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

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

PRIMARY
ALUMINUM PRODUCTION
AP-42 Section 7.1 12.1
Reference Number #8

EMISSION TESTING REPORT

ETB TEST NUMBER 71 - MM - 21

EMISSIONS FROM THE

WET SCRUBBER SYSTEM

at

HARVEY ALUMINUM
THE DALLES, OREGON

PROJECT OFFICER
FREDERICK M ERKER

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR PROGRAMS
RESEARCH TRIANGLE PARK, NORTH CAROLINA

REPORT NO. Y-7730-F June 7, 1972

Ref. 2 490

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I. PREFACE

An Emission Test Program was conducted for the Environmental Protection Agency at the Harvey Aluminum The Dalles Plant, Oregon, from November 8, 1971 through November 11, 1971 inclusive.

Source sampling was performed in accordance with APCO Test Methods and Procedures at the inlet* and outlet* of the wet scrubber system which controls the emissions produced by the reduction process at the Plant.

The following samples were taken:

Emission Sample	Test Method
Particulate	EPA #5 and ASME
Total Nitrogen Oxides	EPA #7
Sulphur Dioxide	EPA #6
Fluorides	EPA (13A)

The York Research test crew consisted of the following members:

Louis Terracciano - Project Director
Robert S. Epstein - Senior Test Engineer
Roger A. Kniskern - Senior Test Engineer
Richard W. Kling - Senior Test Engineer
Geoffrey Knobel - Test Engineer
Kenneth Crepeau - Test Engineer
Erwin Theisz - Field Chemist

Technical Note:

For this phase of the work all analysis of the sampling were conducted by EPA in their own laboratory. The results of these analyses were transmitted to York Research and used as the basis for the emission rate calculations.

*Source sampling was also performed at the secondary system for particulate contaminants.

II. SUMMARY

The Appendix section of this report contains all results and data collected and calculated for this series of tests. For convenience, the most pertinent results and data are tabulated below:

TABULAR SUMMARY

Primary Inlet	Total Fluorides lb/ton Al	Gaseous Fl^0 lb/ton Al	SO_2 ppm	NO_x ppm
#1 Glass Fiber	42.24	38.59	25.3	*
#2 Glass Fiber	56.01	38.57	124.	*
#3 Glass Fiber	62.70	31.73	27.5	*
Primary Outlet				
#1 Glass Fiber	1.266	.877	107.3	*
#2 Glass Fiber	1.666	1.418	23.5	*
#3 Glass Fiber	1.945	1.647	165.	*
Secondary Inlet				
#1 Glass Fiber	.642			
#2 Glass Fiber	2.43			
#3 Glass Fiber	1.89			
Secondary Outlet				
#1 Glass Fiber	1526			
#2 Glass Fiber	18.34			
#3 Glass Fiber	1.102			

III. INTRODUCTION

The Source Test was performed at the Harvey Primary Aluminum Plant in The Dalles, Oregon from 8 November 71 - 11 November 71, for the purpose of gathering emission data for the Performance Standards Branch (SDID) and control unit efficiency data for the Industrial Studies Branch (ATD). Emissions from the cells were manifolded to a wet scrubber system before being released to the atmosphere. A block diagram showing the sampling locations is included in Section V of this report.

The standard EPA particulate train (Method #5) was used to sample both particulate matter and fluorides. Six simultaneous samples were taken across the control system using Whatman 541 paper filters in three of the runs and MSA 1106 BH glass fiber filters in the other three runs. In addition, three samples were taken at the outlet using Millipore AA membrane filters. Triplicate gaseous samples of fluorides, sulfur dioxide (Method #6, adapted), and nitrogen oxides (Method #7) were also taken at both the inlet and outlet. Experimentation with two types of absorbing media in the midget impingers of the fluoride gas train was performed by collecting three fluoride samples in water and three in a 0.1 N solution of sodium hydroxide at both the inlet and outlet.

IV. PROCESS DESCRIPTION

Process description to be supplied by Environmental Protection Agency, Research Triangle Park, North Carolina.

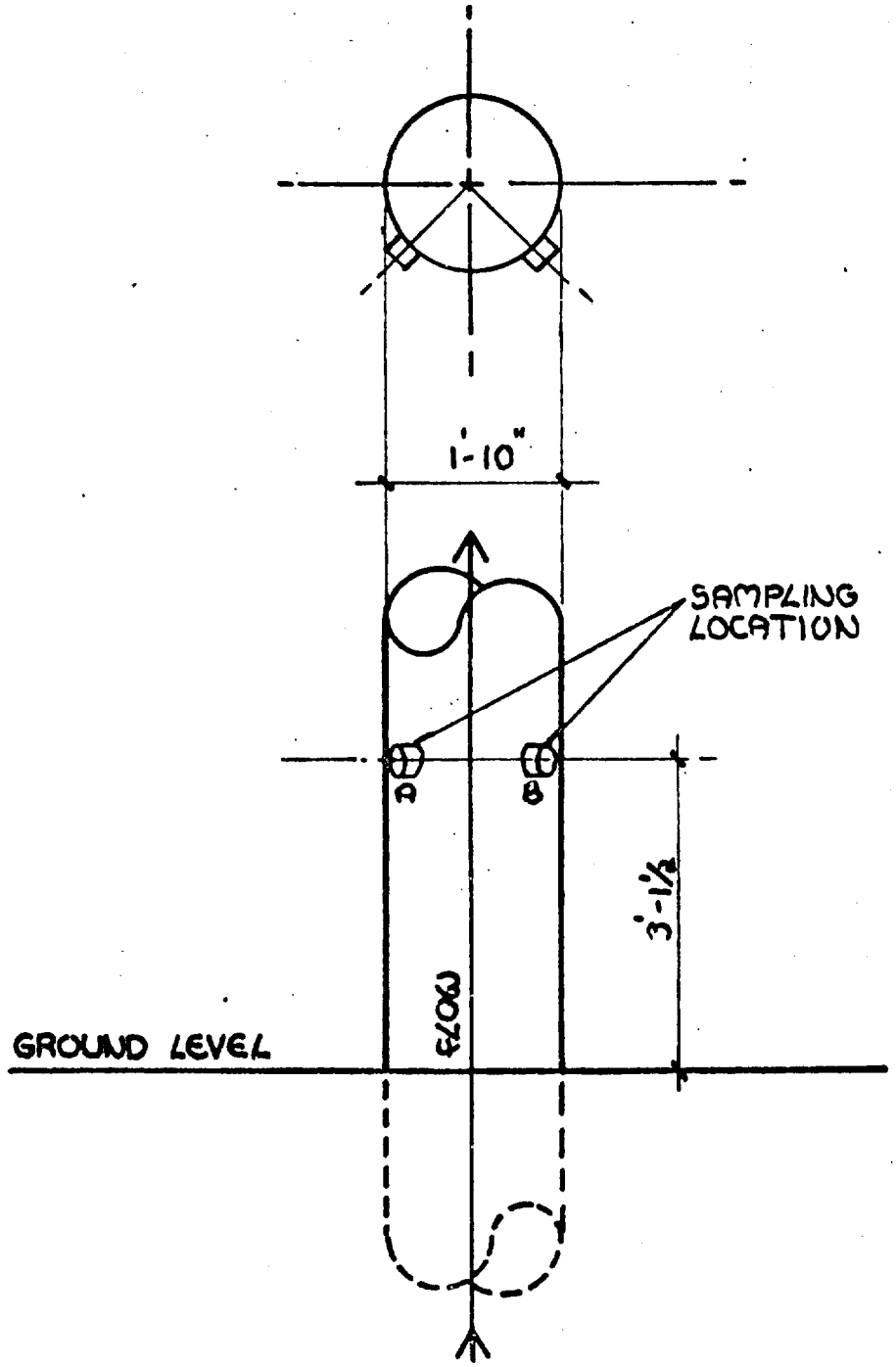
V. SAMPLING POINT LOCATION

The inlet sampling ports were located in a round vertical duct one (1) foot ten (10) inches in diameter. Twenty-two (22) points were located in each port and numbered from one (1) through twenty-two (22) consecutively, preceeded by a letter designation corresponding to the port being used for sampling. The ports were located about three and one-half (3 1/2) feet above ground level, the duct being located in the ground upstream of the ports. The flow was upward and the nearest downstream restriction was about twelve (12) feet above the ports.

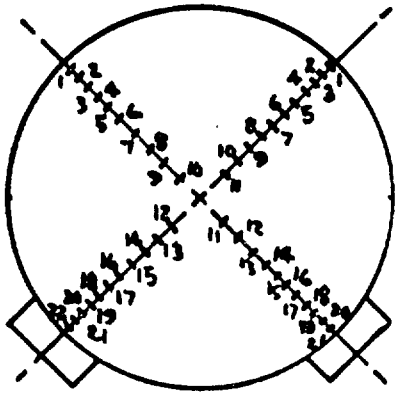
The outlet sampling ports were located in a three (3) foot diameter vertical stack extension, (stack extension was built to develop average velocities within suitable ranges for instruments being used). Twenty (20) points were used for sampling per each port and labeled one (1) through twenty (20). Point one (1) being farthest from the port opening and point twenty (20) being closest to the port opening, each number being preceeded by a letter designation corresponding to the sampling port being used.

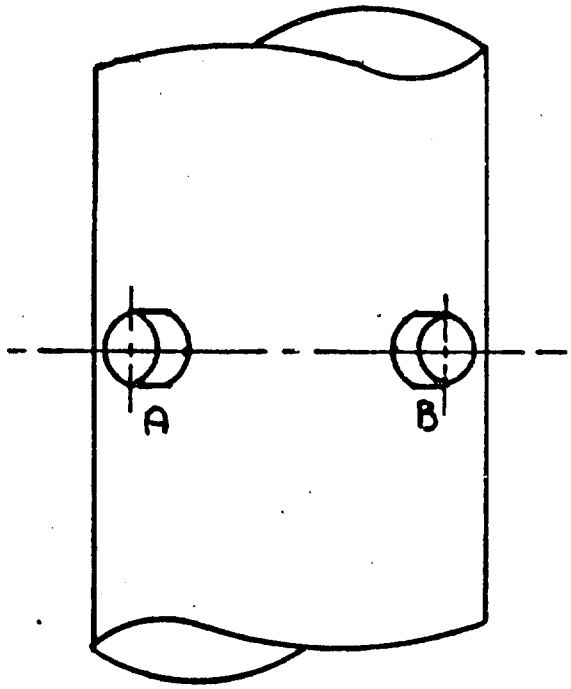
The ports were located about three and one-half (3 1/2) feet from the top of the flue and about five and one-half (5 1/2) feet from the bottom of the extension (See Diagram).

