone Rate ~~Gas Totalizer~~ T/hr.	~~Ft³~~								~~326~~
Gas Rate	Ft³/hr								
% Oil to % Gas	% Oil / % Gas								
Firing Zone Tempt	°F	2620	2600	2590	2610	2610	2620	2590 2620	260
Middle Kiln Tempt	°F	1510	1510	1510	1520	1510	1470	1470 1520	150
Feed End Kiln Tempt	°F	1080	1070	1075	1070	1060	1050	1050 1080	106
ESP Inlet Tempt	°F	725	720	715	715	709	706	700 725	714
ESP Outlet Tempt	°F	700	700	700	700	700	670	670 700	695
ESP "A" Field									
Primary Current	amps	61	~~45~~	48	58	57	57	48 61	56
Primary Voltage	volts	265		250	270	270	273	250 270	264
Precipitator Current	amps	.32		.20	.31	.31	.31	.20 .32	.29
ESP "B" Field									
Primary Current	amps	53		57	54	61	60	53 61	5
Primary Voltage	volts	240		245	245	250	245	240 250	24
Precipitator Current	amps	.34		.35	.37	.35	.32	.32 .37	.3
Mode of Operation A/B	Auto / Manual	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/

COMMENTS: 1/2 AT 1050

WOODVILLE LIME WOODVILLE, OHIO

CHRONOLOGICAL LIST OF NOTES THROUGHOUT PROJECT _____ (NOT COVERED BY DAILY PERSONNEL AND LOG SHEET)

LIME KILN 7-10-79 PAGE #4

DATE	~~TIME~~		EVENT	1600	1700	1800	1900	2000
	1		948046	952527				
	2		44.80	44.81				
	3		688010	688382				
	4		377	372				
	5		2625	2600	2580			
	6		1450	1450	1480			
	7		1050	1036	1020			
	8		710	716	700			
	9		670	675	665			
	10		58	57	58			
	11		270	270	270			
	12		3.20	3.05	.32			
	13		60	64	56			
	14		250	240	235			
	15		3.25	3.80	.30			
	16		A	A	A			
			A	A	A			

Company: Woodville Lime | Location: Woodville, Ohio

Facility: No. 1 Lime Kiln | Unit No. 1

Operators: | Date: See below

Data Set No. | Page

	Units	Time (24-hour clock) 7-8	7-9	7-10					
Stone Totalizer	N.A.								
Stone Rate	Tons/hr.	44.82	44.56	44.73					
Oil Totalizer	Gals.								
Oil Rate	Gals/hr.	322	356	375					
Corrected Stone Rate ~~Gas Totalizer~~ T/hr	Ft^3	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~					
Gas Rate	Ft^3/hr								
% Oil to % Gas	% Oil / % Gas			3590					
Firing Zone Tempt	°F	2620 2650	2600 2650	~~2590~~ 2620					
Middle Kiln Tempt	°F	1460 1465	1450 1475	1470 1520					
Feed End Kiln Tempt	°F	1020 1040	1000 1035	1050 1080					
ESP Inlet Tempt	°F	683 700	685 700	700 725					
ESP Outlet Tempt	°F	660 675	660 690	670 700					
ESP "A" Field									
Primary Current	amps	39- 50	37 46	48 61					
Primary Voltage	volts	250 275	250 265	250 270					
Precipitator Current	amps	.20 .30	.19 .23	.20 .32					
ESP "B" Field									
Primary Current	amps	41 55	50 54	53 61					
Primary Voltage	volts	240 260	240 250	240 250					
Precipitator Current	amps	.27 .35	.28 .30	.32 .37					
Mode of Operation	Auto / Manual	A / A	A / A	A / A					

COMMENTS:

9-30-74
C E Riley

Please [illegible] and return to me. Gene R.

WOODVILLE LIME AND CHEMICAL COMPANY

Office of the Vice President

Phone 849-4311
WOODVILLE, OHIO

August 23, 1974

EPA
Mutual Plaza
Room 926
Research Triangle Park, N. C. 27711

Attn: Mr. Gene Riley

Dear Sir:

Herewith enclosed please find copies of your research data sheets, with the stone rate recalculated to a more reasonable figure. This information was placed in your column for Gas Totalizer, which I have relabled as ~~Corrected~~ Stone Rate T/hr. The factor that I used was 0.7291666. This factor times the total indicated tonnage gives us a reasonable figure to calculate the amount of lime produced.

As I indicated our oil totalizer gives us a very good indication of the total amount of oil used, but as a whole I tend to discount the hour by hour figures.

incorrect factor
C E. Riley

Yours very truly,

George Judd
Chief Chemist

APPENDIX E

FIELD DATA

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Woodville Lime
DATE 5-20-74 & 7-8-74
SAMPLING LOCATION No. 1 Kiln ESP Stack
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A) 63 5/8"
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) 1/8"
STACK I.D., (DISTANCE A - DISTANCE B) 63 1/2"
NEAREST UPSTREAM DISTURBANCE 12'-2" or 146" = 2.30 dia
NEAREST DOWNSTREAM DISTURBANCE 48" = 0.76 dia
CALCULATOR

SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	1.1	63.5	~~.70~~ 1.0	1/8"	1 1/8
2	3.2		2.03		2 1/8
3	5.5		3.49		3 5/8
4	7.9		5.02		5 1/8
5	10.5		6.67		6 3/4
6	13.2		8.38		8 1/2
7	16.1		10.2		10 3/8
8	19.4		12.3		12 1/2
9	23.0		14.6		14 3/4 ? 14 3/4
10	27.2		17.3		17 1/2
11	32.3		20.5		20 5/8
12	39.8		25.3		25 1/2
13	60.2		38.2		38 3/8
14	67.7		43.0		43 1/8
15	72.8		46.2		46 3/8
16	77.10		48.9		49
17	80.6		51.2		51 3/8
18	83.9		53.3		53 1/2
19	86.8		55.1		55 1/4
20	89.5		56.8		56 7/8
21	92.1		58.5		58 5/8
22	94.5		60.0		60 1/8
23	96.8		61.5		61 5/8
24	98.9	63.5	~~62.8~~ 62.5	1/8"	62 5/8

PA (Dur) 232
72

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
Woodville Lime Chem., Woodville Ohio	7/18/79	Lime Kiln #2, ESP Outlet	Particulate

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS (IN.HG)	STATIC PRESS. (IN.H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp
1	EM + MB	120	29.8		100108		.83

PROBE LENGTH AND TYPE	NOZZLE I. D. INCHES	H_2O (%)	SAMPLE BOX NO.	METER BOX NO.	METER ΔH @	C FACTOR	PROBE HEAT SET	BOX HEAT SET.	REF. ΔP	RECORD DATA MINS.
6' Pyrex Glass	.375	12	2	FM-3	1.36	.74	.80	230	2.4 / 2.3	5.0

EMISSION TESTING FIELD DATA

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F
	0	1713	946.294									
24	5.0	①	949.240	.30	2.30	2.30	642	118	118	4.5	200	80
23	10.0		954.115	.31	2.35	2.35	639	118	118	4.5	210	77
22	15.0		958.716	.31	2.35	2.35	640	118	117	4.5	200	90
21	20.0		963.702	.35	2.65	2.65	639	120	117	4.5	198	90
20	25.0		968.988	.39	2.95	2.95	639	123	117	4.5	195	90
19	30.0		974.431	.41	3.05	3.05	641	124	117	5.0	220	90
18	35.0		979.972	.42	3.20	3.20	648	127	117	5.5	195	90
17	40.0		985.635	.44	3.30	3.30	645	129	118	5.5	215	88
16	45.0		991.481	.45	3.40	3.40	645	130	118	5.8	225	87
15	50.0		997.367	.47	3.55	3.55	642	126	118	6.0	215	83
14	55.0		1003.358	.48	3.65	3.65	647	129	118	6.0	210	79
13	60.0		1009.328	.48	3.65	3.65	654	122	118	6.0	215	79
12	65.0		1015.306	.47	3.55	3.55	649	120	117	5.8	215	78
11	70.0		1021.909	.48	3.65	3.65	649	118	117	5.5	220	78
10	75.0		1022.235	.48	3.65	3.65	650	115	114	5.7	225	78
9	80.0		1033.176	.48	3.65	3.65	650	114	114	5.7	230	79
8	85.0		1038.914	.44	3.30	3.30	658	113	113	5.7	230	80
7	90.0		1044.587	.43	3.25	3.25	649	112	112	5.6	230	77
6	95.0		1050.070	.41	3.05	3.05	630	110	110	5.5	230	74
5	100.0		1055.638	.43	3.25	3.25	622	108	108	5.5	200	75
4	105.0		1061.209	.42	3.20	3.20	612	106	106	5.4	200	75
3	110.0	②	1066.593	.38	3.00	3.00	590	106	106	5.5	200	75
2	115.0		1071.426	.30	2.40	2.40	525	104	104	5.0	225	73
1	120.0	19.13	1075.500	.18	1.70	1.70	460	103	103	5.0	250	72

LEAKAGE @ 15 "Hg = 0 CFM

GAS METER COR. 1.11

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CINCINNATI OHIO 45246

[redacted] of stack so First 3 points were sampled on 21

(2) Reset Nomograph for 575° MED.

(3) Reset Nomograph For 450° Med.

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
Woodville Lime Chem, Woodville Ohio	7/8/74	Lime Kiln #2	Particulate

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS (IN.HG)	STATIC PRESS. (IN.H_2)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp
1	EM + MB	90	29.48		100180		.83

PROBE LENGTH AND TYPE	NOZZLE I. D. INCHES	H_2O (%)	SAMPLE BOX NO.	METER BOX NO.	METER ΔH @	C FACTOR	PROBE HEAT SET	BOX HEAT SET.	REF. ΔP	RECORD DATA MINS.
6' Glass	.375	12	2	RM-3	1.36	.74 (2) .71	.80	230	.235 (2) 240 (3) 2.25	5.0

EMISSION TESTING FIELD DATA

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F
	0	1917	075.500									
24	125.0		080.190	.31	2.40	2.40	628	100	100	5.0	210	75
23	130.0		085.191	.32	2.60	2.60	618	101	101	5.8	215	72
22	135.0		090.015	.32	2.50	2.50	617	102	101	5.8	235	74
21	140.0		095.046	.34	2.65	2.65	630	102	101	6.0	230	73
20	145.0		100.314	.36	2.75	2.75	638	102	100	6.0	225	73
19	150.0		105.607	.38	2.90	2.90	639	104	100	6.0	220	72
18	155.0		111.093	.39	3.00	3.00	642	105	100	6.0	220	72
17	160.0		116.563	.42	3.20	3.20	639	106	100	6.1	215	73
16	165.0		122.241	.44	3.35	3.35	639	107	100	6.2	210	75
15	170.0		128.009	.45	3.40	3.40	637	108	99	6.3	215	74
14	175.0		133.735	.45	3.40	3.40	635	108	100	6.3	220	72
13	180.0		139.392	.44	3.35	3.35	640	108	101	6.2	220	70
12	185.0	2027	145.186	.43	3.30	3.30	639	109	100	6.2	225	70
11	190.0		150.435	.41	3.10	3.10	652	104	98	5.8	225	70
10	195.0		156.991	.41	3.10	3.10	649	105	99	5.8	227	71
9	200.0		161.375	.42	3.20	3.20	660	105	98	6.0	230	72
8	205.0		166.811	.41	3.10	3.10	655	106	98	6.0	228	72
7	210.0		172.241	.39	3.00	3.00	650	106	98	5.9	225	71
6	215.0		177.475	.36	2.75	2.75	638	105	98	5.8	221	71
5	220.0		182.467	.35	2.70	2.70	625	105	97	5.8	210	71
4	225.0		187.551	.34	2.60	2.60	521	104	98	5.8	208	72
3	230.0	2140	192.755	.33	2.75	2.75	485	103	97	5.8	205	73
2	235.0		198.091	.33	2.75	2.75	475	97	96	5.8	220	72
1	240.0	2129	203.205	.33	2.75	2.75	475	98	96	5.5	245	70

LEAKAGE @ 15 "Hg = 0 CFM

GAS METER COR. 1.11

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✓ Nomograph set for 625, Samples (24,23,22) first 3 points on #22

(2) Reset nomograph to 100° Meter Temp.

