

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

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02\_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

## **Background Report Reference**

**AP-42 Section Number:** 11.21

**Background Chapter:** 4

**Reference Number:** 9

**Title:** Emission Test Report: Monsanto  
Chemical Company, Soda Springs,  
Idaho

US EPA

June 1972

ELEMENTAL PHOSPHORUS

Test Number

9

72-MM-27

Monsanto Chemical Company

Soda Springs, Idaho

RESEARCH LABORATORY

1952

*ELEMENTAL PHOSPHORUS*

Test Number

72-MM-27

Monsanto Chemical Company

Soda Springs, Idaho

REDUCE ENVIRONMENTAL



Test Number

72-MM-27

Monsanto Chemical Company

Soda Springs, Idaho

Prepared by:

Robert S. Amick

Richard W. Gerstle, P.E.

PEDCo-Environmental Specialists, Inc.

Cincinnati, Ohio

Contract No. 68-02-0237, Task 15

TABLE OF CONTENTS

	<u>Page Number</u>
I. INTRODUCTION .....	1
II. SUMMARY OF RESULTS .....	5
III. PROCESS DESCRIPTION .....	23
IV. LOCATION OF SAMPLING POINTS .....	27
V. SAMPLING PROCEDURES .....	29
APPENDIX A - DATA SUMMARY OF SO <sub>2</sub> /SO <sub>3</sub> , FLUORIDE, AND P <sub>2</sub> O <sub>5</sub> RESULTS, COMPUTER PRINTOUTS, AND EXAMPLE CALCULATIONS	
APPENDIX B - FIELD DATA	
APPENDIX C - LABORATORY REPORT	
APPENDIX D - TEST LOG	
APPENDIX E - PROJECT PARTICIPANTS AND TITLES	

## I. INTRODUCTION

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

### Tests Performed

A series of tests were conducted at the elemental phosphorus plant of Monsanto Chemical Company in Soda Springs, Idaho during October 5 - 11, 1972. Fluoride,  $P_2O_5$ ,  $SO_3$  and  $SO_2$  concentrations before and after the venturi scrubber serving the slag tapping operation of the No. 8 electric furnace were measured. Stack gas velocities, temperatures, moisture content, and molecular weights were also determined where applicable. Separate sets of three runs were made for fluoride and  $P_2O_5$  determinations. However, each sample was later analyzed by EPA for both fluoride and  $P_2O_5$ , resulting in six determinations for each compound at each sampling site.

Table 1 summarizes the test locations, dates, and other pertinent information pertaining to this test series.

All samples were analyzed by EPA.

#### Sampling Sites

Stack gases from the furnace slag tapping operation were collected before and after the venturi scrubber, as shown in Figure 1 at points D and E, respectively. Scrubber water samples were taken at a tap in the recycle line a few feet upstream of the scrubber recycle pump, as shown in Figure 1.

TABLE 1. SUMMARY OF EMISSION MEASUREMENTS  
 MADE AT MONSANTO CHEMICAL COMPANY IN  
 SODA SPRINGS, IDAHO

Date 1972	Test No.	Test Site	Stack Gas Parameters				Emissions
			Velocity	Temp.	%H <sub>2</sub> O	Molec. Wt.	
10/5	1 & 2	No. 8 Furnace Slag Tap Scrubber Inlet and Outlet					Fluorides and Visible Emission
10/6	3						"
10/9	1 & 2						P <sub>2</sub> O <sub>5</sub> and Visible Emission
10/10	3						"
10/10	1 & 2		→	→	→	→	SO <sub>2</sub> & SO <sub>3</sub>
10/11	3						"

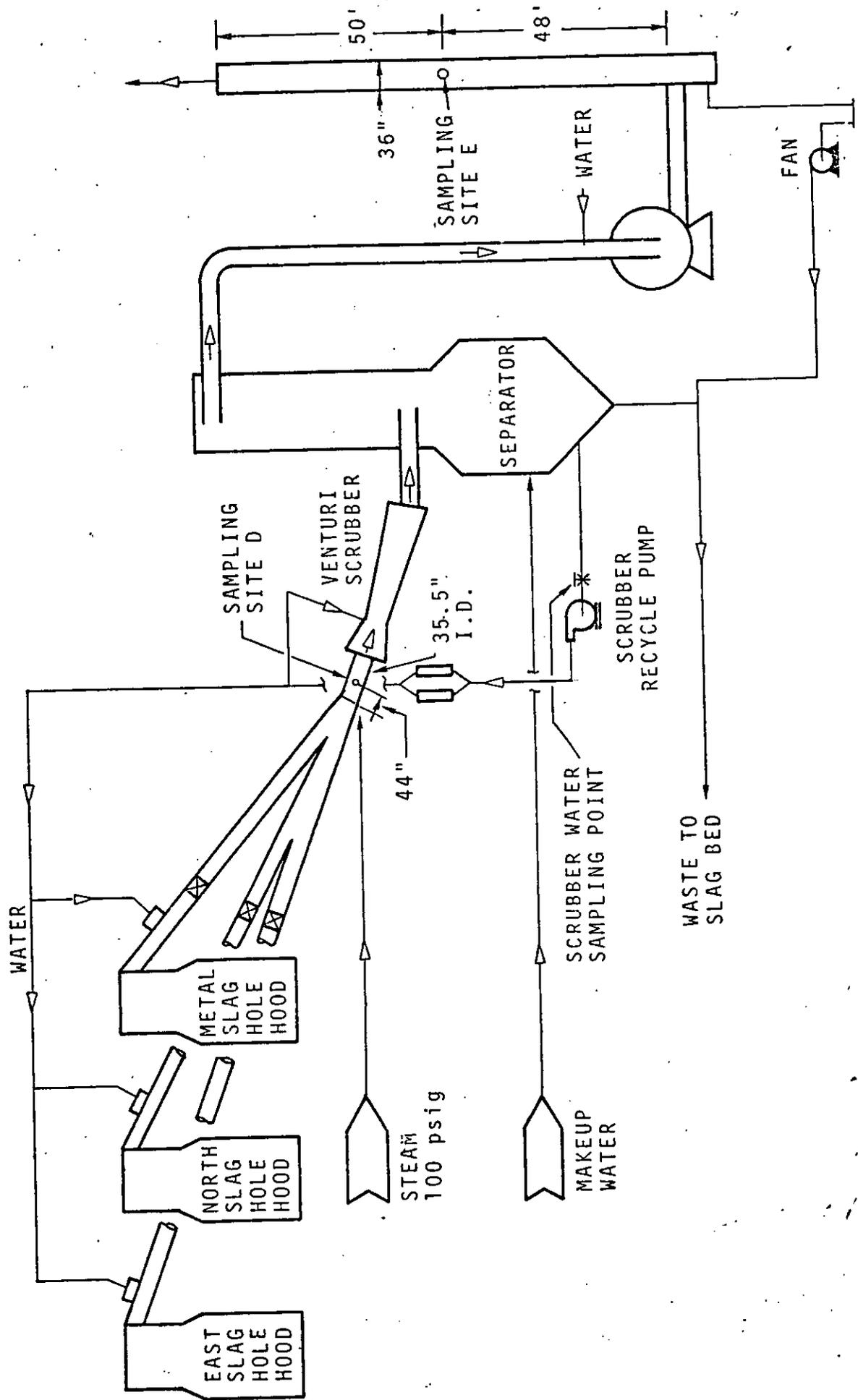


Figure 1. Number 8 phosphorus furnace slag tap scrubber sampling site, Monsanto Chemical Company - Soda Springs, Idaho

## II. SUMMARY OF RESULTS

Fluoride,  $P_2O_5$ , and  $SO_x$  emission data and associated stack gas flow parameters are presented in Tables 2 through 10. Complete sampling data and calculations are presented in the appendices of this report. Emissions reported in pounds per hour are during tapping only, not continuous clock time.

The average interval between the slag taps during the nine inlet-outlet tests was twenty (20) minutes, while the average slag tap duration was ten (10) minutes, i.e., slag tapping occurred for an average of twenty minutes per hour. Since there were three separate slag-tap holes with separate hoods and aspiration ducts, as illustrated in Figure 1, a wide variation occurred in the emission data, as well as the visible emission observations made during some of the tests.

Tables 11, 12, and 13 summarize the average emission results for the fluoride,  $P_2O_5$ , and  $SO_x$  tests, respectively. Tables 14 and 15 summarize the fluoride and  $P_2O_5$  content of the scrubber water and process materials.

### Fluoride Tests

The first Greenburg-Smith impinger plugged with particulate matter after five minutes into the first fluoride test;

TABLE 2: SUMMARY OF EMISSION DATA  
 MONSANTO - SODA SPRINGS, IDAHO  
 NO. 8 FURNACE INLET AND OUTLET  
 RUN NO. 1 - FLUORIDES

	<u>INLET</u>	<u>OUTLET</u>
Date	10-5-72	10-5-72
Volume of Gas Sampled - DSCF <sup>a</sup>	37.638	24.699
Percent Moisture by Volume	.99	2.09
Average Stack Temperature - °F	125	84
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	19,825	20,295
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	27,340	26,208
Percent Isokinetic	104.6	73.5
Percent Excess Air	--	--
Percent Capacity	--	--
Feed Rate - ton/hr	--	--
<u>Flourides</u>		
mg	33.74	3.38
gr/DSCF	.01383	.00211
gr/ACF	.01002	.00163
lb/hr <sup>d</sup>	2.350	.367
lb/ton feed	--	--
efficiency, % <sup>e</sup>		84.4
<u>P<sub>2</sub>O<sub>5</sub></u>		
mg	509.50	15.90
gr/DSCF	.20890	.00993
gr/ACF	.15141	.00769
lb/hr <sup>d</sup>	35.499	1.728
lb/ton feed	--	--
efficiency, % <sup>e</sup>		95.1

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping

<sup>e</sup> Based on emission rate, lb/hr.

TABLE 3: SUMMARY OF EMISSION DATA  
 MONSANTO - SODA SPRINGS, IDAHO  
 NO. 8 FURNACE INLET AND OUTLET  
 RUN NO. 2 - FLUORIDES

	<u>INLET</u>	<u>OUTLET</u>
Date	10-5-72	10-5-72
Volume of Gas Sampled - DSCF <sup>a</sup>	38.107	26.854
Percent Moisture by Volume	.50	3.03
Average Stack Temperature - °F	125	83
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	21,032	21,134
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	28,867	27,480
Percent Isokinetic	103.9	76.8
Percent Excess Air	--	--
Percent Capacity	--	--
Feed Rate - ton/hr	--	--
<u>Flourides</u>		
mg	42.73	1.070
gr/DSCF	.01730	.00061
gr/ACF	.01260	.00047
lb/hr <sup>d</sup>	3.119	.111
lb/ton feed	--	--
efficiency, % <sup>e</sup>		96.4
<u>P<sub>2</sub>O<sub>5</sub></u>		
mg	448.50	11.20
gr/DSCF	.18163	.00643
gr/ACF	.13230	.00494
lb/hr <sup>d</sup>	32.744	1.165
lb/ton feed	--	--
efficiency, % <sup>e</sup>		96.4

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping

<sup>e</sup> Based on emission rate, lb/hr.