HARVEY ALUMINUM PLANT @ THE DALLES, OREGON
SCRUBBER INLET



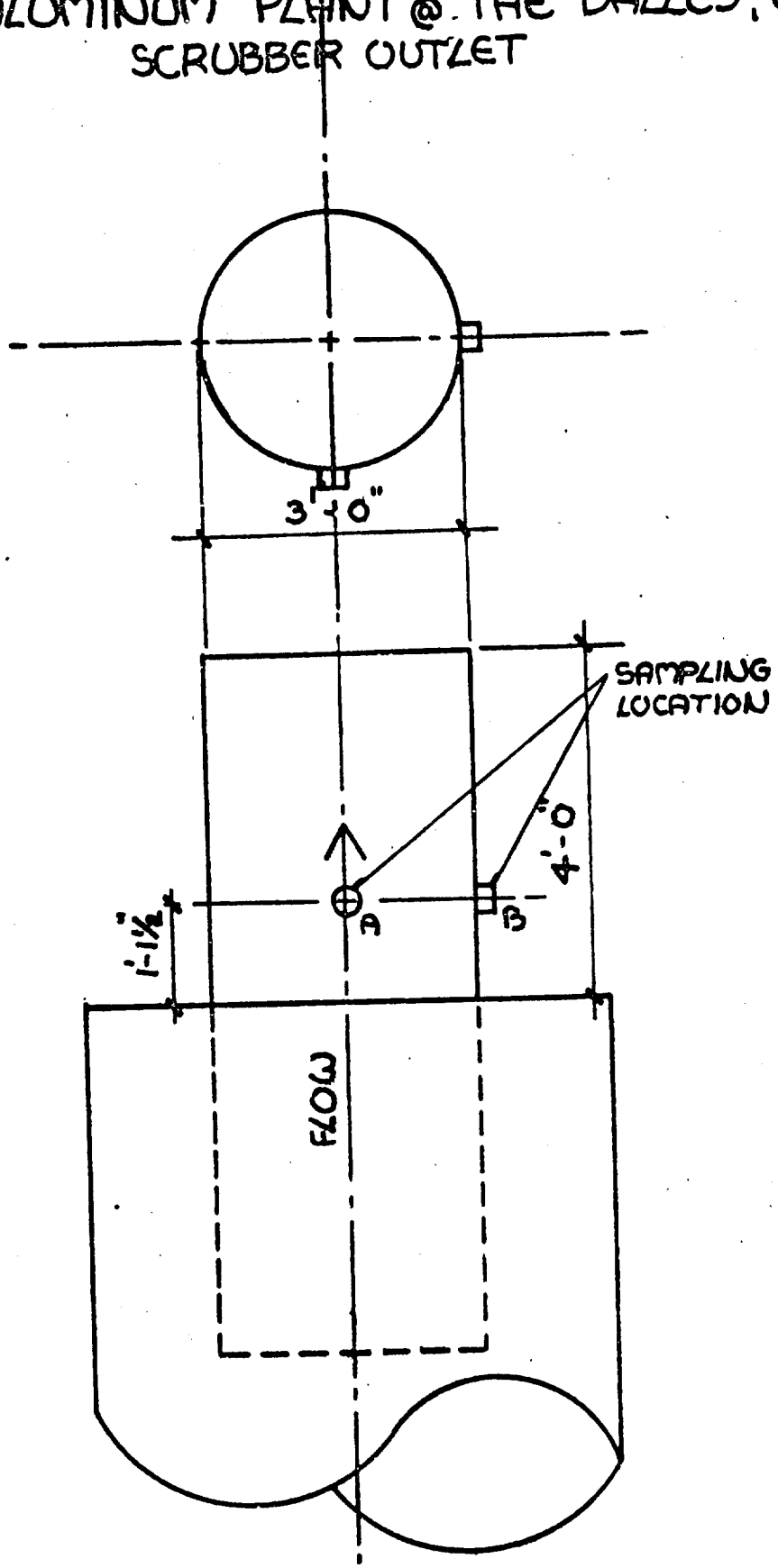
HARVEY ALUMINUM PLANT
POINTS ON TRAVERSE @ INLET



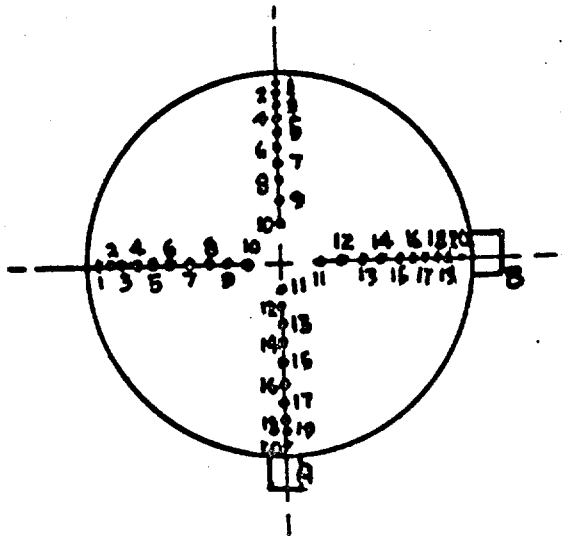


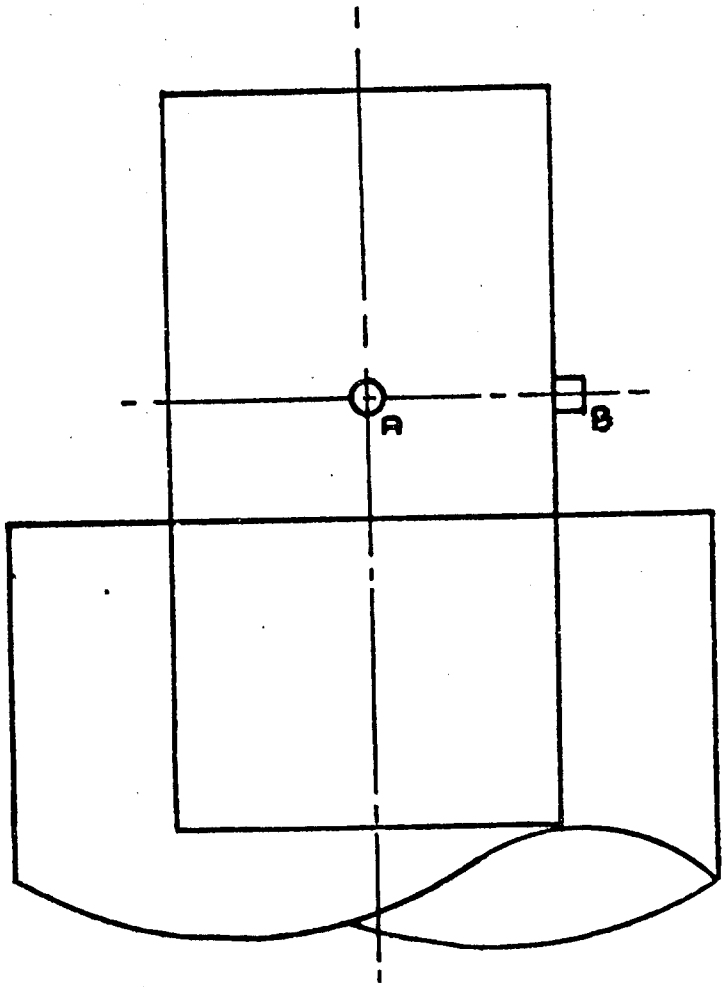
HARVEY ALUMINUM PLANT @ THE DALLES, ORE.

SCRUBBER OUTLET



HARVEY ALUMINUM PLANT
POINTS ON TRAVERSE
@ OUTLET





VI. PROCESS OPERATION

Basic process operating parameters are tabulated in the following Table. This data was supplied to York Research Corporation by the Environmental Protection Agency.

OPERATING DATA

Date:	11/8/71	11/9/71	11/9/71	11/9/71	11/11/71	11/11/71	11/11/71
Time Intervals - From	1540	850	1400	1405	1000	1012	1016
To	1840	1150	1700	1705	1135	1230	1140
No. of Cells to Test Unit							
Primary	15	15	15	15	15	15	15
Secondary	6	6	6	6	6	6	6
Aluminum produced (lbs/day/cell)	1660	1660	1660	1660	1660	1660	1660
No. of Crust Breakings during test interval - Primary	15	15	0	0	0	0	0
Secondary	6	6	0	0	0	0	0
No of Tappings during test interval	-	-	-	-	-	-	-
No. of Studs replaced during test interval	0	0	0	0	0	0	0

OPERATING DATA

Date:	11/11/71	11/11/71	11/11/71	11/11/71	11/11/71	11/11/71	11/11/71	11/11/71
Time Interval - From	1020	1505	1505	1506	1510	1910	1810	1910
To	1200	1645	1655	1656	1648	2030	2036	2100
No. of Cells to Test Unit - Primary	15	15	15	15	15	15	15	15
Secondary	6	6	6	6	6	6	6	6
Aluminum produced (lbs/day/cell)	1660	1660	1660	1660	1660	1660	1660	1660
No. of Crust Breakings during test interval								
Primary	0	0	0	0	0	7	7	7
Secondary	0	0	0	0	0	3	3	3
No. of Tappings during test interval	-	-	-	-	-	-	-	-
No. of Studs replaced during test interval	0	0	0	0	0	0	0	0

VII. SAMPLING AND ANALYTICAL PROCEDURE

Basic Sampling Description

PARTICULATE SAMPLING

Representative particulate samples were collected from the flue gas at the inlet and outlet of the tandem scrubber electrostatic precipitator system. The inlet and outlet were sampled simultaneously for each of three test runs using fiberglass (0.3 micron) filter media. In addition, three outlet test runs were performed using fiberglass (0.3 micron) filters.

TOTAL NITROGEN OXIDES

The samples for total nitrogen oxides were collected in dilute H_2SO_4 - H_2O_2 solution using the evacuated flask technique and analyzed by the phenoldisulphonic acid method. A total of six samples were collected - three at the scrubber inlet and three at scrubber outlet.

SULPHUR DIOXIDE

Samples for sulphur dioxide were aspirated into midget impingers utilizing isopropanol to extract SO_3 and H_2O_2 to absorb the SO_2 as per APCO procedure. A total of six samples were taken - three at the scrubber inlet and three at the wet ESP outlet.

GASEOUS FLUORIDE

Samples for gaseous fluoride were aspirated into midget impingers utilizing two reagent systems. A series of three inlet and three outlet test runs were conducted using water as the reagent. Then a duplicate series of test runs were conducted using 0.1 N NaOH as the reagent. Samples were analyzed by the Spadns-Zirconium Lake Method as presented in the paper by Decker and Smith - Determination of Fluorides in Stack Gas - Spadns Zirconium Lake Method.

ORSAT ANALYSIS

Integrated samples for CO_2, O_2 and CO were collected in leveling bottles over a 60 minute period.

BASIC LABORATORY PROCEDURE

The following paragraphs briefly describe the methods used in the Laboratory to obtain the raw data used in the calculations of our results as reported in Section II of this report.

A. Particulate

The tests are run in the field using a Research Appliance Corporation "Staksampler" particulate train. The clean up is done in the field according to NAPCA. (Section 5.3.6 in the Federal Register.) The filter discs were previously tare weighed and recorded at the Laboratory. Upon return they were dried, cooled in a dessicator, then weighed on an analytical balance and the amount of particulate collected is the difference in the two weights. The particulate wash solution (taken from the train between the filter disc and nozzle) is placed in a tared beaker, the wash solution is evaporated with an Infra-Red Heat Lamp and the beaker weighed again. The difference in weight is the weight of the particulate in the wash. This is combined with the filter catch as the weight of the sample. Examples of the laboratory report (particulate clean up sheet) can be found in the Appendix.

B. Sulfur Oxides

The isopropanol portion of the sample is used in detection of sulphur trioxide. The isopropanol is transferred to a beaker and diluted to 100 milliliters with H_2O. A suitable aliquot is taken and placed in an Erlenmeyer flask. The volume is then brought to 80 milliliters with isopropyl alcohol and titrated with alcoholic $BaCl_2$. Using thorin indicator, titrate from a yellow to orange color. The volume of thorin indicator used to titrate the sample determines the total milligrams of sulphur in the sample.

The H_2O_2 portion of the sample is diluted with H_2O to 250 milliliters and the same procedure is followed as was used for SO_3 with the exception of the $BaCl_2$ solution not being alcoholic but of H_2O_2 and $BaCl_2$. The amount of sulphur determined is from the SO_2 obtained in that portion of the sample.

C. Oxides of Nitrogen

Samples are collected in nominal 2 liter evacuated flasks (pre-calibrated and numbered for identification) as per EPA approved procedures, in a solution of H_2SO_4 and H_2O_2. In the field, immediately after the sample is taken, it is disconnected from the probe and set aside for sixteen (16) more hours in the flask. It is then thoroughly shaken and a final pressure of the flask is taken via a Mercury "U" tube manometer. The sample is then transferred to a plastic bottle for shipment to the laboratory.

In the laboratory, the amount of nitrogen in the sample is determined by the phenoldisulphonic method. This method is as follows:

> The sample is placed in a beaker and NaOH is slowly added until the solution is neutral or slightly basic by litmus paper indication. This solution is then evaporated in the beaker used for neutralization. To the dry residue two (2) milliliters of phenoldisulphonic acid are added and mixed to dampen all the precipitate. Then add two (2) milliliters of H_2O and mix thoroughly; add twenty (20) more milliliters of H_2O and mix. Add concentrated NH_4OH to this solution in excess of neutralizing it. Filter solution if necessary and transfer to a volumetric flask. Using a spectrophotometer at 420 mu, compare results with a standard curve based on standard concentrations, and read milligrams of nitrogen in the sample.

D. Fluorides

Fluorides are collected in an impinger train and determined in the laboratory by a distillation procedure as follows:

> Place 400 ml H_2O, 200 ml concentrated H_2SO_4, and about 25 carborundum chips into the boiling flask, and swirl to mix. Caution - the sulfuric acid-water solution should be mixed thoroughly before heat is applied to prevent splattering. Connect the apparatus as shown in Figure 2. Begin heating slowly at first, then rapidly until a temperature of 180°C has been reached. The connection between the boiling flask and condenser must be separated

immediately after the heat is removed to prevent suck-back of the sample and for safety reasons. About 300 ml of water should have been distilled over in about 45 minutes. At this point, the apparatus has been flushed free of fluoride and the acid H_2O ratio has been adjusted. When the flask has cooled to 120°C, the apparatus is ready for the sample.

Add 200 ml of distilled water containing an aliquot of the impinger sample corresponding to 0.5 to 0.9 mg of fluoride to the boiling flask; swirl to mix; and connect the apparatus and distill as before until the distillation temperature reaches 180°C. For distillation of water-soluble particulate fluorides, take a suitable aliquot of the supernatant liquid of the particulate sample, dilute to 300 ml with distilled water, and add to the distillation flask. For distillation of total particulate fluorides, use a suitable aliquot of the water-soluble plus water-insoluble sample. To obtain a representative sample, withdraw an aliquot using a calibrated, sawed-off pipette, immediately after intimate mixing of the sample. In no case should the aliquot contain more than 0.9 mg of fluoride. Distill the sample, as before, until a temperature of 180°C has been reached. Fluoride content of phosphate rock or fertilizer may be determined using these same procedures, provided the approximate percent weight of fluoride in the sample is known so that the still is not overcharged. Weigh out a sample to the nearest 0.1 mg, corresponding to about 0.5 mg of fluoride, dilute to 300 ml with distilled water and distill as before until a temperature of 180°C has been reached. Pipet a suitable aliquot (containing 10 to 40 ug of fluoride) from the distillate and dilute to 50 ml. Add 10 ml of Spadns reagent, mix thoroughly, and read the absorbance. If the absorbance falls beyond the calibration curve range, repeat the procedure using a smaller aliquot.