(3) Down at 2023 because of large particulates coming out of stack. Up at 2027 by orders of BP

(4) reset nomograph for ~~60~~ 500°

(5) Unable to move box out any further because of ~~[illegible]~~ restrictions scaffolting

2114 Down Fuse blown in ESP
2120 up

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Woodville Lime
DATE 7-8-74
SAMPLING TIME (24-hr CLOCK) 1720 → 1915 & 1920 → 2115
SAMPLING LOCATION ESP kiln outlet
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) integrated
ANALYTICAL METHOD Orsat
AMBIENT TEMPERATURE 100°
OPERATOR Bill Dawes

COMMENTS:

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	21.8	21.8	21.5	21.5	21.7	21.7	21.66	44/100	9.53
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	29.8	8.0	29.6	8.1	29.6	7.9	8.0	32/100	2.56
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	29.8	0	29.6	0	29.6	0	0	28/100	0
N_2 (NET IS 100 MINUS ACTUAL CO READING)							70.34	28/100	19.70
								TOTAL	31.79

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513/771-4330

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
Woodville Chem. Co., Woodville Ohio	7/9/74	Lime Kiln #1, ESP Outlet	Particulate

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS (IN.HG)	STATIC PRESS. (IN.H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp
3	EM + MB	88	29.48		100104		.83

PROBE LENGTH AND TYPE	NOZZLE I. D. INCHES	H_2O (%)	SAMPLE BOX NO.	METER BOX NO.	METER ΔH @	C FACTOR	PROBE HEAT SET	BOX HEAT SET.	REF. ΔP	RECORD DATA MINS.
6' Glass	.375	12		FM-3	1.36	.72	80	230	.250 (2) .230	5.0

EMISSION TESTING FIELD DATA

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F
	0	841	203.456									
24	5.		208.971	.41	3.00	3.00	668	94	90	3.8	240	66
23	10.		214.194	.41	3.00	3.00	670	98	91	3.8	245	64
22	15.		219.621	.41	3.00	3.00	671	101	92	3.8	230	68
21	20.		224.958	.43	3.11	3.11	670	104	93	4.0	225	71
20	25.		230.491	.44	3.20	3.20	670	107	94	4.2	220	74
19	30.		236.086	.45	3.30	3.30	669	109	95	4.4	210	81
18	35.		241.766	.47	3.40	3.40	670	111	96	4.6	205	87
17	40.		247.555	.48	3.50	3.50	668	113	97	4.6	212	84
16	45.		253.516	.50	3.70	3.70	670	114	98	4.8	217	80
15	50.		259.511	.50	3.70	3.70	663	115	100	4.9	222	76
14	55.		265.290	.49	3.60	3.60	668	117	100	4.8	226	79
13	60.		271.189	.49	3.60	3.60	668	117	101	5.0	227	83
12	65.		277.015	.49	3.60	3.60	685	117	103	5.0	230	85
11	70.		282.910	.48	3.50	3.50	691	116	103	5.0	236	81
10	75.		288.674	.46	3.30	3.30	690	116	104	5.0	240	79
9	80.		294.416	.46	3.30	3.30	692	114	104	5.0	245	78
8	85.		299.736	.40	2.95	2.95	695	114	105	4.8	240	80
7	90.		305.271	.41	3.04	3.04	698	114	105	5.0	235	79
6	95.		310.664	.40	2.95	2.95	698	113	106	5.0	230	78
5	100.		315.896	.38	2.75	2.75	688	114	106	4.8	235	78
4	105.		321.214	.39	2.85	2.85	689	115	106	4.8	235	79
3	110.		326.315	.36	2.65	2.65	670	114	106	4.8	230	80
2	115.		(2) 330.886	.27	2.00	2.00	622	114	107	4.3	227	81
1	120.	1049	335.034	.21	1.68	1.68	540.0	113	106	4.2	225	83

LEAKAGE @ 15 "Hg = 0 CFM

GAS METER COR. 1.11

5082 74.73 16083

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① Sample first three points on #22.

② ~~Reset~~ Reset Nomograph for 550°

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
Woodville Chem. Co., Woodville Ohio	7/19/78		

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS (IN.HG)	STATIC PRESS. (IN.H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp
3		111	29.48				

PROBE LENGTH AND TYPE	NOZZLE I. D. INCHES	H_2O (%)	SAMPLE BOX NO.	METER BOX NO.	METER ΔH @	C FACTOR	PROBE HEAT SET	BOX HEAT SET.	REF. ΔP	RECORD DATA MINS.
						.72			.25	

EMISSION TESTING FIELD DATA

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F
	0	1045	335.034									
W24	125.	①	339.788	.33	2.41	2.41	650	110	107	4.5	240	72
23	130.		344.736	.33	2.41	2.41	670	112	107	4.8	240	73
22	135.	1100 D ②	349.505	.33	2.41	2.41	670	112	107	5.0	235	73
21	140.		354.467	.34	2.50	2.50	672	111	107	5.2	230	72
20	145.		359.600	.37	2.70	2.70	675	113	107	5.3	225	71
19	150.		365.188	.42	3.10	3.10	681	115	108	6.0	218	73
18	155.		370.706	.43	3.20	3.20	683	115	108	6.0	213	75
17	160.		376.507	.47	3.40	3.40	678	116	108	6.1	205	77
16	165.		382.378	.48	3.50	3.50	670	117	108	6.2	210	76
15	170.		388.484	.50	3.70	3.70	661	117	109	6.5	215	76
14	175.		394.425	.50	3.70	3.70	660	117	109	6.6	220	75
13	180.		400.476	.52	3.80	3.80	655	118	110	7.0	220	74
12	185.		406.461	.49	3.65	3.65	660	119	110	7.0	225	79
11	190.		412.254	.47	3.40	3.40	672	120	110	6.8	230	79
10	195.		417.899	.46	3.30	3.30	680	120	111	6.8	220	73
9	200.		423.588	.45	3.30	3.30	678	120	111	6.8	210	71
8	205.		429.236	.42	3.10	3.10	678	120	111	6.5	200	70
7	210.		434.100	.36	2.65	2.65	678	117	112	6.3	220	70
6	215.		439.345	.34	2.41	2.41	670	117	111	6.0	230	69
5	220.		443.927	.28	2.05	2.05	662	116	111	5.8	240	69
4	225.		448.583	.30	2.20	2.20	660	116	111	5.5	235	69
3	230.	③	453.364	.31	2.30	2.30	660	116	111	6.0	230	69
2	235.		458.031	.29	2.15	2.15	655	116	111	5.8	224	68
1	240.0	1248	462.683	.29	2.15	2.15	651	115	111	5.8	215	68

LEAKAGE @ ____ "Hg = ____ CFM

GAS METER COR. 1.01

144.22 32,112 10,493

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CINCINNATI, OHIO 45246

① First 3 points sampled at st. #22

② Down to switch silica Gel 1100
1103 up

③ Can't move box out any further

so will hold on #3

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
Woodville Chem. Co., Woodville Ohio	7/10/74	Lime Kiln #2, Esp Outlet	Particulate

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS (IN.HG)	STATIC PRESS. (IN.H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp
5	EM + MB	90	29.40	.	100115	. x .	.83

PROBE LENGTH AND TYPE	NOZZLE I. D. INCHES	H_2O (%)	SAMPLE BOX NO.	METER BOX NO.	METER ΔH @	C FACTOR	PROBE HEAT SET	BOX HEAT SET.	REF. ΔP	RECORD DATA MINS.
6' Glass with 3" SS Tip	.375	12	2	EM-3	1.36	.72	280	230	2.5	5.0

EMISSION TESTING FIELD DATA

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F
	0	824	962.872									
24	~~125~~ .5		467.485	.30	2.20	2.20	690	90	87	7.0	235	67
23	~~130~~ .10		472.035	.30	2.20	2.20	695	93	87	7.0	240	68
22	~~135~~ .15	839	476.800	.34	2.40	2.40	688	99	87	7.8	232	72
21	~~140~~ .20		481.954	.40	2.45	2.95	680	101	90	9.5	228	76
20	~~145~~ .25		487.238	.41	3.00	3.00	671	104	91	10.0	220	78
19	~~150~~ .30	857	492.713	.44	3.20	3.20	672	108	92	11.0	200	64
18	~~155~~ .35	0913 AP	499.216	.51	3.75	3.75	690	108	95	16.5	215	60
17	~~160~~ .40	0922 am	505.051	.48	3.50	3.50	690	108	96	16.5	210	66
16	~~165~~ .45		511.973	.53	3.40	3.90	688	106	96	4.2	220	69
15	~~170~~ .50		518.016	.55	4.00	4.00	685	110	98	4.5	225	72
14	~~175~~ .55		524.173	.55	4.00	4.00	680	111	98	4.5	230	73
13	~~180~~ .60		530.315	.54	3.95	3.95	675	111	99	4.6	235	74
12	~~185~~ .65		536.462	.54	3.95	3.95	681	111	100	4.6	240	75
11	~~190~~ .70		542.446	.51	3.71	3.71	690	110	100	4.6	240	74
10	~~195~~ .75		548.492	.52	3.80	3.80	697	110	100	4.6	230	74
9	~~200~~ .80		554.425	.50	3.70	3.70	690	110	100	4.5	220	75
8	~~205~~ .85		560.365	.47	3.50	3.50	695	111	101	4.5	250	75
7	~~210~~ .90		565.936	.45	3.30	3.30	691	112	101	4.6	240	74
6	~~215~~ .95		571.370	.41	3.00	3.00	690	112	101	4.4	230	73
5	~~220~~ 1.00		576.820	.41	3.00	3.00	695	111	101	4.2	225	72
4	~~225~~ 1.05		582.086	.37	2.75	2.75	695	111	102	4.1	233	71
3	~~230~~ 1.10		587.082	.35	2.55	2.55	675	110	101	4.0	240	71
2	~~235~~ 1.15		591.981	.31	2.28	2.28	625	110	101	3.8	225	71
1	~~240~~ 1.20	1049	596.376	.27	1.95	1.95	580	108	101	3.8	215	72

LEAKAGE @ ____ "Hg = ____ CFM

GAS METER COR. ___

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① sample first two points at point #23.

② Down at 0839 to install Thermocouple probe. MB, G.R
0843 up.

③ Down at 857 to try and fix high vacuum by checking silica Gel impinger
0900 up, 0902 Down again
INT Meter Reading 494.471, Time 31.9 on clock
FIN. 495.642

Problem was silica gel in sample head, new leak check .01 at 15"

Down 0922, Meter 505.051
up 0934 505.922
problem was in silica gel impinger.
Started ~~old~~ with 400g and keep pulling gel into sample head. Solution was to go with 200g.

