SET 2510 02 0874

U.S. Lime Division of Flintkote Company
City of Industry, California

EMB Project Report No. 74-L1M-5

Final Report

Prepared for:

Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

EPA Contract 68-02-0233, Task No. 19

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by

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SET 2510 02 0874

TABLE OF CONTENTS

SET 2510 02 0874

1.0 INTRODUCTION

In accordance with Section III of the Clean Air Act of 1970, the Environmental Protection Agency is charged with the establishment of performance standards for new installations or modifications of existing installations in stationary source categories which may contribute significantly to air pollution. A performance standard is a standard for emissions of air pollutants which reflects the best emission reduction systems that have been adequately demonstrated taking into account economic considerations.

The development of realistic performance standards requires accurate data on pollutant emissions applications to various source categories. Thus Scott Environmental Technology performed source sampling tests at the U.S. Lime Division of the Flintkote Company in the City of Industry, California during the week of April 15, 1974. The purpose of the test was to obtain background data for development of National New Source Performance Standards in the lime industry. The plant under consideration is involved primarily in lime hydration. Wet exhaust gases from a seasoning chamber are passed through a Ducon scrubber where the heavy residue is collected in a slurry tank. The wet gaseous stream is then vented to the atmosphere via a tall stack, about 100 feet above ground and 26.75 inches in diameter.

The original task order specified six two-hour runs on the outlet of the scrubber only. The EPA Project Officer, however, modified this plan to three four-hour runs becuase of low outlet emission rates. Due to a lack of silo storage space at the plant during run three, the sampling time for this run was reduced to two hours. Also, during the second test run, a screw auger to the storage bin plugged up and caused a temporary plant upset. The delay was only for about twenty minutes and did not significantly affect the test run.

The samples were analyzed for the determination of total particulate loading. The test method used was Method 5, "Determination of Particulate Emissions from Stationary Sources" as published in the December 23, 1971 Federal Register. However, two important modifications were incorporated

SET 2510 02 0874

in the sampling scheme: (i) the impinger catches were retained and analyzed, and (ii) a "front-half" water wash was found necessary for complete sample recovery.

The test team comprised of three EPA representatives and two Scott employees. Three complete tests were performed traversing the stack in two perpendicular directions. The test equipment was set up on April 15, 1974, and the tests performed on April 16, 17, and 18, 1974.

SET 2510 02 0874

2.0 SUMMARY & DISCUSSION OF RESULTS

A summary of the test results is presented in Table 1 (British Units) and Table 2 (Metric Units). As can be seen, all three runs showed a very high stack gas moisture content (40-50%). Moreover, the sampling nomograph had to be often reset during runs because of fluctuations in stack temperature that caused large changes in the moisture content of the saturated gas stream. Also, a nozzle size at the low end of the acceptable range (0.210 ins.) was used in the first two runs in order to reduce the volume of water collected in the impingers. This results in over isokinetic (>110%) average sampling rate because the operating orifice pressure drop (ΔH) was forced below the straight-line calibration range. Therefore a larger nozzle size (0.302 ins.) was used in the last run to bring the isokinetic sampling rate to within acceptable limits.

It should be pointed out here that the isokinetic values reported in Tables 1 and 2 are average values, averaged over the isokinetic rates determined at each sampling point. The percent isokinetic rate at each traverse point was based on the volume sampled at each point, the velocity (pressure drop and stack temperature) measured at each point, and the sampling time at each point.

A visible emission check was also conducted during this test program on 4/18/74. Due to the high moisture content, the stack plume was essentially all water vapor. An overcast background, however, rendered detection of any other possible visible emissions virtually impossible.

SET 2510 02 0874

Table 1 SUMMARY OF RESULTS
(British Units)

Run Number	1	2	3	Average
Date:	4/16/74	4/17/74	4/18/74	
Volume of Gas Sampled - DSCF(a)	74.2	80.6	80.5	78.4
Percent Moisture by Volume **	44.5	48.0	47.5	46.7
Average Stack Temperature - °F	174	178	177	176
Stack Volumetric Flow Rate -DSCFM(b)	4901	4775	4797	4824
Stack Volumetric Flow Rate -ACFM(c)	10701	11154	11084	10980
Percent Isokinetic	101.3	115.7	106.7	107.9
Percent Opacity	0	0	0	0
Feed Rate - ton/hr	14	14	14	14
Particulate - probe, cyclone, & filter catch				
mg	104.2	140.8	191.3	145.4
gr/DSCF	0.02164	0.02690	0.03658	0.02855*
gr/ACF	0.00991	0.01151	0.01583	0.01248*
lb/hr	0.91	1.10	1.50	1.17
lb/ton feed	0.065	0.079	0.107	0.084
	0.052		0.086	0.069
Particulate - total catch				
mg	129.6	181.3	211.0	174.0
gr/DSCF	0.02691	0.03463	0.04034	0.03415*
gr/ACF	0.01233	0.01483	0.01746	0.01494*
lb/hr	1.13	1.42	1.66	1.40
lb/ton feed	0.081	0.101	0.119	0.100
	0.013		0.009	0.011
Percent Impinger Catch	19.6	22.3	9.34	17.1

(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.
* Weighted Averages
** Based on saturated psychrometric values at stack temperature.

SET 2510 02 0874

Table 2 SUMMARY OF RESULTS
(Metric Units)

Run Number	1	2	3	Average
Date:	4/16/74	4/17/74	4/18/74	
Volume of Gas Sampled - Nm^3 (a)	2.100	2.281	2.278	2.220
Percent Moisture by Volume **	44.5	48.0	47.5	46.7
Average Stack Temperature - °C	78.9	81.1	80.6	80.2
Stack Volumetric Flow Rate-Nm^3/min (b)	138.8	135.2	135.8	136.6
Stack Volumetric Flow Rate-m^3/min (c)	303.0	315.8	313.9	310.9
Percent Isokinetic	101.3	115.7	106.7	107.9
Percent Opacity	0	0	0	0
Feed Rate - M ton/hr	12.7	12.7	12.7	12.7
Particulate - probe, cyclone, and filter catch				
mg	104.2	140.8	191.3	145.4
mg/Nm^3	49.6	61.7	84.0	65.5*
mg/m^3	22.7	26.3	36.2	28.6*
kg/hr	0.40	0.48	0.66	0.51
kg/M ton	0.031	0.038	0.052	0.040
Particulates - total catch				
mg	129.6	181.3	211.0	174.0
mg/Nm^3	61.7	79.5	92.6	78.4
mg/m^3	28.2	33.9	39.9	34.2
kg/hr	0.49	0.61	0.73	0.61
kg/M ton	0.039	0.048	0.057	0.048
Percent Impinger Catch	19.6	22.3	9.34	17.1

(a) Dry normal cubic meter at 21.1°C and 760 mm Hg.
(b) Dry normal cubic meters per minute at 21.1°C, 760 mm Hg.
(c) Actual cubic meters per minute.
* Weighted average.
** Based on saturated psychrometric values at stack temperature.

SET 2510 02 0874

3.0 PROCESS DESCRIPTION & OPERATION

Limestone consists primarily of calcium carbonate or combinations of calcium and magnesium carbonate with varying amounts of impurities. Lime is a calcined or burned form of limestone, 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 and then hydration.

The Flintkote Company lime plant in Industry, California, operates a calcitic quicklime atmospheric hydrator to produce calcium hydroxide (hydrated lime). The quicklime feed of approximately 14 tons per hour is crushed and pulverized before being fed to a pugmill premixer where it is wet with a lime slurry from the scrubbing system. The reaction takes place in an agitated seasoning chamber. A rate retardant is added to the seasoning chamber to control the high temperatures obtainable in this exothermic reaction. The final moisture content of the hydrated lime was reported to range from 0.5 to 1.0 percent.

The offgas from the seasoning chamber is scrubbed in a Ducon UW-4 dynamic water scrubber with about 165 pounds per minute of water. Gas temperature into the scrubber is 190°F. Operating variables during the tests are summarized in the following Table.

Three particulate samples were taken from the scrubber stack by Scott Environmental Technology, under contract to the EPA. Samples 1 and 2 were of four-hour duration. Sample 3 was of two-hour duration. Visible emission data were recorded by an EPA observer for one hour during the third test. A large steam plume was observed but no other visible emissions were discernible. Preliminary calculations indicated about 4 percent moisture in the gases out of the scrubber.

SET 2510 02 0874

Three baghouse collectors controlled emissions from loading, milling, sacking, screening and separating processes in the lime plant. No visible emissions were apparent from these collectors. No sampling of these emissions was done.

According to Flintkote and EPA process data, the plant was operating normally throughout all three tests. The process shut down for approximately five minutes during the second test due to a blocked feed screw and may result in a slightly lower particulate catch for that test. All three tests appeared to be successful.

TABLE 3 - SUMMARY OF ATMOSPHERIC HYDRATOR AND WATER SCRUBBER OPERATING DATA DURING SAMPLING

Date	4/16/74	4/17/74	4/18/74
Test No.	1	2	3
Lime Feed Rate (tons/hr)	14	14	14
Water Feed Rate (tons/hr)	7	7	7
Hydrated Lime Production (tons/hr)	17-18	17-18	17-18
Scrubber Water (lbs/min)	160-166	165-168	165-169
Scrubber Temp. before airbleed (°F)	203-206	202-210	208-215
Scrubber Temp. after airbleed (°F)	184-192	188-192	188-192

SET 2510 02 0874

4.0 LOCATION OF SAMPLING POINT

The exhaust from the lime hydration operation passes through a Ducon Scrubber before entering the stack. The sample collection ports were located sixteen feet above the scrubber/stack interface as detailed in Figure 1. Two ports whose axes were perpendicular were located at this point. The stack inside diameter is 26.75 inches from the scrubber to the exit.