TABLE 4: SUMMARY OF EMISSION DATA  
 MONSANTO - SODA SPRINGS, IDAHO  
 NO. 8 FURNACE INLET AND OUTLET  
 RUN NO. 3 - FLUORIDES

	<u>INLET</u>	<u>OUTLET</u>
Date	10-6-72	10-6-72
Volume of Gas Sampled - DSCF <sup>a</sup>	36.409	32.569
Percent Moisture by Volume	0.00	0.00
Average Stack Temperature - °F	147	77
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	18,794	21,328
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	26,599	26,547
Percent Isokinetic	108.4	77.8
Percent Excess Air	--	--
Percent Capacity	--	--
Feed Rate - ton/hr	--	--
<u>Flourides</u>		
mg	13.32	1.50
gr/DSCF	.00564	.00084
gr/ACF	.00399	.00067
lb/hr <sup>d</sup>	.909	.154
lb/ton feed	--	--
efficiency, % <sup>e</sup>		83.1
<u>P<sub>2</sub>O<sub>5</sub></u>		
mg	174.00	12.60
gr/DSCF	.07375	.00707
gr/ACF	.05213	.00568
lb/hr <sup>d</sup>	11.880	1.295
lb/ton feed	--	--
efficiency, % <sup>e</sup>		89.1

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping

<sup>e</sup> Based on emission rate, lb/hr.

TABLE 5: SUMMARY OF EMISSION DATA  
 MONSANTO - SODA SPRINGS, IDAHO  
 NO. 8 FURNACE INLET AND OUTLET  
 RUN NO. 1 - P<sub>2</sub>O<sub>5</sub>

	<u>INLET</u>	<u>OUTLET</u>
Date	10-9-72	10-9-72
Volume of Gas Sampled - DSCF <sup>a</sup>	32.689	33.550
Percent Moisture by Volume	0.43	1.90
Average Stack Temperature - °F	137	75
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	18,197	20,045
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	25,444	25,360
Percent Isokinetic	103.8	101.1
Percent Excess Air	--	--
Percent Capacity	--	--
Feed Rate - ton/hr	--	--
 <u>P<sub>2</sub>O<sub>5</sub></u>		
mg	226.0	15.2
gr/DSCF	.1067	.00699
gr/ACF	.0748	.00552
lb/hr <sup>d</sup>	16.640	1.201
lb/ton feed	--	--
efficiency, % <sup>e</sup>		92.8
 <u>Fluorides</u>		
mg	17.69	.860
gr/DSCF	.00835	.00039
gr/ACF	.00585	.00031
lb/hr <sup>d</sup>	1.302	.067
lb/ton feed	--	--
Percent impinger catch	--	--
efficiency, % <sup>e</sup>		94.9

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in./Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping

<sup>e</sup> Based on emission rate, lb/hr.

TABLE 6: SUMMARY OF EMISSION DATA  
 MONSANTO - SODA SPRINGS, IDAHO  
 NO. 8 FURNACE INLET AND OUTLET  
 RUN NO. 2 - P<sub>2</sub>O<sub>5</sub>

	<u>INLET</u>	<u>OUTLET</u>
Date	10-9-72	10-9-72
Volume of Gas Sampled - DSCF <sup>a</sup>	30.204	32.770
Percent Moisture by Volume	1.27	4.01
Average Stack Temperature - °F	106	83
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	15,246	19,559
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	20,372	25,657
Percent Isokinetic	118.3	101.2
Percent Excess Air	--	--
Percent Capacity	--	--
Feed Rate - ton/hr	--	--
<u>P<sub>2</sub>O<sub>5</sub></u>		
mg	274.20	32.10
gr/DSCF	.14010	.01511
gr/ACF	.10478	.01148
lb/hr <sup>d</sup>	18.308	2.534
lb/ton feed	--	--
efficiency, % <sup>e</sup>		86.2
<u>Fluorides</u>		
mg	97.46	7.29
gr/DSCF	.04979	.00343
gr/ACF	.03724	.00261
lb/hr <sup>d</sup>	6.507	.575
lb/ton feed	--	--
Percent impinger catch	--	--
efficiency, % <sup>e</sup>		91.2

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping

<sup>e</sup> Based on emission rate, lb/hr.

TABLE 7: SUMMARY OF EMISSION DATA  
 MONSANTO - SODA SPRINGS, IDAHO  
 NO. 8 FURNACE INLET AND OUTLET  
 RUN NO. 3 - P<sub>2</sub>O<sub>5</sub>

	<u>INLET</u>	<u>OUTLET</u>
Date	10-10-72	10-10-72
Volume of Gas Sampled - DSCF <sup>a</sup>	29.668	34.650
Percent Moisture by Volume	.86	3.09
Average Stack Temperature - °F	149	82
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	18,089	20,005
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	25,939	25,996
Percent Isokinetic	103.8	104.7
Percent Excess Air	--	--
Percent Capacity	--	--
Feed Rate - ton/hr	--	--
<u>P<sub>2</sub>O<sub>5</sub></u>		
mg	231.4	17.9
gr/DSCF	.12036	.00797
gr/ACF	.08394	.00613
lb/hr <sup>d</sup>	18.662	1.367
lb/ton feed	--	--
efficiency, % <sup>e</sup>		92.7
<u>Fluorides</u>		
mg	30.7	2.35
gr/DSCF	.01596	.00104
gr/ACF	.01113	.00080
lb/hr <sup>d</sup>	2.475	.179
lb/ton feed	--	--
Percent impinger catch	--	--
efficiency, % <sup>e</sup>		92.8

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping

<sup>e</sup> Based on emission rate, lb/hr.

TABLE 8: SUMMARY OF EMISSION DATA  
MONSANTO - SODA SPRINGS, IDAHO  
NO. 8 FURNACE INLET AND OUTLET  
RUN NO. 1 - SO<sub>x</sub>

	<u>INLET</u>	<u>OUTLET</u>
Date	10-10-72	10-10-72
Volume of Gas Sampled - DSCF <sup>a</sup>	31.752	34.812
Percent Moisture by Volume	2.42	1.75
Average Stack Temperature - °F	143	80
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	17,811	19,955
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	25,691	25,445
Percent Isokinetic	106.4	105.4
Percent Excess Air	--	--
Percent Opacity	--	--
Feed Rate - ton/hr	--	--
<u>SO<sub>3</sub></u>		
mg	352.50	3.600
gr/DSCF	.17132	.00159
gr/ACF	.11872	.00125
lb/hr <sup>d</sup>	26.155	.27
ppm	125	1.2
lb/ton of feed	--	--
efficiency, % <sup>f</sup>		99.0
<u>SO<sub>2</sub></u>		
mg	60.20	e
gr/DSCF	.02925	e
gr/ACF	.02027	e
lb/hr <sup>d</sup>	4.5	e
ppm	25	e
lb/ton of feed	--	--
efficiency, % <sup>e</sup>		

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping.

<sup>e</sup> SO<sub>2</sub> concentration unavailable - no reproducible value could be obtained due to interferences.

<sup>f</sup> Based on emission rate, lb/hr.

TABLE 9: SUMMARY OF EMISSION DATA  
 MONSANTO - SODA SPRINGS, IDAHO  
 NO. 8 FURNACE INLET AND OUTLET  
 RUN NO. 2 - SO<sub>x</sub>

	<u>INLET</u>	<u>OUTLET</u>
Date	10-10-72	10-10-72
Volume of Gas Sampled - DSCF <sup>a</sup>	33.453	34.558
Percent Moisture by Volume	3.76	3.15
Average Stack Temperature - °F	144	79
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	18,587	19,519
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	27,258	25,190
Percent Isokinetic	107.5	107.0
Percent Excess Air	--	--
Percent Opacity	--	--
Feed Rate - ton/hr	--	--
<u>SO<sub>3</sub></u>		
mg	108.50	7.80
gr/DSCF	.05005	.00348
gr/ACF	.03415	.00270
lb/hr <sup>d</sup>	8.0	.58
ppm	36	2.5
lb/ton of feed	--	--
efficiency, % <sup>e</sup>	92.8	--
<u>SO<sub>2</sub></u>		
mg	37.80	36.40
gr/DSCF	.01743	.01625
gr/ACF	.01189	.01260
lb/hr <sup>d</sup>	2.8	2.7
ppm	15	14
lb/ton of feed	--	--
efficiency, % <sup>e</sup>	--	--

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping

<sup>e</sup> Based on emission rate, lb/hr.

TABLE 10: SUMMARY OF EMISSION DATA  
 MONSANTO - SODA SPRINGS, IDAHO  
 NO. 8 FURNACE INLET AND OUTLET  
 RUN NO. 3 - SO<sub>x</sub>

	<u>INLET</u>	<u>OUTLET</u>
Date	10-11-72	10-11-72
Volume of Gas Sampled - DSCF <sup>a</sup>	28.001	30.896
Percent Moisture by Volume	2.86	2.92
Average Stack Temperature - °F	116	83
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	19,324	18,825
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	26,763	24,385
Percent Isokinetic	102.4	108.4
Percent Excess Air	--	--
Percent Opacity	--	--
Feed Rate - ton/hr	--	--
<u>SO<sub>3</sub></u>		
mg	150.00	10.50
gr/DSCF	.08267	.00524
gr/ACF	.05970	.00404
lb/hr <sup>d</sup>	13.7	.85
ppm	60	3.8
lb/ton of feed	--	--
efficiency, % <sup>e</sup>		
<u>SO<sub>2</sub></u>		
mg	96.60	60.20
gr/DSCF	.05324	.03006
gr/ACF	.03844	.02319
lb/hr <sup>d</sup>	8.8	4.9
ppm	46	26
lb/ton of feed	--	--
efficiency, % <sup>e</sup>		

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping

<sup>e</sup> Based on emission rate, lb/hr

TABLE 11. AVERAGE EMISSION RESULTS FOR  
FLUORIDE TESTS  
1-3

	<u>INLET</u>	<u>OUTLET</u>
Date	---	---
Volume of Gas Sampled - DSCF <sup>a</sup>	---	---
Percent Moisture by Volume	---	---
Average Stack Temperature - °F	132	81
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	19,884	20,919
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	27,602	26,745
Percent Isokinetic	---	---
Percent Excess Air	N.A.	N.A.
Percent Capacity	N.A.	N.A.
Feed Rate - ton/hr	N.A.	N.A.
<u>Flourides</u>		
mg		
gr/DSCF	.01226	.00119
gr/ACF	.00887	.00092
lb/hr <sup>d</sup>	2.1	.21
lb/ton feed		
efficiency, % <sup>e</sup>	90.0	
<u>P<sub>2</sub>O<sub>5</sub></u>		
mg		
gr/DSCF	.15476	.00781
gr/ACF	.11195	.00610
lb/hr <sup>d</sup>	26.708	1.396
lb/ton feed	---	---
efficiency, % <sup>e</sup>	94.8	

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping

<sup>e</sup> Based on average emission rate, lb/hr.