CALCULATIONS

$$X = \frac{44.82\ (C)\ (F)}{V_S}$$

where:

C = concentration fluoride in aliquot, mg

F = dilution factor

V_S = volume of gas sampled at 70°F and 29.92 inches Hg, scf

X = ppm fluoride

$$44.82 = \frac{\frac{530°F}{402°F} \times 22.4 \frac{\text{liters}}{\text{mole}} \times 10^6}{19 \frac{\text{g}}{\text{mole}} \times 10^3 \frac{\text{mg}}{\text{g}} \times 28.32 \frac{\text{liters}}{\text{cu.ft.}}}$$

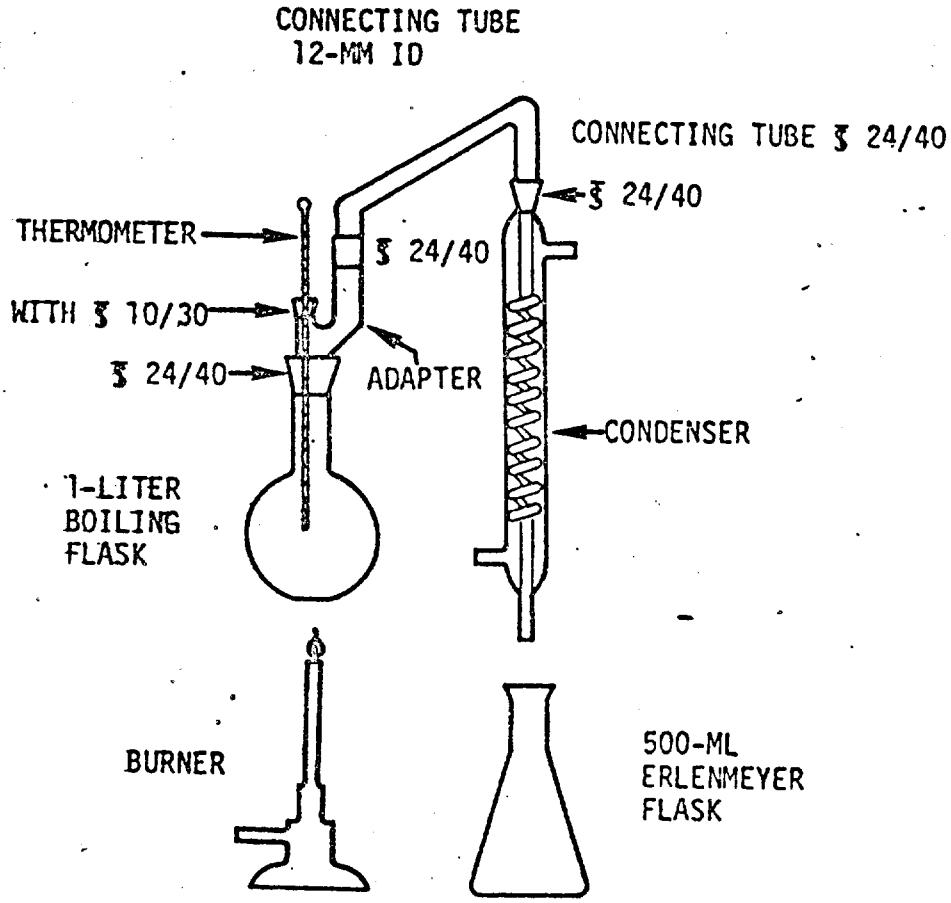


Figure 1. Fluoride distillation apparatus.

Preparation:

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Environmental Test Engineer

Laboratory Supervision:

Gregory Pantchenko
Chief Chemist

Review:

Louis A. Terracciano
Project Director

Approval:

Abraham J. Kurtz
Vice President Environmental Sciences

VIII. APPENDIX

SUMMARY SECTION

To facilitate data correlation, this Section of the report consists of four (4) Tables summarizing the results of the test series. More detailed test data will be found in its entirely in other sections of the Appendix.

TABLE A - I

SUMMARY OF PARTICULATE EMISSIONS USING GLASS FIBER FILTERS

Run No.	1		2		3	
Location:	Primary Inlet	Primary Outlet	Primary Inlet	Primary Outlet	Primary Inlet	Primary Outlet
Date:	11/11/71	11/11/71	11/11/71	11/11/71	11/11/71	11/11/71
CO	0.3	0.6	0.0	0.0	0.0	0.0
CO_2%	3.5	3.5	3.5	3.5	3.5	3.5
O_2%	18.7	18.6	18.7	18.7	18.7	18.7
Stack Temperature °F	210	80	216	80	210	70
Stack Velocity-ft/min	3435	1066	3509	1054	3528	1030
Stack Flow Rate-SCFM	6878	7097	6919	6758	7033	6970
Fluoride Emission						
Impinger Solution						
Front Half (gr/SCF)	.3055	N.M.	.2293	N.M.	.1757	N.M.
(lbs/hr)	18.00	N.M.	13.60	N.M.	10.59	N.M.
Back Half (gr/SCF)	.0179	N.M.	.2263	N.M.	.3363	N.M.
(lbs/hr)	1.055	N.M.	13.42	N.M.	20.27	N.M.
Total (gr/SCF)	.3234	.0075	.4556	.0112	.5121	.0110
(lbs/hr)	19.06	.4562	27.02	.6679	30.87	.6571
Probe, Cyclone & Filter						
Total Insoluble (gr/SCF)	.0408	.0032	.0346	.0033	.0244	.0059
(lbs/hr)	2.58	.1946	2.05	.1968	1.47	.3529
Total Fluorides (gr/SCF)	.5718	.0108	.4902	.0145	.5363	.0169
(lbs/hr)	21.92	.6569	29.07	.8646	32.34	1.0095

TABLE A - II

SUMMARY OF PARTICULATE EMISSIONS USING GLASS FIBER FILTERS

Run No.:	1		2		3	
Location:	Secondary Inlet	Secondary Outlet	Secondary Inlet	Secondary Outlet	Secondary Inlet	Secondary Outlet
Date:	11/8/71	11/8/71	11/9/71	11/9/71	11/9/71	11/9/71
CO	0.0	0.02	0.0	0.03	0.0	0.03
CO_2%	0.0	0.00	0.0	0.00	0.0	0.00
O_2%	20.6	20.5	20.9	20.6	20.9	20.6
Stack Temperature °F	42	50	47	50	52	53
Stack Velocity-ft/min.	725	725	725	725	725	725
Stack Flow Rate-SCFM	143,100	139,200	140,200	138,900	140,500	137,600
Fluoride Emission						
Impinger Solution Front Half (gr/SCF)	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
(lbs/hr)	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Back Half (gr/SCF)	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
(lbs/hr)	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Total: (gr/SCF)	1.92×10^{-4}	1.41×10^{-4}	9.45×10^{-4}	4.31×10^{-4}	7.78×10^{-4}	4.11×10^{-4}
(lbs/hr)	.235	.168	1.34	.513	.937	.485
Probe, Cyclone & Filter						
Total Insoluble Fluorides (gr/SCF)	$.96 \times 10^{-4}$	$.882 \times 10^{-4}$	1.04×10^{-4}	75.7×10^{-4}	$.36 \times 10^{-4}$	$.74 \times 10^{-4}$
(lbs/hr)	.118	.105	.125	9.01	.043	.087
Total Fluorides (gr/SCF)	2.88×10^{-4}	2.29×10^{-4}	10.49×10^{-4}	80.0×10^{-4}	8.14×10^{-4}	4.85×10^{-4}
(lbs/hr)	.353	.273	1.26	9.52	.980	.572

TABLE A - III

SUMMARY OF GASEOUS EMISSIONS

Run No.:	1		2		3	
Location:	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Date:	11/9/71	11/11/71	11/9/71	11/11/71	11/9/71	11/11/71
SO_2 ppm	25.3	107.3	124.	23.5	27.5	165.
Date:	11/9/71	11/11/71	11/9/71	11/11/71	11/9/71	11/11/71
NO_x ppm	*	*	*	*	*	*
Date:	11/11/71	11/11/71	11/11/71	11/11/71	11/11/71	11/11/71
$\frac{\text{lb. } F^-}{\text{Ton Alum.}}$ (in water)	38.59	.877	28.57	1.418	31.73	1.647

*Samples not neutralized with caustic during analytical preparation.

TABLE A - IV

SUMMARY OF GASEOUS EMISSIONS

Run No.:	4		5		6	
Location:	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Date:	11/9/71	11/11/71				
SO_2 ppm	91.9	125	-	-	-	-

PARTICULATE CALCULATIONS

The following are the basic equations used in calculating final data as found in the final summary.

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

$$V_{m_{std}} = \frac{17.7 \times V_m \left(P_b + \frac{P_m}{13.6}\right)}{(T_m + 460)} = Ft.^3$$

$$38.80 = \frac{17.7 \times 38.86 \left(29.66 + \frac{.910}{13.6}\right)}{(67 + 460)}$$

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

$$V_{w_{gas}} = 0.0474 \times V_w = Ft.^3$$

$$.673 = 0.474 \times 14.2$$

3. % Moisture in stack gas

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

$$1.7 = \frac{100 \times .673}{38.80 + .673}$$

4. Mole fraction of dry gas

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

$$.983 = \frac{100 - 1.7}{100}$$

5. Average molecular weight of dry stack gas

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

$$29.31 = \left(3.5 \times \frac{44}{100}\right) \times 18.8 \times \frac{32}{100}\right) + \left(77.5 \times \frac{28}{100}\right) + \left(0.3 \times \frac{28}{100}\right)$$

6. Molecular weight of stack gas

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

$$29.44 = 29.31 \times .983 + 18\,(1 - .983$$

7. Stack velocity at stack conditions, fpm

$$V_s = 4350 \times P_s \times (T_s + 460) \left[\frac{1}{P_s \times M\,W}\right]^{1/2} = \text{fpm}$$

$$3435 = 4350 \times 23.15 \left[\frac{1}{29.20 \times 29.44}\right]^{1/2}$$

8. Stack gas volume at standard conditions, SCFM

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

$$6878 = \frac{0.123 \times 3435 \times 380 \times .983 \times 29.20}{(210 + 460)}$$

9. Percent isokinetic

$$\%I = \frac{1032 \times (T_s + 460) \times V_{m_{std}}}{V_s \times T_t \times P_s \times M_d \times (Dn)^2} = \%$$

$$101.8 = \frac{1032 \times (210 + 460) \times 38.80}{3435 \times 76 \times 29.20 \times .983 \times (.1875)^2}$$

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

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

$$.3234 = 0.0154 \times 769.6/38.80$$

11. Particulate total, gr/SCF

$$C_{ao} = 0.0154 \times \frac{M_t}{V_{m\ std}} = \text{gr/SCF}$$

$$.0484 = 0.0154 \times 814.7/38.80$$

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

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

$$.0367 = \frac{17.7 \times .3234 \times 29.20 \times .983}{(210 + 460)}$$

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

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

$$= \frac{17.7 \times .0484 \times 29.20 \times .983}{(210 + 460)}$$

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

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

$$1.055 = 0.00857 \times .3234 \times 6878$$

15. Particulate - total, lb/hr.

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

$$19.06 = 0.00857 \times .0484 \times 6878$$

EXAMPLE GAS CALCULATIONS

$$\text{ppm } NO_2 = \frac{29.63 \times \text{mg } NO_2 \times (T_f + 460)}{V_f \times (P_i - P_f)}$$

$$\text{ppm } SO_2 = \frac{0.7332 \times \text{mg } SO_2 \times (T_m + 460)}{P_b \times V_m}$$

$$\text{ppb } F^- = \frac{2.054 \times \text{mg } F^- \times (T_m + 460)}{V_m \times P_b}$$

VELOCITY TRAVERSE DATA

CLIENT EPA

Location of Test HARVEY ALUM PRIMARY INLET

Conditions PRELIMINARY PITOT TRAV.

Personnel

Ba. _____ " Hg

AMBIENT TEMP. _____ °F

MOLECULAR WGT. _____ #/CU. FT.

PAGE 30 OF 166

DATE OF TEST

TEST NO.

JOB NO.

STACK AREA _____ SQ. FT.

$$Vs = 2.90 \times Fs \sqrt{\frac{29.92}{Ps} \times \frac{28.95}{M.Wgt.} \times \Delta P \times T}$$

Fs = 1.0 FOR STD. PITOT TUBE
Fs = 0.83 FOR TYPE "S" PITOT TUBE

$$K = \_\_\_\_ \sqrt{\frac{29.92}{\_\_\_\_} \times \frac{28.95}{\_\_\_\_}} = \_\_\_\_$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
B 1	—				—			
2	—				—			
3	210				.77			
4	210				.73			
5	210				.72			
6	210				.68			
7	210				.68			
8	210				.62			
9	210				.69			
10	210				.72			
11	210				1.05			
12	210				1.20			
13	200				1.20			
14	200				1.20			
15	200				1.10			
16	195				1.05			
17	195				.98			
18	170				.90			
19	100				.41			
20	60				.13			
TOTAL								
READINGS								
AVE.								

VELOCITY TRAVERSE DATA

CLIENT EPA PAGE 31 OF 166

Location of Test HARVEY ALUM PRIMARY INLET DATE OF TEST

Conditions PRELIMINARY PITOT TRAV. TEST NO.

Personnel JOB NO.

Ba. _____ " Hg AMBIENT TEMP. _____ °F STACK AREA _____ SQ. FT.

MOLECULAR WGT. _____ #/CU. FT.

$$Vs = \frac{2.90 \times Fs}{\sqrt{\frac{29.92}{Ps} \times \frac{28.95}{M.Wgt.} \times \Delta P \times T}}$$

Fs = 1.0 FOR STD. PITOT TUBE
Fs = 0.83 FOR TYPE "S" PITOT TUBE

$$K = \frac{}{\sqrt{\frac{29.92}{} \times \frac{28.95}{}}} = \_\_\_\_\_$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
A 1					.94			
2					1.30			
3					1.30			
4					1.30			
5					1.30			
6					1.20			
7					1.20			
8					1.20			
9					.98			
10					.55			
11					.51			
12					.54			
13					.56			
14					.69			
15					.82			
16					.79			
17					.56			
18					.27			
19					.09			
20								
TOTAL								
READINGS								
AVE.								

VELOCITY TRAVERSE DATA

CLIENT EPA — PAGE 32 OF 166

Location of Test PRIMARY OUTLET — DATE OF TEST

Conditions PRELIMINARY PITOT TRAVERSE — TEST NO.

Personnel — JOB NO.

Ba. ____ " Hg — AMBIENT TEMP. ____ °F — STACK AREA ____ SQ. FT.

MOLECULAR WGT. ____ #/CU. FT.

$$Vs = \frac{2.90 \times Fs}{\sqrt{\frac{29.92}{Ps} \times \frac{28.95}{M.Wgt.} \times \Delta P \times T}}$$

Fs = 1.0 FOR STD. PITOT TUBE
Fs = 0.83 FOR TYPE "S" PITOT TUBE

$$K = \frac{\quad}{\sqrt{\frac{29.92}{\quad} \times \frac{28.95}{\quad}}} = \quad$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
R 1	47				.07			
2	47				.08			
3	47				.08			
4	47				.08			
5	47				.09			
6	47				.09			
7	47				.10			
8	47				.11			
9	47				.12			
10	47				.12			
11	47				.11			
12	47				.10			
13	47				.12			
14	47				.13			
15	47				.13			
16	47				.13			
17	47				.10			
18	47				.05			
19	47				.03			
20	47				.02			
21	47				.00			
22	47				.00			
23	47				.00			
24	47				.00			
TOTAL								
READINGS								
AVE.								