The sampling probe was traversed in and out of each port sampling at twelve locations in each direction. The location of each sampling point is shown in Figure 2.

SET 2510 02 0874

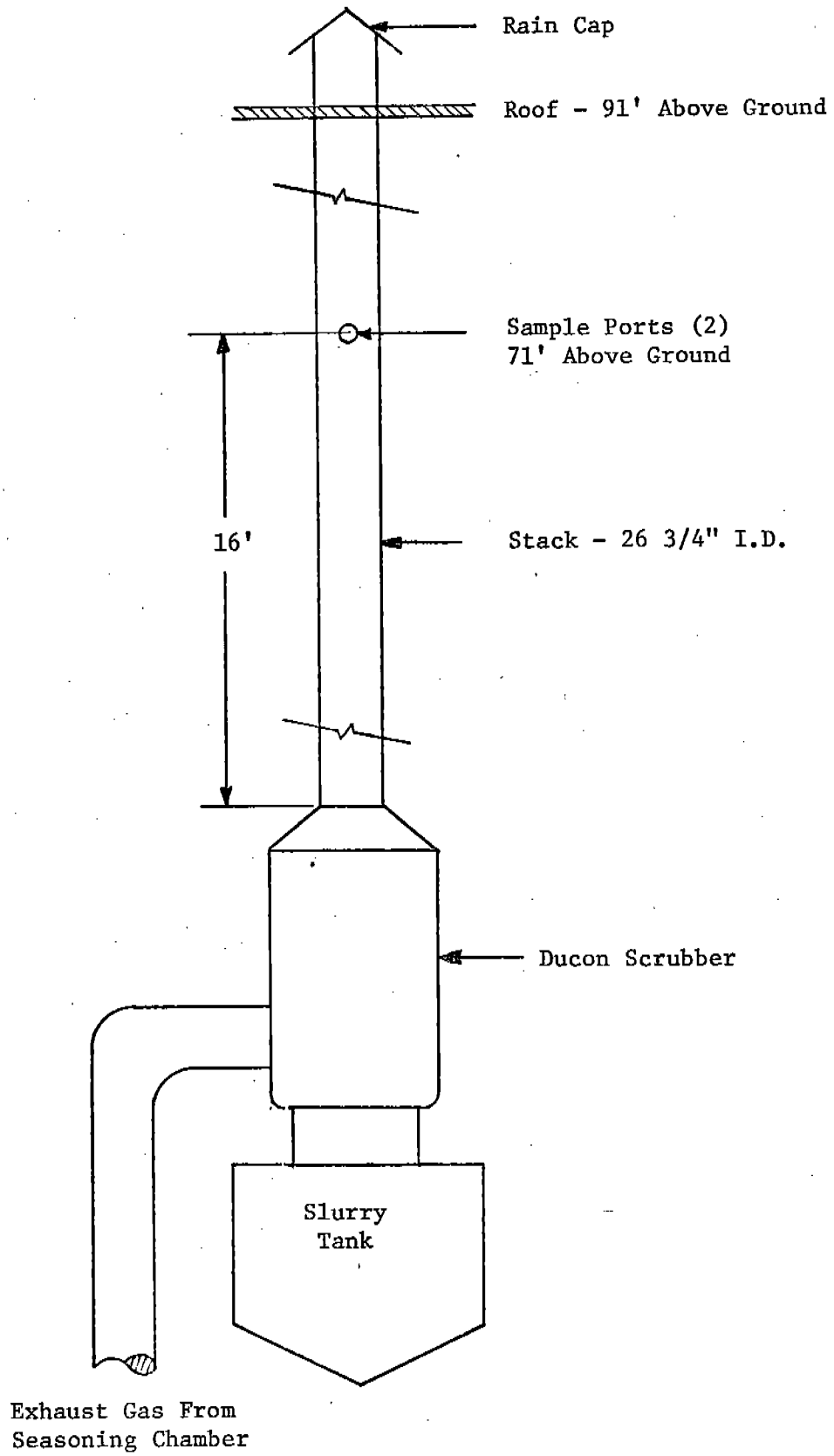
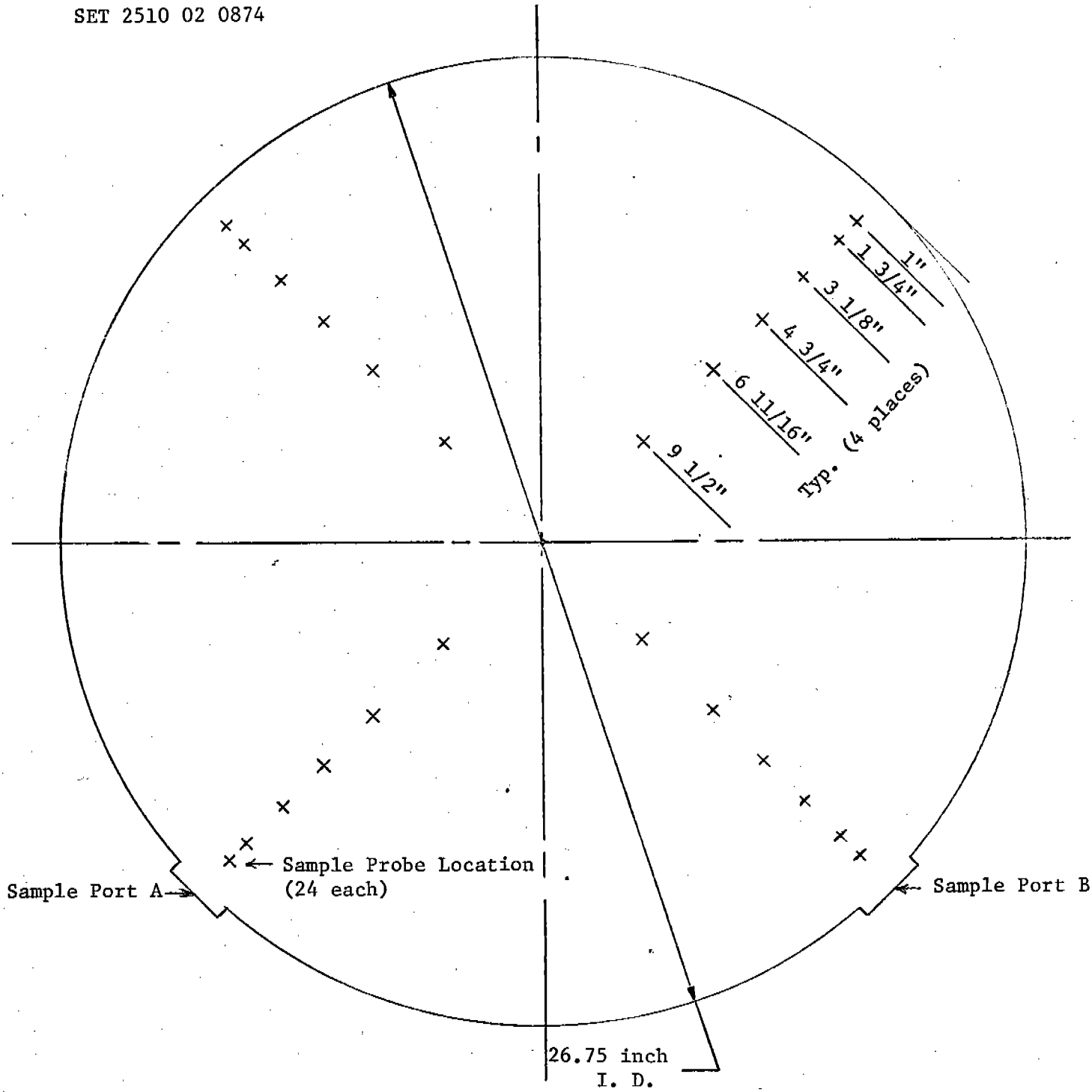


Figure 1 Sample Port Locations

SET 2510 02 0874



Cross Section of Stack

Figure 2 Sampling Point Locations

SET 2510 02 0874

5.0 SAMPLING AND ANALYTICAL PROCEDURES

Samples for the determination of total particulate loading were collected using one probe and traversing two perpendicular ports. The sampling and analytical procedures used were in accordance with Method 5, "Determination of Particulate Emissions from Stationary Sources," as published in the Federal Register, Volume 36, No. 247, Tuesday, December 23, 1971. However, two important modifications were incorporated in this procedure: (i) the impinger catches were retained and analyzed, and (ii) a "front-half" water wash was found necessary for complete sample recovery. All dried particulate samples collected were forwarded to the EPA for analysis after determination of particulate mass.

Briefly, the method consisted of withdrawing a sample isokinetically from the stack through a heated probe into a filter and impinger train as shown in Figure 3. The sample volume is measured with a dry gas meter and isokinetic conditions were maintained by monitoring the stack gas velocity. After testing was completed, the train was thoroughly washed including the probe. A water and acetone wash were used and collected in separate containers. These washings were evaporated, dried and weighed along with the filter and summed to obtain the total weight of particulate matter collected.