TABLE 12. AVERAGE EMISSION RESULTS FOR  
 $P_2O_5$  TESTS  
 1-3

	<u>INLET</u>	<u>OUTLET</u>
Date	---	---
Volume of Gas Sampled - DSCF <sup>a</sup>	---	---
Percent Moisture by Volume	---	---
Average Stack Temperature - °F	131	80
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	17,177	19,870
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	23,918	25,671
Percent Isokinetic	---	---
Percent Excess Air	N.A.	N.A.
Percent Capacity	N.A.	N.A.
Feed Rate - ton/hr	N.A.	N.A.
<u><math>P_2O_5</math></u>	---	---
mg	---	---
gr/DSCF	.12239	.01002
gr/ACF	.08784	.00771
lb/hr <sup>d</sup>	17.87	1.70
lb/ton feed	---	---
efficiency, % <sup>e</sup>	90.4	
<u>Fluorides</u>	---	---
mg	---	---
gr/DSCF	.02470	.00162
gr/ACF	.01807	.00124
lb/hr <sup>d</sup>	3.43	.274
lb/ton feed	---	---
efficiency, % <sup>e</sup>	92.0	

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping

<sup>e</sup> Based on average emission rate, lb/hr

TABLE 13. AVERAGE EMISSION RESULTS FOR  
SO<sub>x</sub> TESTS  
x<sub>1-3</sub>

	<u>INLET</u>	<u>OUTLET</u>
Date	---	---
Volume of Gas Sampled - DSCF <sup>a</sup>	---	---
Percent Moisture by Volume	---	---
Average Stack Temperature - °F	134	81
Stack Volumetric Flow Rate - DSCFM <sup>b</sup>	18,574	19,433
Stack Volumetric Flow Rate - ACFM <sup>c</sup>	26,571	25,007
Percent Isokinetic	N.A.	N.A.
Percent Excess Air	N.A.	N.A.
Percent Opacity	N.A.	N.A.
Feed Rate - ton/hr	N.A.	N.A.
<u>SO<sub>3</sub></u>		
mg	---	---
gr/DSCF	.10135	.00344
gr/ACF <sup>d</sup>	.07086	.00266
lb/hr	15.95	.567
ppm	74	2.5
lb/ton of feed efficiency, % <sup>e</sup>	---	96.6
<u>SO<sub>2</sub></u>		
mg	---	---
gr/DSCF	.03331	.02316
gr/ACF <sup>d</sup>	.02353	.01790
lb/hr	5.4	3.8
ppm	28.7	20.0
lb/ton of feed efficiency, % <sup>e</sup>	---	29.6

<sup>a</sup> Dry standard cubic feet at 70°F, 29.92 in. Hg.

<sup>b</sup> Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

<sup>c</sup> Actual cubic feet per minute

<sup>d</sup> Emission rate during tapping

<sup>e</sup> Based on average emission rate, lb/hr

TABLE 14. SUMMARY OF SCRUBBER  
WATER ANALYSES FOR FLUORIDES AND P<sub>2</sub>O<sub>5</sub>

TEST	DATE	SCRUBBER WATER FLUORIDES (MG/L)	CONCENTRATIONS P <sub>2</sub> O <sub>5</sub> (MG/ML)
1-Fluorides	10/5/72	125.2 <sup>a,b</sup>	3.5 <sup>a,b</sup>
		124.0 (outlet to lake)	1.8 (outlet to lake)
2-Fluorides	10/5/72	168.9 <sup>a,b</sup>	3.7 <sup>a,b</sup>
3-Fluorides	10/6/72	98.9 <sup>a,b</sup>	2.7 <sup>a,b</sup>
1-P <sub>2</sub> O <sub>5</sub>	10/9/72	399.1 <sup>b</sup>	8.8 <sup>b</sup>
2-P <sub>2</sub> O <sub>5</sub>	10/9/72	1000 <sup>b</sup>	14.3 <sup>b</sup>
3-P <sub>2</sub> O <sub>5</sub>	10/10/72	268.2 <sup>b</sup>	3.7 <sup>b</sup>

- a) Average concentration of 2 samples taken  
b) See Figure 1 for scrubber water sample location.

TABLE 15. SUMMARY OF PROCESS  
MATERIAL ANALYSES

RAW MATERIAL	DATE	TOTAL FLUORIDES	TOTAL P <sub>2</sub> O <sub>5</sub>
Silica Sand	10/6/72	< .06 mg/gm	0
Phosphorus Nodules	10/6/72	2.63% (by weight) <sup>a</sup>	27.4% (by weight) <sup>a</sup>
	10/10/72	2.80% (by weight) <sup>a</sup>	28.9% (by weight) <sup>a</sup>
Coke	10/6/72	-	<.1% (by weight)
Precipitator Dust	10/9/72	7.5 mg/gm	26.1%

a) Represents average of 2 samples

consequently, the Greenburg-Smith impinger was replaced with a modified straight tip impinger, which alleviated this plugging for the rest of the test. The modified tip first impinger was used throughout the remaining eight tests at the inlet site.

Particulate concentration at the inlet site was observed to vary widely throughout the nine tests.

The percent isokinetic values for the scrubber outlet fluoride tests were low, averaging 76.03%, because the moisture had been assumed to be approximately 20%, when it was actually less than 2 percent.

A ferrophos tap occurred for 12 minutes during the third fluoride test. This tap yielded visible emissions which were similar to the ordinary slag taps' visible emissions.

The rest of the fluoride tests were run without incident. The average inlet fluoride emission rate was 2.1 lbs/hr and the outlet was .21 lb/hr. The scrubber therefore removed 90.0% of the fluorides on the average.

Opacity readings of visible emissions recorded during the three fluoride tests are included in Appendix A, Field Data. The individual average - weighted opacities for these three

test periods were: Test 1: 14.1%; Test 2: 14.9%; Test 3: 12.0%; the average opacity for the three tests was 13.7%.

#### P<sub>2</sub>O<sub>5</sub> Tests

The relatively low P<sub>2</sub>O<sub>5</sub> and fluoride concentrations in Test 1 (when compared with the other P<sub>2</sub>O<sub>5</sub> tests) confirmed the following observations made during the first P<sub>2</sub>O<sub>5</sub> test:

1. Opacity of the scrubber outlet stack exhaust was considerably less than that observed for the three previous fluoride tests;
2. Dust concentration was about 25% of that observed during the other tests, as evidenced by the lack of appreciable particulate build-up on the fiberglass inlet filter and visual observation of the inlet gas stream.

A ferrophos tap occurred for 18 minutes during P<sub>2</sub>O<sub>5</sub> Test No. 2. This tap yielded visible emissions which were similar to the ordinary slag taps' visible emissions.

The third P<sub>2</sub>O<sub>5</sub> test was run without incident. The average P<sub>2</sub>O<sub>5</sub> emission rate for the three tests was 17.9 lb/hr at the inlet and 1.7 lb/hr at the outlet, yielding an average scrubber efficiency of 90.4%.

#### SO<sub>x</sub> Tests

SO<sub>x</sub> tests were made with a single traverse through one port, at both the inlet and outlet, as space restrictions

precluded traversing through both ports with a rigid probe. All tests were made under apparently ordinary conditions.

Average concentrations for  $\text{SO}_3$  before and after the scrubber were 74 and 2.6 ppm respectively. The  $\text{SO}_2$  average concentrations were 29 and 20 ppm at the inlet and outlet respectively.

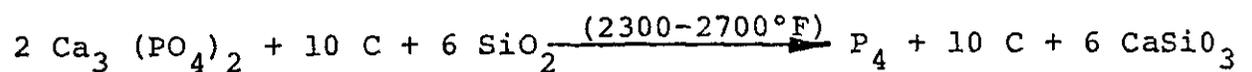
### III. PROCESS DESCRIPTION

Elemental phosphorus is produced from phosphate rock by reduction in an electric arc furnace. Typical ores contain 10-13% phosphorus so that about 10 tons of rock must be processed per ton of phosphorus produced. Considerable quantities of coke, silica, and recycled materials are fed to the furnaces with the beneficiated ore.

Prior to being fed to the furnace, the rock is agglomerated and heat-hardened in a kiln. The partially fused product is cooled and crushed to a specified size before being fed to the furnace as shown in Figure 1.

Phosphate feed is carefully proportioned with silica and coke before being transferred to feed bins directly above the furnace. The feed mixture then moves by gravity from the bins down into the furnace as the furnace feed is consumed.

The reaction within the furnace is approximated by the following equation:



Elemental phosphorous and carbon monoxide leave the furnace as gases. Dust is removed from the stream by an electrostatic precipitator and the phosphorous vapor is later condensed out in direct-contact water condensers. Waste CO gas is used as a fuel in the kiln operation.

The molten process by-products and some coke must be periodically removed from the furnace by tapping. This molten material separates into two layers inside the furnace. The lighter top layer is a slag from the ore material. This slag has no economic value except as an aggregate. It is tapped alternately from two tapholes at 15-minute intervals. The slag runs out into water-filled pits behind the furnace building.

The heavier bottom layer is about twice the density of the slag, and is largely a phosphorous-iron mixture known as ferrophos. This metal by-product is tapped from the furnace twice each day. The ferrophos is poured into chills and then shipped to a nearby plant for vanadium recovery.

The tapping of slag and ferrophos results in the evolution of significant amounts of fumes, most of which are  $P_2O_5$  particulates.

The No. 8 furnace at Monsanto's Soda Springs, Idaho plant has been partially controlled since 1971 by a taphole-hooding system vented to a scrubber.

Each of the three tapholes is hooded by a completely enclosed box. Each box is refractory lined with outside dimensions of 8' x 6' x 7'. The refractory lining is necessary

to prevent warping of the metal shell from the intense heat. There are access ports and doors on the hoods which are usually kept closed. However, even when the doors are open, fume pickup is very effective within the hooded area. There is no hooding over the slag runners or at the chill line or metal well.

A three-foot diameter duct directs the fumes from each hood to the control device. Each duct has interior water sprays for cooling purposes and dampers to control draft on each hood. Usually, two ducts are open and one is closed. The intake velocity across the access ports is approximately 700 feet per minute.

The three ducts join and lead to a high pressure-drop venturi scrubber. Water is sprayed from nozzles on each side of the throat at 370-420 gpm, depending on the amount of water being sprayed into the ductwork prior to the scrubber. The pressure drop across the scrubber is maintained at 48-52 inches of water. From the scrubber the exhaust stream enters a cyclonic separator. The removed water is recirculated from the bottom of the separator back to the venturi throat. Make-up water is added at a rate of 30-40 gallons per minute. From the separator, the cleaned gas is exhausted through an induced draft fan to a 175' fiberglass stack to the atmosphere.

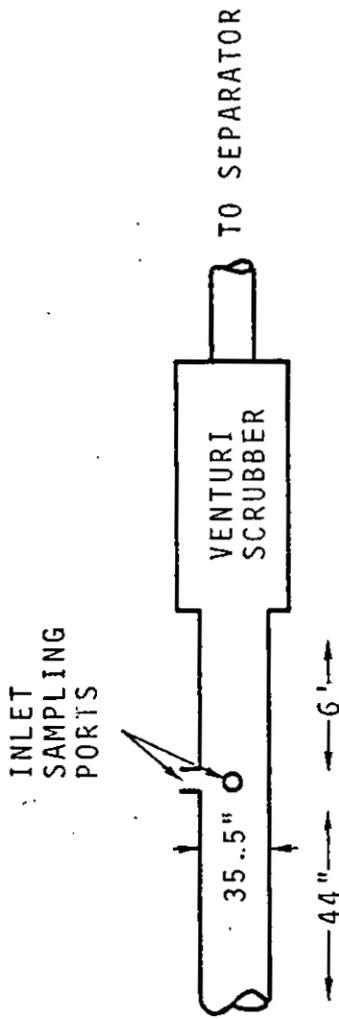
During testing, the furnace and scrubber control system were operating normally and at rated capacity.