VELOCITY TRAVERSE DATA

CLIENT EPA PAGE 33 OF 166

Location of Test PRIMARY OUTLET DATE OF TEST

Conditions PRELIMINARY PITOT TRAVERSE TEST NO.

Personnel JOB NO.

Ba. _____ " Hg AMBIENT TEMP. _____ °F STACK AREA _____ SQ. FT.

MOLECULAR WGT. _____ #/CU. FT.

$$Vs = \frac{2.90 \times Fs}{\sqrt{\frac{29.92}{Ps} \times \frac{28.95}{M.Wgt.} \times \Delta P \times T}}$$

Fs = 1.0 FOR STD. PITOT TUBE
Fs = 0.83 FOR TYPE "S" PITOT TUBE

$$K = \_\_\_\_ \sqrt{\frac{29.92}{\_\_\_\_} \times \frac{28.95}{\_\_\_\_}} = \_\_\_\_$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
H 1	47				.09			
2	47				.11			
3	47				.13			
4	47				.14			
5	47				.15			
6	47				.14			
7	47				.15			
8	47				.14			
9	47				.13			
10	47				.12			
11	47				.10			
12	47				.10			
13	47				.14			
14	47				.15			
15	47				.16			
16	47				.16			
17	47				.16			
18	47				.14			
19	47				.11			
20	47				.08			
21	47				.02			
22	47				.02			
23	47				.00			
24	47				.00			
TOTAL								
READINGS								
AVE.								

SOURCE TESTING CALCULATION FORMS

Test No. — No. Runs 3

Name of Firm HARVEY Aluminum

Location of Plant The Dalles, Oregon

Type of Plant Primary Aluminum Reduction

Control Equipment Scrubber

Sampling Point Locations Primary System Inlet

Pollutants Sampled Particulate

Time of Particulate Test:

Run No. 1	Date 11/11/71	Begin 1000	End 1135
Run No. 2	Date 11/11/71	Begin 1510	End 1648
Run No. 3	Date 11/11/71	Begin 1710	End 2035

PARTICULATE EMISSION DATA

Run No.	1	2	3	
P_b barometric pressure, "Hg Absolute	29.66	29.47	29.59	
P_m orifice pressure drop, "H_2O	.910	.930	.930	
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	38.86	39.67	40.57	
T_m Average Gas Meter Temperature, °F	67	75	75	
V_m Volume of Dry Gas Sampled @ Standard std. conditions, ft.^{3}	38.80	38.77	39.81	
V_w Total H_2O collected, ml., Impingers & Silica Gel.	14.2	13.7	6.3	
V_w gas Volume of Water Vapor Collected ft.^{3} @ Standard Conditions*	.673	.649	.273	

* 70°F, 29.92" Hg.

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PARTICULATE EMISSION DATA (cont'd)

Run No:	1	2	3	
% - % Moisture in the stack gas by volume	1.70	1.65	1.90	
M_d - Mole fraction of dry gas	.983	.983	.981	
% CO	0.3	0.0	0.0	
% CO_2	3.5	3.5	3.5	
% O_2	18.7	18.7	18.7	
% N_2	77.5	77.8	77.8	
M_{Wd} - Molecular weight of dry stack gas	29.31	29.31	29.31	
M W - Molecular weight of stack gas	29.14	29.11	29.10	
ΔP_s - Velocity Head of stack gas, In. H_2O	.830	.850	.854	
T_s - Stack Temperature, °F	210	216	210	
$\sqrt{\Delta P_s X (T_s+460)}$	23.15	23.44	23.61	
P_s - Stack Pressure, "Hg. Absolute	29.20	29.01	29.13	
V_s - Stack Velocity @ stack conditions, fpm	3435.	3509.	3528.	
A_s - Stack Area, $in.^2$	380	380	380	
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	6878.	6919.	7033.	
T_t - Net Time of Test, min.	76	76	76	
D_n - Sampling Nozzle Diameter, in.	3/16	3/16	3/16	
%I - Percent isokinetic	101.8	101.2	102.2	
mf - Water Soluble Fluoride Front half, mg.	769.6	577.4	454.3	
mw - Water Soluble Fluoride Back half, mg.	45.1	569.6	869.5	
mt - Total Water Soluble Fluoride mg.	814.7	1147.0	1323.8	
mu - Total insoluble Fluoride mg.	122.0	87.0	63.0	
mv - Total Fluoride mg.	936.7	1234.0	1386.8	

PARTICULATE EMISSION DATA (cont'd)

Run No.				
CAL - WATER SOLUBLE FLUORIDE FRONT HALF, gr/SCF	.3055	.2293	.1757	
CAM - WATER SOLUBLE FLUORIDE BACK HALF, gr/SCF	.0179	.2263	.3363	
CAN - TOTAL WATER SOLUBLE FLUORIDE gr/SCF	.3234	.4556	.5121	
CAO - TOTAL INSOLUBLE FLUORIDE, gr/SCF	.0484	.0346	.0244	
CAP - TOTAL FLUORIDE gr/SCF	.3718	.4902	.5365	
CAQ - WATER SOLUBLE FLUORIDE FRONT HALF gr/CF @ STACK CONDITION	.2317	.1712	.1326	
CAR - WATER SOLUBLE FLUORIDE BACK HALF, gr/CF @ STACK CONDITION	.0136	.1690	.2540	
CAS - TOTAL WATER SOLUBLE FLUORIDE gr/CF @ STACK CONDITION	.2452	.3402	.3860	
CAT - TOTAL INSOLUBLE FLUORIDE gr/CF @ STACK CONDITION	.0367	.0258	.0184	
CAU - TOTAL FLOURIDE gr/CF @ STACK CONDITION	.2819	.3660	.4650	
CAV - WATER SOLUBLE FLUORIDE FRONT HALF, lb/hr	18.00	13.60	10.59	
CAW - WATER SOLUBLE FLUORIDE BACK HALF, lb/hr	1.055	13.42	20.27	
CAX - TOTAL WATER SOLUBLE FLUORIDE lb/hr	19.06	27.02	30.87	
CAY - TOTAL INSOLUBLE FLUORIDE lb/hr	2.85	205	1.47	
CAZ - TOTAL FLOURIDE lb/hr	21.92	29.07	32.34	

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY ALUMINIUM

Run No. 1

Location PRIMARY INLET

Date 11/11/71

Operator RAK / GVK

Sample Box No. —

Meter Box No. 557

Meter H 1.90

C Factor 1.05

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F-271
F-85

Ambient Temp °F 40

Bar.Press. "Hg 29.66

Assumed Moisture % 2

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Probe Length 5'

Probe Heater Setting 65

Avg. ΔP ____ Avg. ΔH .910

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice Δ H in H_2O Desired	Orifice Δ H in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp °F
A 1	1000	823.503	.75	.84	.84	49	48	3.0	235	50	—	240
2	1002	824.54	1.30	1.45	1.45	54	48	5.0	235	50	—	240
3	1004	825.76	1.50	1.70	1.70	60	50	6.0	235	50	—	240
4	1006	827.15	1.60	1.80	1.80	65	50	8.0	230	50	—	230
5	1008	828.52	1.40	1.58	1.58	67	51	8.0	215	50	—	240
6	1010	829.86	1.20	1.35	1.35	68	51	7.5	235	50	—	235
7	1012	831.08	1.30	1.45	1.45	69	52	8.0	250	50	—	230
8	1014	832.31	1.15	1.30	1.30	69	52	9.0	260	50	—	240
9	1016	833.49	1.20	1.35	1.35	69	53	11.0	265	50	—	235
10	1018	834.71	1.00	1.10	1.10	70	54	10.5	265	50	—	230
11	1020	835.84	.52	.60	.60	70	54	7.5	265	50	—	230
12	1022	836.78	.52	.60	.60	69	54	8.5	265	50	—	230
13	1024	837.62	.50	.57	.57	68	55	9.0	235	50	—	220
14	1026	838.45	.50	.57	.57	68	55	10.0	250	50	—	215
15	1028	839.28	.48	.55	.55	68	55	10.5	255	50	—	205
16	1030	840.12	.63	.72	.72	68	56	14.0	260	50	—	215

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
				Desired	Actual	Inlet	Outlet					
17	1032	841.05	.67	.76	.76	68	56	17.0	260	50	—	185
18	1034	841.90	.58	.66	.66	68	56	19.0	265	50	—	170
19	1036	842.60	.73	.82	.82	69	56	13.5	265	50	—	90
20	1038	843.90	.70	.79	.79	70	56	14.0	275	50	—	85
FINAL	1040	844.875	—	—	—	—	—	—	—	—	—	—
B 1	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—
3	1049	844.875	.76	.87	.87	67	58	18.0	260	50	—	230
4	1051	845.90	.74	.83	.83	70	60	18.0	265	50	—	240
5	1053	846.93	.60	.69	.69	72	60	18.0	270	50	—	240
6	1055	847.85	.53	.61	.61	76	61	19.5	275	50	—	240
7	1057	848.74	.43	.49	.49	78	61	18.0	275	50	—	240
8	1059	849.53	.43	.49	.49	80	62	21.0	255	50	—	230
9	1101	850.33	.43	.49	.49	82	63	19.5	265	50	—	235
10	1103	851.10	.47	.53	.53	84	64	21.0	275	50	—	240
11	1105	851.92	.80	.91	.65	84	64	26.0	260	50	—	240
12	1107	852.78	.93	1.05	.60	84	64	26.0	260	50	—	240
* FINAL	1109	853.630	—	—	—	—	—	—	—	—	—	—
13	1119	853.630	1.05	1.15	1.15	80	66	8.0	250	50	—	210
14	1121	854.82	1.10	1.20	1.20	83	66	9.0	255	50	—	230
15	1123	856.00	1.10	1.20	1.20	88	67	13.0	265	50	—	230
16	1125	857.20	1.10	1.20	1.20	91	68	13.0	270	50	—	210
17	1127	858.38	.90	1.00	1.00	93	68	17.0	275	50	—	185
18	1129	859.47	.80	.90	.90	94	68	19.0	280	50	—	145
19	1131	860.65	.65	.73	.73	95	69	15.0	285	50	—	100
20	1133	861.51	.48	.55	.55	96	70	13.0	260	50	—	90
FINAL	1135	862.365	—	—	—	—	—	—	—	—	—	—
NET TIME	76 min.	28.862			.91	79.3	63.4					210
							15.35					
	* FILTER CHANGE											

YORK RESEARCH CORPORATION

Date: 11/11/71 Plant: HARVEY

Run Number: 1 Location of sample port: PRIMARY INLET

Operator: RAK / GVK Barometric Pressure: 29.66

Sample Box Number: - Ambient Temperature: 40

Impinger H_2O

Volume after sampling 204 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

Impinger prefilled with 200 ml Extra No. ____ Impinger water residue ____ mg

Volume Collected 4 ml

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

Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. 7

Extra No. ____ Weight results ____ mg

Probe, cyclone, flask, and front half of filter, acetone wash: Container No. 2

Extra No. ____ Weight results ____ mg

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-271	1		
F-85	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	310.2				
Weight before test:	300.0				
Moisture weight collected:	10.2				Moisture Total 14.2 gm
Container Number: 4	1.	2.	3.	4.	

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY ALUMINIUM

Run No. 2

Location PRIMARY INLET

Date 11/11/71

Operator RAK / GVK

Sample Box No. —

Meter Box No. 557

Meter H 1.90

C Factor 1.05

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F-310
F-235
F-206

Ambient Temp °F 40

Bar. Press. "Hg 29.47

Assumed Moisture % 2

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Probe Length 5'

Probe Heater Setting 75

Avg. ΔP ____ Avg. ΔH .930

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice Δ H in H_2O Desired	Orifice Δ H in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
A 1	1510	862.458	1.20	1.35	1.35	60	60	13.0	250	50	—	240
2	1512	863.67	1.30	1.45	1.45	66	60	16.0	235	50	—	240
3	1514	864.91	1.40	1.55	1.55	72	60	18.0	260	50	—	240
4	1516	866.26	1.20	1.35	1.35	78	61	16.0	235	50	—	240
5	1518	867.50	1.20	1.35	1.35	81	61	17.0	250	50	—	240
6	1520	868.70	1.10	1.25	1.25	84	62	19.5	240	50	—	240
7	1522	869.85	1.10	1.25	1.25	86	63	22.0	250	50	—	240
8	1524	871.07	.92	1.05	1.05	90	64	15.0	240	50	—	240
9	1526	872.19	1.00	1.10	1.10	90	64	17.0	250	50	—	240
10	1528	873.32	.87	1.00	1.00	90	65	18.5	255	50	—	230
11	1530	874.40	.50	.57	.57	90	66	11.0	250	50	—	230
12	1532	875.30	.40	.47	.47	87	66	10.0	255	50	—	230
13	1534	876.08	.42	.49	.49	84	66	11.0	250	50	—	220
14	1536	876.87	.45	.53	.53	83	67	13.0	265	50	—	210
15	1538	877.67	.68	.65	.65	81	67	25.0	250	50	—	190
16	1540	878.57	.74	.60	.60	82	68	26.0	250	50	—	145