SET 2510 02 0874

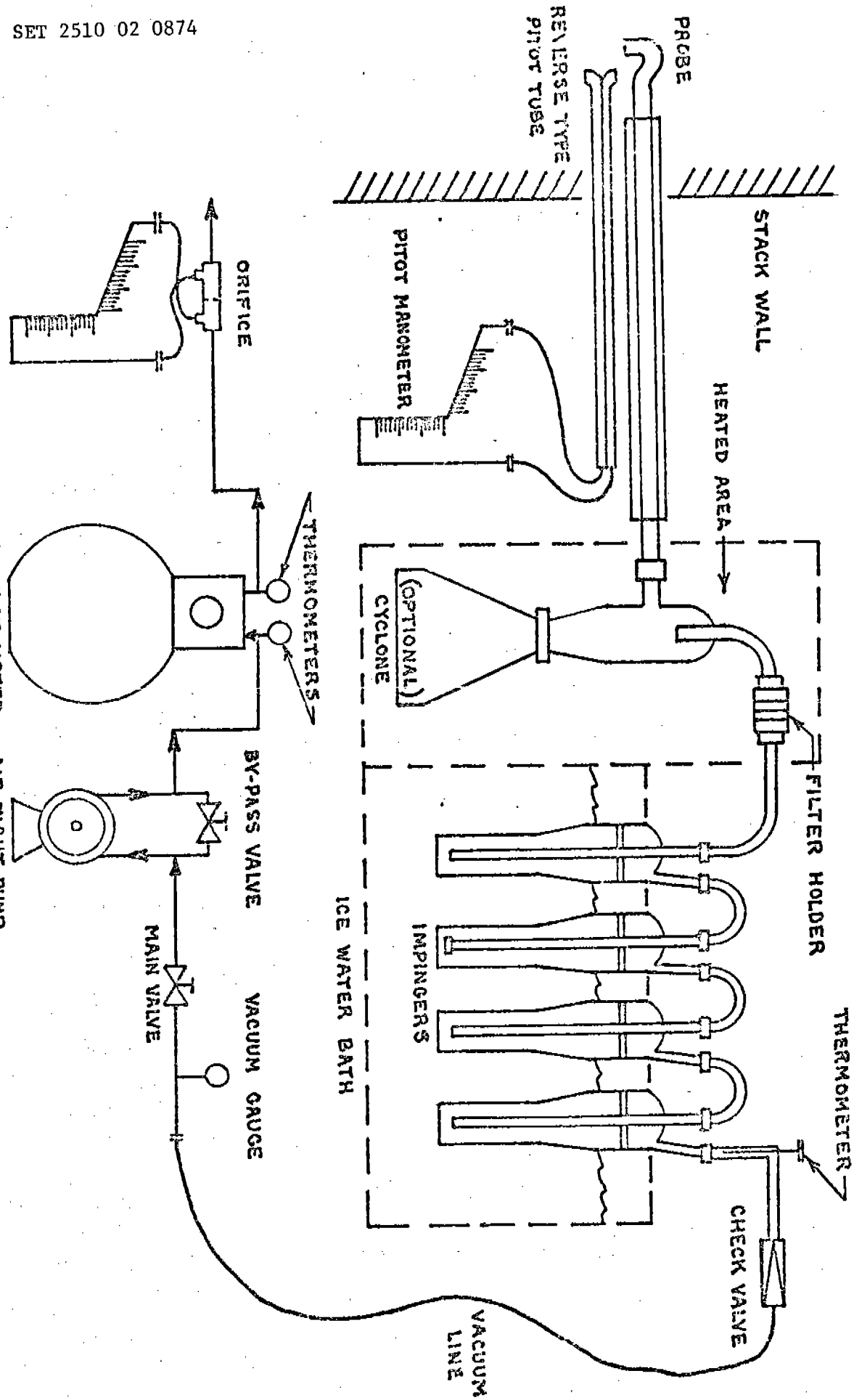


FIG. 3 PARTICULATE SAMPLING TRAIN

SET 2510 02 0874

APPENDIX A

Complete particulate results with example calculation.

SET 2510 02 0874

SAMPLING DATA

Run No.		1	2	3
Test Date		4/16/74	4/17/74	4/18/74
Sampling Time, 24 hour clock		1038-1458	0934-1419	0840-1057
D_n	Sampling Nozzle Diameter, in.	0.210	0.210	0.302
T_t	Net Time of Test, Min.	240	240	125
P_b	Barometric Pressure, in. Hg Absolute	29.54	29.62	29.60
P_m	Average Orifice Pressure Drop, in. H_2O	0.400	0.425	1.681
V_m	Volume of Dry Gas Sampled at Meter Conditions, DCF	82.67	88.28	86.51
T_m	Average Gas Meter Temperature, °F	123.9	115.2	105.6
$V_{m_{std}}$	Volume of Dry Gas Sampled at Standard Conditions[a], DSCF	74.2	80.6	80.5
V_w	Total H_2O Collected in Impingers and Silica Gel, ml	1363.4	1768.4	1652.2
$V_{w_{gas}}$	Volume of Water Vapor Collected at Standard Conditions[b], SCF	64.4	83.6	78.1
% M	% Moisture in Stack Gas, by Volume*	44.5	48.0	47.5
M_d	Mole Fraction of Dry Gas	0.555	0.520	0.525
% CO_2	Volume % Dry	0.00	0.00	0.00
% O_2	Volume % Dry	20.43	20.43	20.43
% CO	Volume % Dry	0.00	0.00	0.00
% N_2	Volume % Dry	79.57	79.57	79.57
MW_d	Molecular Weight of Stack Gas, Dry Basis	28.82	28.81	28.82
MW	Molecular Weight of Stack Gas, Wet Basis	24.00	23.63	23.68
C_p	Pitot Tube Coefficient	0.82	0.82	0.82
T_s	Average Stack Temperature °F	174	178	177
N_p	Net Sampling Points	48	48	25
P_{st}	Static Pressure of Stack Gas, in. Hg	0.01	0.01	0.01
P_s	Stack Gas Pressure, in. Hg Absolute	29.55	29.63	29.61

SET 2510 02 0874

SAMPLING DATA

Run No.		1	2	3
V_s	Stack Gas Velocity at Stack Conditions, fpm	2742	2858	2840
A_s	Stack Area, $in.^2$	562	562	562
Q_s	Dry Stack Gas Volumetric Flow Rate at Standard Conditions,[c] DSCFM	4901	4775	4797
Q_a	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	10701	11154	11084
% I	Percent Isokinetic	101.3	115.7	106.7
% O	Percent Opacity	0	0	0
T_c	Unit Feed Rate-ton/hr	14	14	14
m_f	Particulate - Probe, Cyclone, and Filter, mg	104.2	140.8	191.3
m_t	Particulate - Total, mg	129.6	181.3	211.0
I_c	% Impinger Catch	19.6	22.3	9.34
C_{an}	Particulate - Probe, Cyclone, and Filter, gr/SCF	0.02164	0.02690	0.03658
C_{ao}	Particulate - Total, gr/SCF	0.02691	0.03463	0.04034
C_{at}	Particulate - Probe, Cyclone, and Filter, gr/ACF	0.00991	0.01151	0.01583
C_{au}	Particulate - Total, gr/ACF	0.01233	0.01483	0.01746
C_{aw}	Particulate - Probe, Cyclone, and Filter, lb/hr	0.91	1.10	1.50
C_{ax}	Particulate - Total, lb/hr	1.13	1.42	1.66
P_{tf}	Particulate - Probe, Cyclone, and Filter, lb/ton feed	0.065	0.079	0.107
P_{tt}	Particulate - Total, lb/ton feed	0.081	0.101	0.119

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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.

* Based on saturated psychrometric values at stack temperature.

SET 2510 02 0874

PARTICULATE CALCULATIONS
(Example for Run #1)

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

$$V_{m_{std}} = \frac{17.7 \times V_m \left(P_B + \frac{P_m}{13.6} \right)}{(T_m + 460)} = \text{Ft.}^3 = \frac{17.714 \times 82.67 \left(29.54 + \frac{0.400}{13.6}\right)}{(123.9 + 460)}$$

$$= \underline{74.2} \text{ cu. ft.}$$

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

$$V_{w_{gas}} = 0.0473 \times V_w = \text{Ft.}^3 = 0.0473 \times 1363.4 = \underline{64.4} \text{ cu. ft.}$$

3. % Moisture in stack gas

$$\%M = \frac{100 \times V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} = \% = \underline{44.5\ \%}^*$$

4. Mole fraction of dry gas

$$M_d = \frac{100 - \%M}{100} = \frac{100 - 44.5}{100} = \underline{0.555}$$

5. Average molecular weight of dry stack gas

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

$$= (-o-) + (20.43 \times 0.32) + (79.57 \times 0.28) + (-o) = \underline{28.82}$$

6. Molecular weight of stack gas

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

$$= 28.82 \times 0.555 + 18(1 - 0.555) = \underline{24.00}$$

* Based on saturated psychrometric values at stack temperature

SET 2510 02 0874

7. Stack velocity & Stack conditions, fpm

$$V_s = \frac{5130.27 \times C_p}{\cancel{4350}} \times \sqrt{\Delta P_s \times (T_s + 460)} \left[\frac{1}{P_s \times M W}\right]^{1/2} = \text{fpm} = \underline{2742} \text{ fpm}$$

(Averaged over 48 points)

8. Stack gas volume @ standard conditions, SCFM

$$Q_s = \frac{0.123 \times V_s \times A_s \times M_d \times P_s}{(T_s + 460)} = \text{SCFM} = \frac{0.123 \times 2742 \times 562 \times 0.555 \times 29.55}{(174 + 460)}$$

$$= \underline{4901} \text{ SCFM}$$

9. Per cent isokinetic

$$\%I = \frac{1032 \times (T_s + 460) \times V_{m_{std}}}{V_s \times T_t \times P_s \times M_d \times (D_n)^2} = \% = \underline{101.3}\ \% \quad \text{(Averaged over 48 points)}$$