#### IV. LOCATION OF SAMPLING POINTS

Figure 2 shows the sampling ports and the number of sampling points at the inlet and outlet sites used to determine the emissions from the slag tapping process. The inlet site was located in a 35.5-inch round horizontal duct, and samples here were collected at 48 points (24 along each diameter) of a vertical and a horizontal port. This inlet port location (Figures 1 and 2) does not conform to requirements of the Federal Register<sup>1</sup>, which specifies a minimum sampling distance from obstructions of two (2) duct diameters and one-half (1/2) duct diameter upstream and downstream of the sampling port respectively. The site was nonetheless used because it was the only available location for sampling. As shown, outlet samples were extracted at 12 points (6 along each diameter) from two ports in a 36-inch round vertical stack 48' above the slag tap scrubber exhaust fan.

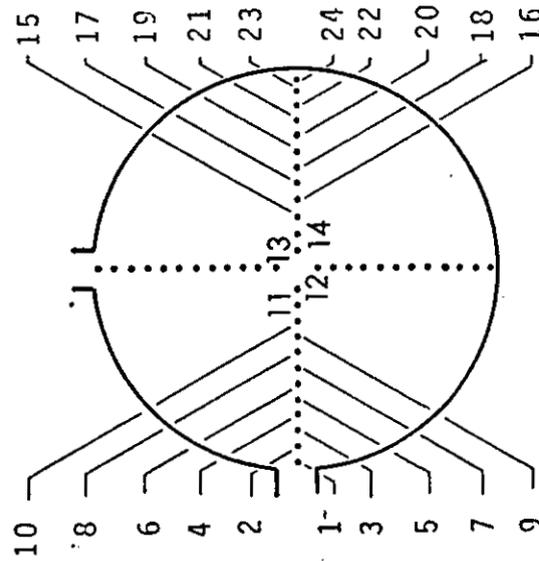
---

<sup>1</sup> Federal Register, Vol. 36, No. 247, December 23, 1971

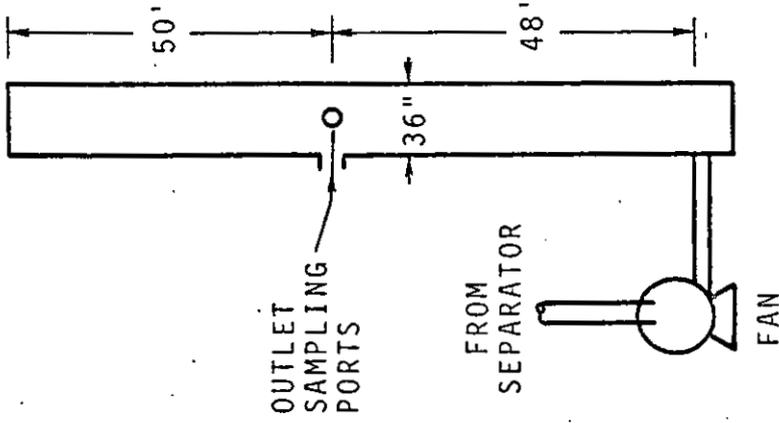


TRAVERSE POINT DISTANCES FROM INSIDE OF STACK, inches

1.	0.4	13.	21.4
2.	1.1	14.	24.0
3.	2.0	15.	25.8
4.	2.8	16.	27.3
5.	3.7	17.	28.6
6.	4.7	18.	29.8
7.	5.7	19.	30.8
8.	6.9	20.	31.8
9.	8.2	21.	32.7
10.	9.7	22.	33.6
11.	11.5	23.	34.4
12.	14.1	24.	35.1

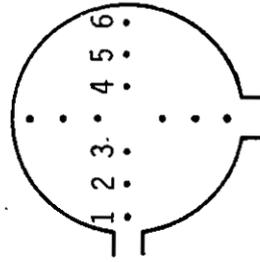


NO. 8 PHOSPHORUS FURNACE SLAG TAP SCRUBBER INLET



TRAVERSE POINT DISTANCES FROM INSIDE OF STACK, inches

1.	1.6	4.	25.4
2.	5.3	5.	30.7
3.	10.6	6.	34.4



NO. 8 PHOSPHORUS FURNACE SLAG TAP SCRUBBER OUTLET

Figure 2. Slag tap scrubber sampling sites and location of sampling points- Monsanto Chemical Company

## V. SAMPLING PROCEDURES

All sampling procedures were selected by EPA prior to field sampling. All analysis of collected samples were also performed by EPA. Field data sheets were submitted to EPA at the test site.

### Velocity and Gas Temperature

All gas velocities were measured with a type S pitot tube and inclined draft gage. In all cases velocities were measured at each sampling point across the stack diameter to determine an average value according to procedures described in the Federal Register<sup>1</sup> - Method 1. Temperatures were measured by long stem dial thermometers.

### Molecular Weight

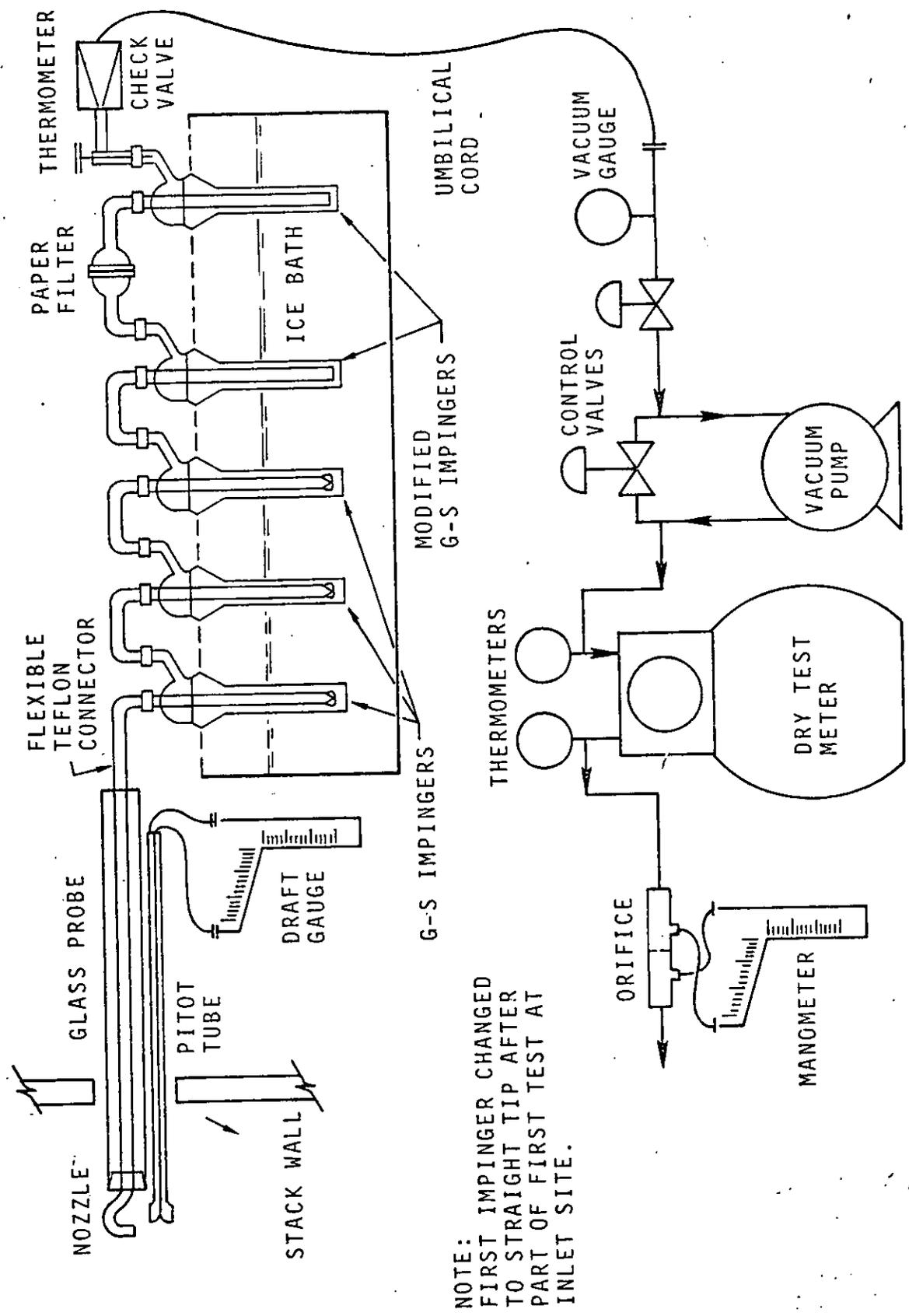
An integrated sample of the stack gases was collected during each run by pumping gas into a Mylar plastic bag at the rate of approximately 0.5 liter per minute. This bag sample was then analyzed with an Orsat apparatus for CO<sub>2</sub> and O<sub>2</sub> as described in the Federal Register, December 23, 1971, in Method 3.<sup>1</sup>

### Fluorides

The basic train for total fluoride samples, as shown in Figure 3, consisted of three standard Greenburg-Smith impingers

---

<sup>1</sup> Federal Register, Vol. 36, No. 247, December 23, 1971.



NOTE:  
 FIRST IMPINGER CHANGED  
 TO STRAIGHT TIP AFTER  
 PART OF FIRST TEST AT  
 INLET SITE.

Figure 3. Fluoride and P<sub>2</sub>O<sub>5</sub> sampling train.

containing 250 ml each of 2.5% sodium hydroxide<sup>a</sup>, one empty straight tip impinger, a 3" or 4" unheated Whatman #1 paper filter, and an impinger containing approximately 200 grams of accurately weighed silica gel. The impingers were contained in an ice-water bath. A stainless steel nozzle and glass lined probe were used in all cases. A flexible Teflon connector (5' long) was used at both test sites to connect the probe to the first impinger, as space limitations precluded the use of a rigid train configuration.

After sampling, the entire train was rinsed with distilled water and combined with the impinger contents and the filter into a single container. An acetone rinse of all components was placed in a second container.

#### P<sub>2</sub>O<sub>5</sub>

A sampling train identical to that used for fluorides was employed for the collection of P<sub>2</sub>O<sub>5</sub> except that only 100 ml of 2.5% sodium hydroxide was used in the first three impingers. Sample recovery was identical to the fluoride procedure.