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
				Desired	Actual	Inlet	Outlet					
17	1542	879.45	.76	.87	.58	81	68	26.0	265	50	—	70
18	1544	880.30	.76	.87	.55	80	68	26.0	245	50	—	60
19	1546	881.15	.54	.62	.53	80	68	26.0	260	50	—	70
20	1548	881.95	.60	.69	.50	80	70	26.0	260	50	—	70
FINAL	1550	882.764	—	—	—	—	—	—	—	—	—	—
B 1	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—
3	1603	882.793	.75	.85	.85	77	69	4.5	260	50	—	240
4	1605	883.92	.70	.80	.80	80	70	5.0	275	50	—	240
5	1607	884.97	.63	.73	.73	81	70	5.0	240	50	—	240
6	1609	885.95	.55	.64	.64	82	70	5.0	250	50	—	240
7	1611	886.91	.50	.57	.57	83	70	5.0	240	50	—	240
8	1613	887.78	.57	.65	.65	84	70	6.0	250	50	—	240
9	1615	888.73	.65	.74	.74	85	70	8.0	240	50	—	240
10	1617	889.70	1.10	1.25	1.25	86	70	12.0	250	50	—	240
11	1619	890.86	1.20	1.35	1.35	86	70	16.0	250	50	—	235
12	1621	892.08	1.10	1.25	1.25	88	70	18.5	250	50	—	235
13	1623	893.28	1.10	1.25	1.25	89	70	20.0	250	50	—	230
14	1625	894.45	1.10	1.25	1.15	89	70	25.0	250	50	—	230
FINAL	1627	895.631	—	—	—	—	—	—	—	—	—	—
15	1636	895.631	1.20	1.35	1.35	80	68	12.5	250	50	—	220
16	1638	896.93	1.05	1.20	1.20	86	70	11.0	250	50	—	210
17	1640	898.20	.70	.80	.80	90	70	8.0	270	50	—	145
18	1642	899.30	.75	.86	.86	92	70	9.0	270	50	—	135
19	1644	900.32	.75	.86	.86	93	70	10.0	250	50	—	125
20	1646	901.37	.75	.86	.86	94	71	11.0	270	50	—	130
FINAL	1648	902.414	—	—	—	—	—	—	—	—	—	—
	76	39.666			.93	81.2	69.1					215.5
							25.15					

PARTICULATE CLEANUP SHEET

Date: 11/11/71 Plant: HARVEY

Run Number: 2 Location of sample port: PRIMARY INLET

Operator: RAK/GVK Barometric Pressure: 29.47

Sample Box Number: — Ambient Temperature: 40

Impinger H_2O

Volume after sampling 204 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

Impinger prefilled with 200 ml Extra No. ____ Impinger water residue ____ mg

Volume Collected 4 ml

Impingers and back half of filter, acetone wash: Container No. 5 Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. 7 Extra No. ____ Weight results ____ mg

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

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-310	1		
F-235	1		
F-206	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	309.7			
Weight before test:	300.0			
Moisture weight collected:	9.7			
Container Number: 4	1. ____	2. ____	3. ____	4. ____

Moisture Total 13.7 gm

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

QUALITY CONTROLLED MRI RESEARCH CORPORATION

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY

Run No. 3

Location PRIMARY INLET

Date 11/11/71

Operator RAK/GVK

Sample Box No. —

Meter Box No. 557

Meter H 1.90

C Factor 1.05

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F-135
F-148

Ambient Temp °F 45

Bar. Press. "Hg 29.59

Assumed Moisture % 2

Heater Box Setting, °F 275

Probe Tip Dia., In. 3/16

Probe Length 5'

Probe Heater Setting 75

Avg. ΔP ____ Avg. ΔH ____

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
B 1	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—
3	1910	902.650	.74	.85	.85	62	60	10.0	265	50	—	240
4	1912	903.67	.67	.77	.77	66	60	10.0	275	50	—	240
5	1914	904.62	.58	.67	.67	69	61	10.0	280	50	—	240
6	1916	905.56	.53	.62	.62	72	62	10.5	285	50	—	245
7	1918	906.43	.55	.64	.64	75	62	13.0	285	50	—	240
8	1920	907.34	.52	.60	.60	79	63	12.5	295	50	—	240
9	1922	908.20	.55	.64	.64	80	63	15.0	295	50	—	240
10	1924	909.12	.65	.74	.74	82	64	15.0	295	50	—	240
11	1926	910.07	1.00	1.10	1.10	85	64	19.5	295	50	—	245
12	1928	911.24	1.10	1.25	1.25	86	65	21.0	295	50	—	240
13	1930	912.41	1.20	1.35	1.35	89	66	24.0	295	50	—	240
14	1932	913.67	1.10	1.25	1.25	91	66	23.5	295	50	—	240
15	1934	914.89	1.10	1.25	1.25	91	67	23.5	295	50	—	225
16	1936	916.07	1.10	1.25	1.10	91	67	25.0	290	50	—	220

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
				Desired	Actual	Inlet	Outlet					
17	1950	917.22	.95	1.05	1.05	97	68	25.0	290	50	—	165
18	1950	918.33	.75	.86	.86	92	68	22.5	290	50	—	140
19	1952	919.40	.75	.86	.86	92	68	22.5	290	50	—	130
20	1954	920.43	.75	.86	.86	92	69	23.0	290	50	—	125
FINAL	1956	921.478	—	—	—	—	—	—	—	—	—	—
A 1	1955	921.478	.97	1.10	1.10	77	68	9.0	265	50	—	240
2	1957	922.65	1.20	1.35	1.35	80	68	11.0	275	50	—	235
3	1959	923.89	1.30	1.45	1.45	83	68	13.0	280	50	—	235
4	2001	925.15	1.30	1.45	1.45	86	68	14.0	285	50	—	235
5	2003	926.44	1.40	1.55	1.55	86	68	18.0	290	50	—	230
6	2005	927.70	1.20	1.35	1.35	88	69	18.0	290	50	—	230
7	2007	928.98	1.20	1.35	1.35	89	69	19.0	290	50	—	230
8	2009	930.20	1.20	1.35	1.35	87	69	21.0	295	50	—	230
9	2011	931.44	1.05	1.20	1.20	86	69	21.0	295	50	—	230
10	2013	932.66	.80	1.00	1.00	85	69	19.0	300	50	—	230
11	2015	933.77	.52	.60	.60	84	68	11.0	275	50	—	230
12	2017	934.69	.45	.51	.51	83	68	10.0	285	50	—	230
13	2019	935.52	.43	.50	.50	83	68	10.0	290	50	—	230
14	2021	936.31	.58	.66	.66	84	68	13.0	290	50	—	230
15	2023	937.20	.60	.69	.69	85	69	15.0	295	50	—	215
16	2025	938.14	.65	.75	.75	86	69	18.0	295	50	—	180
17	2027	939.11	.75	.86	.86	86	70	23.0	300	50	—	150
18	2029	940.15	.70	.80	.80	86	70	22.0	270	50	—	120
19	2031	941.15	.75	.86	.86	86	70	24.0	275	50	—	90
20	2033	942.21	.70	.80	.80	86	70	25.0	285	50	—	75
FINAL	2035	943.215	—	—	—	—	—	—	—	—	—	—
	72	45.515			.93	83.7	66.0					210.3
							75.25					

PARTICULATE CLEANUP SHEET

Date: 11/11/71 Plant: HARVEY

Run Number: 3 Location of sample port: PRIMARY INLET

Operator: RAK | GVK Barometric Pressure: 29.59

Sample Box Number: — Ambient Temperature: 45

Impinger H_2O

Volume after sampling 204 ml Container No. 3 Ether-chloroform extraction of impinger water _____ mg

Impinger prefilled with 200 ml Extra No. _____ Impinger water residue _____ mg

Volume Collected 4 ml

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

Extra No. _____ Weight results _____ mg

Dry probe and cyclone catch: Container No. 7

Extra No. _____ Weight results _____ mg

Probe, cyclone, flask, and front half of filter, acetone wash: Container No. 2

Extra No. _____ Weight results _____ mg

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-135	1		
F-143	1		

Filter particulate weight _____ mg

Total particulate weight _____ mg

Silica Gel

Weight after test:	312.3			
Weight before test:	300.0			
Moisture weight collected:	12.3			
Container Number:	4	1.	2.	3. 4.

Moisture Total 16.3 gm

Sample Number: _____ Analyze for: _____

Method determination: _____

Comments: _____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

SOURCE TESTING CALCULATION FORMS

Test No. — No. Runs 3

Name of Firm HARVEY Aluminum

Location of Plant The Dalles, Oregon

Type of Plant Primary Aluminum Reduction

Control Equipment Scrubber

Sampling Point Locations Primary System Outlet

Pollutants Sampled Particulate

Time of Particulate Test:

Run No.	1	Date	11/11/71	Begin	1012	End	1236
Run No.	2	Date	11/11/71	Begin	1506	End	1652
Run No.	3	Date	11/11/71	Begin	1920	End	2100

PARTICULATE EMISSION DATA

Run No.	1	2	3	
P_b barometric pressure, "Hg Absolute	29.66	29.47	29.59	
P_g orifice pressure drop, "H_2O	1.020	1.000	1.040	
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	45.33	44.72	42.68	
T_m Average Gas Meter Temperature, °F	64	68	68	
V_m Volume of Dry Gas Sampled @ Standard std. conditions, ft.^{3}	45.36	44.29	42.45	
V_w Total H_2O collected, ml., Impingers & Silica Gel.	29.5	31.7	28.6	
V_w Volume of Water Vapor Collected gas ft.^{3} @ Standard Conditions*	1.40	1.50	1.36	

* 70°F, 29.92" Hg.

QUALITY CONTROLLED RESEARCH CORPORATION

PARTICULATE EMISSION DATA (cont'd)

	1	2	3	
Run No.				
%M - % Moisture in the stack gas by volume	3.11	3.28	3.10	
M_d - Mole fraction of dry gas	.969	.967	.969	
% CO_2 / % CO	3.5 / 0.6	3.5 / 0.0	3.5 / 0.0	/
% O_2	18.6	18.7	18.7	
% N_2	77.84	77.80	77.80	
M W $_d$ - Molecular weight of dry stack gas	29.46	29.31	29.31	
M W - Molecular weight of stack gas	29.10	28.93	28.96	
ΔP_s - Velocity Head of stack gas, In. H_2O	.100	.097	.101	
T_s Stack Temperature, °F	80	80	70	
$\sqrt{\Delta P_s \times (T_s+460)}$	7.200	7.074	6.931	
P_s Stack Pressure, "Hg. Absolute	29.66	29.47	29.59	
V_s Stack Velocity @ stack conditions, fpm	1066	1054	1030	
A_s - Stack Area, $in.^2$	1017	1017	1017	
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	7097	6958	6970	
Tt - Net Time of Test, min.	86	88	80	
D_n - Sampling Nozzle Diameter, in.	0.312	0.312	0.312	
%I - Percent isokinetic	98.6	95.9	101.0	
mf - Water Soluble Fluoride Filter & Impinger, mg.	—	—	—	
Mw - Water Soluble Fluoride Water Wash, mg.	—	—	—	
mt - Water Soluble Fluoride, total mg.	22.1	32.2	30.3	
MU - TOTAL INSOLUBLE FLUORIDE mg.	9.7	9.6	16.3	
MV - TOTAL FLUORIDE mg	31.8	41.8	46.6	

PARTICULATE EMISSION DATA (cont'd)

Run No.	1	2	3	
CAI - WATER SOLUBLE FLUORIDE FRONT HALF, gr/SCF	—	—	—	
CAM - WATER SOLUBLE FLUORIDE BACK HALF, gr/SCF	—	—	—	
CAN - TOTAL WATER SOLUBLE FLUORIDE gr/SCF	.0075	.0112	.0110	
CAO TOTAL INSOLUBLE FLUORIDE, gr/SCF	.0032	.0033	.0059	
CAP - TOTAL FLUORIDE gr/SCF	.0108	.0145	.0169	
CAQ - WATER SOLUBLE FLUORIDE FRONT HALF gr/CF @ STACK CONDITION	—	—	—	
CAR - WATER SOLUBLE FLUORIDE BACK HALF, gr/CF @ STACK CONDITION	—	—	—	
CAS - TOTAL WATER SOLUBLE FLUORIDE gr/CF@ STACK CONDITION	.0071	.0105	.0105	
CAT - TOTAL INSOLUBLE FLUORIDE gr/CF @ STACK CONDITION	.0030	.0031	.0056	
CAU - TOTAL FLOURIDE gr/CF @ STACK CONDITION	.0102	.0135	.0162	
CAV - WATER SOLUBLE FLUORIDE FRONT HALF, lb/hr	—	—	—	
CAW - WATER SOLUBLE FLUORIDE BACK HALF, lb/hr	—	—	—	
CAX - TOTAL WATER SOLUBLE FLUORIDE lb/hr	.4562	.6679	.6571	
CAY - TOTAL INSOLUBLE FLUORIDE lb/hr	.1946	.1968	.3524	
CAZ - TOTAL FLOURIDE lb/hr	.6569	.8646	1.0095	

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY

Run No. 1

Location PRIMARY OUTLET

Date 11/11/71

Operator KLING & CREPEAU

Sample Box No. —

Meter Box No. —

Meter H 1.89

C Factor —

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F-237
F-233
F-105

Ambient Temp °F 40

Bar. Press. "Hg 29.66

Assumed Moisture % 6

Heater Box Setting, °F 275

Probe Tip Dia., In. 5/16

Probe Length 3'

Probe Heater Setting 65

Avg. ΔP Avg. ΔH

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice Δ H in H_2O Desired	Orifice Δ H in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
Δ 1	1012	470.433	.09	.93	.93	60	56	2.0	250	50	—	80
2	1014	471.70	.11	1.15	1.15	62	56	3.0	250	50	—	80
3	1016	472.80	.11	1.15	1.15	64	58	4.0	250	50	—	80
4	1018	473.90	.09	.93	.93	65	59	4.0	250	50	—	80
5	1020	474.60	.09	.93	.01	68	60	22.0	250	50	—	80
FINAL	1022	475.241	—	—	—	—	—	—	—	—	—	—
6	1104	475.241	.09	.93	.93	56	50	4.0	270	50	—	80
7	1106	476.20	.09	.93	.93	58	51	4.0	270	50	—	80
8	1108	477.20	.09	.93	.93	60	53	5.0	275	50	—	80
9	1110	478.20	.09	.93	.93	60	54	6.0	275	50	—	80
10	1112	479.30	.09	.93	.93	62	54	6.0	270	55	—	80
11	1114	480.30	.09	.93	.93	64	54	7.0	270	55	—	80
12	1116	481.30	.13	1.35	1.35	67	55	10.0	270	55	—	80
13	1118	482.40	.13	1.35	1.35	68	54	12.0	270	55	—	80
14	1120	483.60	.13	1.35	1.35	68	54	13.0	270	55	—	80
15	1122	484.70	.13	1.35	1.35	68	54	14.0	270	55	—	80