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

$$C_{an} = 0.0154 \times \frac{M_f}{V_{m\ std}} = \text{gr/SCF} = \frac{0.0154 \times 104.2}{74.2} = \underline{0.0216} \text{ gr/SCF}$$

11. Particulate total, gr/SCF

$$C_{ao} = 0.0154 \times \frac{M_t}{V_{m_{std}}} = \text{gr/SCF} = \frac{0.0154 \times 129.6}{74.2} = \underline{0.0269} \text{ gr/SCF}$$

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

$$C_{at} = \frac{17.7 \times C_{an} \times P_s \times M_d}{(T_s + 460)} = \text{gr/CF} = \frac{17.714 \times 0.0216 \times 29.55 \times 0.555}{(174 + 460)}$$

$$= \underline{0.00991} \text{ gr/CF}$$

SET 2510 02 0874

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

$$C_{au} = \frac{17.7 \text{ X } C_{ao} \text{ X } P_s \text{ X } M_d}{(T_s + 460)} = \text{gr/CF} \quad = \frac{17.714 \times 0.0269 \times 29.55 \times 0.555}{(174 + 460)}$$

$= 0.01233$ gr/CF

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

$$C_{aw} = 0.00857 \text{ X } C_{an} \text{ X } Q_s = \text{lb/hr.} \quad = 0.00857 \times 0.0216 \times 4901$$

$= 0.91$ lb/hr

15. Particulate - total, lb/hr.

$$C_{ax} = 0.00857 \text{ X } C_{ao} \text{ X } Q_s = \text{lb/hr.} \quad = 0.00857 \times 0.0269 \times 4901$$

$= 1.13$ lb/hr

16. % excess air at sampling point

$$\% \text{ EA} = \frac{100 \text{ X } \% O_2}{0.266 \text{ X } \% N_2 - \% O_2} = \% \quad \text{(not applicable)}$$

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

$$P_{tf} = \frac{C_{aw}}{T_c} = \text{lb/ton feed} \quad = \frac{0.91}{14} = 0.065 \text{ lb/ton feed}$$

18. Particulate - total, lb/ton feed

$$P_{tt} = \frac{C_{ax}}{T_c} = \text{lb/ton feed} \quad = \frac{1.13}{14} = 0.081 \text{ lb/ton feed}$$

SET 2510 02 0874

APPENDIX B

Field Data

SET 2510 02 0874

NOMOGRAPH DATA

PLANT US Zinc 2510-13

DATE 4/16/74

SAMPLING LOCATION Hydrator Scrubber Outlet

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.86
AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F	$T_{m_{avg.}}$	105
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	~~29.54~~ 40
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	~~29.54~~
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	+.13
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1.
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	162
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	.57
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	
C FACTOR		~~.58~~ .50
CALCULATED NOZZLE DIAMETER, in.		~~.280~~ .290
ACTUAL NOZZLE DIAMETER, in.		.210
REFERENCE Δp, in. H_2O		~~1.8~~ 2.05

EPA (Dur) 234
4/72

SET 2510 02 0874

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT U.S. LIME (FLINTKOTE) INDUSTRY, CALIF.
DATE 4-15-74
SAMPLING LOCATION HYDRATER SCRUBBER STACK
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A) 27"
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) 1/4"
STACK I.D., (DISTANCE A - DISTANCE B) 26 3/4"
NEAREST UPSTREAM DISTURBANCE 16 ft.
NEAREST DOWNSTREAM DISTURBANCE
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	.025	26.75"	0.669 ⇒ 1"	~~@~~ 1/4"	1 1/4
2	.082		~~2.193~~ ~~2 1/4~~	~~2 1/4~~	2 1/2
3	.146		3.906 - 3 7/8	~~3~~	4 1/8
4	.226		6.046 - 6		6 1/4
5	.342		~~9.149~~ - 9 1/8		9 3/8
6	.658		17.602 - 17 5/8		17 7/8
7	.774		20.705 - 20 3/4		21
8	.854		22.845 - 22 7/8		23 1/8
9	.918		24.557 - 24 1/2		24 3/4
10	.975	↓	~~25.981~~ ~~25.486~~ ⇒ 25 3/4	↓	26
Use 12 pts. per traverse (total of 24 pts.) to get 2 hours sample time @ 5 min./pt.					
1	.021	26.75"	.562 Move to ⇒ 1"	1/4"	1 1/4"
2	.067		1.792 = 1 3/4		2
3	.118		3.157 = 3 1/8		3 3/8
4	.177		4.735 = 4 3/4		5
5	.250		6.6875 = 6 11/16		6 15/16
6	.355		9.496 = 9 1/2		9 3/4
7	.645		17.254 = 17 1/4		17 1/2
8	.750		20.0625 = 20 1/16		20 5/16
9	.823		22.015 = 22		22 1/4
10	.882		23.594 = 23 5/8		23 7/8
11	.933		24.958 = 25		25 1/4
12	.979	↓	26.188 Move to ⇒ 25 3/4	↓	26

EPA (Dur) 232
4/72

SET 2510 02 0874

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

2510-13

PLANT U.S. Lime (Flintkote) Industry, Calif.
DATE 4/15/74
SAMPLING LOCATION Hydrator Scrubber Stack
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A) 27
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) 1/4
STACK I.D., (DISTANCE A - DISTANCE B) 26 3/4
NEAREST UPSTREAM DISTURBANCE 16
NEAREST DOWNSTREAM DISTURBANCE
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	.021	26.75	.562 make 1/2		
2	.067		1.792		
3	.118		3.157		
4	.177		4.735		
5	.250		6.6875		
6	.355		9.496		
7	.645		17.254		
8	.750		20.0625		
9	.823		22.015		
10	.882		23.594		
11	.933		24.958		
12	.979		26.188 make 25.75		

EPA (Dur) 232

PRELIMINARY VELOCITY TRAVERSE

7.05
13.30
ΔP avg = 0.57

SET 2510-02 0874

2510-13

PLANT U.S. Lime

DATE 4/16/74

LOCATION Hydrator Scrubber Outlet

STACK I.D. 2 6 3/4

BAROMETRIC PRESSURE, in. Hg 29.54 70 °F

STACK GAUGE PRESSURE, in. H_2O

OPERATORS

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
B 1	.17	163
2	.33	
3	.48	
4	.78	
5	.21	
6	.14	
7	.48	
8	.85	
9	1.05	
10	1.05	
11	.95	
12	.86	
AVERAGE		

163 ± 13

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
A 1	.55	
2	.54	
3	.53	
4	.43	163 ± 13
5	.20	
6	.13	
7	.23	
8	.53	
9	.83	
10	.90	
11	.92	
12	.83	
AVERAGE		

U. S. LIME DIVISION
THE FLINTKOTE CO.
CITY OF INDUSTRY, CALIF.

B-6

SET 2510 02 0874

SAMPLE IDENTIFICATION LOG

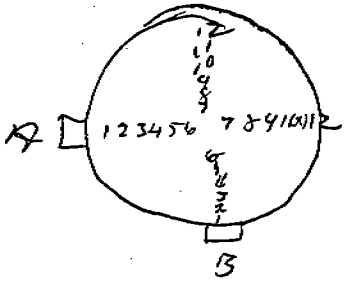
EPA Number	Sample Location	Run	Contents	No. of containers, etc. Comments
S-74-002 101	Scrubber Stack	1	Front half water wash	Some water caught in cyclone
102	"		Front half acetone wash	
103	"		Filter	
104	"		Imp. Water & Back Water Wash	4 Containers
~~105~~	~~"~~		~~Chloroform-Ether Extract (Back Half)~~	VOID- Do not perform extraction.
106	"	↓	Back half acetone wash	
107	Water Wash Bottle	1	Water Blank (100 ml. minimum)	
108	Acetone Wash Bottle	1	Acetone Blank (100 ml. minimum)	
109	Scrubber Stack	2	Front Half Water Wash	Some water caught in cyclone
110	"		Front Half acetone wash	
111	"		Filter	
112	"		Imp. Water & Back Half Water Wash	
~~113~~	~~"~~		~~Back Half Chloroform-Ether Extract~~	VOID- Do not perform extraction
114	"	↓	Back Half Acetone Wash	
115	Scrubber Stack	3	Front Half Water Wash	Some water caught in cyclone
116	"		Front Half Acetone Wash	
117	"		Filter	
118	"		Back Half Water & Water Wash	
119	"	↓	Back Half Acetone Wash	

FIELD DATA

PLANT C/S Linde 2510-13
DATE 4/16/24
SAMPLING LOC. Hydrator Scrubber
SAMPLE TYPE 5
RUN NUMBER 1
OPERATOR GW TS
AMBIENT TEMP. 74 80

BAR. PRESS. 29.52
STATIC PRESS. (P_s) +.13
FILTER NO(S) 2.4019
PROBE LENGTH/TYPE 6 ft
NOZZLE I.D. .210
ASSUMED MOIST.% 50
SAMPLE BOX NO.