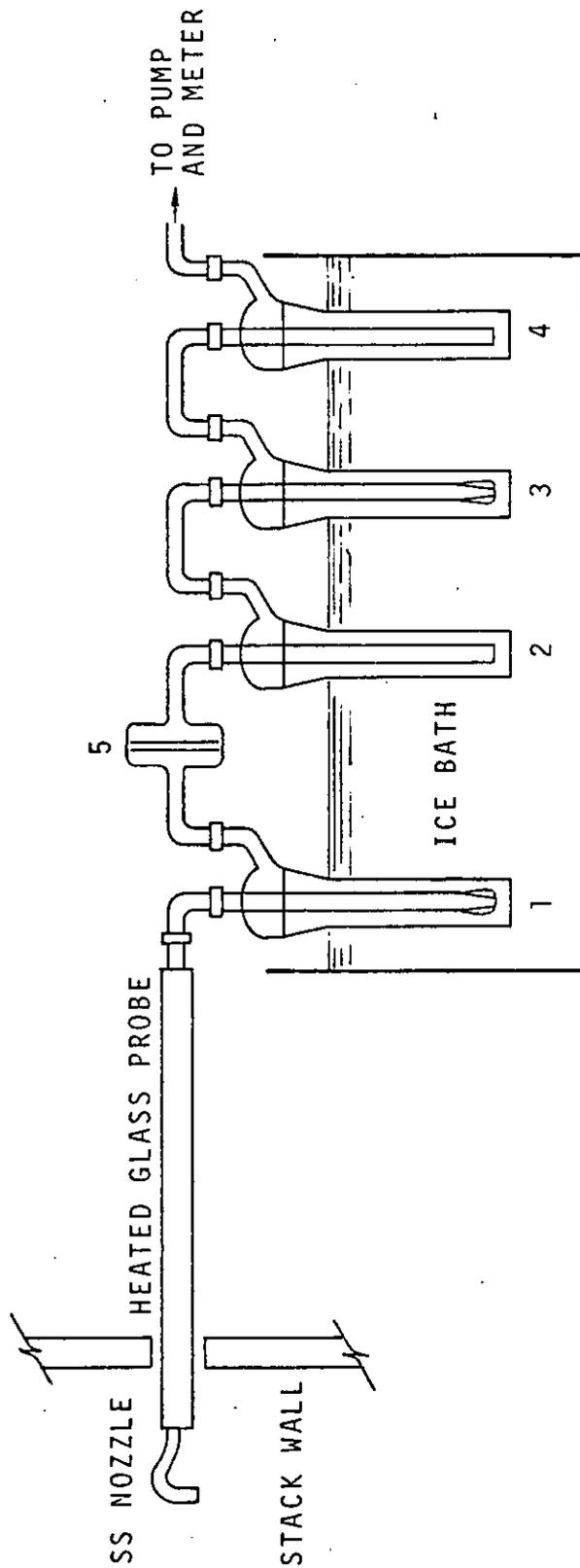
#### SO<sub>2</sub> and SO<sub>3</sub>

Method 8 as described in the Federal Register<sup>1</sup> was used to measure sulfur oxides as shown in Figure 4. A rigid train

---

<sup>a</sup> Though a 10% NaOH solution was originally planned, this was changed to 2.5% based on tests conducted at another plant during the previous week.

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



1. G-S IMPINGER - 100 ml. 80% ISOPROPANOL
2. MODIFIED G-S IMPINGER - 100 ml. 3% H<sub>2</sub>O<sub>2</sub>
3. G-S IMPINGER - 100 ml. 3% H<sub>2</sub>O<sub>2</sub>
4. MODIFIED G-S IMPINGER - 200 g. SILICA GEL
5. FILTER HOLDER w/GLASS FIBER FILTER

Figure 4. SO<sub>2</sub>/SO<sub>3</sub> sampling train.

with heated glass lined probe was employed at both the inlet and outlet of the venturi scrubber.

In all cases sampling was conducted under isokinetic conditions by continually monitoring the velocity with a pitot tube and adjusting the sampling rate accordingly. When slag tapping and sampling stopped in the middle of a traverse, that traverse point was completed at the start of the next slag tap before going to the next traverse point.

Sample recovery consisted of rinsing the probe with distilled water and adding the washings to the first impinger along with the filter. The contents of the two impingers after the filter were poured into another container and rinsed with distilled water.

APPENDIX A  
TEST RESULTS  
WITH  
EXAMPLE CALCULATIONS

TABLE A-1  
FLUORIDES - RUN 1

Run No.	1 FLUORIDES	1 FLUORIDES
Test Date	10/5/72	10/5/72
Sampling Time, 24 hour clock	1010	1010
Sampling Location	INLET	OUTLET
$D_n$ Sampling Nozzle Diameter, in.	.1875	.1890
$T_t$ Net Time of Test, Min.	65	60
$P_b$ Barometric Pressure, in. Hg Absolute	24.30	24.30
$P_m$ Average Orifice Pressure Drop, in. H <sub>2</sub> O	1.13	.58
$V_m$ Volume of Dry Gas Sampled at Meter Conditions, DCF	45.061	31.051
$T_m$ Average Gas Meter Temperature, °F	57.0	82.5
$V_{m\text{std}}$ Volume of Dry Gas Sampled at Standard Conditions <sup>a</sup> , DSCF	37.638	24.699
$V_w$ Total H <sub>2</sub> O Collected in Impingers and Silica Gel, ml	7.9	11.1
$V_{w\text{gas}}$ Volume of Water Vapor Collected at Standard Conditions <sup>b</sup> , SCF	.374	.526
% M % Moisture in Stack Gas, by Volume	.99	2.09
$M_d$ Mole Fraction of Dry Gas	.990	.979
% CO <sub>2</sub> Volume % Dry	0.0	0.0
% O <sub>2</sub> Volume % Dry	20.2	21.1
% CO Volume % Dry	0.0	0.0
% N <sub>2</sub> Volume % Dry	79.8	78.9
% EA Percent Excess Air	-	-
$MW_d$ Molecular Weight of Stack Gas, Dry Basis	28.81	28.84

TABLE A-1  
(Continued)

Run No.			
MW	Molecular Weight of Stack Gas, Wet Basis	28.70	28.62
C <sub>p</sub>	Pitot Tube Coefficient	.85	.85
T <sub>s</sub>	Average Stack Temperature, °F	125	84
N <sub>p</sub>	Net Sampling Points	49	12
P <sub>st</sub>	Static Pressure of Stack Gas, in. H <sub>2</sub> O	-1.70	.00
P <sub>s</sub>	Stack Gas Pressure, in. Hg Absolute	24.17	24.30
V <sub>s</sub>	Stack Gas Velocity at Stack Conditions, fps	66.3	61.8
A <sub>s</sub>	Stack Area,	6.873 ft. <sup>2</sup>	7.068 ft. <sup>2</sup>
Q <sub>s</sub>	Dry Stack Gas Volumetric Flow Rate at Standard Conditions, °C, DSCFM	19,825	20,295
Q <sub>a</sub>	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	27,340	26,208
% I	Percent Isokinetic	104.6	73.5
% O	Percent Opacity	N/A	14.1
T <sub>c</sub>	Unit Production Rate	N/A	N/A
m <sub>f</sub>	Particulate - Probe, Cyclone, and Filter, mg	N/A	N/A
m <sub>t</sub>	Fluoride - Total mg P <sub>2</sub> O <sub>5</sub> - Total mg.	33.74 509.5	3.38 15.90
I <sub>c</sub>	% Impinger Catch	N/A	N/A
C <sub>an</sub>	Particulate - Probe, Cyclone, and Filter, gr/SCF	N/A	N/A
C <sub>ao</sub>	Fluoride - Total, gr/SCF P <sub>2</sub> O <sub>5</sub> - Total, gr/SCF	.01383 .20890	.00211 .00993

TABLE A-1  
(Continued)

<u>Run No.</u>			
C <sub>at</sub>	Particulate - Probe, Cyclone, and Filter, gr/ACF	N/A	N/A
C <sub>au</sub>	Particulate - Total, gr/ACF	N/A	N/A
C <sub>aw</sub>	Particulate - Probe, Cyclone, and Filter, lb/hr.	N/A	N/A
C <sub>ax</sub>	Fluoride - Total, lb/hr. <sup>d</sup> P <sub>2</sub> O <sub>5</sub> - Total, lb/hr. <sup>d</sup>	2.350 35.499	.367 1.728
P <sub>tf</sub>	Particulate - Probe, Cyclone and Filter, lb/ton	N/A	N/A
P <sub>tt</sub>	Particulate - Total, lb/ton	N/A	N/A

<sup>a</sup> Dry standard cubic feet at 70° F, 29.92 in. Hg.

<sup>b</sup> Standard conditions at 70°F, 29.92 in. Hg.

<sup>c</sup> Dry standard cubic feet per minute at 70°F, 20.92 in. Hg.

<sup>d</sup> Emission rate during tapping only

TABLE A-2  
FLUORIDES - RUN 2

Run No.		2 FLUORIDES	2 FLUORIDES
Test Date		10/5/72	10/5/72
Sampling Time, 24 hour clock		1741	1741
Sampling Location		INLET	OUTLET
$D_n$	Sampling Nozzle Diameter, in.	.1875	.1890
$T_t$	Net Time of Test, Min.	62.5	60.0
$P_b$	Barometric Pressure, in. Hg Absolute	24.30	24.30
$P_m$	Average Orifice Pressure Drop, in. H <sub>2</sub> O	1.27	.63
$V_m$	Volume of Dry Gas Sampled at Meter Conditions, DCF	45.956	34.253
$T_m$	Average Gas Meter Temperature, °F	61	90.5
$V_{m_{std}}$	Volume of Dry Gas Sampled at Standard Conditions <sup>a</sup> , DSCF	38.107	26.854
$V_w$	Total H <sub>2</sub> O Collected in Impin- gers and Silica Gel, ml	4.0	17.7
$V_{w_{gas}}$	Volume of Water Vapor Collected at Standard Conditions <sup>b</sup> , SCF	.190	.839
% M	% Moisture in Stack Gas, by Volume	.50	3.03
$M_d$	Mole Fraction of Dry Gas	.995	.970
% CO <sub>2</sub>	Volume % Dry	0.0	0.0
% O <sub>2</sub>	Volume % Dry	21.1	20.7
% CO	Volume % Dry	0.0	0.0
% N <sub>2</sub>	Volume % Dry	78.9	79.3
% EA	Percent Excess Air	-	-
MW <sub>d</sub>	Molecular Weight of Stack Gas, Dry Basis	28.84	28.83

TABLE A-2  
(Continued)

Run No.			
MW	Molecular Weight of Stack Gas, Wet Basis	28.79	28.50
C <sub>p</sub>	Pitot Tube Coefficient	.85	.85
T <sub>s</sub>	Average Stack Temperature, °F	125	83
N <sub>p</sub>	Net Sampling Points	50	12
P <sub>st</sub>	Static Pressure of Stack Gas, in. H <sub>2</sub> O	-1.70	.00
P <sub>s</sub>	Stack Gas Pressure, in. Hg Absolute	24.17	24.30
V <sub>s</sub>	Stack Gas Velocity at Stack Conditions, fps	70.0	64.8
A <sub>s</sub>	Stack Area,	6.873 ft. <sup>2</sup>	7.068 ft. <sup>2</sup>
Q <sub>s</sub>	Dry Stack Gas Volumetric Flow Rate at Standard Conditions, °C DSCFM	21,032	21,134
Q <sub>a</sub>	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	28,867	27,480
% I	Percent Isokinetic	103.9	76.8
% O	Percent Opacity	N/A	14.9
T <sub>c</sub>	Unit Production Rate	N/A	N/A
m <sub>f</sub>	Particulate - Probe, Cyclone, and Filter, mg	N/A	N/A
m <sub>t</sub>	Fluoride - Total mg P <sub>2</sub> O <sub>5</sub> - Total mg.	42.73 448.50	1.07 11.20
I <sub>c</sub>	% Impinger Catch	N/A	N/A
C <sub>an</sub>	Particulate - Probe, Cyclone, and Filter, gr/SCF	N/A	N/A
C <sub>ao</sub>	Fluoride - Total, gr/SCF P <sub>2</sub> O <sub>5</sub> - Total, gr/SCF	.01730 .18163	.00061 .00643

TABLE A-2  
(Continued)

<u>Run No.</u>			
C <sub>at</sub>	Particulate - Probe, Cyclone, and Filter, gr/ACF	N/A	N/A
C <sub>au</sub>	Particulate - Total, gr/ACF	N/A	N/A
C <sub>aw</sub>	Particulate - Probe, Cyclone, and Filter, lb/hr.	N/A	N/A
C <sub>ax</sub>	Fluoride - Total, lb/hr. <sup>d</sup> P <sub>2</sub> O <sub>5</sub> - Total, lb/hr. <sup>a</sup>	3.119 32.744	.111 1.165
P <sub>tf</sub>	Particulate - Probe, Cyclone and Filter, lb/ton	N/A	N/A
P <sub>tt</sub>	Particulate - Total, lb/ton	N/A	N/A

<sup>a</sup> Dry standard cubic feet at 70° F, 29.92 in. Hg.