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
Woodville Chem. Co., Woodville Ohio	7/10/74	Lime Kiln # 1 ESP Outlet	Particulate

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS (IN.HG)	STATIC PRESS. (IN.H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp
5	EMr MB	[illegible]	29.90		100815		.83

PROBE LENGTH AND TYPE	NOZZLE I. D. INCHES	H_2O (%)	SAMPLE BOX NO.	METER BOX NO.	METER ΔH @	C FACTOR	PROBE HEAT SET	BOX HEAT SET.	REF. ΔP	RECORD DATA MINS.
6' Glass with 3" S.S. cp	.375	12	2	FM-3	1.36	.250	.80	230	.12	5.0

EMISSION TESTING FIELD DATA

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F
	0	1055	593.376									
24	~~5~~ 13	0	601.625	.39	2.50	2.50	665	102	100	4.2	245	81
23	~~10~~ 30		606.207	.39	2.50	2.50	650	104	100	4.2	250	80
22	~~15~~ 35		611.631	.42	3.10	3.10	652	106	100	5.0	225	78
21	~~20~~ 40		617.195	.44	3.20	3.20	655	106	98	5.0	215	76
20	~~25~~ 45		622.885	.47	3.45	3.45	662	107	99	5.4	218	73
19	~~30~~ 50		628.803	.50	3.70	3.70	662	108	99	5.4	220	70
18	~~35~~ 55		634.817	.51	3.71	3.71	668	110	99	5.5	245	70
17	~~40~~ 60		640.879	.53	3.90	3.90	665	113	100	5.5	243	72
16	~~45~~ 65		646.970	.53	3.90	3.90	660	116	100	5.6	240	74
15	~~50~~ 70		653.096	.54	3.95	3.95	662	117	100	5.7	245	74
14	~~55~~ 75		659.275	.53	3.90	3.90	665	116	101	5.7	255	75
13	~~60~~ 80		665.359	.53	3.90	3.90	665	116	102	5.7	265	76
12	~~65~~ 85		671.513	.54	3.95	3.95	663	116	102	5.7	210	81
11	~~70~~ 90		677.648	.53	3.90	3.90	670	115	103	6.0	245	75
10	~~75~~ 95		683.613	.51	3.71	3.71	672	113	102	5.8	235	75
9	~~80~~ 100		689.595	.50	3.70	3.70	688	114	102	5.8	238	75
8	~~85~~ 105		695.298	.45	3.30	3.30	698	113	102	5.7	240	76
7	~~90~~ 110		700.875	.43	3.15	3.15	695	112	102	5.5	245	74
6	~~95~~ 115		706.407	.43	3.15	3.15	690	111	103	5.5	250	71
5	~~100~~ 120		711.915	.41	3.05	3.05	688	115	102	5.3	215	69
4	~~105~~ 125		717.435	.43	3.15	3.15	695	115	102	5.3	230	71
3	~~110~~ 130		722.951	.42	3.10	3.10	685	114	103	5.3	246	73
2	~~115~~ 135		727.825	.32	2.38	2.38	695	115	104	5.0	230	75
1	~~120~~ 140	1255	732.105	.24	1.78	1.78	610	114	105	4.5	220	78

LEAKAGE @ 15 "Hg = .005 CFM

GAS METER COR. 1.011

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0 First two points sampled
at #23

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Woodville Lime & Chemical

DATE 7-10-74

SAMPLING TIME (24-hr CLOCK) 0830 ⇒ 1030 & 1100 ⇒ 1245

SAMPLING LOCATION ESP outlet - Lime kiln No. 1

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) integrated

ANALYTICAL METHOD Orsat

AMBIENT TEMPERATURE 95°

OPERATOR E. Meer

COMMENTS:

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	19.8	19.8	19.6	19.6	19.5	19.5	19.6	44/100	8.62
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	31.0	11.2	31.0	11.4	31.2	11.7	11.4	32/100	3.65
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	31.0	0.0	31.0	0.0	31.2	0.0	0.0	28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)							69.0	28/100	19.32
								TOTAL	~~32~~.59 31.59 C.E.L.

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SAMPLING SUMMARY SHEET

Plant Woodville Lime Location Woodville Ohio

Sampled source ESP outlet

Run	Date	N_p	P_m	P_b	V_m	T_m	$V_{m_{std}}$	V_w	$V_{w_{gas}}$	%M	M_d
1	7-8-74	48	3.01	29.48	256.911	109	232.37	636.7	30.18	11.28	.887
2	7-9-74	48	3.00	29.48	259.227	104	239.50	698.5	33.11	12.15	.879
3	7-10-74	48	3.26	29.40	267.191	104	248.54	675.0	32.00	11.41	.886

Run	MW_d	MW	P_{st}	P_s	C_p	$\sqrt{\Delta P_s \times (T_s+460)}$ [c]	V_s	T_s	T_t	D_n	%I
1	31.78	30.22	0	29.48	.83	20.54	2929	621	240	.375	102.4
2	31.70	30.04	0	29.48	.83	21.42	3064	669	240	.375	104.1
3	31.59	30.04	0	29.40	.83	22.35	3201	674	240	.375	103.4

$$V_{m_{std}} = \frac{17.7 \times V_m \left(P_b + \frac{P_m}{13.6}\right)}{(T_m + 460)}$$

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

$$V_{w_{gas}} = 0.0474 \times V_w$$

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

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

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

$$P_s = P_b \pm P_{st}$$

$$V_s = 5120.8 \times Cp \times \sqrt{\Delta P_s \times (T_s + 460)} \left[\frac{1}{P_s \times MW}\right]^{1/2}$$

$$\%I = \frac{1.032 \times (T_s + 460) \times V_{m_{std}}}{V_s \times T_t \times P_s \times M_d \times (D_n)^2}$$

N_p Total No. of Sampling Points

P_m Average Orifice Pressure Drop, in. H_2O

P_b Barometric Pressure, in. Hg. Absolute

V_m Volume of Dry Gas at Meter Conditions, DCF

T_m Average Meter Temperature, °F

$V_{m_{std}}$ Volume of Dry Gas at STP, DSCF[a]

V_w Total H_2O Collected in Impingers and Silica Gel, ml

$V_{w_{gas}}$ Volume of Water Vapor Collected at STP, SCF[b]

% M Moisture by Volume

M_d Mole Fraction of Dry Gas

$\% CO_2$ Volume % Dry

$\% O_2$ Volume % Dry

% CO Volume % Dry

$\% N_2$ Volume % Dry

MW_d Molecular Weight of Stack Gas, Dry Basis

MW Molecular Weight of Stack Gas, Wet Basis

P_{st} Static Pressure of Stack Gas, in. Hg

P_s Stack Gas Pressure, in. Hg Absolute

C_p Pitot Tube Coefficient

V_s Stack Gas Velocity at Stack Conditions, fpm

T_s Average Stack Temperature °F

T_t Net Time of Test, Min.

D_n Sampling Nozzle Diameter, in.

% I Percent Isokinetic

[a] Dry standard cubic feet at 70°F, 29.92 in. Hg.

[b] Standard conditions at 70°F, 29.92 in. Hg.

[c] $\sqrt{\Delta P_s \times (T_s + 460)}$ is determined by averaging the square root of the product of the velocity head (ΔP_s) and the absolute stack temperature from each sampling point.

109	621	669	104	674
460	460	460	460	460
569	1081	1129	564	1134

3rd run probe - had metal tip on end of glass

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
WOODVILLE LIME CO. WOODVILLE, OHIO	7/8/74	LIME KILN NO. 1 ESP OUTLET	SO2

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS (IN.HG)	STATIC PRESS. (IN.H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp
2	F. MEADOWS	117	29.98	+	100109	X	.NA

PROBE LENGTH AND TYPE	NOZZLE I. D. INCHES	H_2O (%)	SAMPLE BOX NO.	METER BOX NO.	METER ΔH @	C FACTOR	PROBE HEAT SET	BOX HEAT SET.	REF. ΔP	RECORD DATA MINS.
4' PYREX HEATED	0.375	12	A	GI-1	1.74	—	240	—	—	15.0

EMISSION TESTING FIELD DATA

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F
	0	1713	369.659									
	21.0	1734	386.105	•	1.90	1.90		125	119	6.5		
	41.0	1754	402.020	•	1.90	1.90		128	122	6.5		84
	62.0	1815	418.610	•	1.90	1.90		115	110	6.5		85
	75.0	1828	428.785	•	1.90	1.90		112	108	7.0		85
	90.0	1843	440.500	•	1.90	1.90		111	107	7.0		83
	105.0	1858	452.137	•	1.90	1.90		110	102	7.0		80
	120.0	1913	463.852	•	1.90	1.90		109	100	7.0		80
	135.0	1932	475.311	•	1.90	1.90		105	99	7.0		74
	150.0	1947	486.882	•	1.90	1.90		108	100	7.0		74
	165.0	2002	498.465	•	1.90	1.90		107	100	7.0		72
	180.0	2017	510.027	•	1.90	1.90		107	100	7.0		71
	* 18.50	2022	513.929	•	1.90	1.90		107	100	7.0		71
	195.0	2037	521.622	•	1.90	1.90		100	98	7.0		70
	215.0	2057	537.031	•	1.90	1.90		104	99	7.0		73
	225.0	2107	544.700	•	1.90	1.90		102	98	7.0		72
	~~240.0~~	~~2122~~		•	1.90	1.90				7.0		~~72~~
	231.5	2114	549.721	•	1.90	1.90		102	98	7.0		72
	•	•	•	•	•	•				•		
	•	•	•	•	•	•				•		
	•	•	•	•	•	•				•		
	•	•	•	•	•	•				•		
	•	•	•	•	•	•				•		
	•	•	•	•	•	•				•		
	•	•	•	•	•	•				•		

LEAKAGE @ 15 "Hg = 0.01 CFM

GAS METER COR. 1.111

* TEST HALTED — LARGE PARTICLES EMITTING FROM STACK OUTLET RESUMED @ 2027

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ANALYTICAL DATA

1. Plant WOODVILLE LIME CO. Date 7-8-74
2. Sampling location LIME KILN NO. 1 ESP OUTLET Run No. 1
3. Sample Type SULFURIC ACID MIST Sample Box No. A
4. Clean-up Man F. MEADOWS

NOTE: SILICA GEL WAS SATURATED

IMPINGERS			MOISTURE SILICA GEL				
Final Volume	658	ML	Final Wt.	233.7 g.	g.	g.	358
Initial Volume	300	ML	Initial Wt.	200.0 g.	g.	g.	33.7
Net Volume	358	ML	Net Wt.	33.7 g.	g.	g.	391.7
			TOTAL MOISTURE	391.7 g.			

Final H_2O_2 375
Sol'n Impinger 283

LABORATORY RESULTS

	1	2	3	4	5	6	7
GROSS							
TARE							
BLANK							

FRONT HALF

Acetone wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder. — Container _____ 1. _____ mg

Filter Number _____ _____ — Container _____ 2. _____ mg

Water wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder. — Container _____ Water 3. _____ mg

Container _____ Ether-Chloroform Extraction 4. _____ mg

FRONT HALF SUBTOTAL _____ mg

BACK HALF

Impinger contents and water wash of impingers, connectors, and back half of filter holder. — Container _____ Impinger Water 5. _____ mg

Container _____ Ether-Chloroform Extraction 6. _____ mg

Acetone wash of impingers, connectors, and back half of filter holder — Container _____ 7. _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
1. WOODVILLE LIME CO WOODVILLE, OHIO	7/9/74	LIME KILN NO. 1 ESP OUTLET	SO2

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS (IN.HG)	STATIC PRESS. (IN.H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE
4	F. MEADOWS	90					—

PROBE LENGTH AND TYPE	NOZZLE I. D. INCHES	H_2O (%)	SAMPLE BOX NO.	METER BOX NO.	METER ΔH @	C FACTOR	PROBE HEAT SET	BOX HEAT SET.	REF. ΔP	RECORD DATA MINS.
3. 4' PYREX HEATED	0.375	12	A	GI-1	1.74	—	240	—	—	1510

EMISSION TESTING FIELD DATA

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F
	0	0842	562.086									
	15.0	0857	573.742		1.90	1.90		104	99	2.0	—	94
	30.0	0912	585.315		1.90	1.90		110	102	2.0	—	94
	45.0	0927	596.780		1.90	1.90		111	105	2.0		94
	60.0	0942	608.380		1.90	1.90		112	108	3.5		94
	75.0	0957	620.314		1.90	1.90		113	109	4.0		92
	90.0	1012	632.800		1.90	1.90		115	110	3.0		92
	* 115.0	1037	652.819		1.90	1.90		115	111	3.5		92
LEAK CHECK			.16" Hg	.005 CFM								
START ①		1046	652.977									
	125.0	1056	660.948		1.90	1.90		115	111	2.0		92
	140.0	1111	672.958		1.90	1.90		118	112	2.0		92
	160.0	1131	686.237		1.90	1.90		118	112	7.5		94
	175.0	1146	697.200		1.90	1.90		118	112	9.5		94
	185.0	1156	704.878		1.90	1.90		120	116	10.5		94
	200.0	1211	716.564		1.75	1.75		121	117	11.0		94
	215.	1216	727.920		1.70	1.70		121	117	11.0		90
	230.0	1241	739.400		1.70	1.70		122	117	11.0		90
	235.0	1246	743.196		1.70	1.70		122	117	11.0		90

LEAKAGE @ 15 "Hg - 0.015 CFM

GAS METER COR. 1.11

* See Back
Purged collector for 1 min. after test end!

① Sampled 2 minutes w/probe out of stack. ?? See back
Spiked 25 ml. isopropanol

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* 1st Impinger initially filled with 100 ml. 80% Isopropanol at midway point of test impinger was replaced with a new one containing 200 ml 80% Isopropanol. This action was taken because of the high stack gas temp and high condensate collected during Test 2 on 7-8-74

① Approximate leakage amount = 1.6 cf @ Tm 112°F

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ANALYTICAL DATA

1. Plant WOODVILLE LIME Date 7-9-74
2. Sampling location LIME KILN #1 OUTLET Run No. 34
3. Sample Type SO_2 Sample Box No. _____
4. Clean-up Man J.L.A

315
61.1
376.1

IMPINGERS			MOISTURE SILICA GEL			
Final Volume	~~860~~ 815	ML	Final Wt.	461.1 g.	_____ g.	_____ g.
Initial Volume	500	ML	Initial Wt.	400.0 g.	_____ g.	_____ g.
Net Volume	315	ML	Net Wt.	61.1 g.	_____ g.	_____ g.
			TOTAL MOISTURE	~~386.1~~ 376.1 g.		