METER BOX NO.
METER ΔH@ 1.86
C FACTOR ~~.90~~ .35
PROBE HTR. SETG.
HTR.BOX SETG.
REF. ΔP ~~2.05~~ 2.9



Schematic of Traverse Point Layout

SET 2510 02 0874

READ AND RECORD ALL DATA EVERY 5 MINUTES (TOTAL DURATION)

TRAVERSE POINT NUMBER	CLOCK TIME (24-Hr CLOCK) / SAMPLING TIME, MIN (1038)	GAS METER READING (V_m), Ft^3 360,834	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
1	5	361.909	.16	.11	.11	~~176~~	~~78~~	80	2	~~295~~	70
2	10	363.505	.40	.33	.33		83	82	3		60
3	15	364.962	.36	.25	.25		87	84	3	300	60
4	20	366.436	.36	.25	.25		86	85	3		60
5	25	367.478	.12	.12	.12	~~176~~	89	86	2.5		60
6	30	368.192	.10	.05	.05		101	99	1.5		60
7	35 +18 sec	369.821	.46	.31	.31		~~108~~	102	3		65
8	40	372.00	.86	.57	.57		110	105	4	300	65
9	45	374.374	1.05	.69	.69		113	109	~~4.2~~		60
10	50	376.865	1.05	.69	.69	177	118	112	4.2		60
11	55	378.612	.97	.64	.64		123	118	4.2		60
12	60	381.344	.90	.60	.60		126	119	4.2		60
1	65	383.138	.90	.60	.60		128	120	4.2	300	59
2	70	385.975	.93	.61	.61		130	121	4.4		60
3	75	388.237	1.02	.67	.67	177	132	123	4.6		60
4	80	390.691	1.00	.65	.65		133	125	4.7		62
5	85	392.882	.85	.56	.56		134	126	4.5	250	62
6	90	394.542	.51	.34	.34	~~166~~ 176	135	127	4.2		62
7	95	395.602	.15	.10	.10		135	128	3.5		65
8	100	396.849	~~.17~~ .25	~~.17~~ .25	~~.25~~ .17	174	135	129	3.8	290	66
9	105	398.425	.42	.29	.29	173	135	129	4.0		62
10	110	399.948	.39	.26	.26	172	135	129	4.0		62
11	115	401.478	.37	.25	.25	171	135	129	4.0	295	62
12	120/1245	402.655	.25	.17	.17	171	135	130	3.8		68

SET 2510 02 0874

Correction factor .44 This half of test

Ref ΔP 2.3

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
	5	1238	402.695									
1	5		404.438	.45	.39	.39	173	128	127	3.5		
2	10	+36 sec	405.964	.37	.32	.32	170	124	123	3.5	300	65
3	15		407.671	.33	.29	.29	171	125	124	3.5		65
4	20		408.745	.14	.125	.125	172	128	125	3.0		65
5	25		409.173	.05	.025	.025	170	128	126	2.5		65
6	30		409.564	.05	.025	.025	171	129	126.5	2.5		65
7	35		410.075	.32	.028	.028	171	129	127.5	2.8		70
8	40		412.148	.65	.56	.56	171	130	128	4.5	290	70
9	45		414.658	.91	.74	.74	171	132	129	4.5		60
10	50		417.202	.92	.76	.76	171	135	130	5.0		60
11	55		419.674	.85	.71	.71	172	137	132	4.7		60
12	60		422.035	.75	.64	.64	172	139	131	4.6		60
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					60
12	65		424.471	.84	.72	.72	172	139.5	131.5	5.0		
11	70		426.655	.85	.74	.74	174	141.	132	5.2		60
10	75		429.490	.90	.75	.75	173	141.5	132.5	5.3		60
9	80		431.946	.86	.72	.72	173	141.5	132.5	5.2		60
8	85		434.142	.63	.54	.54	174	142.	133	4.8		60
7	90		435.678	.29	.255	.255	175	142.	133.5	4.3		60
6	95		436.875	.04	.03	.03	175	141	133.5	3.4		60
5	100		438.303	.07	.035	.035	176	139.5	134.0	3.3		60
4	105		439.425	.36	.31	.31	176	137.5	133.5	4.5		65
3	110		440.107	.36	.31	.31	175	137.5	133.5	4.5		65
2	115		441.782	.36	.31	.31	176	138.5	134.0	4.5		65
1	120		443.560	.37	.32	.32	177	139.	134.0	4.4		65

SET 2510 02 0874

ANALYTICAL DATA

PLANT U. S. Lime

DATE 4/16/74

SAMPLING LOCATION Hydrator Scrubber

SAMPLE TYPE EPA 5

RUN NUMBER 1

SAMPLE BOX NUMBER

CLEAN-UP MAN Tom W

COMMENTS:

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER _____ _____ mg

FILTER NUMBER _____ _____

_____ _____

_____ _____

CONTAINER _____ _____ mg

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER _____ _____ mg

ETHER-CHLOROFORM EXTRACTION _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

	1411		
IMPINGERS	135		
FINAL VOLUME	1546 ml		
INITIAL VOLUME	200 ml		
NET VOLUME	1346 ml		
SILICA GEL			
FINAL WEIGHT	522.09 g	_____ g	_____ g
INITIAL WEIGHT	504.65 g	_____ g	_____ g
NET WEIGHT	17.44 g	_____ g	_____ g

TOTAL MOISTURE _____

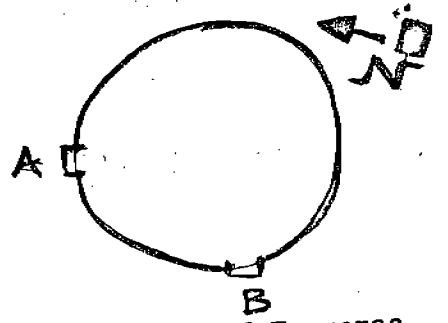
EPA (Dur) 231
4/72

- FIELD DATA -

PLANT GS Line 2510-13
DATE 4/17/74
SAMPLING LOC. Hydrator Outlet
SAMPLE TYPE S
RUN NUMBER 2
OPERATOR JW TS
AMBIENT TEMP. 63 - 86

BAR. PRESS. 29.62
STATIC PRESS. (P_s) +1.3
FILTER NO(S) 3, 3977
PROBE LENGTH/TYPE 6 ft
NOZZLE I.D. .210
ASSUMED MOIST. % See Margins
SAMPLE BOX NO.

METER BOX NO.
METER $\Delta H@$ 1.86
C FACTOR See Margins
PROBE HTR. SETG. 9
HTR. BOX SETG. 300
REF. ΔP See Margins



Schematic of Traverse Point Layout

SET 2510 02 0874

READ AND RECORD ALL DATA EVERY 5 MINUTES (TOTAL DURATION)

TRAVERSE POINT NUMBER	CLOCK TIME (24-Hr CLOCK) / SAMPLING TIME, MIN (1237)	GAS METER READING (V_m), Ft^3 443.579	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O Desired	Actual	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	PUMP VACUUM in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
											60
1	5	445.147	.39	.28*	.325	176	70	70	2.5	300	60
	10	446.750	.29	.28*	.325	177	72	70	3.0		55
2	15	448.412	.38	.36	.36	178	79	77	3.3		56
	20	450.132	.38	.36	.34	178.5	83	78	3.3		55
3	25	451.825	.36	.34	.34	178	87	85	3.2		55
	30	453.505	.36	.34	.305	178	91.5	87	3.3	300	55
4	35	455.115	.32	.305	.305	178	97	92	3.3		55
	40	456.703	.32	.165	.165	179	99.5	95	3.3		55
5	45	458.082	.17	.165	.165	179	107	102	2.6		55
	50	459.105	.17	.105	.105	178	110	105	2.5		62
6	55	460.030	.10	.10	.10	178	110.5	105	2.5		62
	60	461.0915	.10	.195	.195	178	112.0	108	2.2		60
7	65	462.235	.25	.195	.195	178	114	109	2.2		60
	70	463.575	.25	.425	.425	178	116	112	3.8	300	58
8	75	465.195	.56	.425	.425	178	119	113	3.9		58
	80	467.415	.56	.64	.64	177	121.5	115	4.5	300	56
9	85	469.745	.85	.64	.64	177	124.5	116	4.5		56
	90	472.075	.85	.705	.705	176	127	117	4.85	300	55
10	95	474.498	.95	.705	.705	176	129	118	4.9		55
	100	476.915	.95	.69	.69	176	132	119.5	5.0	300	56
11	105	479.330	.93	.69	.69	176	133	120.5	5.0	300	56
	110	481.754	.93	.67	.67	176	134.5	121.2	5.0	300	56
12	115	484.169	.91	.67	.67	176	135	122.5	4.8	300	56
	120 1156	486.577	.91								

COMMENTS: 2 min delay at 119 min auger jam in system

B-10

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		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
				DESIRED	ACTUAL		INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F			
	12:16	486.577									
1	5	488.245	.40	.34	.34	172	110	109	32.0	290	65
	10	489.935	.38	.33	.33	176	110	108	32.2	300	60
2	15	491.606	.42	.33	.33	~~178~~ 177	112	110	32.4		60
~~3~~	20	493.238	.41	.31	.31	177	114	111	32.4		60
3	25	494.934	.44	.34	.34	178	117	113	32.8		60
	30	496.648	.44	.34	.34	177	120	115	32.8		60
4	35	498.342	.43	.33	.33	177	123	116	32.8		60
	40	500.057	.44	.34	.34	177	124	118	32.8		62
5	45	501.365	.25	.19	.19	177	124	119	3.5		63
	50	502.685	.25	.194	.194	177	126	119.5	3.5		63
6	55	503.765	.16	.125	.125	178	126.5	121.	3.5		65
	60	504.825	.16	.125	.125	178	127	121.5	3.5		65
7	65	506.675	.51	.385	.385	180	127.5	122.5	4.0		60
	70	508.455	.48	.365	.365	179	128	123.5	4.0		60
8	75	510.640	.74	.555	.555	180	130.5	124.	4.65		58
	80	512.790	.74	.555	.555	180	132	125	4.7		58
9	85	515.236	.99	.695	.695	180	133.5	126	5.3		56
	90	517.598	.99	.695	.695	180	134.	126.5	5.3		56
10	95	520.000	.99	.695	.695	180	134	127	5.4		56
	100	522.425	.99	.695	.695	180	136.5	127	5.5		56
11	105	524.790	.94	.67	.67	180	137.5	127.5	5.4		58
	110	527.165	.94	.67	.67	180	138.	128	5.65		58
12	115	529.485	.91	.64	.64	179	138.5	128.5	5.6		58
	120	531.863	.91	.64	.64	180	138.5	128.5	6		58-60
	14:19										