<sup>b</sup> Standard conditions at 70°F, 29.92 in. Hg.

<sup>c</sup> Dry standard cubic feet per minute at 70°F, 20.92 in. Hg.

<sup>d</sup> Emission rate during tapping only

TABLE A-3  
FLUORIDES - RUN 3

Run No.		3 FLUORIDES	3 FLUORIDES
Test Date		10/6/72	10/6/72
Sampling Time, 24 hour clock		---	---
Sampling Location		INLET	OUTLET
$D_n$ Sampling Nozzle Diameter, in.		.1875	.1890
$T_t$ Net Time of Test, Min.		64.0	60
$P_b$ Barometric Pressure, in. Hg Absolute		24.35	24.35
$P_m$ Average Orifice Pressure Drop, in. $H_2O$		1.02	.61
$V_m$ Volume of Dry Gas Sampled at Meter Conditions, DCF		43.009	32.569
$T_m$ Average Gas Meter Temperature, $^{\circ}F$		51.5	52.5
$V_{m\text{std}}$ Volume of Dry Gas Sampled at Standard Conditions <sup>a</sup> , DSCF		36.409	32.569
$V_w$ Total $H_2O$ Collected in Impin- gers and Silica Gel, ml		.0	0.000
$V_{w\text{gas}}$ Volume of Water Vapor Collected at Standard Conditions <sup>b</sup> , SCF		.000	0
% M % Moisture in Stack Gas, by Volume		0.00	0.00
$M_d$ Mole Fraction of Dry Gas		1.000	1.000
% $CO_2$ Volume % Dry		0.0	0.0
% $O_2$ Volume % Dry		21.0	21.6
% CO Volume % Dry		0.0	0.0
% $N_2$ Volume % Dry		79.0	78.4
% EA Percent Excess Air			
$MW_d$ Molecular Weight of Stack Gas, Dry Basis		28.84	28.86

TABLE A-3  
(Continued)

Run No.			
MW	Molecular Weight of Stack Gas, Wet Basis	28.84	28.86
C <sub>p</sub>	Pitot Tube Coefficient	.85	.85
T <sub>s</sub>	Average Stack Temperature, °F	147	77
N <sub>p</sub>	Net Sampling Points	49	12
P <sub>st</sub>	Static Pressure of Stack Gas, in. H <sub>2</sub> O	-1.70	.00
P <sub>s</sub>	Stack Gas Pressure, in. Hg Absolute	24.22	24.35
V <sub>s</sub>	Stack Gas Velocity at Stack Conditions, fps	64.5	62.6
A <sub>s</sub>	Stack Area,	6.873 ft. <sup>2</sup>	7.068 ft. <sup>2</sup>
Q <sub>s</sub>	Dry Stack Gas Volumetric Flow Rate at Standard Conditions, °C DSCFM	18,794	21,328
Q <sub>a</sub>	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	26,599	26,547
% I	Percent Isokinetic	108.4	77.8
% O	Percent Opacity	N/A	N/A
T <sub>c</sub>	Unit Production Rate	N/A	12.0
m <sub>f</sub>	Particulate - Probe, Cyclone, and Filter, mg	N/A	N/A
m <sub>t</sub>	Fluoride - Total mg P <sub>2</sub> O <sub>5</sub> - Total mg.	13,32 174.0	1.50 12.60
I <sub>c</sub>	% Impinger Catch	N/A	N/A
C <sub>an</sub>	Particulate - Probe, Cyclone, and Filter, gr/SCF	N/A	N/A
C <sub>ao</sub>	Fluoride - Total, gr/SCF P <sub>2</sub> O <sub>5</sub> - Total, gr/SCF	.00564 .07375	.00084 .00707

TABLE A-3  
(Continued)

<u>Run No.</u>			
C <sub>at</sub>	Particulate - Probe, Cyclone, and Filter, gr/ACF	N/A	N/A
C <sub>au</sub>	Particulate - Total, gr/ACF	N/A	N/A
C <sub>aw</sub>	Particulate - Probe, Cyclone, and Filter, lb/hr.	N/A	N/A
C <sub>ax</sub>	Fluoride - Total, lb/hr. <sup>d</sup> P <sub>2</sub> O <sub>5</sub> - Total, lb/hr. <sup>d</sup>	.909 11.880	.154 1.295
P <sub>tf</sub>	Particulate - Probe, Cyclone and Filter, lb/ton	N/A	N/A
P <sub>tt</sub>	Particulate - Total, lb/ton	N/A	N/A

<sup>a</sup> Dry standard cubic feet at 70° F, 29.92 in. Hg.

<sup>b</sup> Standard conditions at 70°F, 29.92 in. Hg.

<sup>c</sup> Dry standard cubic feet per minute at 70°F, 20.92 in. Hg.

<sup>d</sup> Emission rate during tapping only

TABLE A-4  
P<sub>2</sub>O<sub>5</sub> - RUN 1

Run No.		1 P <sub>2</sub> O <sub>5</sub>	1 P <sub>2</sub> O <sub>5</sub>
Test Date		10/9/72	10/9/72
Sampling Time, 24 hour clock		1140	1136
Sampling Location		INLET	OUTLET
D <sub>n</sub>	Sampling Nozzle Diameter, in.	.1875	.1890
T <sub>t</sub>	Net Time of Test, Min.	62.0	60.0
P <sub>b</sub>	Barometric Pressure, in. Hg Absolute	24.33	24.33
P <sub>m</sub>	Average Orifice Pressure Drop, in. H <sub>2</sub> O	.92	.98
V <sub>m</sub>	Volume of Dry Gas Sampled at Meter Conditions, DCF	39.491	42.386
T <sub>m</sub>	Average Gas Meter Temperature, °F	62.5	86
V <sub>m</sub> std	Volume of Dry Gas Sampled at Standard Conditions <sup>a</sup> , DSCF	32.689	33.550
V <sub>w</sub>	Total H <sub>2</sub> O Collected in Impingers and Silica Gel, ml	3.0	13.7
V <sub>w</sub> gas	Volume of Water Vapor Collected at Standard Conditions <sup>b</sup> , SCF	.142	.649
% M	% Moisture in Stack Gas, by Volume	0.43	1.90
M <sub>d</sub>	Mole Fraction of Dry Gas	.996	.981
% CO <sub>2</sub>	Volume % Dry	0.0	0.0
% O <sub>2</sub>	Volume % Dry	21.1	21.1
% CO	Volume % Dry	0.0	0.0
% N <sub>2</sub>	Volume % Dry	78.9	78.9
% EA	Percent Excess Air	-	-
MW <sub>d</sub>	Molecular Weight of Stack Gas, Dry Basis	28.84	28.84

TABLE A-4  
(Continued)

Run No.			
MW	Molecular Weight of Stack Gas, Wet Basis	28.80	28.64
C <sub>P</sub>	Pitot Tube Coefficient	.85	.85
T <sub>S</sub>	Average Stack Temperature, °F	137	75
N <sub>P</sub>	Net Sampling Points	49	12
P <sub>st</sub>	Static Pressure of Stack Gas, in. H <sub>2</sub> O	-1.70	.00
P <sub>s</sub>	Stack Gas Pressure, in. Hg Absolute	24.20	24.33
V <sub>s</sub>	Stack Gas Velocity at Stack Conditions, fps	61.7	59.8
A <sub>s</sub>	Stack Area,	6.873 ft. <sup>2</sup>	7.068 ft. <sup>2</sup>
Q <sub>s</sub>	Dry Stack Gas Volumetric Flow Rate at Standard Conditions, <sup>c</sup> DSCFM	18,197	20,045
Q <sub>a</sub>	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	25,444	25,360
% I	Percent Isokinetic	103.8	101.1
% O	Percent Opacity	N/A	N/A
T <sub>C</sub>	Unit Production Rate	N/A	N/A
m <sub>f</sub>	Particulate - Probe, Cyclone, and Filter, mg	N/A	N/A
m <sub>t</sub>	Fluoride - Total mg P <sub>2</sub> O <sub>5</sub> - Total mg.	17.69 226.0	.86 15.20
I <sub>c</sub>	% Impinger Catch	N/A	N/A
C <sub>an</sub>	Particulate - Probe, Cyclone, and Filter, gr/SCF	N/A	N/A
C <sub>ao</sub>	Fluoride - Total, gr/SCF P <sub>2</sub> O <sub>5</sub> - Total, gr/SCF	.00835 .10669	.00039 .00699

TABLE A-4  
(Continued)

<sup>c</sup> ax	Fluoride - Total, lb/hr. <sup>d</sup>	1.302	.067
	P <sub>2</sub> O <sub>5</sub> - Total, lb/hr. <sup>d</sup>	16.640	1.201

<sup>a</sup> Dry standard cubic feet at 70° F, 29.92 in. Hg.

<sup>b</sup> Standard conditions at 70°F, 29.92 in. Hg.

<sup>c</sup> Dry standard cubic feet per minute at 70°F, 20.92 in. Hg.