LABORATORY RESULTS

	1	2	3	4	5	6	7
GROSS							
TARE							
BLANK							

FRONT HALF

Acetone wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder.	Container _____	1. _____ mg
Filter Number _____ _____	Container _____	2. _____ mg
Water wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder.	Container _____ Water	3. _____ mg
	Container _____ Ether-Chloroform Extraction	4. _____ mg
	FRONT HALF SUBTOTAL	_____ mg

BACK HALF

Impinger contents and water wash of impingers, connectors, and back half of filter holder.	Container _____ Impinger Water	5. _____ mg
	Container _____ Ether-Chloroform Extraction	6. _____ mg
Acetone wash of impingers, connectors, and back half of filter holder	Container _____	7. _____ mg
	BACK HALF SUBTOTAL	_____ mg
	TOTAL WEIGHT	_____ mg

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
WOODVILLE LIME CO. WOODVILLE, O	7/10/74	LIME KILN NO. 1 ESP OUTLET	SO2

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS (IN.HG)	STATIC PRESS. (IN.H_2)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp
6	F. MEADOWS	85	29.40	.	100116	. X .	—

PROBE LENGTH AND TYPE	NOZZLE I. D. INCHES	H_2O (%)	SAMPLE BOX NO.	METER BOX NO.	METER ΔH @	C FACTOR	PROBE HEAT SET	BOX HEAT SET.	REF. ΔP	RECORD DATA MINS.
4 PYREX HEATED	0.375	12	A	GI-1	1.74	—	240	—	—	15.0

EMISSION TESTING FIELD DATA

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F
	0	0824	749.542									
	* 15.0	0839	761.315	—	1.85	1.85		98	92	8.5	NA	90
	RESTART.	0843	761.315	—	.	.				.		
	30.0	0858	773.168	—	1.85	1.85		98	93	8.5		85
	** 30.0	0904	775.437	—	1.85	1.85		100	100	8.5		85
	RESTART	0914	775.437	—	.	.				.		
	*** .	0915	776.227	—	1.85	1.85		90	90	8.5		88
	RESTART.	0919	776.227	—	.	.				.		
	OFF 39.0	0925	780.193	—	1.85	1.85		93	93	8.5		85
	RESTART 45.0	0929	780.193	—	.	.				.		
	45.0	0935	784.641	—	1.70	1.70		100	99	7.5		80
	60.0	0950	795.900	—	1.70	1.70		108	101	7.5		75
	75.0	1005	807.181	—	1.72	1.72		105	100	7.5		75
	90.0	1020	818.606	—	1.72	1.72		110	100	7.5		72
	120.0	1050	841.335	—	1.72	1.72		105	100	7.5		72
	135.0	1110	852.917	—	1.80	1.80		102	99	7.5		74
	150.0	1125	864.465	—	1.80	1.80		107	100	7.5		74
	165.0	1140	875.962	—	1.80	1.80		110	100	7.5		74
	180.0	1155	887.520	—	1.80	1.80		111	101	7.5		75
	195.0	1210	899.150	—	1.80	1.80		111	101	7.5		75
	210.0	1225	910.620	—	1.80	1.80		113	105	7.5		76
	225.0	1240	921.935	—	1.70	1.70		111	105	7.5		76
	235.0	1250	929.566	—	1.75	1.75		112	105	7.5		76
	.		TRAIN PURGED W/ AMBIENT AIR FOR 15 minutes							.		

LEAKAGE @ 15 "Hg = 0 CFM

GAS METER COR. 1.11

* Shut down to install thermocouple on particulate probe

** shut down to find cause of this line on start up

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① SHUT OFF TO FIX PART TRAIN HI VACUUM 0925
Purged collector 15 min after test end!

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ANALYTICAL DATA

1. Plant WOODVILLE LIME Date 7-10-74
2. Sampling location LIME KILN #1 OUTLET Run No. 6
3. Sample Type SO2 Sample Box No. _____
4. Clean-up Man F. MEADOWS

IMPINGERS			MOISTURE SILICA GEL			
Final Volume	803	ML	Final Wt.	492.4 g.	____ g.	____ g.
Initial Volume	600	ML	Initial Wt.	400 g.	____ g.	____ g.
Net Volume	203	ML	Net Wt.	92.4 g.	____ g.	____ g.
			TOTAL MOISTURE	____ g.		

Initial 400 60% isopropanol 295
200 3% H2O2 40
803

LABORATORY RESULTS

	1	2	3	4	5	6	7
GROSS							
TARE							
BLANK							

FRONT HALF

Acetone wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder. Container _____ 1. _____ mg

Filter Number _____ _____ Container _____ 2. _____ mg

Water wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder. Container _____ Water 3. _____ mg

Container _____ Ether-Chloroform Extraction 4. _____ mg

FRONT HALF SUBTOTAL _____ mg

BACK HALF

Impinger contents and water wash of impingers, connectors, and back half of filter holder. Container _____ Impinger Water 5. _____ mg

Container _____ Ether-Chloroform Extraction 6. _____ mg

Acetone wash of impingers, connectors, and back half of filter holder Container _____ 7. _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-Y

TEST NO.	DATE	LOCATION
A	7-18-74	WOODVILLE LIME CO.

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN NO. 1	22	20130

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-ITIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
1245	1300	1130	1150	105	104	29.48	1748 ~~1348~~ ~~1352~~ 1752	27.619

REAGENT		Mg NO_x IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
250	~~H2O2~~ PDS	1.119 0.83	FM

PEDCo-ENVIRONMENTAL
SUITE 13 · ATKINSON SQUARE
CINCINNATI, OHIO 45246

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-Y

TEST NO.	DATE	LOCATION
B	7-18-74	WOODVILLE LIME CO ~~LIME~~

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN NO. 1 ESP OUTLET		20860

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-TIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
1270	1330	120	130	105	104	29.48	1848 1852	27.619

REAGENT		Mg NO_x IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
250	H2O2	~~9.07~~ 4.672	FM

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SUITE 13 · ATKINSON SQUARE
CINCINNATI, OHIO 45246

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-4

TEST NO.	DATE	LOCATION
C	7-8-74	WOODVILLE LIME CO

1 5 13 37

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN ESP OUTLET	19	2074.0

38 68 76 80

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-ITIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
12.85	12.65	.90	11.10	110.6	102.2	29.48	1951 1957	22.619

1 5 9 13 17 21 25 30 38 45

REAGENT		Mg NO_x IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
250	H2O2	~~1.284~~ 1.433	FM

46 52 59 66 75

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CINCINNATI, OHIO 45246

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-4

TEST NO.	DATE	LOCATION
4	7-18-74	WOODVILLE LIME CO

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN NO. 1 ESP OUTLET	20	20700

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-TIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
13.0	12.30	11.0	11.20	103	100	29.48	2048	27.619

REAGENT		$Mg\ NO_x$ IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
250	4202	~~1.290~~ 0.957	FM

PEDCo-ENVIRONMENTAL
SUITE 13 · ATKINSON SQUARE
CINCINNATI, OHIO 45246

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-Y

TEST NO.	DATE	LOCATION
E	7-9-74	WOODVILLE LIME CO

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN NO. 1 ESP OUTLET	4	20440

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-TIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
12.70	13.30	11.00	11.10	90	90	29.48	0915 0920	27.390

REAGENT		Mg NO_x IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
250	H2O2	~~13.16~~ 4.976	FM

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SUITE 13 · ATKINSON SQUARE
CINCINNATI, OHIO 45246

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-4

TEST NO.	DATE	LOCATION
F	7-19-74	WOODVILLE LIME CO

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN NO. 1 ESP OUTLET	52	8610

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-ITIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
12.50	13.10	11.00	11.15	95	93	29.48	10.15	27.390

REAGENT		Mg. NO_x IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
25.0	H2O2	~~1.258~~ 0.43-1	FM

PEDCo-ENVIRONMENTAL
SUITE 13 · ATKINSON SQUARE
CINCINNATI, OHIO 45246

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-4

TEST NO.	DATE	LOCATION
G	7-9-74	WOODVILLE LIME CO

1 5 13 37

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN NO. 1 ESP OUTLET	11	2062

38 68 76 80

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-TIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
12.95	12.35	11.90	11.10	104	103	29.48	1115	27.390

1 5 9 13 17 21 25 30 38 45

REAGENT		Mg NO_x IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
250	H2O2	1.394 / 1.934	FM

46 52 59 66 75

PEDCo-ENVIRONMENTAL
SUITE 13 - ATKINSON SQUARE
CINCINNATI, OHIO 45246

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-4

TEST NO.	DATE	LOCATION
H	7-9-74	WOODVILLE LIME CO

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN NO. 1 ESP OUTLET	6	2091 10

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-ITIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
12 5 0	13 1 0	1 0 0	1 1 5	99	103	29.48	1215 1220	27 39 0

REAGENT		Mg NO_x IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
125 0	H2O2	1.366 1.91-1	FM

PEDCo-ENVIRONMENTAL
SUITE 13 · ATKINSON SQUARE
CINCINNATI, OHIO 45246

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-Y

TEST NO.	DATE	LOCATION
I	7-10-74	WOODVILLE LIME CO

1 5 13 37

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN NO. 1 ESP OUTLET	15	20830

38 68 76 80

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-ITIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
27.5	13.30	11.00	11.10	85	85	29.40	0920	28.658

1 5 9 13 17 21 25 30 38 45

0924

REAGENT		Mg NO_x IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
250	H2O2	~~1.473~~ 1.093	FM

46 52 59 66 75

PEDCo-ENVIRONMENTAL
SUITE 13 · ATKINSON SQUARE
CINCINNATI, OHIO 45246

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-Y

TEST NO.	DATE	LOCATION
15	12-10-74	WOODVILLE LIME CO

1 5 13 37

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN NO. 1 ESP OUTLET	18 ~~1~~	2074.0 ~~2007.0~~

38 68 76 80

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-TIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
12.75 ~~13.00~~	13.35 ~~13.60~~	1.00 ~~1.00~~	1.10 ~~1.10~~	95 ~~92~~	~~91~~	29.40	1033 ~~1023~~ ~~1027~~ 1039	28.6 ~~58~~

1 5 9 13 17 21 25 30 38 45

REAGENT		Mg NO_x IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
250	H2O2	1.575 1.164	FM

46 52 59 66 75

PEDCo-ENVIRONMENTAL
SUITE 13 · ATKINSON SQUARE
CINCINNATI, OHIO 45246

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-Y

TEST NO.	DATE	LOCATION
K	7-10-74	WOODVILLE KIMG CO

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN NO. 1 ESP OUTLET	1	20017.0

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-ITIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
13.25	13.85	11.00	11.10	81	83	29.40	1130	28.658

REAGENT		Mg NO_x IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
25.0	H_2O_2	~~1.818~~ 1.349	FM

PEDCo-ENVIRONMENTAL
SUITE 13 · ATKINSON SQUARE
CINCINNATI, OHIO 45246

NO_x GAS SAMPLING-EVACUATED FLASK

COMPUTER INPUT DATA

Prepared By F. MEADOWS

Project No. 3082-4

TEST NO.	DATE	LOCATION
L	7-10-74	WOODVILLE LIME CO

1 5 13 37

TYPE OF OPERATION	SAMPLING FLASK NO.	FLASK VOLUME (ml)
LIME KILN NO. 1 ESP OUTLET		72074

38 68 76 80

FLASK VACUUM-in. Hg.				FLASK TEMP. °F		BARO-METRIC PRES-SURE	CLOCK TIME	DSCFM
INITIAL		FINAL		IN-ITIAL	FINAL			
LEG 1	LEG 2	LEG 1	LEG 2					
13.25	13.85	11.05	11.15	80	84	29.40	<1230> 1236	28658

1 5 9 13 17 21 25 30 38 45

REAGENT		Mg NO_x IN SAMPLE	TEST BY
VOL. (ml)	TYPE		
250	H2O2	1.7139 1.290	FM

46 52 59 66 75

PEDCo-ENVIRONMENTAL
SUITE 13 · ATKINSON SQUARE
CINCINNATI, OHIO 45246

APPENDIX F

SAMPLE IDENTIFICATION LOG

SAMPLE IDENTIFICATION LOG

EPA Number	Sample Location	Run	Contents	Comments	
S74-001-718	ESP outlet	1	NO_x sample + H_2O wash	A 1748	~~7-8-74~~ ~~7-18-74~~
-719	" "	1	" " " "	B 1848	"
-720	" "	1	" " " "	C 1951	"
-721	" "	1	" " " "	D 2048	"
S74-001-722	ESP outlet	2	NO_x sample + H_2O wash	E 0915	7-9-74
-723	" "	2	" " " "	F 1015	"
-724	" "	2	" " " "	G 1115	"
-725	" "	2	" " " "	H 1215	"
S74-001-726	ESP outlet	3	NO_x sample + H_2O wash	I 0920	7-10-74
-727	" "	3	" " " "	J 1033	"
-728	" "	3	" " " "	K 1130	"
-729	" "	3	" " " "	L 1230	"
~~S74-001-73~~					
S74-001-801	ESP outlet	4	NO_x sample + H_2O wash	M	
-802	" "	4	" " " "	N	
-803	" "	4	" " " "	O	
-804	" "	4	" " " "	P	
S74-001-~~805~~ 695	Blank NO_x	—	NO_x collection reagent	volume - 40 mls	
S74-001-730	Blank H_2O	—	NO_x water blank	volume - 40 mls	

Comments - Dallas S74-001-801 through 805 [illegible] to Police by Glen Riley!