SET 2510 02 0874

B-11

SET 2510 02 0874

ANALYTICAL DATA

PLANT U.S. Lime

DATE 4/17/74

SAMPLING LOCATION Hydrator Scrubber

SAMPLE TYPE EPA 5

RUN NUMBER 2

SAMPLE BOX NUMBER

CLEAN-UP MAN MW TS

COMMENTS:

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER _____ _____ mg

FILTER NUMBER _____ _____

_____ _____

_____ _____

CONTAINER _____ _____ mg

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER _____ _____ mg

ETHER-CHLOROFORM EXTRACTION _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

135

1814

IMPINGERS

FINAL VOLUME 1949 ml

INITIAL VOLUME 200 ml

NET VOLUME 1749 ml

SILICA GEL			
FINAL WEIGHT	520.10 g	_____ g	_____ g
INITIAL WEIGHT	500.70 g	_____ g	_____ g
NET WEIGHT	19.40 g	_____ g	_____ g

TOTAL MOISTURE _____

EPA (Dur) 231
4/72

FIELD DATA

PLANT US Lime 2510-13 BAR. PRESS. 29.60 METER BOX NO. Scott
DATE 4/18/74 STATIC PRESS. (P_s) METER ΔH@ 1.86
SAMPLING LOC. Hydrator Scrub. Out FILTER NO(S) 4 C FACTOR See Margins
SAMPLE TYPE S PROBE LENGTH/TYPE 6 ft PROBE HTR. SETG. 4
RUN NUMBER 3 NOZZLE I.D. ~~.370~~ .382 HTR.BOX SETG. 300
OPERATOR Q4U TS ASSUMED MOIST.% see Margins REF. ΔP See Margins
AMBIENT TEMP. 66- SAMPLE BOX NO. South

SET 2510 02 0874

READ AND RECORD ALL DATA EVERY 5 MINUTES (TOTAL DURATION)

Schematic of Traverse Point Layout

TRAVERSE POINT NUMBER	CLOCK TIME (24-Hr CLOCK) / SAMPLING TIME, MIN	GAS METER READING (V_m), Ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
				Desired	Actual		Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F			
	0640	531.986									~~58~~
B 1	5	535.208	.42	1.6	1.6	170	65	64	4.5	302	60
	10	538.412	.39	~~1.65~~ 1.65	1.65	172	70	67	6.	300	68
2	15	542.064	.44	1.45	1.45	173	76	70	6.2	300	72
	~~20~~										
3	~~25~~ 20	545.283	.44	1.45	1.45	174	82	75	5.2	300	60
	~~30~~		~~.40~~	~~1.35~~							
4	~~35~~ 25	548.446	.40	1.35	1.35	174	91	80	5.1		60
	~~40~~										
5	~~45~~ 30	550.528	.25	.55	.55	174	97	84	4.4		60
	50										
6	55 35	553.042	.17	.59	.59	174	101	88	4.0		60
	60										
7	65 40	556.681	.54	1.75	1.75	176	105	93	6.0		60
	70										
8	75 45	561.069	.90	2.60	2.60	176	110	98	8.1		60
	80										
9	85 50	565.841	1.05	3.05	3.05	177	116	100	10.0		60
	90										
10	95 55	570.593	1.05	3.05	3.05	178	121	103	10.0		60
	100										
11	105 60	575.206	.93	2.85	2.85	177	126	104	9.5		60
	110										
12	115 65	579.721	.89	2.59	2.59	177	129	107	9.0		60
	120										

COMMENTS: 0945

B-13

Ts = 132 — 6-point, 39
0/H2O = 48 Rys 1.630

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		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
				DESIRED	ACTUAL		INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F			
	0957	579,721									
A 1	70	582,334	.28	.86	.86	177	120	107	4	300	60
2	75	585,552	.46	1.30	1.30	177	119	107	6		53
3	80	588,634	.37	1.15	1.15	178	119	108	5.5		51
4	85	591,391	.30	.93	.93	177	121	110	5.0		53
5	90	593,441	.16	.48	.48	179	122	111	4.0		56
6	95	595,164	.09	.30	.30	179	123	113	3.5		56
7	100	597,338	.23	.67	.67	179	123	114	4.5		52
8	105	600,956	.58	1.75	1.75	179	124	115	7.2		53
9	110	605,338	.85	2.50	2.50	180	127	115	10.		52
10	115	609,866	.90	2.60	2.60	179	130	116	12		54
11	120	614,246	.85	2.50	2.50	179	139	119	10		57
12	125 / 1057	618,499	.75	2.30	2.30	180	136	119	10.5		60
		TH IS VELOCITY					SIM				
		$\overline{\sqrt{\Delta p}}$ = .714									

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B-14

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ANALYTICAL DATA

PLANT U. S. Lime

DATE 4/18/74

SAMPLING LOCATION Hydrator Scrubber

SAMPLE TYPE EPA 5

RUN NUMBER 3

SAMPLE BOX NUMBER _____

CLEAN-UP MAN [illegible]

COMMENTS:

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER _____ _____ mg

FILTER NUMBER _____ _____

CONTAINER _____ _____ mg

_____ _____

_____ _____

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER _____ _____ mg

ETHER-CHLOROFORM EXTRACTION _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

IMPINGERS

FINAL VOLUME	1749 ml		
INITIAL VOLUME	200 ml		
NET VOLUME	1549 ml		

SILICA GEL

FINAL WEIGHT	604.90 g	_____ g	_____ g
INITIAL WEIGHT	501.75 g	_____ g	_____ g
NET WEIGHT	103.15 g	_____ g	_____ g

TOTAL MOISTURE _____ g

EPA (Dur) 231
4/72

DRY MOLECULAR WEIGHT DETERMINATION

PLANT US Lime
DATE 4/17/94
SAMPLING TIME (24-hr CLOCK) 0930 - 1415
SAMPLING LOCATION Hydrator Scrubber Outlet
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Integrated bag
ANALYTICAL METHOD Orsat
AMBIENT TEMPERATURE 80
OPERATOR JGW

COMMENTS:

GAS \ RUN	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	100	0	100	0	100	0	0.0	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	79.6	20.4	79.7	20.3	79.4	20.6	20.43	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	79.6	0	79.7	0	79.4	0	0.0	28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)							79.57	28/100	
								TOTAL	

EPA (Dur) 230
4/72

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B-16

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ENVIRONMENTAL PROTECTION AG. .CY

COMPANY NAME U.S. Lime (FLINTKOTE)

EQUIPMENT LOCATION (ADDRESS) INDUSTRY, CALIF.

TIME OF OBSERVATION: FROM 10:13 A.M./P.M. TO ____ A.M./P.M. DATE 4-18-74

RECORD OF VISIBLE EMISSIONS

Start/hour 10 13 S

R. No.	%
5	100
4¾	95
4½	90
4¼	85
4	80
3¾	75
3½	70
3¼	65
3	60
2¾	55
2½	50
2¼	45
2	40
1¾	35
1½	30
1¼	25
1	20
¾	15
½	10
¼	5
0	0

Min. 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20

Start/hour

Min. 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

Start/hour

Min. 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

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Source of Air Contaminants LIME HYDRATOR

Type of Air Contaminants PARTICULATE

Point of Discharge: Stack ☑ Other ____

Point of Observation:

Distance to Base of Point of Discharge, feet ≈ 225' EAST OF STACK

Height of Point of Discharge Above Ground Level, feet ≈100'

Background Description SKY

Weather: Clear ☐ Overcast ☑ Partly Cloudy ☐ Other ____

Wind Direction S Wind Velocity, mi/hr 0-10 VARIABLE

Plume Description:

Detached: Yes ☐ No ☑

Color: Black ☐ White ☑ Other ____

Plume Dispersion Behavior: Looping ☐ Coning ☐ Fanning ☐

Lofting ☐ Fumigating ☐ See Comments ☐

Estimated Distance (feet) Plume Visible (Maximum) 100 (Minimum) 50 (STEAM PLUME)

Comments STACK PLUME ESSENTIALLY ALL WATER VAPOR DUE TO VERY HIGH % MOISTURE (≈ 50%). STACK RAIN CAP BROADLY DISPERSED PLUME. THE STEAM PLUME WAS THE ONLY DISCERNABLE VISIBLE EMISSION. THE OVERCAST BACKGROUND RENDERED DETECTION OF ANY OTHER POSSIBLE VISIBLE EMISSIONS VIRTUALLY IMPOSSIBLE.

Signed J. W. Rowe Title ____

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APPENDIX C

Laboratory Report

C.1 WASHES

All washes were transferred from the field to the laboratory in sealed (screw-top) glass jars. The two hundred and fifty milliliter beakers to be used for the water and acetone wash transfers were leached for 24 hours in a 50% nitric acid solution, washed thoroughly and oven dried overnight. These were then desiccated for 24 hours and tared, the beakers were sealed and handled only with tongs or "Kim Wipes."