<sup>d</sup> Emission rate during tapping only

TABLE A-5  
P<sub>2</sub>O<sub>5</sub> - RUN 2

Run No.	2 P <sub>2</sub> O <sub>5</sub>	2 P <sub>2</sub> O <sub>5</sub>
Test Date	10/9/72	10/9/72
Sampling Time, 24 hour clock	2100	2105
Sampling Location	INLET	OUTLET
D <sub>n</sub> Sampling Nozzle Diameter, in.	.1875	.1890
T <sub>t</sub> Net Time of Test, Min.	60.0	60.0
P <sub>b</sub> Barometric Pressure, in. Hg Absolute	24.33	24.33
P <sub>m</sub> Average Orifice Pressure Drop, in. H <sub>2</sub> O	.81	1.03
V <sub>m</sub> Volume of Dry Gas Sampled at Meter Conditions, DCF	36.430	44.200
T <sub>m</sub> Average Gas Meter Temperature, °F	61.5	123.5
V <sub>m</sub> <sup>std</sup> Volume of Dry Gas Sampled at Standard Conditions <sup>a</sup> , DSCF	30.204	32.770
V <sub>w</sub> Total H <sub>2</sub> O Collected in Impingers and Silica Gel, ml	8.2	28.9
V <sub>w</sub> <sup>gas</sup> Volume of Water Vapor Collected at Standard Conditions <sup>b</sup> , SCF	.389	1.370
% M % Moisture in Stack Gas, by Volume	1.27	4.01
M <sub>d</sub> Mole Fraction of Dry Gas	.987	.960
% CO <sub>2</sub> Volume % Dry	0.0	0.0
% O <sub>2</sub> Volume % Dry	21.1	21.8
% CO Volume % Dry	0.0	0.0
% N <sub>2</sub> Volume % Dry	78.9	78.2
% EA Percent Excess Air	-	-
MW <sub>d</sub> Molecular Weight of Stack Gas, Dry Basis	28.85	28.87

TABLE A-5  
(Continued)

Run No.			
MW	Molecular Weight of Stack Gas, Wet Basis	28.71	28.43
C <sub>p</sub>	Pitot Tube Coefficient	.85	.85
T <sub>s</sub>	Average Stack Temperature, °F	106	83
N <sub>p</sub>	Net Sampling Points	48	12
P <sub>st</sub>	Static Pressure of Stack Gas, in.H <sub>2</sub> O	-1.70	.00
P <sub>s</sub>	Stack Gas Pressure, in. Hg Absolute	24.20	24.33
V <sub>s</sub>	Stack Gas Velocity at Stack Conditions, fps	49.4	60.5
A <sub>s</sub>	Stack Area, ...	6.873 ft. <sup>2</sup>	7.068 ft. <sup>2</sup>
Q <sub>s</sub>	Dry Stack Gas Volumetric Flow Rate at Standard Conditions, °C DSCFM	15,246	19,559
Q <sub>a</sub>	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	20,372	25,657
% I	Percent Isokinetic	118.3	101.2
% O	Percent Opacity	N/A	N/A
T <sub>c</sub>	Unit Production Rate	N/A	N/A
m <sub>f</sub>	Particulate - Probe, Cyclone, and Filter, mg	N/A	N/A
m <sub>t</sub>	Fluoride - Total mg P <sub>2</sub> O <sub>5</sub> - Total mg.	97.46 274.20	7.29 32.10
I <sub>c</sub>	% Impinger Catch	N/A	N/A
C <sub>an</sub>	Particulate - Probe, Cyclone, and Filter, gr/SCF	N/A	N/A
C <sub>ao</sub>	Fluoride - Total, gr/SCF P <sub>2</sub> O <sub>5</sub> - Total, gr/SCF	.04979 .14010	.00343 .01511

TABLE A-5  
(Continued)

<u>Run No.</u>			
C <sub>at</sub>	Particulate - Probe, Cyclone, and Filter, gr/ACF	N/A	N/A
C <sub>au</sub>	Particulate - Total, gr/ACF	N/A	N/A
C <sub>aw</sub>	Particulate - Probe, Cyclone, and Filter, lb/hr.	N/A	N/A
C <sub>ax</sub>	Fluoride - Total, lb/hr. <sup>d</sup> P <sub>2</sub> O <sub>5</sub> - Total, lb/hr. <sup>d</sup>	6.507 18.308	.575 2.534
P <sub>tf</sub>	Particulate - Probe, Cyclone and Filter, lb/ton	N/A	N/A
P <sub>tt</sub>	Particulate - Total, lb/ton	N/A	N/A

<sup>a</sup> Dry standard cubic feet at 70° F, 29.92 in. Hg.

<sup>b</sup> Standard conditions at 70°F, 29.92 in. Hg.

<sup>c</sup> Dry standard cubic feet per minute at 70°F, 20.92 in. Hg.

<sup>d</sup> Emission rate during tapping only

TABLE A-6  
P<sub>2</sub>O<sub>5</sub> - RUN 3

Run No.		3 P <sub>2</sub> O <sub>5</sub>	3 P <sub>2</sub> O <sub>5</sub>
Test Date		10/10/72	10/10/72
Sampling Time, 24 hour clock			
Sampling Location		INLET	OUTLET
D <sub>n</sub>	Sampling Nozzle Diameter, in.	.1875	.1890
T <sub>t</sub>	Net Time of Test, Min.	56.6	60.0
P <sub>b</sub>	Barometric Pressure, in. Hg Absolute	24.31	24.30
P <sub>m</sub>	Average Orifice Pressure Drop, in. H <sub>2</sub> O	.89	1.08
V <sub>m</sub>	Volume of Dry Gas Sampled at Meter Conditions, DCF	35.805	44.137
T <sub>m</sub>	Average Gas Meter Temperature, °F	61.0	90.5
V <sub>m</sub> <sup>std</sup>	Volume of Dry Gas Sampled at Standard Conditions <sup>a</sup> , DSCF	29.668	34.650
V <sub>w</sub>	Total H <sub>2</sub> O Collected in Impin- gers and Silica Gel, ml	5.4	23.3
V <sub>w</sub> <sup>gas</sup>	Volume of Water Vapor Collected at Standard Conditions <sup>b</sup> , SCF	.256	1.104
% M	% Moisture in Stack Gas, by Volume	.86	3.09
M <sub>d</sub>	Mole Fraction of Dry Gas	.991	.969
% CO <sub>2</sub>	Volume % Dry	0.0	0.0
% O <sub>2</sub>	Volume % Dry	21.1	21.8
% CO	Volume % Dry	0.0	0.0
% N <sub>2</sub>	Volume % Dry	78.9	78.2
% EA	Percent Excess Air	-	-
MW <sub>d</sub>	Molecular Weight of Stack Gas, Dry Basis	28.85	28.87

TABLE A-6  
(Continued)

Run No.			
MW	Molecular Weight of Stack Gas, Wet Basis	28.75	28.54
C <sub>p</sub>	Pitot Tube Coefficient	.85	.85
T <sub>s</sub>	Average Stack Temperature, °F	149	82
N <sub>p</sub>	Net Sampling Points	45	12
P <sub>st</sub>	Static Pressure of Stack Gas, in. H <sub>2</sub> O	-1.70	.00
P <sub>s</sub>	Stack Gas Pressure, in. Hg Absolute	24.18	24.30
V <sub>s</sub>	Stack Gas Velocity at Stack Conditions, fps	62.9	61.3
A <sub>s</sub>	Stack Area, -	6.873 ft. <sup>2</sup>	7.068 ft. <sup>2</sup>
Q <sub>s</sub>	Dry Stack Gas Volumetric Flow Rate at Standard Conditions, °C DSCFM	18,089	20,005
Q <sub>a</sub>	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	25,939	25,996
% I	Percent Isokinetic	103.8	104.7
% O	Percent Opacity	N/A	N/A
T <sub>c</sub>	Unit Production Rate	N/A	N/A
m <sub>f</sub>	Particulate - Probe, Cyclone, and Filter, mg	N/A	N/A
m <sub>t</sub>	Fluoride - Total mg P <sub>2</sub> O <sub>5</sub> - Total mg.	30.70 231.40	2.35 17.90
I <sub>c</sub>	% Impinger Catch	N/A	N/A
C <sub>an</sub>	Particulate - Probe, Cyclone, and Filter, gr/SCF	N/A	N/A
C <sub>ao</sub>	Fluoride - Total, gr/SCF P <sub>2</sub> O <sub>5</sub> - Total, gr/SCF	.01596 .12036	.00104 .00797

TABLE A-6  
(Continued)

Run No.			
C <sub>at</sub>	Particulate - Probe, Cyclone, and Filter, gr/ACF	N/A	N/A
C <sub>au</sub>	Particulate - Total, gr/ACF	N/A	N/A
C <sub>aw</sub>	Particulate - Probe, Cyclone, and Filter, lb/hr.	N/A	N/A
C <sub>ax</sub>	Fluoride - Total, lb/hr. <sup>d</sup> P <sub>2</sub> O <sub>5</sub> - Total, lb/hr. <sup>d</sup>	2.475 18.662	.179 1.367
P <sub>tf</sub>	Particulate - Probe, Cyclone and Filter, lb/ton	N/A	N/A
P <sub>tt</sub>	Particulate - Total, lb/ton	N/A	N/A

<sup>a</sup> Dry standard cubic feet at 70° F, 29.92 in. Hg.

<sup>b</sup> Standard conditions at 70°F, 29.92 in. Hg.

<sup>c</sup> Dry standard cubic feet per minute at 70°F, 20.92 in. Hg.

<sup>d</sup> Emission rate during tapping only

TABLE A-7  
SO<sub>2</sub>/SO<sub>3</sub> - RUN 1

Run No.		1 SO <sub>x</sub>	1 SO <sub>x</sub>
Test Date		10/10/72	10/10/72
Sampling Time, 24 hour clock		1800	1800
Sampling Location		INLET	OUTLET
D <sub>n</sub>	Sampling Nozzle Diameter, in.	.1875	.1890
T <sub>t</sub>	Net Time of Test, Min.	60	60
P <sub>b</sub>	Barometric Pressure, in. Hg Absolute	24.30	24.30
P <sub>m</sub>	Average Orifice Pressure Drop, in. H <sub>2</sub> O	.93	1.02
V <sub>m</sub>	Volume of Dry Gas Sampled at Meter Conditions, DCF	38.184	43.627
T <sub>m</sub>	Average Gas Meter Temperature, °F	59	81.5
V <sub>m std</sub>	Volume of Dry Gas Sampled at Standard Conditions <sup>a</sup> , DSCF	31.752	34.812
V <sub>w</sub>	Total H <sub>2</sub> O Collected in Impin- gers and Silica Gel, ml	16.6	13.1
V <sub>w gas</sub>	Volume of Water Vapor Collected at Standard Conditions <sup>b</sup> , SCF	.787	.621
% M	% Moisture in Stack Gas, by Volume	2.42	1.75
M <sub>d</sub>	Mole Fraction of Dry Gas	.976	.983
% CO <sub>2</sub>	Volume % Dry		
% O <sub>2</sub>	Volume % Dry		
% CO	Volume % Dry		
% N <sub>2</sub>	Volume % Dry		
% EA	Percent Excess Air		
MW <sub>d</sub>	Molecular Weight of Stack Gas, Dry Basis	28.83	28.84

ORSAT ANALYSIS

NOT RUN

FOR THIS

TEST

TABLE A-7  
(Continued)