SO_2

SAMPLE IDENTIFICATION LOG

EPA Number	Sample Location	Run	Contents	Comments
574-001-692	ESP outlet	1	SO_2 imping contents + wash	7-8-74
-693	ESP outlet	2	SO_2 imping contents + wash	7-9-74
-694	ESP outlet	3	SO_2 imping contents + wash	7-10-74
~~-695~~	~~ESP outlet~~	~~4~~	~~SO_2 imping contents + wash~~	use lab # on NO_x
				(H_2O_2) 3%
574-001-798	Woodrill Lim	Blank	SO_2 collection reagent volume	– 50 mls
-799	Woodrill Lim	Blank	Dist water blank volume	– 50 mls
-800	Woodrill Lim	Blank	80% Isopropal blank	– 50 mls.

~~Since #695 ESP outlet 4 will be collected at a later date!~~
~~Contents [illegible]~~

SAMPLE IDENTIFICATION LOG

EPA Number	Sample Location	Run	Contents	Comments
S74-001-731	Feed-in Silo	1	Rock feed-in to kiln	7-8-74 - 1750
732	Feed-in Silo	1	" " "	7-8-74 - 2036
733	Composite	1	Rock feed-in composite of -731 & -732	
S74-001-734	Control room ~~No 6 oil~~	1	No. 6 fuel oil for kiln	7-8-74 1900
-735	Control room	1	No. 6 fuel oil " "	7-8-74 2030
-736	Composite	1	No. 6 fuel oil composite of -734 & 735	
S74-001-737	Kiln discharge	1	Kiln product (lime)	7-8-74 1750
-738	Kiln "	1	Kiln product (lime)	7-8-74 2030
-739	composite	1	Kiln product, composite of -737 & 738	
S74-001-740	ESP	1	ESP collector dust	7-8-74 1830
-741	ESP	1	" " "	7-8-74 2030
-742	Composite	1	ESP collector dust composite of -740 & -741	
S74-001-743	Feed-in Silo	2	Rock feed-in to kiln	7-9-74 1100
-744	Feed-in Silo	2	" " "	7-9-74 1230
-745	Composite	2	Rock feed-in composite of -743 & -744	
S74-001-746	Control room	2	No. 6 fuel oil for kiln	7-9-74 0930
-747	" "	2	No. 6 fuel oil for kiln	7-9-74 1230
-748	Composite	2	No. 6 fuel oil composite of -746 & -747	
S74-001-749	Kiln discharge	2	Kiln product (lime)	7-9-74 0930
-750	" "	2	" " "	7-9-74 1300
-751	Composite	2	Kiln product composite of -749 & 750	
S74-001-752	ESP	2	ESP collector dust	7-9-74 1015
-753	ESP	2	" " "	7-9-74 1255
-754	Composite	2	ESP collector dust composite of -752 & -753	
S74-001-760	Feed-in silo	3	Rock feed-in to kiln	7-10-74 1000
-761	Feed-in silo	3	" " " " "	7-10-74 1300
-~~762~~ 762	Composite	3	Rock feed-in composite of -760 & -761	

2 of 2

SAMPLE IDENTIFICATION LOG

EPA Number	Sample Location	Run	Contents	Comments
S74-001-763	Control room	3	No. 6 fuel oil for kiln	7-10-74 1100
-764	" "	3	" " " " " "	7-10-74 1230
-765	Composite	3	No. 6 fuel oil composite of -763 & -764	
S74-001-766	kiln discharge	3	kiln product (lime)	7-10-74 1000
-767	" "	3	kiln product (lime)	7-10-74 1230
-768	Composite	3	kiln product composite of -766 & -767	
S74-001-769	ESP	3	ESP collector dust	7-10-74 0800
-770	ESP	3	ESP collector dust	7-10-74 1030
-771	Composite	3	ESP dust composite of -769 & -770	
* ~~S74-001-786~~	~~Feed silo~~	~~4~~	~~Rock feed-in to kiln~~	
~~-787~~	~~" " "~~	~~4~~	~~" " " " "~~	
~~-788~~	~~Composite~~	~~4~~	~~Rock feed-in composite of -786 & -787~~	
~~S74-001-789~~	~~Control room~~	~~4~~	~~No. 6 fuel oil for kiln~~	
~~-790~~	~~" "~~	~~4~~	~~" " " "~~	
~~-791~~	~~Composite~~	~~4~~	~~No. 6 fuel oil composite of -789 & -790~~	
~~S74-001-792~~	~~kiln discharge~~	~~4~~	~~kiln product (lime)~~	
~~-793~~	~~kiln discharge~~	~~4~~	~~kiln product (lime)~~	
~~-794~~	~~composite~~	~~4~~	~~kiln product composite of -792 & -793~~	
~~S74-001-795~~	~~ESP~~	~~4~~	~~ESP collector dust~~	
~~-796~~	~~ESP~~	~~4~~	~~" " "~~	
~~-797~~	~~Composite~~	~~4~~	~~ESP collector dust composite - 795 & -796~~	

* samples to be collected at a later date!

SAMPLE IDENTIFICATION LOG

Piece of glass in sample bottle

EPA Number	Sample Location	Run	Contents	Comments
S-74-001-696	ESP outlet	1	Filter	7-8-74
-697	" "	1	Front half acetone wash	Broken probe "
-698	" "	1	Back half acetone wash	"
-699	" "	1	Impg H_2O & wash	"
700	"	1	Impg. E/C extraction	"
S74-001-755	ESP outlet	2 3	Filter	7-9-74
-756	" "	2 3	Front half acetone wash	"
-757	" "	2 3	Back half acetone wash	"
-758	" "	2 3	Impg H_2O & wash	"
-759	" "	2 3	Impg E/C extraction	"
S74-001-772	ESP outlet	3 5	Filter	7-10-74
-773	" "	3 5	Front half acetone wash	"
-774	" "	3 5	Back half acetone wash	"
-775	" "	3 5	Impg H_2O & wash	"
-776	" "	3 5	Impg E/C extraction	"
~~S74-001-777~~	~~ESP outlet~~	~~4~~	~~Filter~~	
~~-778~~	~~" "~~	~~4~~	~~Front half acetone wash~~	
~~-779~~	~~" "~~	~~4~~	~~Back half acetone wash~~	Do not have a
~~-780~~	~~" "~~	~~4~~	~~Impg H_2O & wash~~	
~~-781~~	~~" "~~	~~4~~	~~Impg E/C extraction~~	
S74-001-782	Woodrill test	blank	Acetone blank - volume - 500	
-783	" "	"	Dist H_2O blank - volume - 500	
-784	" "	"	E/C extraction blank - 500	
-785	" "	"	Filter (6) blanks	

APPENDIX G

LABORATORY REPORT

SUITE 8 · ATKINSON SQUARE
CINCINNATI, OHIO 45246
513/771-4330

ANALYTICAL DATA

1. Plant Woodville Lime Co. Date 7/8/74
2. Sampling location ESP Outlet Run No. 1
3. Sample Type Particulate Sample Box No. 2
4. Clean-up Man U.L.A.

* Found That Glass Tip Of Probe Was Broken During Run.

IMPINGERS			MOISTURE SILICA GEL			
Final Volume	792	ML	Final Wt.	244.7 g.	g.	g.
Initial Volume	200	ML	Initial Wt.	200 g.	g.	g.
Net Volume	592	ML	Net Wt.	44.7 g.	g.	g.
			TOTAL MOISTURE	636.7 g.		

LABORATORY RESULTS

	1	2	3	4	5	6	7
GROSS	93.5377	.7528			90.5014	96.3458	98.5678
TARE	93.1911	.4158			90.4102	95.9699	98.1054
BLANK	0.0026	0			0	0.0034	0.0026

FRONT HALF

Acetone wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder. — Container 697 — 1. 444.1 mg

Filter Number 100108 — Container 696 — 2. 337.0 mg

Water wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder. — Container _____ Water — 3. _____ mg

Container _____ Ether-Chloroform Extraction — 4. _____ mg

FRONT HALF SUBTOTAL 781.1 mg

BACK HALF

Impinger contents and water wash of impingers, connectors, and back half of filter holder. — Container 699 Impinger Water — 5. 91.2 mg

Container 700 Ether-Chloroform Extraction — 6. 370.5 mg

Acetone wash of impingers, connectors, and back half of filter holder — Container 698 — 7. 461.8 mg

BACK HALF SUBTOTAL 923.5 mg

TOTAL WEIGHT 1704.6 mg

1704.6

SUITE 8 · ATKINSON SQUARE
CINCINNATI, OHIO 45246
513/771-4330

ANALYTICAL DATA

1. Plant Woodville Lime Co. Date 7-9-74
2. Sampling location ESP Outlet Run No. 3
3. Sample Type Particulate Sample Box No. A
4. Clean-up Man J.L.A.

IMPINGERS			MOISTURE SILICA GEL			
Final Volume	800	ML	Final Wt.	698.5 g.	g.	g.
Initial Volume	200	ML	Initial Wt.	600 g.	g.	g.
Net Volume	600	ML	Net Wt.	98.5 g.	g.	g.
			TOTAL MOISTURE	698.5 g.		

LABORATORY RESULTS

	1	2	3	4	5	6	7
GROSS	96.2594	0.7893			98.6601	96.6726	101.6564
TARE	95.9038	0.7234			98.5525	96.5815	101.5731
BLANK	0.0026	0			0	0.0034	0.0026

FRONT HALF

Acetone wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder. — Container 756 — 1. 353.0 mg

Filter Number 100114 — Container 755 — 2. 365.9 mg

Water wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder. — Container ____ Water — 3. ____ mg

Container ____ Ether-Chloroform Extraction — 4. ____ mg

FRONT HALF SUBTOTAL 718.9 mg

BACK HALF

Impinger contents and water wash of impingers, connectors, and back half of filter holder. — Container 758 Impinger Water — 5. 107.6 mg

Container 759 Ether-Chloroform Extraction — 6. 87.7 mg

Acetone wash of impingers, connectors, and back half of filter holder — Container 757 — 7. 75.7 mg

BACK HALF SUBTOTAL 271.0 mg

TOTAL WEIGHT 989.9 mg

PEDCO ENVIRONMENTAL
SUITE 8 · ATKINSON SQUARE
CINCINNATI, OHIO 45246
513/771-4330

ANALYTICAL DATA

1. Plant Woodville Lime Co. Date 7-10-74
2. Sampling location ESP Outlet Run No. 5
3. Sample Type Particulate Sample Box No. A
4. Clean-up Man VLA

IMPINGERS			MOISTURE SILICA GEL			
Final Volume	800	ML	Final Wt.	675 g.	g.	g.
Initial Volume	200	ML	Initial Wt.	600 g.	g.	g.
Net Volume	600	ML	Net Wt.	75 g.	g.	g.
			TOTAL MOISTURE	675 g.		