The water and acetone washes returned from the test site were transferred into one or several 250 ml. beakers. A small additional amount of water or acetone was used to remove any residue from the jar walls. Beakers containing acetone wash were evaporated at ambient temperature (~70°F) and beakers containing water wash were evaporated in an oven at approximately 90°F. (The one beaker containing a water and acetone wash was first evaporated at ambient temperature until no trace of acetone was present by smell and then placed in an oven at 90°F until the water had been evaporated.) Each beaker was desiccated for 24 hours and weighed. A summary of each beaker's weight before and after sample is presented in Table C-1. Also presented in Table C-1 are the volumes of acetone or water used and each sample's total weight.

C.2 FILTERS

Prior to proceeding to the test site several pieces of filter paper were desiccated for 24 hours, tared and placed in labeled containers. Three pieces of filter paper were used during the three test runs. Upon return from the test site these three filter papers were desiccated for 24 hours and weighed. A summary of these weights is presented in Table C-2.

C.3 SILICA

Three glass jars were tared prior to proceeding to the test site. Each jar was filled with approximately 200 grams of silica, capped, sealed and weighed. Following each run the silica was placed in its respective jar, capped and sealed. Upon return to the laboratory, each jar was re-weighed. Table C-3 presents a summary of these weights.

Table C-1

Summary of Beaker Weight Measurements

EPA Sample Number (S-74-002-)	Run No.	Wash[1] Fraction	Wash Type	Wash Gross Wt. (g)	Wash Tare Wt. (g)	Ml. Wash Used	Uncorrected Wash Wt. (mg)	Blank Wt. (g)	Net Wash Wt. (mg)
101	1	F/H	Water	171.4058[5]	171.3752[5]	315	30.6	6.3	24.3
102	1	F/H	Acetone	84.5029[5]	84.4610[5]	130	41.9	2.7	39.2
104	1	B/H	Water	355.0420[5]	355.0146[5]	194[(2)]	27.4	3.9	23.5
106	1	B/H	Acetone	85.1783	85.1752	55	3.1	1.2	1.9
	Total (Run 1)						103.0	14.1	88.9
107	Water	Blank	Water	98.9839	98.9814	125	2.5	N/A	2.0/100 ml
108	Acetone	Blank	Acetone	83.3381	83.3360	100	2.1	N/A	2.1/100 ml
109	2	F/H	Water	86.3509	86.2483	450	102.6	9.0	93.6
110	2	F/H	Acetone	85.1976[5]	85.1916[5]	190	6.0	4.0	2.0
112	2	B/H	Water	680.6727[5]	680.6352[5]	26[(3)]	37.5	0.5	37.0
114	2	B/H	Acetone	99.4313	99.4257	100	5.6	2.1	3.5
	Total (Run 2)						151.7	15.6	136.1
115	3	F/H	Water	86.8596	86.7505	235	109.1	4.7	104.4
116	3	F/H	Acetone	84.8494[5]	84.8426[5]	135	6.8	2.8	4.0
118	3	B/H	Water	341.5593[5]	341.5384[5]	176[(4)]	20.9	3.5	17.4
119	3	B/H	Acetone	88.2353	88.2306	115	4.7	2.4	2.3
	Total (Run 3)						141.5	13.4	128.1

[1] F/H - Front half of sampling train; B/H - Back half of sampling train

(2) Total - 1540 ml, Bubbler volume (H_2O) - 1346 ml, Total wash 194 ml

(3) Total - 1775 ml, Bubbler volume (H_2O) - 1749 ml, Total wash 26 ml.

(4) Total - 1725 ml, Bubbler volume (H_2O) - 1549 ml, Total wash 176 ml.

[5] Due to wash volume, several beakers were used

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Table C-2

Summary of Filter Paper Weights

Run Number	Filter Gross Wt. (g)	Filter Tare Wt. (g)	Filter Net Wt. (mg)
1	0.4426	0.4019	40.7
2	0.4429	0.3977	45.2
3	0.5034	0.4205	82.9

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Table C-3

Summary of Silica Weights

Run Number	Tare Wt (g)	Tare and Silica Wt. (g)	Tare and Used Silica Wt. (g)	Net H_2O (g)
1	300.15	504.65	522.09	17.44
2	299.45	500.70	520.10	19.40
3	299.25	501.75	604.9	103.15[1]

[1]See field report - Run 3.

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APPENDIX D

Test Log

On April 15, 1974 the Scott team arrived at the U. S. Lime Division of the Flintkote Company in the City of Industry, California and began setting up equipment. They were unable to obtain preliminary data because the plant was not operating. The project officer decided to use 24 traverse sampling points. Each point was sampled for five minutes for a total sample time of two hours in each port.

On April 16, 1974 set-up and checkout of sampling equipment was finished. Preliminary traverse velocity and temperature data were obtained. Stack temperature reached 180°F after an hour of operation. The project officer determined it was not feasible to test before the scrubber; therefore, it was decided to sample at two ports (at right angles to each other) per test run located after the scrubber Total sample time was four hours per run.

The probe heat nichrome wire shortcircuited just prior to the start of Run 1. To compensate for no heat in the probe, it was decided to raise the temperature in the filter box. Run 1 was started about 10:30 a.m. The project officer decided to traverse in and out one port prior to sampling the other port to save switchover time. The first axis of Run 1 was finished at 12:45 p.m. A quantity of water was extracted from the impingers before the second axis was started. The second axis of Run 1 was completed at 15:05. During cleanup it was found that a water and acetone washwas required to clean the probe. The cyclone was full of water which was added to front half water wash. A leak was discovered in the sample bag so that a questionable Orsat analysis was obtained for Run 1.

At 9:35 a.m. on April 17, 1974, the team began Run 2. Fifty milliliters of water were used in the first and second impingers. During sampling of the first axis, stack temperature dropped when process shut down due to plugged auger to storage bin. As this occurred at the end of the run (last 5 min.) the results should not be significantly affected. The first half of testing was completed at 11:56. A quantity of water was removed from the impingers before sampling the second axis. The project officer decided to sample each point for 10 continuous

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minutes taking readings every five minutes since the process was continuous and steady. The second traverse of Run 2 was finished at 14:15. During the probe cleanup of Run 2, the probe was inadvertently washed first with acetone into "front half water wash" bottle. A comparison of front half water and acetone washes will not be made.

On April 18, 1974 prior to beginning Run 3, the team checked data and calculated isokinetic sampling at 111.9%. The Project Officer requested an increase in nozzle diameter (0.302 inches compared to 0.210 inches). The plant superintendent stated a shortage of silo storage was occurring and a four-hour run would not be feasible. After the first point had been sampled for 10 minutes, the Project Officer decided to sample 5 minutes per point for the remainder of the test, for a two hour sample time. Run 3 was completed at 10:57. John Brown read visible emissions during the last hour of sampling. All readings were zero (difficult to read due to cloud cover). Some water was pushed over into the silica gel impinger during the last few minutes of the run. The Project Officer did not consider this to be significant due to the supersaturated condition of the stack gas. Equipment was cleaned and packed. Testing was completed at 3:00 p.m.

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APPENDIX E

Process Operation Data

Source Test
April 16, 1974

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Flintkote
~~Flintcoat~~ Company
U.S. Lime Division
Industry, Calif.

Atmospheric Lime Hydrator – Ducon water scrubber

data to record:

1. power to ~~[illegible]~~ ducon scrubber (control room
2. rpm ~~[illegible]~~ (feed bin) to pulverizer 12rpm (" "
3. water feed to ~~[illegible]~~ (scrubber) fan 2nd floor
4. temp. before scrubber (before airbleed) (193-205°F) 3rd floor
5. stack temp. (EMB data)
6. quicklime sample (before ground) rail car
7. lime sample (exit from seasoning chamber) 2nd floor
8. make-up water for scrubber 2nd floor

Samples every ½ hour
readings every ½ hour

other information:

1. description of dust equipment @ what emissions controlled by each baghouse ⓑ size of baghouse ⓒ description ⓓ design airflow ⓔ cloth size + material
2. Air leaks – esp. low velocity, horizontal flow areas

amount of make-up water determined by the quality of quickline fed.

Flintcoat - US Lime Division Industry, California

time:	[amps] to scrubber	Crusher screwfeed [rpm]	[pounds/minute] water to scrubber	[pounds/min] makeup water	temperature to scrubber: Before air heat	temperature to scrubber: After air htr.
← Run #1		April 16, 1974				
1023	30	12	166	0*	205	190
1055	30	12	165.5	0	205	192
1131	30	12	164	0	206	190
1207	30	12	160.5	0	205	189
1231	30	12	160	0	200	185
1308	30	12	161	0	204	184
1345	30	12	160	0	203	185
1412	30	12	161	0	204	186
1442	30	12	163	0	206	188
1502	29.5	12	163	0	204	191
← Test Run #2		April 17, 1974				
0920	30	12	166	0*	205	188
1000	30	12	165	0	205	190
1105	30	12	166	54*	202	187
1200	31	12	168	0	204	184
1255	30	12	167	0	210	190
1415	30	12	168	0	208	192
← Test Run #3		April 18, 1974				
0840	30	12	167	0*	208**	188
0934	30	12	165	0	209**	190
0951	30	12	166	0	215**	190
1011	30	12	166	0	210**	190
1108	30	12	169	0	212**	192

Test Run 1 — 4 hour sample
Test Run 2 — 4 hour sample
Test Run 3 — 2 hour sample

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Test Run # 1

Sampling began at: 1038
Crushers turned on at: 1134
" turned off: ~1430
Sampling 1st half complete: 1245
Sampling 2nd half began: 1258
Sampling Concluded: 1505

Test Run #2

Sampling began at: 0925
plant down approx. 1130 to 1145 [screw feed to mill loaded up]
crushers on at 1145
Sampling discontinued 1136 to 1155 for plant shutdown
stopped at 1156 — 1st ½ sampling complete

If the feed is { 1. dust (fines) — temp. decreases (cut H_2O)
2. coarse — temp. increases (add retarder)

---

* make up water: zero or too small to read on meter

BAGHOUSE:
Mikro Pulsaire Collector
Size: IF-2
Bag Type: Polypropylene HCE 8' long
Motor for fans: 20hp each
Design flow rate: 7500 CFM
1800 CFM

{ Mikro Products
Pulverizing Machinery Division
Summit, N.J.