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
16	1128	485.9	.13	1.35	1.45	70	55	16.0	270	55	—	80
17	1126	487.1	.10	1.05	1.05	72	55	18.0	270	55	—	80
18	1128	488.0	.06	.65	.65	72	55	19.0	270	55	—	80
19	1130	489.2	.05	.54	.54	74	56	11.0	270	55	—	80
20	1132	490.1	.01	.12	.12	76	57	4.0	270	55	—	80
21	1134	490.6	.01	.12	.12	79	58	0.0	270	55	—	85
FINAL	1136	490.681	—	—	—	—	—	—	—	—	—	—
B 1	1142	490.681	.09	.95	.95	76	56	18.0	285	55	—	80
2	1144	491.50	.09	.95	.95	76	56	16.0	285	55	—	80
3	1146	492.70	.09	.95	.95	78	58	20.0	285	55	—	80
4	1148	493.60	.09	.95	.95	79	58	20.0	285	55	—	80
5	1150	494.70	.10	1.05	.95	80	60	24.0	285	55	—	80
FINAL	1152	495.763	—	—	—	—	—	—	—	—	—	—
6	1202	495.763	.10	1.05	1.05	76	58	11.0	285	55	—	80
7	1204	497.1	.11	1.15	1.15	77	58	10.0	285	55	—	80
8	1206	498.5	.12	1.23	1.23	78	59	10.0	285	55	—	80
9	1208	499.8	.12	1.23	1.23	79	60	10.0	285	55	—	80
10	1210	501.0	.12	1.23	1.23	79	60	10.0	285	55	—	80
11	1212	502.2	.12	1.23	1.23	80	60	10.0	285	55	—	80
12	1214	503.3	.12	1.23	1.23	80	60	10.0	285	55	—	80
13	1216	504.5	.13	1.35	1.35	80	61	12.0	285	60	—	80
14	1218	505.6	.13	1.35	1.35	80	61	13.0	285	60	—	80
15	1220	506.7	.14	1.45	1.45	82	62	15.0	285	60	—	80
16	1222	508.0	.16	1.65	1.65	82	62	20.0	285	60	—	80
17	1224	509.2	.14	1.45	1.45	82	62	23.0	285	60	—	80
18	1226	510.5	.11	1.15	1.15	82	62	22.0	285	60	—	80
19	1228	511.7	.11	1.15	1.15	84	63	22.0	285	60	—	80
20	1230	512.9	.12	1.23	1.23	84	63	21.0	285	60	—	80
21	1232	514.1	.05	.54	.54	84	63	20.0	285	60	—	80
22	1234	515.0	.03	.31	.31	85	63	9.0	285	60	—	80
FINAL	1236	515.763	—	—	—	—	—	—	—	—	—	—
	86	45.33			1.02	73.4	57.4					80
						115	55					
		* FILTER CHANGE										

* FILTER CHANGE

PARTICULATE CLEANUP SHEET

Date: 11/11/71 Plant: HARVEY

Run Number: 1 Location of sample port: PRIMARY OUTLET

Operator: KLING & CLEPEAU Barometric Pressure: _____

Sample Box Number: — Ambient Temperature: _____

Impinger H_2O

Volume after sampling 214 ml Container No. 3 Ether-chloroform extraction of impinger water _____ mg

Impinger prefilled with 200 ml Extra No. _____ Impinger water residue _____ mg

Volume Collected 14 ml

Impingers and back half of filter, acetone wash: Container No. 5 Extra No. _____ Weight results _____ mg

Dry probe and cyclone catch: Container No. 7 Extra No. _____ Weight results _____ mg

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

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-237	1		
F-233	1		
F-105	1		

Filter particulate weight _____ mg

Total particulate weight _____ mg

Silica Gel

Weight after test:	315.5				
Weight before test:	300.0				
Moisture weight collected:	15.5				Moisture Total 29.5 gm
Container Number: 4	1.	2.	3.	4.	

Sample Number: _____ Analyze for: _____

Method determination: _____

Comments: _____

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY

Run No. 2

Location PRIMARY OUTLET

Date 11/11/71

Operator KLING + CREPEAU

Sample Box No. —

Meter Box No. —

Meter H 1.89

C Factor —

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F-205
F-230

Ambient Temp °F 40

Bar.Press. "Hg 29.57

Assumed Moisture % 6

Heater Box Setting, °F 275

Probe Tip Dia., In. 5/16

Probe Length 6'

Probe Heater Setting 65

Avg. ΔP ____ Avg. ΔH ____

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice Δ H in H_2O Desired	Orifice Δ H in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp °F
A 1	1506	515.838	.07	.74	.74	50	50	5.0	265	50	—	80
2	1508	516.7	.08	.85	.85	52	50	6.0	265	50	—	80
3	1510	517.7	.09	.93	.93	54	50	7.0	265	50	—	80
4	1512	518.7	.09	.93	.93	56	52	7.0	265	50	—	80
5	1514	519.8	.09	.93	.93	62	54	8.0	265	50	—	80
6	1516	520.8	.09	.93	.93	65	55	9.0	265	50	—	80
7	1518	521.8	.09	.93	.93	68	55	10.0	265	50	—	80
8	1520	522.9	.08	.85	.85	72	56	10.0	265	50	—	80
9	1522	523.9	.08	.85	.85	75	57	10.0	265	50	—	80
10	1524	524.9	.09	.93	.93	77	57	12.0	265	50	—	80
11	1526	525.9	.10	1.05	1.05	80	58	14.0	265	50	—	80
12	1528	527.0	.11	1.15	1.15	80	58	16.0	265	50	—	80
13	1530	528.1	.10	1.05	1.05	80	59	16.0	265	50	—	80
14	1532	529.2	.13	1.35	1.35	80	59	20.0	265	50	—	80
15	1534	530.3	.13	1.35	1.35	80	59	22.0	265	50	—	80
16	1536	531.5	.13	1.35	1.35	80	59	22.0	265	50	—	80

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
17	1538	532.60	.13	1.35	1.35	80	59	23.0	265	50	—	80
18	1540	533.70	.13	1.35	1.35	81	60	24.0	265	50	—	80
19	1542	534.80	.07	.73	.73	81	60	20.0	265	50	—	80
20	1544	535.90	.05	.52	.52	81	60	14.0	265	50	—	80
21	1546	536.70	.01	.11	.11	81	60	6.0	265	50	—	80
22	1548	537.20	.01	.11	.11	81	60	3.0	265	50	—	80
FINAL	1550	537.522	—	—	—	—	—	—	—	—	—	—
B 1	1554	537.522	.08	.85	.85	80	60	16.0	265	50	—	80
2	1556	538.40	.09	.93	.93	80	60	21.0	265	50	—	80
3	1558	539.30	.10	1.05	.82	80	60	24.0	265	50	—	80
* FINAL	1600	540.357	—	—	—	—	—	—	—	—	—	—
4	1616	540.357	.10	1.05	1.05	74	56	10.0	265	50	—	80
5	1618	541.70	.11	1.15	1.15	75	57	10.0	265	50	—	80
6	1620	542.80	.11	1.15	1.15	77	58	10.0	265	50	—	80
7	1622	544.10	.11	1.15	1.15	78	58	10.0	265	50	—	80
8	1624	545.20	.11	1.15	1.15	79	60	10.0	265	50	—	80
9	1626	546.30	.11	1.15	1.15	79	60	10.0	265	50	—	80
10	1628	547.40	.12	1.23	1.23	80	60	12.0	265	50	—	80
11	1630	548.50	.12	1.23	1.23	80	60	12.0	265	50	—	80
12	1632	549.70	.12	1.23	1.23	80	60	12.0	265	50	—	80
13	1634	550.80	.10	1.05	1.05	80	60	13.0	265	50	—	80
14	1636	551.90	.14	1.45	1.45	80	60	15.0	265	50	—	80
15	1638	553.10	.15	1.55	1.55	80	60	20.0	265	50	—	80
16	1640	554.30	.15	1.55	1.55	80	60	20.0	265	50	—	80
17	1642	555.50	.15	1.55	1.55	80	60	23.0	265	50	—	80
18	1644	556.70	.12	1.23	1.23	80	60	23.0	265	50	—	80
19	1646	558.00	.07	.73	.73	80	60	16.0	265	50	—	80
20	1648	559.10	.03	.32	.32	80	60	7.0	265	50	—	80
21	1650	559.90	.03	.32	.32	80	60	6.0	265	50	—	80
FINAL	1652	560.552	—	—	—	—	—	—	—	—	—	—
	88	44.719			1.00	77.2	58.0					80
							67.6					

* FILTER CHANGE

PARTICULATE CLEANUP SHEET

Date: 11/11/71 Plant: HARVEY

Run Number: 2 Location of sample port: _____

Operator: KLING + CREPEAU Barometric Pressure: _____

Sample Box Number: — Ambient Temperature: _____

Impinger H_2O

Volume after sampling 220 ml Container No. 3 Ether-chloroform extraction of impinger water _____ mg

Impinger prefilled with 200 ml Extra No. _____ Impinger water residue _____ mg

Volume Collected 20 ml

Impingers and back half of filter, acetone wash: Container No. 5 Extra No. _____ Weight results _____ mg

Dry probe and cyclone catch: Container No. 7 Extra No. _____ Weight results _____ mg

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

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-205	1		
F-230	1		

Filter particulate weight _____ mg

Total particulate weight _____ mg

Silica Gel

Weight after test:	311.7			
Weight before test:	300.0			
Moisture weight collected:	11.7			

Moisture Total 31.7 gm

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

Sample Number: _____ Analyze for: _____

Method determination: _____

Comments: _____

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
												70
17	1952	577.9	.05	.53	.53	80	65	14.0	240	50	—	70
18	1954	579.0	.02	.21	.21	80	65	6.0	240	50	—	70
19	1956	579.7	.02	.21	.21	80	65	5.0	240	50	—	—
FINAL	1958	580,222	—	—	—	—	—	—	—	—	—	
B 1	2002	580.222	.09	.93	.93	80	65	15.0	240	50	—	70
2	2004	581.2	.09	.93	.93	80	65	17.0	240	50	—	70
3	2006	582.2	.12	1.23	1.23	80	65	23.0	240	50	—	70
4	2008	583.2	.12	1.23	1.23	80	65	24.0	240	50	—	70
*FINAL	2010	584.370	—	—	—	—	—	—	—	—	—	—
5	2026	584.370	.12	1.23	1.23	80	65	11.0	270	50	—	70
6	2028	585.7	.12	1.23	1.23	80	65	11.0	270	50	—	70
7	2030	587.0	.12	1.23	1.23	80	65	11.0	270	50	—	70
8	2032	588.3	.14	1.45	1.45	80	65	12.0	270	50	—	70
9	2034	589.6	.13	1.35	1.35	80	65	12.0	270	50	—	70
10	2036	590.7	.13	1.35	1.35	80	65	14.0	270	50	—	70
11	2038	591.9	.13	1.35	1.35	80	65	14.0	270	50	—	70
12	2040	593.1	.12	1.23	1.23	80	65	14.0	270	50	—	70
13	2042	594.2	.12	1.23	1.23	80	65	16.0	270	50	—	70
14	2044	595.4	.14	1.45	1.45	80	65	20.0	270	50	—	70
15	2046	596.6	.14	1.45	1.45	80	65	23.0	270	50	—	70
16	2048	597.8	.14	1.45	1.45	80	65	23.0	270	50	—	70
17	2050	599.0	.12	1.23	1.23	80	65	23.0	270	50	—	70
18	2052	600.1	.09	.93	.93	80	65	21.0	270	50	—	70
19	2054	601.2	.04	.41	.41	80	65	12.0	270	50	—	70
20	2056	602.1	.02	.21	.21	80	65	6.0	270	50	—	70
21	2058	602.7	.02	.21	.21	80	65	6.0	270	50	—	70
FINAL	2100	603.302	—	—	—	—	—	—	—	—	—	—
	40	42.684			1.04	74.9	64.6					70.6
							68.25					
		* FILTER	CHANGE									

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY

Run No. 3

Location PRIMARY OUTLET

Date 11/11/71

Operator KLING & CREPEAU

Sample Box No. —

Meter Box No. —

Meter H 1.89

C Factor —

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F-297

F-242

Ambient Temp °F 40

Bar.Press. "Hg 29.59

Assumed Moisture % 6

Heater Box Setting, °F 275

Probe Tip Dia., In. 5/16

Probe Length 3'

Probe Heater Setting 75

Avg. ΔP ____ Avg. ΔH ____

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice Δ H in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
A 1	1920	560.618	.07	.74	.74	52	50	5.0	240	50	—	75
2	1922	561.5	.08	.83	.83	53	50	5.0	240	50	—	75
3	1924	562.5	.09	.93	.93	53	51	6.0	240	50	—	75
4	1926	563.5	.09	.93	.93	56	51	6.0	240	50	—	75
5	1928	564.5	.09	.93	.93	58	52	7.0	240	50	—	75
6	1930	565.6	.09	.93	.93	60	52	7.0	240	50	—	70
7	1932	566.6	.09	.93	.93	63	53	8.0	240	50	—	70
8	1934	567.6	.10	1.05	1.05	66	54	10.0	240	50	—	70
9	1936	568.7	.11	1.15	1.15	69	56	10.0	240	50	—	70
10	1938	569.8	.10	1.05	1.05	73	58	11.0	240	50	—	70
11	1940	570.9	.10	1.05	1.05	76	61	12.0	240	50	—	70
12	1942	572.0	.13	1.35	1.35	78	62	15.0	240	50	—	70
13	1944	573.1	.14	1.45	1.45	79	62	16.0	240	50	—	70
14	1946	574.3	.14	1.45	1.45	80	63	19.0	240	50	—	70
15	1948	575.5	.14	1.45	1.45	80	64	20.0	240	50	—	70
16	1950	576.7	.11	1.15	1.15	80	64	20.0	240	50	—	70

PARTICULATE CLEANUP SHEET

Date: 11/11/71 Plant: HARVEY

Run Number: 3 Location of sample port: PRIMARY OUTLET

Operator: KLING + CREPEAD Barometric Pressure: 29.59

Sample Box Number: — Ambient Temperature: 40°

Impinger H_2O

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

Impinger prefilled with 200 ml Extra No. _____ Impinger water residue _____ mg

Volume Collected 16 ml

Impingers and back half of filter, acetone wash: Container No. 5 Extra No. _____ Weight results _____ mg

Dry probe and cyclone catch: Container No. 7 Extra No. _____ Weight results _____ mg

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

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-297	1		
F-242	1		

Filter particulate weight _____ mg

Total particulate weight _____ mg

Silica Gel

Weight after test:	312.6				
Weight before test:	300.0				
Moisture weight collected:	12.6				Moisture Total 28.6 gm
Container Number: 4	1.	2.	3.	4.	