LABORATORY RESULTS

	1	2	3	4	5	6	7
GROSS	98.6476	0.6483			92.8696	98.2868	85.7010
TARE	98.4621	0.4142			92.7695	98.0149	85.5947
BLANK	0.0026	0			0	0.0034	0.0026

FRONT HALF

Acetone wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder. — Container 773 — 1. 182.9 mg

Filter Number 100155 — Container 772 — 2. 234.1 mg

Water wash of nozzle, probe, cyclone (bypass), flask, front half of filter holder. — Container ____ Water — 3. ____ mg

Container ____ Ether-Chloroform Extraction — 4. ____ mg

FRONT HALF SUBTOTAL 417.0 mg

BACK HALF

Impinger contents and water wash of impingers, connectors, and back half of filter holder. — Container 775 Impinger Water — 5. 100.1 mg

Container 776 Ether-Chloroform Extraction — 6. 268.5 mg

Acetone wash of impingers, connectors, and back half of filter holder — Container 774 — 7. 103.7 mg

BACK HALF SUBTOTAL 472.3 mg

TOTAL WEIGHT 889.3 mg

CASCADE® L1-C2462 Woodville PN-3082-Y BSM 7-17-74

#	Sample #	Vol.	Beaker tare	Beaker gross	Beaker Net	Net – blank
697	Run 1 Front ½ 7-8	550 ml	93.0911	93.5377	0.4467	0.4441
698	Run 1 Back ½	375 ml	98.1054	98.5698	0.4644	0.4618
726	Run 3 Front ½ 7-9	260 ml	95.9038	96.2594	0.3556	0.3530
750	Run 3 Back ½	250 ml	101.5781	101.6564	0.0783	0.0757
773	Run 5 Front ½ 7-10	275 ml	98.4621	98.6476	0.1855	0.1829
774	Run 5 Back ½	275 ml	88.5947	88.7010	0.1063	0.1037
	H_2O Blank	212 ml	98.6604	98.6604	0	
	Acetone Blank	250 ml	95.4573	95.4599	0.0026	
	E/C Blank	125/125	93.6620	93.6654	0.0034	
700 / 671	organic Run 1	1025	95.9699	96.3438	0.3739	0.3705
699	inorganic Run 1		90.4102	90.5014	0.0912	0.0912
759 / 728	organic Run 3	1000 ml	96.5815	96.6726	0.0911	0.0877
758	inorganic Run 3		98.5525	98.6601	0.1076	0.1076
776 / 775	organic Run 5	1050 ml	98.0747	98.2862	0.2119	0.2685
772	inorganic Run 5		92.7695	92.8696	0.1001	0.1001
	Filters					
696	test 1 100108		.4158	.7528	0.3310	
755	test 3 100114		.4234	.7893	0.3659	
772	test 5 100115		.4142	.6483	0.2341	

SO_2

	VOL.	aliquot	ml 0.0125 N BaCl	g SO_2 / 10 ml	total g. SO_2
Run 1	510	10.0	28.55	0.017	0.867
	"		28.50	0.017	0.867
Run 4	650		3.10	0.002	0.130
	"		3.15	0.002	0.130
Run 6	590		17.90	0.011	0.649
	"	↓	17.90	0.011	0.649

vent

(NOx)

CASCADE® L1-C2462 Woodville PN-3082-Y BSM 7-23-74 MINTED IN U.S.A.

Sample #	Vol	aliquot	418 O.D.	µg/ml	avg	total µg
A 7-8	49½ ml	5.0 ml	.178	2.18	2.26	NO_3 1118.9 NO_2 = 830
			.190	2.35		
B 7-8	49 ml		.150	1.85	1.85	906.5 = 672
			.150	1.85		
C 7-8	49 ml		.208	2.55	2.62	1283.8 = 953
			.218	2.68		
D 7-8	50 ml		.208	2.55	2.58	1290.0 = 957
			.210	2.60		
E 7-9	70 ml		.158	1.95	1.88	1316.0 = 976
			.148	1.80		
F 7-9	52 ml		.193	2.40	2.42	1258.4 = 934
			.200	2.45		
G 7-9	52 ml		.223	2.75	2.68	1393.6 = 1034
			.210	2.60		
H 7-9	56 ml		.198	2.43	2.44	1366.4 1014
			.200	2.45		
I 7-10	53 ml		.233	2.83	2.78	1473.4 1093
			.225	2.73		
J 7-10	52½ ml		.245	3.00	3.00	1575.0 1169
			.245	3.00		
K 7-10	50½ ml		.300	3.65	3.60	1818.0 1349
			.290	3.55		
L 7-10	54 ml		.258	3.13	3.22	1738.8 = 1290
			.270	3.30		
H_2O blank			0	0		
NO_x blank			0	0		

total µg NO_3 = $\frac{(\mu g/ml) \text{ from curve} \times 50X \text{ total volume of sample}}{\text{aliquot of sample}}$

Total µg x 0.742 = µg of NO_2

PEDCo-ENVIRONMENTAL SPECIALISTS, INC.

MEMORANDUM

TO: R. Gerstle

DATE: Oct. 29, 1974

SUBJECT: Woodville Lime

FROM: E. Barnett
E. Barnett

FILE: 3082-Y

cc: Wm. DeWees

Following are the results of anlaysis of the rock and oil samples from Woodville Lime.

Sample	Date	Time	EPA 574-001-	Results (mg S/grams of sample)
#1 ESP Col Dust	7/8/74	1830	740	9.0
#1 ESP Col Dust	7/9/74	1015	752	13.2
#1 ESP Col Dust	7/10/74	0800	769	12.8
#2 ESP Col Dust	7/8/74	2030	741	7.8
#2 ESP Col Dust	7/9/74	1255	753	11.6
#2 ESP Col Dust	7/10/74	1030	770	16.4
#1 Stone	7/8/74	1750	735	0.2
#1 Rock	7/9/74	1100	743	0.7
#1 Rock	7/10/74	1700	?	0.6
#1 Rock	7/10/74	1000	760	0.7
#2 Stone	7/8/74	2030	732	1.4
#2 Rock	7/9/74	1230	749	0.4
#2 Rock	7/10/74	1300	761	0.4
#2 Kiln	7/9/74	1300	750	1.0
#1 Lime	7/8/74	1720	737	0.7
#1 Lime	7/9/74	0930	749	0.4
#1 Lime	7/10/74	1000	766	0.2
#2 Lime	7/8/74	2030	738	0.6
#2 Lime	7/10/74	1230	767	0.7
#1 Kiln Fuel Oil	7/9/74	0930	746	17.54
#1 Fuel Oil	7/8/74	1900	739	22.63
#2 Kiln Fuel Oil	7/9/74	1230	747	17.12
#2 Fuel Oil	7/10/74	1230	764	8.75
#2 Kiln Fuel Oil	7/8/74	2030	735	32.16
#1 Fuel Oil	7/10/74	1100	763	22.56

Solids were analyzed using Standard Methods of Chemical Analysis of Limestone, Quicklime, and Hydraded Lime, C25-67, A.S.T.M. Standards, Part 9, Cement; Lime; Gypsum, 1972, American Society for

Testing and Materials, Philadelphia, Pa.

Fuel oil samples were analyzed using Standard Method of Test for Sulfur in Petroleum Products by the Bomb Method, D 129-64, A.S.T.M. Standards, Part 17, Petroleum Products - Fuels, Solvents, Burner Fuel Oils, Lubricating Oils, Cutting Oils, Lubricating Greases, Hydraulic Fluids, 1972, American Society for Testing Materials, Philadelphia, Pa.

APPENDIX H

SAMPLING METHODS

DETERMINATION OF PARTICULATE EMISSIONS

The following method was used in this test program. Sampling procedures followed those described in the Federal Register.[1]

SAMPLING APPARATUS

The particulate sampling train used in these tests met design specifications established by the Federal EPA and was assembled by PEDCo personnel. It consisted of:

Nozzle - Stainless steel (316) with sharp, tapered leading edge and accurately measured round opening.

Probe - Pyrex glass with a heating system capable of maintaining a minimum gas temperature of 250°F at the exit end during sampling.

Pitot Tube - Calibrated type S attached to probe to monitor stack gas velocity.

Filter Holder - Pryex glass with heating system capable of maintaining minimum temperature of 225°F.

Draft Gage - An inclined manometer made by Dwyer with a readability of 0.01 inches H_2O in the 0-1 inch range was used.

Impingers - Four impingers connected in series with glass ball joints. The first, third, and fourth impingers were of the Greenburg-Smith design, modified by replacing the tip with a 1/2 inch I.D. glass tube extending to 1/2 inch from the bottom of the flask. The second impinger was of the Greenburg-Smith design with a standard tip.

Thermometer - Dial type with long stem.

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[1] Federal Register, Vol. 36, No. 247, Part II, December 23, 1971.

Metering System - Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5°F, dry gas meter with 2% accuracy, and related equipment, to maintain an isokinetic sampling rate and to determine sample volume. The dry gas meter is made by Rockwell and the fiber vane pump is made by Gast.

Barometer - Bourden tube type to measure atmospheric pressures to ± 0.1 inches Hg.

SAMPLING PROCEDURE

After selecting the sampling site and the minimum number of traverse points, the stack pressure, temperature, moisture, and range of velocity head was measured according to procedures described in Method 1 of the Federal Register (December 23, 1971).

Approximately 200 grams of silica gel were weighed in a sealed impinger prior to each test. Glass fiber filters* (3" diameter) were desiccated for at least 24 hours and weighed to the nearest 0.1 milligram on an analytical balance. One-hundred ml of distilled water was placed in each of the first two impingers; the third impinger was initially empty; and the impinger containing the silica gel was placed next in series. The train was set up without the probe as shown in Figure A-1. The sampling train was leak checked at the sampling site by plugging the inlet to the filter holder and pulling a 15 inch Hg vacuum. Leakage rates of less than 0.02 cfm at a vacuum of 15 in. Hg were recorded in all cases. The probe assembly was then attached, and crushed ice placed around the impingers. More ice was added during the run to keep the temperature of the gases leaving the last impinger at approximately 70°F.

* MSA 1106 BH

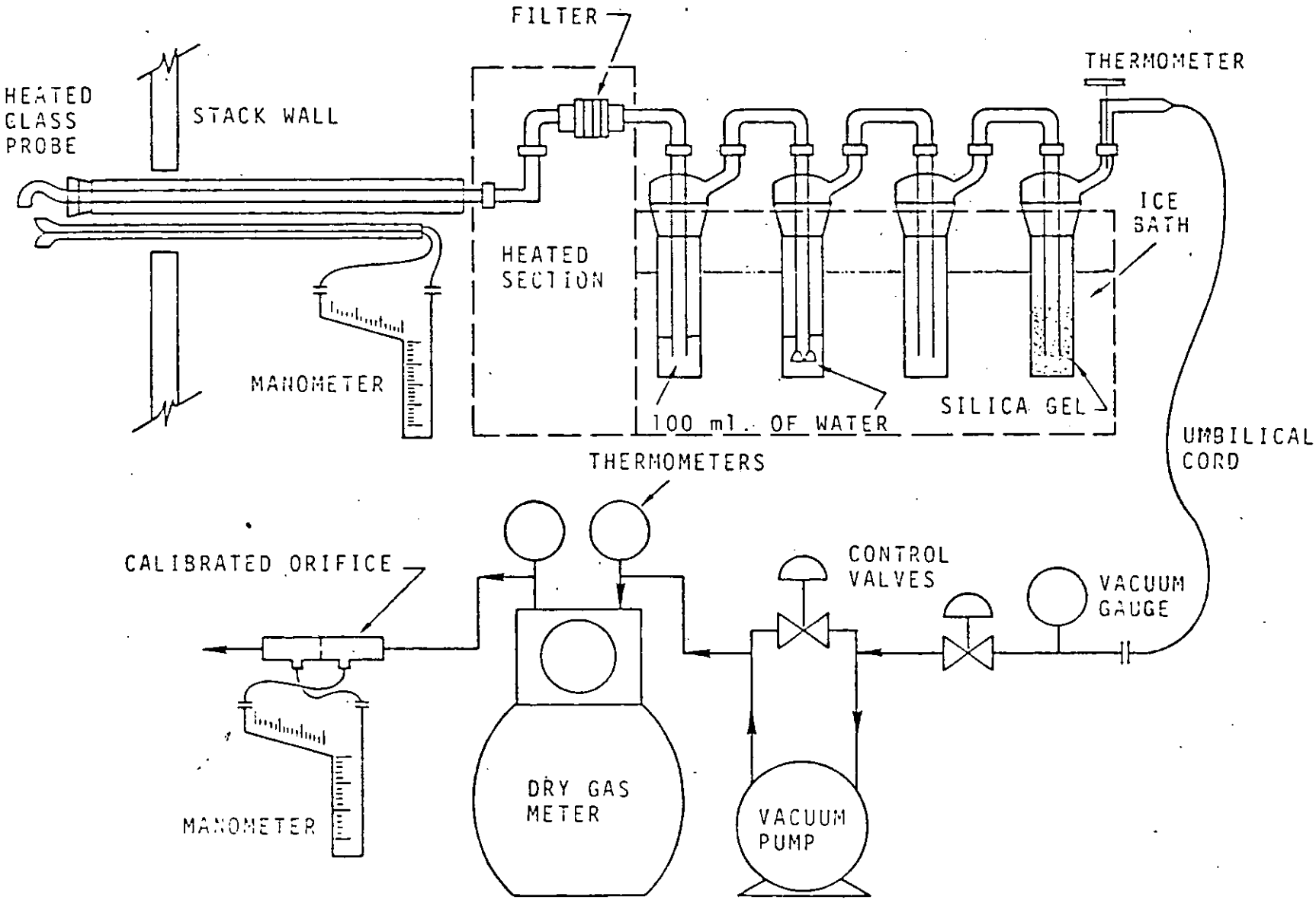

Figure A-1. Particulate sampling train.