2 large (8') baghouses
small baghouses

Test Run # 2 — 2nd half started at 1215
ended at 1415

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Sample slurry water – weight rate to be determined

Test Run #3

** Temp. gauge changed for this test
testing started at 0840
Slurry water sampled at 0936
0953
1015

Sampling finished at: 1057

Dry Collection Equipment

Hydrate baghouse: (collects from)
1. mill
2. sacker
3. finish bins
4. reject elevator
5. discharge elevator from hydrator (when not hydrating) + bin
6. separator
7. truck loading elevator
8. quicklime sacker

Quicklime baghouse: (Collects from)
1. screens
2 rail car elevator
3. crusher (hammermill)
4 elevator - "
5. 2 bins
6 2 screws

Small baghouse:
1. Bulk hydrate loading

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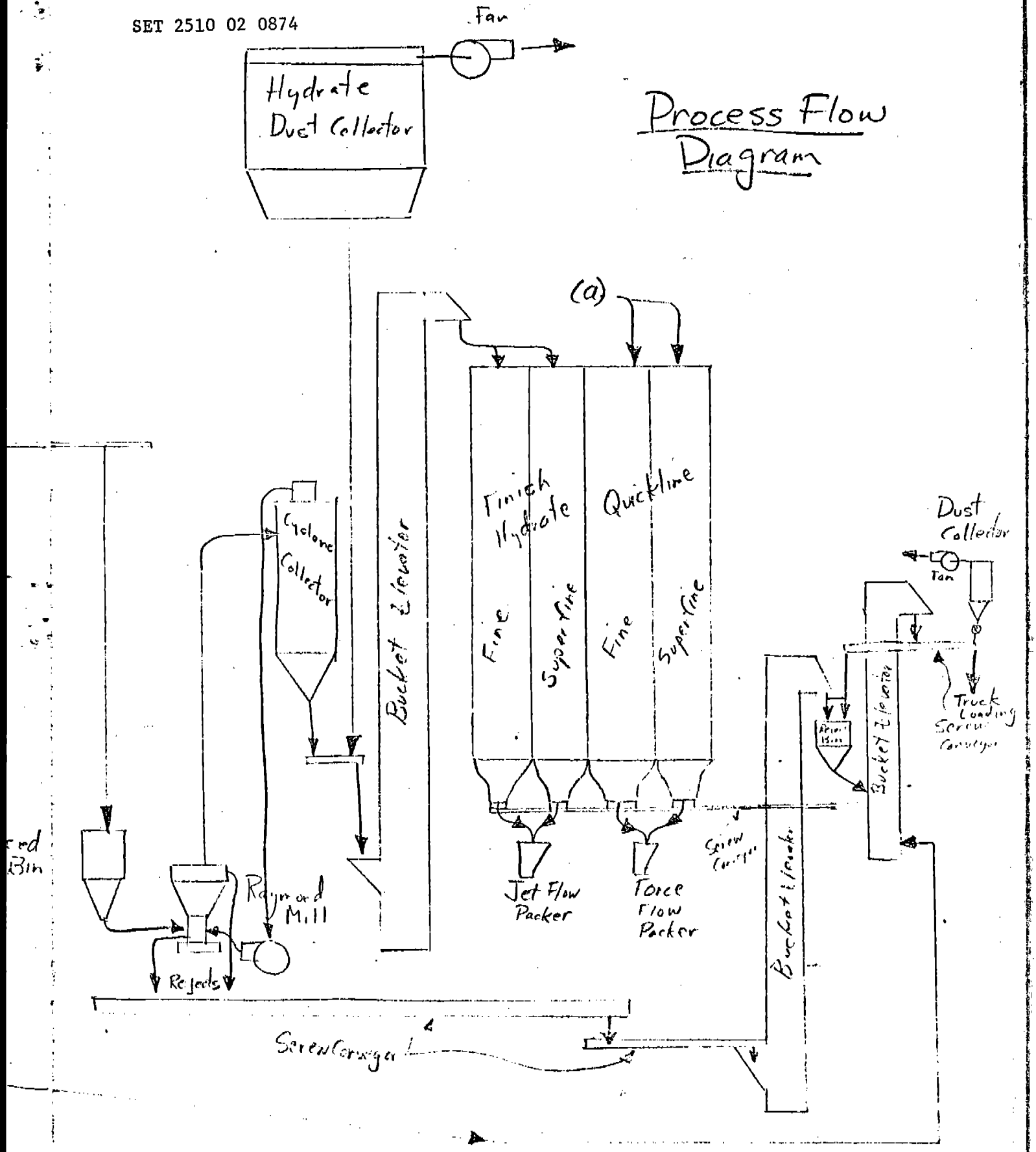
Process Flow Diagram



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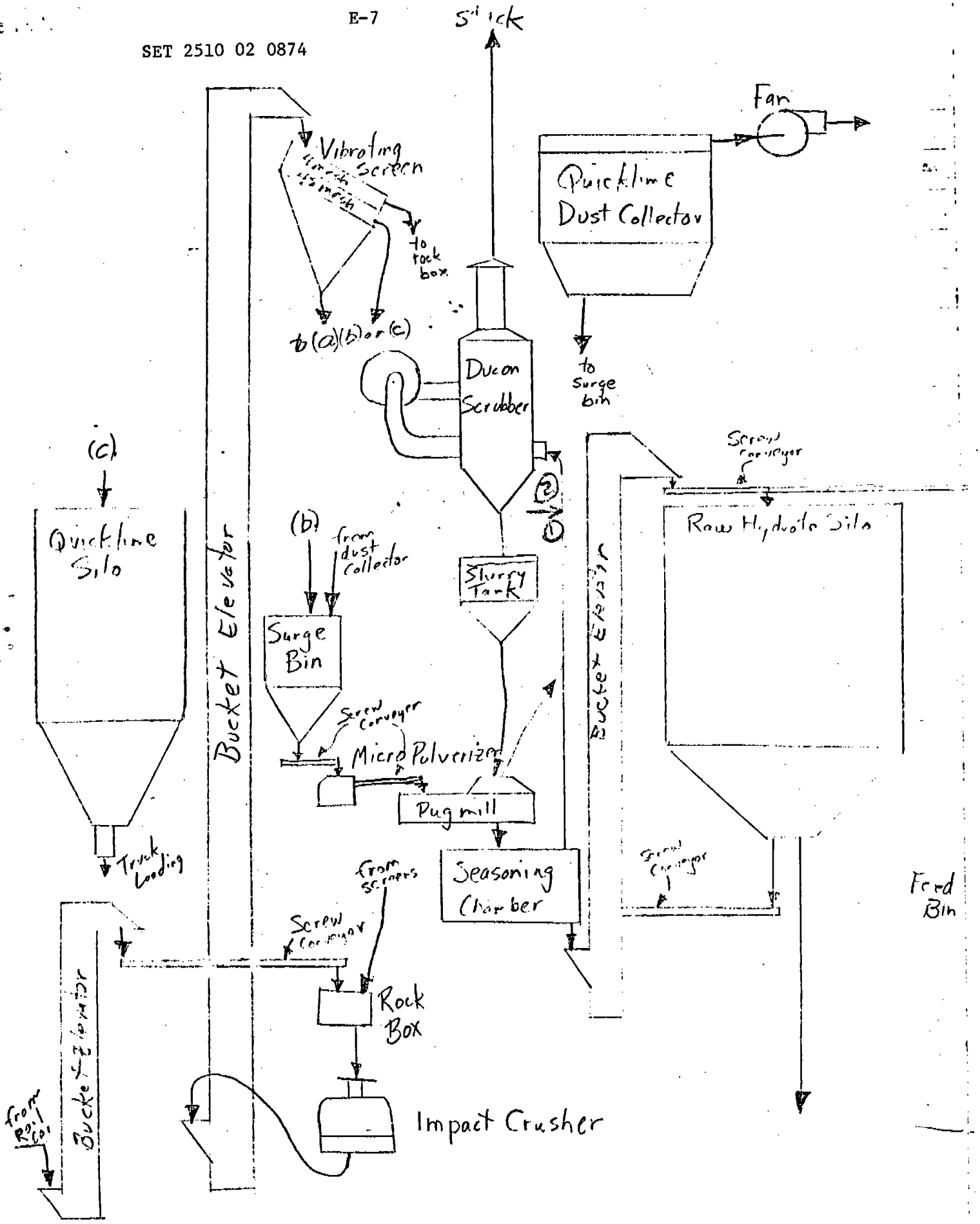

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APPENDIX F

Project Participants and Titles

Personnel taking part in the project included:

John Snyder, Project Officer	EPA
John Brown	EPA
R. Vong	EPA
Joseph Wilson, Field Team Leader	Scott
Tim Sharp, Technician	Scott