Run No.			
MW	Molecular Weight of Stack Gas, Wet Basis	28.57	28.65
C <sub>p</sub>	Pitot Tube Coefficient	.85	.85
T <sub>s</sub>	Average Stack Temperature, °F	143	80
N <sub>p</sub>	Net Sampling Points	24	6
P <sub>st</sub>	Static Pressure of Stack Gas, in. H <sub>2</sub> O	-1.70	.77
P <sub>s</sub>	Stack Gas Pressure, in. Hg Absolute	24.17	24.36
V <sub>s</sub>	Stack Gas Velocity at Stack Conditions, fps	62.3	60.0
A <sub>s</sub>	Stack Area, ft <sup>2</sup>	6.873 ft <sup>2</sup>	7.068 ft <sup>2</sup>
Q <sub>s</sub>	Dry Stack Gas Volumetric Flow Rate at Standard Conditions, DSCFM	17,811	19,955
Q <sub>a</sub>	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	25,691	25,445
% I	Percent Isokinetic	106.4	105.4
% O	Percent Opacity	N/A	N/A
T <sub>c</sub>	Unit Production Rate	N/A	N/A
m <sub>f</sub>	Particulate - Probe, Cyclone, and Filter, mg	N/A	N/A
m <sub>t</sub>	SO <sub>3</sub> - Total, mg	352.5	3.6
	SO <sub>2</sub> - Total, mg	60.2	--
I <sub>c</sub>	% Impinger Catch	N/A	N/A
C <sub>an</sub>	Particulate - Probe, Cyclone, and Filter, gr/SCF		
C <sub>ao</sub>	SO <sub>3</sub> - Total, gr/SCF	.17132	.00159
	SO <sub>2</sub> - Total, gr/SCF	.02925	Lab Data Not Available

TABLE A-7  
(Continued)

<u>Run No.</u>			
C <sub>at</sub>	Particulate - Probe, Cyclone, and Filter, gr/ACF	N/A	N/A
C <sub>au</sub>	Particulate - Total, gr/ACF	N/A	N/A
C <sub>aw</sub>	Particulate - Probe, Cyclone, and Filter, lb/hr.	N/A	N/A
C <sub>ax</sub>	SO <sub>3</sub> - Total, lb/hr. <sup>d</sup>	26.155	.272
	SO <sub>2</sub> - Total, lb/hr. <sup>d</sup>	4.466	Lab Data Not Available
P <sub>tf</sub>	Particulate - Probe, Cyclone and Filter, lb/ton	N/A	N/A
P <sub>tt</sub>	Particulate - Total, lb/ton	N/A	N/A

<sup>a</sup> Dry standard cubic feet at 70°F, 20.92 in. Hg.

<sup>b</sup> Standard conditions at 70°F, 20.92 in. Hg.

<sup>c</sup> Dry standard cubic feet per minute at 70°F, 20.92 in. Hg.

<sup>d</sup> Emission rates during tapping only

TABLE A-8  
SO<sub>2</sub>/SO<sub>3</sub> - RUN 2

Run No.	2 SO <sub>x</sub>	2 SO <sub>x</sub>
Test Date	10/10/72	10/10/72
Sampling Time, 24 hour clock	2205	2205
Sampling Location	INLET	OUTLET
D <sub>n</sub> Sampling Nozzle Diameter, in.	.1875	.1890
T <sub>t</sub> Net Time of Test, Min.	60	60
P <sub>b</sub> Barometric Pressure, in. Hg Absolute	24.30	24.30
P <sub>m</sub> Average Orifice Pressure Drop, in. H <sub>2</sub> O	1.02	1.00
V <sub>m</sub> Volume of Dry Gas Sampled at Meter Conditions, DCF	40.296	42.670
T <sub>m</sub> Average Gas Meter Temperature, °F	60	73.5
V <sub>m std</sub> Volume of Dry Gas Sampled at Standard Conditions <sup>a</sup> , DSCF	33.453	34.558
V <sub>w</sub> Total H <sub>2</sub> O Collected in Impingers and Silica Gel, ml	27.6	23.7
V <sub>w gas</sub> Volume of Water Vapor Collected at Standard Conditions <sup>b</sup> , SCF	1.308	1.123
% M % Moisture in Stack Gas, by Volume	3.76	3.15
M <sub>d</sub> Mole Fraction of Dry Gas	.962	.969
% CO <sub>2</sub> Volume % Dry	ORSAT ANALYSIS	
% O <sub>2</sub> Volume % Dry	NOT RUN	
% CO Volume % Dry	FOR THIS	
% N <sub>2</sub> Volume % Dry	TEST	
% EA Percent Excess Air		
MW <sub>d</sub> Molecular Weight of Stack Gas, Dry Basis	28.83	28.84

TABLE A-8  
(Continued)

Run No.			
MW	Molecular Weight of Stack Gas, Wet Basis	28.42	28.50
C <sub>p</sub>	Pitot Tube Coefficient	.85	.85
T <sub>s</sub>	Average Stack Temperature, °F	144	79
N <sub>p</sub>	Net Sampling Points	24	6
P <sub>st</sub>	Static Pressure of Stack Gas, in. H <sub>2</sub> O	-1.70	.83
P <sub>s</sub>	Stack Gas Pressure, in. Hg Absolute	24.17	24.36
V <sub>s</sub>	Stack Gas Velocity at Stack Conditions, fps	66.1	59.4
A <sub>s</sub>	Stack Area, ft <sup>2</sup>	6.873	7.068
Q <sub>s</sub>	Dry Stack Gas Volumetric Flow Rate at Standard Conditions, DSCFM	18,587	19,519
Q <sub>a</sub>	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	27,258	25,190
% I	Percent Isokinetic	107.5	107.0
% O	Percent Opacity	N/A	N/A
T <sub>c</sub>	Unit Production Rate	N/A	N/A
m <sub>f</sub>	Particulate - Probe, Cyclone, and Filter, mg	N/A	N/A
m <sub>t</sub>	SO <sub>3</sub> - Total, mg	108.5	7.8
	SO <sub>2</sub> - Total, mg	37.8	36.4
I <sub>c</sub>	% Impinger Catch	N/A	N/A
C <sub>an</sub>	Particulate - Probe, Cyclone, and Filter, gr/SCF	N/A	N/A
C <sub>ao</sub>	SO <sub>3</sub> - Total, gr/SCF	.05005	.00348
	SO <sub>2</sub> - Total, gr/SCF	.01743	.01625

TABLE A-8  
(Continued)

<u>Run No.</u>			
C <sub>at</sub>	Particulate - Probe, Cyclone, and Filter, gr/ACF	N/A	N/A
C <sub>au</sub>	Particulate - Total, gr/ACF	N/A	N/A
C <sub>aw</sub>	Particulate - Probe, Cyclone, and Filter, lb/hr.	N/A	N/A
C <sub>ax</sub>	SO <sub>3</sub> - Total, lb/hr. <sup>d</sup>	7.974	.582
	SO <sub>2</sub> - Total, lb/hr. <sup>d</sup>	2.778	2.719
P <sub>tf</sub>	Particulate - Probe, Cyclone and Filter, lb/ton	N/A	N/A
P <sub>tt</sub>	Particulate - Total, lb/ton	N/A	N/A

<sup>a</sup> Dry standard cubic feet at 70°F, 20.92 in. Hg.

<sup>b</sup> Standard conditions at 70°F, 20.92 in. Hg.

<sup>c</sup> Dry standard cubic feet per minute at 70°F, 20.92 in. Hg.

<sup>d</sup> Emission rate during tapping only

TABLE A-9  
SO<sub>2</sub>/SO<sub>3</sub> - RUN 3

Run No.		3 SO <sub>x</sub>	3 SO <sub>x</sub>
Test Date		10/11/72	10/11/72
Sampling Time, 24 hour clock		0754	0754
Sampling Location		INLET	OUTLET
D <sub>n</sub> Sampling Nozzle Diameter, in.		.1875	.1890
T <sub>t</sub> Net Time of Test, Min.		50.7	54.9
P <sub>b</sub> Barometric Pressure, in. Hg Absolute		24.30	24.30
P <sub>m</sub> Average Orifice Pressure Drop, in. H <sub>2</sub> O		1.00	.92
V <sub>m</sub> Volume of Dry Gas Sampled at Meter Conditions, DCF		33.471	37.943
T <sub>m</sub> Average Gas Meter Temperature, °F		56	70.5
V <sub>m std</sub> Volume of Dry Gas Sampled at Standard Conditions <sup>a</sup> , DSCF		28.001	30.896
V <sub>w</sub> Total H <sub>2</sub> O Collected in Impingers and Silica Gel, ml		17.4	19.6
V <sub>w gas</sub> Volume of Water Vapor Collected at Standard Conditions <sup>b</sup> , SCF		.825	.929
% M % Moisture in Stack Gas, by Volume		2.86	2.92
M <sub>d</sub> Mole Fraction of Dry Gas		.971	.971
% CO <sub>2</sub> Volume % Dry		ORSAT ANALYSIS	
% O <sub>2</sub> Volume % Dry		NOT RUN	
% CO Volume % Dry		DURING THIS	
% N <sub>2</sub> Volume % Dry		TEST	
% EA Percent Excess Air			
MW <sub>d</sub> Molecular Weight of Stack Gas, Dry Basis		28.83	28.84

TABLE A-9  
(Continued)

<u>Run No.</u>			
MW	Molecular Weight of Stack Gas, Wet Basis	28.52	28.52
C <sub>p</sub>	Pitot Tube Coefficient	.85	.85
T <sub>s</sub>	Average Stack Temperature, °F	116	83
N <sub>p</sub>	Net Sampling Points	22	6
P <sub>st</sub>	Static Pressure of Stack Gas, in. H <sub>2</sub> O	-1.70	.83
P <sub>s</sub>	Stack Gas Pressure, in. Hg Absolute	24.17	24.36
V <sub>s</sub>	Stack Gas Velocity at Stack Conditions, fps	64.9	57.5
A <sub>s</sub>	Stack Area,	6.873	7.068
Q <sub>s</sub>	Dry Stack Gas Volumetric Flow Rate at Standard Conditions, DSCFM	19,324	18,825
Q <sub>a</sub>	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	26,763	24,385
% I	Percent Isokinetic	102.4	108.4
% O	Percent Opacity	N/A	N/A
T <sub>c</sub>	Unit Production Rate	N/A	N/A
m <sub>f</sub>	Particulate - Probe, Cyclone, and Filter, mg	N/A	N/A
m <sub>t</sub>	SO <sub>3</sub> - Total, mg	150.0	10.5
	SO <sub>2</sub> - Total, mg	96.6	60.2
I <sub>c</sub>	% Impinger Catch	N/A	N/A
C <sub>an</sub>	Particulate - Probe, Cyclone, and Filter, gr/SCF	N/A	N/A
C <sub>ao</sub>	SO <sub>3</sub> - Total, gr/SCF	.08267	.00524
	SO <sub>2</sub> - Total, gr/SCF	.05324	.03006

TABLE A-9  
(Continued)

<u>Run No.</u>			
C <sub>at</sub>	Particulate - Probe, Cyclone, and Filter, gr/ACF	N/A	N/A
C <sub>au</sub>	Particulate - Total, gr/ACF	N/A	N/A
C <sub>aw</sub>	Particulate - Probe, Cyclone, and Filter, lb/hr.	N/A	N/A
C <sub>ax</sub>	SO <sub>3</sub> - Total, lb/hr. <sup>d</sup>	13.693	.846
	SO <sub>2</sub> - Total, lb/hr. <sup>d</sup>	8.818	4.851
P <sub>tf</sub>	Particulate - Probe, Cyclone and Filter, lb/ton	N/A	N/A
P <sub>tt</sub>	Particulate - Total, lb/ton	N/A	N/A

<sup>a</sup> Dry standard cubic feet at 70°F, 20.92 in. Hg.

<sup>b</sup> Standard conditions at 70°F, 20.92 in. Hg.

<sup>c</sup> Dry standard cubic feet per minute at 70°F, 20.92 in. Hg.

<sup>d</sup> Emission rate during tapping only.