During sampling, stack gas and sampling train data were recorded at each sampling point and when significant changes in stack flow conditions occurred. Isokinetic sampling rates were set throughout the sampling period with the aid of a nomograph.

SAMPLE RECOVERY PROCEDURE

The sampling train was moved carefully from the test site to the cleanup area. Samples of the acetone and water used in the sample recovery were taken for use as blanks. The sample fractions were recovered as follows:

Container No. 1 - The filter was removed from its holder and placed in a petri dish and sealed.

Container No. 2 - Loose particulate and acetone washings from all sample-exposed surfaces prior to the filter were placed in a glass jar and sealed. Particulate was removed from the probe with the aid of a brush and acetone rinsing.

Container No. 3 - The condensate from the first three Greenburg-Smith impingers was measured within ± 1 ml and placed into a glass jar. Water rinsings from the back half of the filter holder, all connectors, and the first three Greenburg-Smith impingers were placed in this container and the container sealed.

Container No. 4 - Acetone rinsings from the back half of the filter holder, support, all connectors, and the first three Greenburg-Smith impingers were placed in this container and sealed.

Container No. 5 - A minimum of 300 ml of acetone was taken for the blank analysis.

Container No. 6 - A minimum of 300 ml of distilled water was taken for a blank.

The silica gel from the fourth impinger was weighed and recorded. The used silica gel was discarded.

ANALYTICAL PROCEDURES

The following procedures were used and follow the methods described in the Federal Register of August 17, 1971.[1]

Container No. 1 - The filter and any loose particulate matter from this sample container were placed into a tared glass weighing dish, desiccated to a constant weight and weighed to the nearest 0.1 mg.

Container No. 2 - The acetone washings were transferred to a tared beaker and evaporated to dryness at ambient temperature and pressure; desiccated to a constant weight; and weighed to the nearest 0.1 mg.

Container No. 3 - Organic matter from the impinger solution was extracted with three 25 ml. portions each of ethyl ether and chloroform. The extracts were combined into a tared beaker, and evaporated until no solvent remained at about 70°F. The sample was then desiccated to a constant weight and weighed to the nearest 0.1 mg. The remaining water was evaporated by boiling in a tared beaker, and the residue weighed.

Container No. 4 - The acetone washings from the back half of the filter holder, connectors and first three Greenburg-Smith impingers were transferred to a tared beaker; evaporated to dryness at ambient temperature and pressure; desiccated to a constant weight; and weighed to the nearest 0.1 mg.

Container No. 5 - The acetone blank was transferred to a tared beaker, and evaporated to dryness at ambient temperature and pressure. The blank was then desiccated to a constant weight and weighed to the nearest 0.1 mg.

Container No. 6 - The water blank was evaporated by boiling in a tared beaker, desiccated to a constant weight, and weighed to the nearest 0.1 mg. Blank corrections were made in proportion to the amount of reagent used.

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[1] Federal Register, Vol. 36, No. 159, Part II, August 17, 1971.

DETERMINATION OF NITROGEN OXIDES IN STACK GAS: PHENOLDISULFONIC ACID METHOD

INTRODUCTION

The following method was used to determine total oxides of nitrogen. Samples were collected in evacuated flasks containing a dilute sulfuric acid-hydrogen peroxide absorbing solution, and the nitrogen oxides, except nitrous oxides were measured spectrophotometrically at 410 nm.

REAGENTS

The following reagents were used in this sampling program:

(All chemicals were ACS analytical-reagent grade.)

Water - Distilled - deionized water.

Hydrogen Peroxide (3%) - 10 ml. of 30 percent H_2O_2 was diluted to 100 ml in a 100 ml volumetric flask with water.

Absorbing Reagent - 2.8 ml of concentrated H_2SO_4 was diluted to one liter with distilled water. After mixing well, 6 ml of 3 percent hydrogen peroxide were added. The solution is prepared fresh every two or three days.

Sodium Hydroxide (1 N) - 40 gm of NaOH were dissolved in distilled water and diluted to one liter.

Ammonium Hydroxide (concentrated)

Sulfuric Acid (fuming) - (15-18% SO_3)

Phenoldisulfonic Acid Solution - 25 grams of pure white phenol were dissolved in 150 ml of concentrated H_2SO_4 on a steam bath. After the solution cooled, 75 ml fuming sulfuric acid were added. It was then heated to 100°C for two hours. The reagent was stored in a dark stoppered reagent bottle.

Potassium Nitrate Solution (standard) - 0.5495 grams of KNO_3 were dissolved in one liter of water in a volumetric flask. 100 ml of this solution was diluted to one liter in a volumetric flask. One ml of the final solution was equivalent to 0.025 mg NO_2.

SAMPLING APPARATUS

Flasks - Two-liter, Pyrex, round-bottom flask were encased in a simple container with a sleeve and accompanying stopcock valve as shown in Figure A-2.

Vacuum System - The vacuum system consisted of a vacuum pump, capable of producing a vacuum of 3 inches Hg absolute pressure, connected to a 0-36" Hg u-tube manometer.

Thermometer - Dial thermometer, range 25 to 125°F. 5-inch stem.

Probe - Pyrex glass, heated, with a filter to remove particulate matter.

Variable Transformer - Rated at 12 amps, 0 to 140 volts.

Spectrophotometer - A Bausch & Lomb Spectronic 70, capable of measuring optical density at 410 nm in 0.5 inch absorbance cells was used.

SAMPLING PROCEDURES

25 ml of absorbing solution were pipetted into a sample flask. The flask valve stopper was inserted into the flask with the valve in the "closed" position. The sampling train was assembled as shown in Figure A-2 with all valves closed. The probe was placed at the sampling point. The probe valve and the pump-manometer valve were turned to their "open" positions and the probe purged. The probe valve was then closed and the flask valve opened to its "evacuate" position. The flask was evacuated to at least 3 in. Hg absolute pressure. The manometer reading was taken by turning the pump-manometer valve to the "manometer" position. The pump was turned off and the system was checked for leaks by observing any drop in the mercury level.

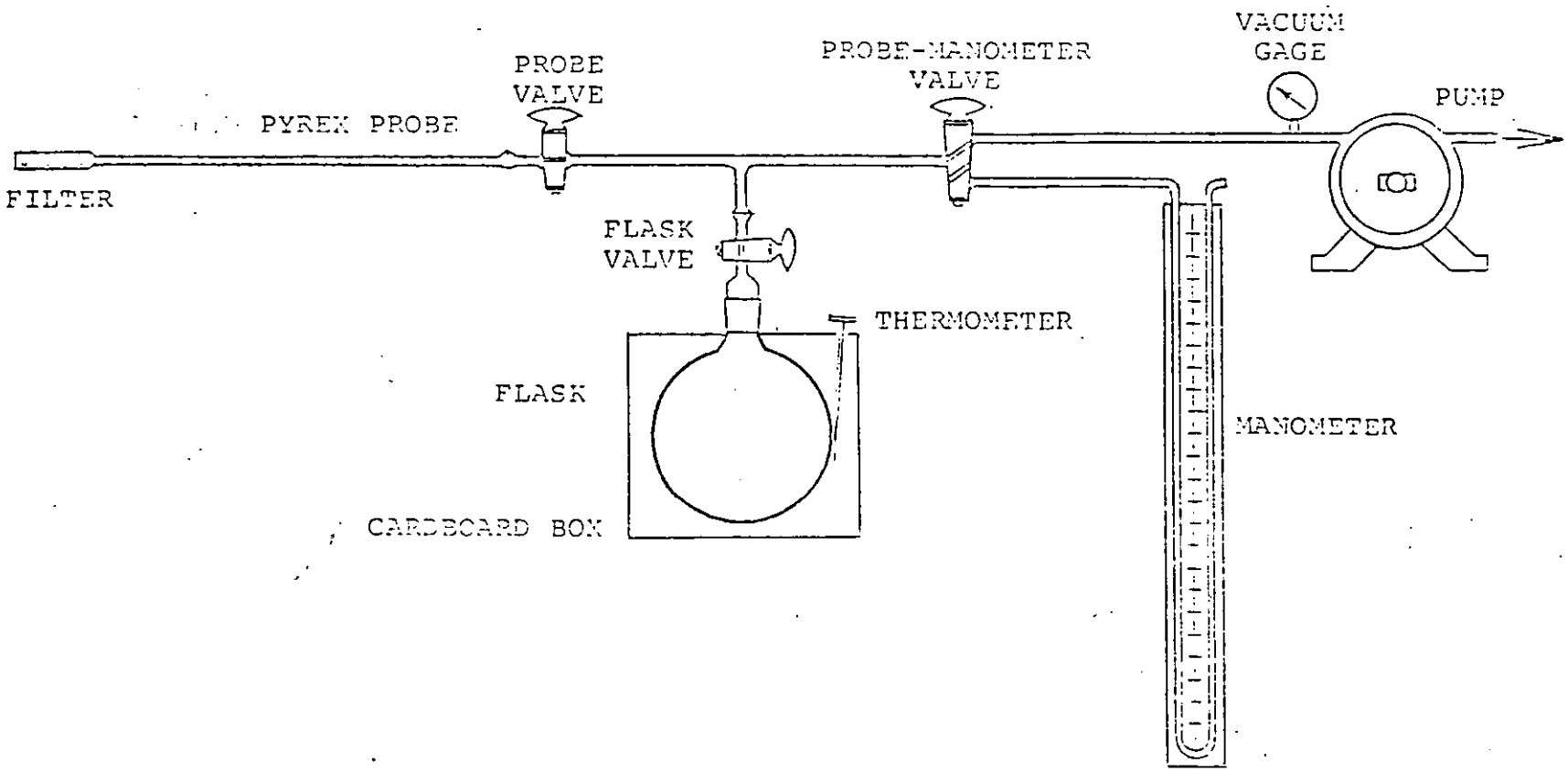

Figure A-2 Nitrogen Oxides Sampling Train

The initial flask pressure, volume, temperature, and barometric pressure were recorded on the data sheet. The probe valve was slowly turned to the "sample" position until a slight drop in the manometer mercury level was observed. The sample was allowed to enter the flask for about 3 to 4 minutes. The probe valve was then closed when there was approximately a one inch mercury vacuum left in the flask. The final flask pressure and temperature were then recorded. The flask valve was closed and the flask contents were shaken for five minutes.

Sample Recovery

The samples were allowed to remain in the flasks for at least 24 hours. The sample was then transferred to a 250 ml beaker using a small amount of water.