Sample Number: _____ Analyze for: _____

Method determination: _____

Comments: _____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

SOURCE TESTING CALCULATION FORMS

Test No. — No. Runs 3

Name of Firm HARVEY ALUMINUM

Location of Plant THE DALLES, OREGON

Type of Plant PRIMARY ALUMINUM REDUCTION

Control Equipment SCRUBBER

Sampling Point Locations SECONDARY SYSTEM INLET

Pollutants Sampled PARTICULATE

Time of Particulate Test:

Run No.	1	Date	11/8/71	Begin	1540	End	1840
Run No.	2	Date	11/9/71	Begin	0850	End	1150
Run No.	3	Date	11/9/71	Begin	1405	End	1705

PARTICULATE EMISSION DATA

Run No.	1	2	3	
P_b barometric pressure, "Hg Absolute	29.65	29.47	29.64	
P_m orifice pressure drop, "H_2O	3.313	2.841	3.169	
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	180.2	153.9	178.0	
T_m Average Gas Meter Temperature, °F	81	85	93	
V_m Volume of Dry Gas Sampled @ Standard std. conditions, ft.^{3}	176.2	148.3	170.2	
V_w Total H_2O collected, ml., Impingers & Silica Gel.	7.9	19.7	0.0	
V_w gas Volume of Water Vapor Collected ft.^{3} @ Standard Conditions*	.374	.934	0.0	

* 70°F, 29.92" Hg.

QUALITY CONTROLLED YORK RESEARCH CORPORATION

CALCULATIONS FOR SECONDARY INLET & OUTLET STANDARD GAS VOLUMES - STANDARD CONDITIONS

Volume H_2O = (Volume Stack Gas) (% Water)

$$Q_s = (\text{Volume Stack Gas - Volume Water}) \frac{Ps}{29.92} \frac{530}{Ts} \frac{As}{144}$$

	Volume H_2O (CF)	Q_s (SCFM)
Inlet	1.53	143100
	4.54	140200
	0.0	140500

	Volume H_2O (CF)	Q_s (SCFM)
OUTLET	9.69	139200
	7.29	138900
	13.9	137600

PARTICULATE EMISSION DATA (cont'd)

	1	2	3	
Run No.				
%M - % Moisture in the stack gas by volume	.212	.626	0.0	
M_d - Mole fraction of dry gas	.998	.994	1.000	
% CO_2 / % CO	0.0/0.0	0.0/0.0	0.0/0.0	/
% O_2	20.6	20.9	20.9	
% N_2	79.4	79.1	79.1	
M W d - Molecular weight of dry stack gas	28.82	28.84	28.84	
M W - Molecular weight of stack gas	28.80	28.78	28.84	
ΔP_s - Velocity Head of stack gas, In. H_2O	—	—	—	
T_s - Stack Temperature, °F	42	47	52	
$\sqrt{\Delta P_s X (T_s+460)}$	—	—	—	
P_s Stack Pressure, "Hg. Absolute	29.65	29.47	29.64	
V_s Stack Velocity @ stack conditions, fpm	725	725	725	
A_s - Stack Area, $in.^2$	27220	27220	27220	
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	143,100	140,200	140,500	
T_t - Net Time of Test, min.	180	180	180	
D_n - Sampling Nozzle Diameter, in.	—	—	—	
%I - Percent isokinetic	—	—	—	
mf - Water Soluble Fluoride Filter & Impinger, mg.	—	—	—	
Mw - Water Soluble Fluoride Water Wash, mg.	—	—	—	
mt - Water Soluble Fluoride, total mg.	2.2	9.1	8.6	
MU - TOTAL INSOLUBLE FLUORIDE mg.	1.1	1.0	0.4	
MV - TOTAL FLUORIDE mg	3.3	10.1	9.0	

PARTICULATE EMISSION DATA (cont'd)

Run No.	1	2	3	
CAL - WATER SOLUBLE FLUORIDE FRONT HALF, gr/SCF	—	—	—	
CAM - WATER SOLUBLE FLUORIDE BACK HALF, gr/SCF	—	—	—	
CAN - TOTAL WATER SOLUBLE FLUORIDE gr/SCF	1.92×10^{-4}	9.45×10^{-4}	7.78×10^{-4}	
CAO - TOTAL INSOLUBLE FLUORIDE, gr/SCF	$.96 \times 10^{-4}$	1.04×10^{-4}	$.36 \times 10^{-4}$	
CAP - TOTAL FLUORIDE gr/SCF	2.88×10^{-4}	10.49×10^{-4}	8.14×10^{-4}	
CAQ - WATER SOLUBLE FLUORIDE FRONT HALF gr/CF @ STACK CONDITION	—	—	—	
CAR - WATER SOLUBLE FLUORIDE BACK HALF, gr/CF @ STACK CONDITION	—	—	—	
CAS - TOTAL WATER SOLUBLE FLUORIDE gr/CF @ STACK CONDITION	2.00×10^{-4}	9.66×10^{-4}	1.97×10^{-4}	
CAT - TOTAL INSOLUBLE FLUORIDE gr/CF @ STACK CONDITION	1.00×10^{-4}	1.06×10^{-4}	$.37 \times 10^{-4}$	
CAU - TOTAL FLOURIDE gr/CF @ STACK CONDITION	3.00×10^{-4}	10.73×10^{-4}	8.34×10^{-4}	
CAV - WATER SOLUBLE FLUORIDE FRONT HALF, lb/hr	—	—	—	
CAW - WATER SOLUBLE FLUORIDE BACK HALF, lb/hr :	—	—	—	
CAX - TOTAL WATER SOLUBLE FLUORIDE lb/hr	.235	1.34	.937	
CAY - TOTAL INSOLUBLE FLUORIDE lb/hr	.118	.125	.043	
CAZ - TOTAL FLOURIDE lb/hr	.353	1.26	.980	

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY

Run No. 1

Location SECONDARY Inlet

Date 11/8/71

Operator RAK

Sample Box No. —

Meter Box No. —

Meter H 1.89

C Factor —

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F-219

Ambient Temp °F 50

Bar.Press. "Hg 29.65

Assumed Moisture % 2

Heater Box Setting, °F 250

Probe Tip Dia., In. —

Probe Length 3'

Probe Heater Setting 65

Avg. ΔP ____ Avg. ΔH 3.313

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice Δ H in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp °F
				CFM	Actual	Inlet	Outlet					
START	1540	957.649	—	—	3.50	65	60	6.0	—	—	—	50
1	1545	962.74	—	1.018	3.45	82	62	6.0	—	—	—	50
2	1550	967.81	—	1.014	3.40	90	64	6.0	—	—	—	45
3	1555	972.85	—	1.008	3.30	91	65	6.0	—	—	—	45
4	1600	977.85	—	1.000	3.30	91	66	6.0	—	—	—	45
5	1605	982.83	—	.996	3.30	92	68	6.0	—	—	—	45
6	1610	987.83	—	1.000	3.30	91	68	6.0	—	—	—	45
7	1615	992.83	—	1.000	3.30	90	68	6.0	—	—	—	45
8	1620	997.84	—	1.002	3.30	90	68	6.0	—	—	—	40
9	1625	002.85	—	.998	3.30	94	69	6.0	—	—	—	40
10	1630	007.85	—	1.000	3.30	92	69	6.0	—	—	—	45
11	1635	012.84	—	.998	3.30	92	69	6.0	—	—	—	40
12	1640	017.84	—	1.000	3.30	92	69	6.0	—	—	—	40
13	1645	022.85	—	1.002	3.30	95	70	6.0	—	—	—	40
14	1650	027.85	—	1.000	3.30	95	70	6.0	—	—	—	45
15	1655	032.89	—	1.008	3.30	96	71	6.0	—	—	—	40

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
				CFM	Actual	Inlet	Outlet					
16	1700	037.89	—	1.000	3.30	96	71	6.0	—	—	—	40
17	1705	042.89	—	1.000	3.30	97	72	6.0	—	—	—	40
18	1710	047.89	—	1.000	3.30	97	72	6.0	—	—	—	40
19	1715	052.89	—	1.000	3.30	97	72	6.0	—	—	—	40
20	1720	057.94	—	1.010	3.30	97	72	6.0	—	—	—	40
21	1725	062.93	—	.998	3.30	96	72	6.0	—	—	—	40
22	1730	067.90	—	.994	3.30	94	70	6.0	—	—	—	40
23	1735	072.85	—	.990	3.30	92	70	6.0	—	—	—	40
24	1740	077.81	—	.992	3.30	92	70	6.0	—	—	—	45
25	1745	082.81	—	1.000	3.30	92	70	6.0	—	—	—	40
26	1750	087.83	—	1.004	3.30	92	70	6.0	—	—	—	40
27	1755	092.85	—	1.004	3.30	92	70	6.0	—	—	—	40
28	1800	097.85	—	1.000	3.30	92	70	6.0	—	—	—	40
29	1805	102.84	—	.998	3.30	93	70	6.0	—	—	—	40
30	1810	107.82	—	.996	3.30	93	70	6.0	—	—	—	40
31	1815	112.82	—	1.000	3.30	94	70	6.0	—	—	—	40
32	1820	117.84	—	1.004	3.30	94	71	6.0	—	—	—	40
33	1825	122.85	—	1.002	3.30	94	71	6.0	—	—	—	40
34	1830	127.85	—	1.000	3.30	94	71	6.0	—	—	—	40
35	1835	132.85	—	1.000	3.30	94	71	6.0	—	—	—	40
FINAL	1840	137.840	—	.998	—	—	—	—	—	—	—	—
NET TIME	180 MIN	180.191				92	69					42
							81					

PARTICULATE CLEANUP SHEET

Date: 11/8/71 Plant: HARVEY

Run Number: 1 Location of sample port: SECONDARY INLET

Operator: RAK Barometric Pressure: 29.65

Sample Box Number: — Ambient Temperature: 50

Impinger H_2O

Volume after sampling 146 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

Impinger prefilled with 200 ml Extra No. ____ Impinger water residue ____ mg

Volume Collected -54 ml

Impingers and back half of filter, acetone wash: Container No. 5 Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. 7 Extra No. ____ Weight results ____ mg

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

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-219	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	361.9				
Weight before test:	300.0				
Moisture weight collected:	61.9				Moisture Total 7.9 gm
Container Number: 4	1.	2.	3.	4.	

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY

Run No. 2

Location SECONDARY INLET

Date 11/9/71

Operator RAK

Sample Box No. —

Meter Box No. —

Meter H 1.89

C Factor —

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F-229

Ambient Temp °F 45

Bar.Press. "Hg 29.47

Assumed Moisture % 2

Heater Box Setting, °F 250

Probe Tip Dia., In. —

Probe Length 3'

Probe Heater Setting 65

Avg. ΔP ____ Avg. ΔH 2.481

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice Δ H in H_2O CFM	Orifice Δ H in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp °F
START	0850	137.966	—	—	2.60	72	49	22.0	—	—	—	45
1	0855	140.80	—	.567	2.60	72	49	22.0	—	—	—	45
2	0900	146.42	—	1.124	2.60	78	50	22.0	—	—	—	45
3	0905	150.67	—	.850	2.60	86	54	22.0	—	—	—	45
4	0910	154.89	—	.844	2.40	92	57	22.0	—	—	—	45
5	0915	159.16	—	854	2.50	95	60	22.0	—	—	—	45
6	0920	163.41	—	.850	2.50	90	63	22.0	—	—	—	45
7	0925	167.67	—	.852	2.50	97	65	22.0	—	—	—	45
8	0930	171.89	—	.844	2.50	99	66	22.0	—	—	—	45
9	0935	176.17	—	.856	2.50	101	68	22.0	—	—	—	45
10	0940	180.44	—	.854	2.50	100	69	22.0	—	—	—	45
11	0945	184.74	—	.860	2.50	98	70	22.0	—	—	—	45
12	0950	189.02	—	.856	2.50	99	70	22.0	—	—	—	45
13	0955	193.30	—	.856	2.50	101	71	22.0	—	—	—	50
14	1000	197.57	—	.854	2.50	104	72	22.0	—	—	—	50
15	1005	201.83	—	.852	2.50	104	72	22.0	—	—	—	50

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
				CFM	Actual	Inlet	Outlet					
16	1010	206.18	—	.870	2.45	105	74	22.0	—	—	—	45
17	1015	210.40	—	.844	2.45	105	75	22.0	—	—	—	45
18	1020	214.80	—	.880	2.45	104	72	22.0	—	—	—	45
19	1025	218.84	—	.808	2.45	104	75	22.0	—	—	—	50
20	1030	223.08	—	.848	2.45	104	75	22.0	—	—	—	45
21	1035	227.47	—	.878	2.45	104	75	22.0	—	—	—	45
22	1040	231.66	—	.838	2.45	104	75	22.0	—	—	—	45
23	1045	235.96	—	.860	2.45	104	75	22.0	—	—	—	45
24	1050	240.25	—	.858	2.45	103	75	22.0	—	—	—	50
25	1055	244.54	—	.858	2.45	103	75	22.0	—	—	—	50
26	1100	248.80	—	.852	2.45	103	75	22.0	—	—	—	50
27	1105	253.08	—	.856	2.45	103	75	22.0	—	—	—	50
28	1110	257.39	—	.862	2.45	103	75	22.0	—	—	—	50
29	1115	261.73	—	.868	2.45	103	75	22.0	—	—	—	50
30	1120	266.05	—	.864	2.45	103	76	22.0	—	—	—	50
31	1125	270.40	—	.870	2.45	103	76	22.0	—	—	—	50
32	1130	274.66	—	.852	2.45	103	76	22.0	—	—	—	50
33	1135	278.95	—	.858	2.45	102	76	22.0	—	—	—	50
34	1140	283.23	—	.856	2.45	100	76	22.0	—	—	—	50
35	1145	287.53	—	.860	2.45	100	76	22.0	—	—	—	50
FINAL	1150	291.834	—	.861	—	—	—	—	—	—	—	—
												47
NET TIME	180 MIN	153.869				99	70					
							85					

PARTICULATE CLEANUP SHEET

Date: 11/11/71 Plant: HARVEY

Run Number: 2 Location of sample port: SECONDARY INET

Operator: RAK Barometric Pressure: 29.47

Sample Box Number: — Ambient Temperature: 40

Impinger H_2O

Volume after sampling 176 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

Impinger prefilled with 200 ml Extra No. ____ Impinger water residue ____ mg

Volume Collected - 24 ml

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

Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. 7

Extra No. ____ Weight results ____ mg

Probe, cyclone, flask, and front half of filter, acetone wash: Container No. 2

Extra No. ____ Weight results ____ mg

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-229	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	343.7				
Weight before test:	300.0				
Moisture weight collected:	43.7				Moisture Total 19.7 gm
Container Number: 4	1.	2.	3.	4.	