Analysis

The sample was evaporated to dryness in an oven and then cooled. Two ml of phenoldisulfonic acid solution were added to the dried residue and triturated thoroughly with a glass rod. One ml of water and 4 drops of concentrated sulfuric acid were then added. The solution was heated on a steam bath for three minutes with occasional stirring. After cooling, 20 ml of water were added and mixed well by stirring. Concentrated ammonium hydroxide was added dropwise with constant stirring until alkaline to litmus paper. The solution was transferred to a 100 ml volumetric flask and the beaker washed three times with 4 to 5 ml portions of water. The solution was diluted to the mark and mixed thoroughly. The absorbance of each sample was measured at 410 nm using the blank solution as a zero. A half inch absor-

bance cell was used.

CALIBRATION PROCEDURES

Flask Volume - The flask and flask valve were assembled and filled with water to the stopcock. The volume of water was measured to ± 1 ml. The flasks were numbered and the volume recorded on each.

Spectrophotometer - Aliquots of 0.0 to 16.0 ml of potassium nitrate solution (standard) was added to a series of beakers, and 25 ml of absorbing solution added to each. Sodium hydroxide (1N) was added dropwise until alkaline to litmus paper (about 25 to 35 drops). These solutions were transferred to 100 ml volumetric flasks and the absorbance read at 410 nm. The calibration curve was checked prior to each set of samples.

DETERMINATION OF SULFUR DIOXIDE EMISSIONS IN STACK GASES

This method was used to measure sulfur dioxide in stack gases and follows Method 6 of the Federal Register[1], with modifications as noted below.

SAMPLING APPARATUS

Nozzle - Stainless Steel (316) with sharp, tapered leading edge.

Probe - Pyrex glass with a heating system capable of maintaining a minimum gas temperature of 225 F at the exit end during sampling and prevent condensation form occurring.

Pitot Tube - Type S, attached to probe to monitor stack gas velocity.

Filter Holder - Pyrex glass

Impingers - Four as shown in Figure A-3. The first and third are of the Greenburg-Smith design with standard tip. The second and fourth were modified by replacing the standard tip with a 1/2 - inch ID glass tube extending to within one-half inch of the bottom of the impinger flask.

Metering System - Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5°F, dry gas meter with 2% accuracy, and related equipment, to maintain an isokinetic sampling rate and to determine sample volume.

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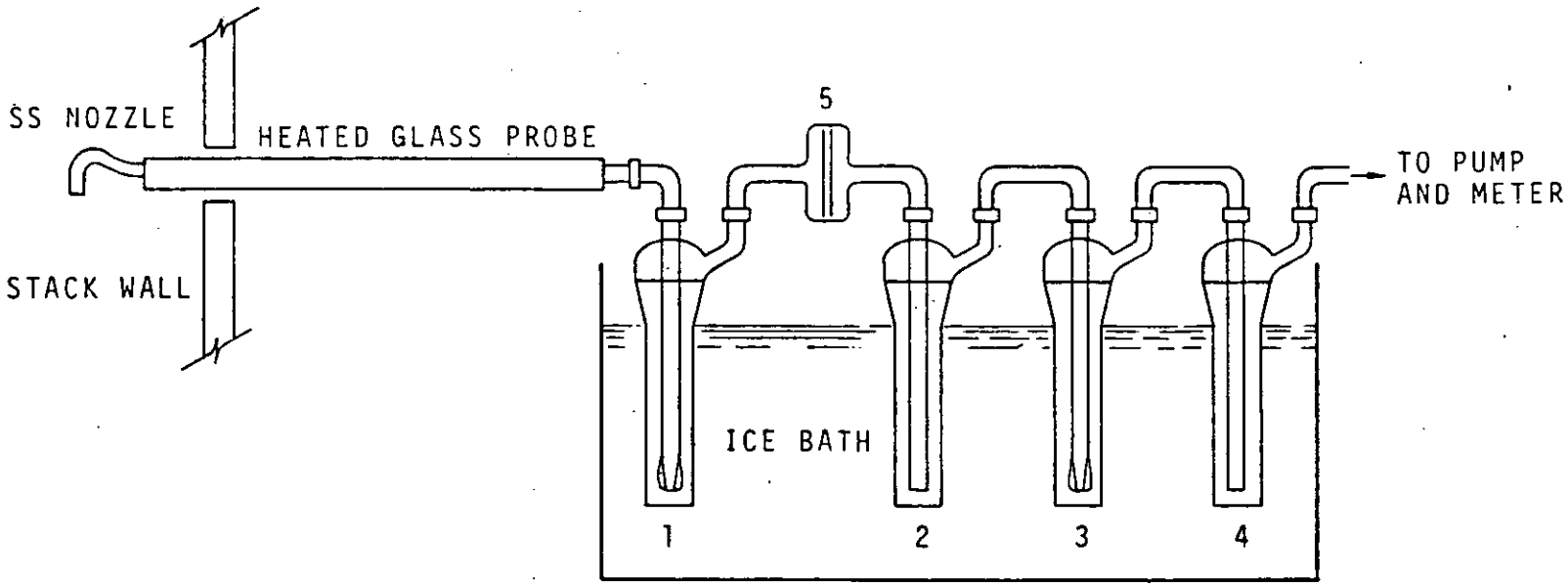
1. Federal Register, Vol. 36, No. 247 - December 23, 1971.



1. G-S IMPINGER - 150 ml. 80% ISOPROPANOL
2. MODIFIED G-S IMPINGER - 100 ml. 3% H_2O_2
3. G-S IMPINGER - 100 ml. 3% H_2O_2
4. MODIFIED G-S IMPINGER - 200 g. SILICA GEL
5. FILTER HOLDER w/GLASS FIBER FILTER

Figure A-3. SO_2/SO_3 sampling train.

Barometer - Bourden tube type to measure atmospheric pressure to ± 0.1 inches Hg.

SAMPLING REAGENTS

Filters - Glass fiber, MSA type 1106 BH of a suitable size to fit in the filterholder.

Silica Gel - Indicating type , 6-16 mesh.

Water - Deionized, distilled.

Isopropanol, 80% - Mix 800 ml. of isopropanol with 200 ml. of deionized, distilled water.

Hydrogen Peroxide, 3% - Dilute 100 ml. of 30% hydrogen peroxide to 1 liter with deionized, distilled water.

ANALYTICAL REAGENTS

Water - Deionized, distilled.

Isopropanol

Thorin Indicator - 1 - (0-arsonophenylazo)-2-naphthol-3, 6-disulfonic acid, disodium salt. Dissolve 0.20 gram in 100 ml . distilled water.

Barium Chloride (0.0200N) - Dissolve 2.4431 grams of barium chloride [$BaCl_2$] in 200 ml. distilled water and dilute to 1 liter with isopropanol. Standardize with sulfuric acid.

Sulfuric Acid Standard (0.02N)- Standardize to ± 0.0002 N against 0.01N NaOH which has previously been standardized against primary standard potassium acid phthalate.

SAMPLING PROCEDURE

One sampling point of average velocity was chosen which was more than 2 feet from the inner walls of the stack. The train was assembled as follows: 150 ml. of 80% isopropanol in the first impinger, 100 ml. of 3% hydrogen peroxide in both the second and third impingers,

and about 200 grams of weighed silica gel in the fourth impinger. A portion of the reagents were retained for use as a blank. The train was assembled without the probe and was leak checked at the sampling site by plugging the inlet of the first impinger and pulling a 15-inch Hg vacuum. A leakage rate not in excess of 0.02 cfm at a vacuum of 15 inches Hg was recorded in all cases. The probe was then attached and the probe heating system turned on. The probe heater setting was adjusted during sampling to prevent any visible condensation. Crushed ice was placed around the impingers and more ice was added during the run to keep the temperature of the gases leaving the last impinger to 70°F or less.

For each run, the data were recorded at startup, on completion of the test and at 15 minute intervals. Sampling was begun by positioning the probe at the sample point. The pump was then started and sampling proceeded at a rate of approximately 0.8 cfm for a 240 minute period.

At the completion of the test, the probe was removed from the stack and the train was pruged for 20 minutes by drawing ambient air through the system.

SAMPLE RECOVERY

The solutions from the second and third impingers were transferred to a Wheaton bottle. These impingers and their connecting glassware were rinsed with deionized distilled water and other washings added to the same container. The isopropanol from the first impinger and filter were discarded.

ANALYTICAL PROCEDURES

The volume of the sample was recorded. A 10 ml aliquot of sample was pippetted into a 100 ml Erlenmeyer flask. 40 ml of isopropanol and 2 to 4 drops of thorin indicator were added. The sample was then titrated with barium chloride to a pink end point. Each titration was repeated with a second aliquot of sample. The blanks were titrated in the same manner as the samples.

APPENDIX I

TEST LOG

CHRONOLOGICAL LIST OF NOTES THROUGHOUT PROJECT _____ (NOT COVERED BY DAILY PERSONNEL AND LOG SHEET)

DATE	TIME	EVENT
7/8/74	1130	Crew Arrives at Plant, MB, JA, FM, BD, EM.
	1145	Crew leaves for Lunch
	1220	Crew returns, JA sets up lab while rest of crew sets up test site
	1300	BA arrives at Plant, helps set up test site
	1400	Setup complete, must wait for EPA personal to arrive before tests can start
	1500	NO_x reagent is mixed
	1635	Gene Riley arrives at plant
	1713	MB+EM start particulate tests, JA starts process data FM starts SO_3 tests, BD+BA start visible,
	1720	FM starts orsat bag
	1748	First NO_x flask started
	1848	Second NO_x flask started
	1951	Third NO_x flask started
	2023	Shut down Particulate test, chunks coming from stack
	2027	Restart test
	2048	Fourth NO_x started
	2119	Shut down because ESP field blew fuss
	2120	Restart tests
	2129	Tests finished, Particulate + SO_3
	2150	BA, MB, EM leave plant
	2300	FM, JA, BD leave plant
7/9/74	730	FM, JA, BD arrive at plant
	750	BA, MB, EM arrive at plant
	841	MB+EM start particulate test, FM starts SO_3 test JA starts process data, BA+BD start visible
	845	FM starts orsat bag
	915	First NO_x flask started
	1015	Second NO_x flask started
	1100	Shut down to switch silica gel in Part. train
	1103	Retart test
	1115	Third NO_x flask started
	1215	Fourth NO_x flask started

During cleanup discovered probe tip liner cracked

CHRONOLOGICAL LIST OF NOTES THROUGHOUT PROJECT _____ (NOT COVERED BY DAILY PERSONNEL AND LOG SHEET)

DATE	TIME	EVENT
7/9/74	1248	Tests Finished, Particulate + SO_3
	1630	Crew leaves plant
7/10/74	700	Crew arrives at plant
	824	MB HEM start particulate, FM starts SO_3 JA starts Process BA + BD start visible
	829	FM starts orsat bag
	839	Shut down to install thermocouple lead on P. probe
	843	Restart tests
	857	Shut down, High vacuum in particulate train
	0900	Restart
	0902	Shut down, high vacuum
	913	Restart, too much silca gel problem
	922	Shut down, high vacuum
	934	Restart, replaced gel
	920	NO_x flask started
	1033	Second NO_x flask started
	1133	Third NO_x flask started
	1200	BD leaves plant for North Carolina
	1230	Fourth NO_x flask started
	1255	Test finished
	1330	Crew leaves for lunch
	1400	Crew returns to plant
	1820	FM, JA, MD leave plant
	1900	EM, BA leave plant
7/11/74	745	Crew arrives at plant
	900	Crew leaves plant for breakfast, can't test
	945	Crew returns to plant
	1500	Crew leaves plant, can't test, plant
		conditions not right. JA leaves for Cin.
7/12/74	700	Crew arrives at plant
	800	BD arrives at plant

CHRONOLOGICAL LIST OF NOTES THROUGHOUT PROJECT _____ (NOT COVERED BY DAILY PERSONNEL AND LOG SHEET)

DATE	TIME	EVENT
7/12/74	830	EM leaves plant for Cincinnati
	1025	Crew starts to take down gear,
	1115	Crew finishes removing Test gear
	1200	Crew leaves plant for Cincinnati.

APPENDIX J

RELATED REPORTS

(Supplied by EPA)

RELATED REPORTS

Because of the process and control equipment problems that were encountered, two additional test series were performed at the Woodville Lime and Chemical Company. The first test series began on May 21, 1974, and is discussed in EPA Report No. 74-LIM-3A. The last test series performed started on August 5, 1974, and is presented in EPA's Report No. 75-LIM-8.