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY

Run No. 3

Location SECONDARY INLET

Date 11/9/71

Operator RAK

Sample Box No. —

Meter Box No. —

Meter H 1.90

C Factor —

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F-299

Ambient Temp °F 40

Bar.Press. "Hg 29.64

Assumed Moisture % 2

Heater Box Setting, °F 250'

Probe Tip Dia., In. —

Probe Length 3'

Probe Heater Setting 65

Avg. ΔP ____ Avg. ΔH 3.169

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice Δ H in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp °F
				CFM	Actual	Inlet	Outlet					
START	1405	291.930	—	—	3.30	71	67	19.0	—	—	—	55
1	1410	296.92	—	.998	3.30	87	68	20.0	—	—	—	55
2	1415	301.96	—	1.008	3.30	95	70	20.0	—	—	—	55
3	1420	306.96	—	1.000	3.30	100	73	20.0	—	—	—	50
4	1425	311.96	—	1.000	3.30	101	74	20.0	—	—	—	55
5	1430	316.94	—	.996	3.30	101	75	20.0	—	—	—	55
6	1435	321.91	—	.994	3.30	101	75	20.0	—	—	—	55
7	1440	326.86	—	.990	3.10	105	78	20.0	—	—	—	55
8	1445	331.83	—	.994	3.10	103	78	20.0	—	—	—	55
9	1450	336.87	—	1.008	3.20	103	78	20.0	—	—	—	55
10	1455	341.89	—	1.004	3.20	101	79	20.0	—	—	—	50
11	1500	346.90	—	1.002	3.20	101	79	20.0	—	—	—	55
12	1505	351.94	—	1.008	3.20	100	78	20.0	—	—	—	50
13	1510	356.94	—	1.000	3.20	104	78	20.0	—	—	—	50
14	1515	361.94	—	1.000	3.20	104	78	20.0	—	—	—	50
15	1520	366.96	—	1.004	3.20	109	80	21.0	—	—	—	50

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O CFM	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
16	1525	372.03	—	1.014	3.30	111	80	21.0	—	—	—	50
17	1530	377.06	—	1.006	3.30	112	82	21.0	—	—	—	55
18	1535	382.08	—	1.004	3.30	112	82	21.0	—	—	—	55
19	1540	386.98	—	.980	3.30	110	83	21.0	—	—	—	50
20	1545	391.98	—	1.000	3.30	110	83	21.0	—	—	—	50
21	1550	396.80	—	.964	3.30	114	83	21.0	—	—	—	55
22	1555	401.75	—	.990	3.20	116	84	21.0	—	—	—	50
23	1600	406.69	—	.988	3.10	115	84	21.0	—	—	—	55
24	1605	411.62	—	.986	3.10	113	84	21.0	—	—	—	50
25	1610	416.60	—	.996	3.10	112	84	21.0	—	—	—	50
26	1615	421.45	—	.970	3.10	113	85	21.0	—	—	—	55
27	1620	426.35	—	.980	3.00	113	85	21.0	—	—	—	50
28	1625	431.25	—	.980	3.00	113	85	21.0	—	—	—	50
29	1630	436.12	—	.974	3.00	113	85	21.0	—	—	—	50
30	1635	440.98	—	.972	3.00	111	84	21.0	—	—	—	50
31	1640	445.82	—	.968	3.00	112	83	21.0	—	—	—	55
32	1645	450.65	—	.966	3.00	110	84	21.0	—	—	—	50
33	1650	455.46	—	.962	3.00	110	84	21.0	—	—	—	50
34	1655	460.32	—	.972	3.00	110	84	21.0	—	—	—	50
35	1700	465.12	—	.960	3.00	110	84	21.0	—	—	—	55
FINAL	1705	469.947	—	.965	—	—	—	—	—	—	—	—
NET TIME	180 MIN.	178.017				106	80					52
						93						

PARTICULATE CLEANUP SHEET

Date: 11/9/71 Plant: HARVEY

Run Number: 3 Location of sample port: SECONDARY INLET

Operator: RAK Barometric Pressure: 29.64

Sample Box Number: — Ambient Temperature: 40

Impinger H_2O

Volume after sampling 150 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

Impinger prefilled with 200 ml Extra No. ____ Impinger water residue ____ mg

Volume Collected -50 ml

Impingers and back half of filter, acetone wash: Container No. 5 Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. 7 Extra No. ____ Weight results ____ mg

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

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-299	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	341.5			
Weight before test:	300.0			
Moisture weight collected:	41.5			

Moisture Total -8.5 gm

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

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

SOURCE TESTING CALCULATION FORMS

Test No. — No. Runs 3

Name of Firm HARVEY Aluminum

Location of Plant The Dalles, Oregon

Type of Plant Primary Aluminum Reduction

Control Equipment Scrubber

Sampling Point Locations Secondary System Outlet

Pollutants Sampled Particulate

Time of Particulate Test:

Run No.	1	Date	11/8/71	Begin	1540	End	1840
Run No.	2	Date	11/9/71	Begin	0850	End	1150
Run No.	3	Date	11/9/71	Begin	1400	End	1700

PARTICULATE EMISSION DATA

Run No.	1	2	3	
P_b barometric pressure, "Hg Absolute	29.65	29.47	29.64	
P_m orifice pressure drop, "H_2O	3.431	2.400	2.400	
V_m volume of dry gas sampled @ meter conditions, $ft.^3$	182.1	155.6	152.8	
T_m Average Gas Meter Temperature, °F	92	84	92	
V_m Volume of Dry Gas Sampled @ Standard std. conditions, $ft.^3$	174.6	150.1	146.1	
V_w Total H_2O collected, ml., Impingers & Silica Gel.	49.9	32.2	60.4	
V_w gas Volume of Water Vapor Collected $ft.^3$ @ Standard Conditions*	2.365	1.526	2.863	

* 70°F, 29.92" Hg.

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PARTICULATE EMISSION DATA (cont'd)

Run No.	1	2	3	
%M - % Moisture in the stack gas by volume	1.337	1.006	1.922	
M_d - Mole fraction of dry gas	.987	.990	.981	
% CO_2 / % CO	0.00 / 0.02	0.00 / 0.03	0.00 / 0.03	/
% O_2	20.50	20.60	20.60	
% N_2	79.48	79.37	79.37	
M W $_d$ - Molecular weight of dry stack gas	28.82	28.82	28.82	
M W - Molecular weight of stack gas	28.68	28.72	28.62	
ΔP_s - Velocity Head of stack gas, In. H_2O	—	—	—	
T_s - Stack Temperature, °F	50	50	53	
$\sqrt{\Delta P_s X (T_s+460)}$	—	—	—	
P_s - Stack Pressure, "Hg. Absolute	29.65	29.47	29.64	
V_s - Stack Velocity @ stack conditions, fpm	725	725	725	
A_s - Stack Area, in.^{2}	27220	27220	27220	
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	139200	138900	137600	
T_t - Net Time of Test, min.	180	180	180	
D_n - Sampling Nozzle Diameter, in.	—	—	—	
%I - Percent isokinetic	—	—	—	
mf - Water Soluble Fluoride Filter & Impinger, mg.	—	—	—	
Mw - Water Soluble Fluoride Water Wash, mg.	—	—	—	
mt - Water Soluble Fluoride, total mg.	1.6	4.2	3.9	
MU - TOTAL INSOLUBLE FLUORIDE mg.	1.0	73.8	.70	
MV - TOTAL FLUORIDE mg	2.6	78	4.6	

PARTICULATE EMISSION DATA (cont'd)

Run No.	1	2	3	
CAL - WATER SOLUBLE FLUORIDE FRONT HALF, gr/SCF	—	—	—	
CAM - WATER SOLUBLE FLUORIDE BACK HALF, gr/SCF	—	—	—	
CAN - TOTAL WATER SOLUBLE FLUORIDE gr/SCF	1.41×10^{-4}	4.31×10^{-4}	4.11×10^{-4}	
CAO - TOTAL INSOLUBLE FLUORIDE, gr/SCF	$.882 \times 10^{-4}$	25.7×10^{-4}	$.74 \times 10^{-4}$	
CAP TOTAL FLUORIDE gr/SCF	2.29×10^{-4}	80.0×10^{-4}	4.85×10^{-4}	
CAQ WATER SOLUBLE FLUORIDE FRONT HALF gr/CF @ STACK CONDITION	—	—	—	
CAR WATER SOLUBLE FLUORIDE BACK HALF gr/CF @ STACK CONDITION	—	—	—	
CAS - TOTAL WATER SOLUBLE FLUORIDE gr/CF@ STACK CONDITION	1.43×10^{-4}	4.36×10^{-4}	4.14×10^{-4}	
CAT - TOTAL INSOLUBLE FLUORIDE gr/CF @ STACK CONDITION	$.896 \times 10^{-4}$	76.7×10^{-4}	$.75 \times 10^{-4}$	
CAU - TOTAL FLOURIDE gr/CF @ STACK CONDITION	2.33×10^{-4}	81.0×10^{-4}	4.89×10^{-4}	
CAV - WATER SOLUBLE FLUORIDE FRONT HALF, lb/hr	—	—	—	
CAW - WATER SOLUBLE FLUORIDE BACK HALF, lb/hr	—	—	—	
CAX - TOTAL WATER SOLUBLE FLUORIDE lb/hr	.168	.513	.485	
CAY - TOTAL INSOLUBLE FLUORIDE lb/hr	.105	9.01	.087	
CAZ - TOTAL FLOURIDE lb/hr	.273	9.52	.572	

.168 lb/hr .513 .485

YORK

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY

Run No. 1

Location SECONDARY OUTLET

Date 11/8/71

Operator RSE / KC

Sample Box No. —

Meter Box No. —

Meter H 1.90

C Factor —

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F-144

Ambient Temp °F 50

Bar.Press. "Hg 29.65

Assumed Moisture % —

Heater Box Setting, °F 250

Probe Tip Dia., In. —

Probe Length 6'

Probe Heater Setting 45

Avg. ΔP ____ Avg. ΔH 3.431

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice Δ H in H_2O CFM	Orifice Δ H in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp °F
START	1540	332.630	—	—	3.30	58	64	22.0	220	50	—	45
1	1545	337.20	—	.914	3.30	73	64	22.0	220	50	—	45
2	1550	342.21	—	1.002	3.30	94	64	22.0	250	50	—	50
3	1555	347.17	—	.992	3.30	98	66	22.0	250	50	—	50
4	1600	352.18	—	1.002	3.30	99	67	22.0	250	50	—	50
5	1605	357.02	—	.968	3.30	102	70	22.0	250	50	—	50
6	1610	361.95	—	.986	3.30	104	72	22.0	250	50	—	50
7	1615	366.90	—	.990	3.30	108	72	22.0	250	50	—	50
8	1620	371.88	—	.996	3.30	110	74	22.0	250	50	—	50
9	1625	376.94	—	1.012	3.30	110	75	22.0	250	50	—	50
10	1630	381.97	—	1.006	3.30	109	75	22.0	245	50	—	50
11	1635	387.10	—	1.026	3.30	109	75	22.0	240	50	—	50
12	1640	392.25	—	1.030	3.40	110	77	22.0	245	50	—	50
13	1645	397.37	—	1.024	3.50	110	77	22.0	250	50	—	50
14	1650	402.57	—	1.040	3.50	112	79	22.0	255	50	—	50
15	1655	407.78	—	1.042	3.50	112	79	22.0	255	50	—	50

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O CFM	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
16	1700	412.89	—	1.022	3.50	112	80	22.0	265	50	—	50
17	1705	418.10	—	1.042	3.50	112	80	22.0	270	50	—	50
18	1710	423.19	—	1.018	3.50	112	80	22.0	270	50	—	50
19	1715	428.40	—	1.042	3.50	112	80	22.0	270	50	—	50
20	1720	433.50	—	1.020	3.50	112	80	22.0	270	50	—	50
21	1725	438.65	—	1.030	3.50	112	80	22.0	265	50	—	50
22	1730	443.82	—	1.034	3.50	112	80	22.0	265	50	—	50
23	1735	449.00	—	1.036	3.50	112	80	22.0	270	50	—	50
24	1740	454.20	—	1.040	3.50	112	80	22.0	270	50	—	50
25	1745	459.22	—	1.004	3.50	112	80	22.0	270	50	—	50
26	1750	464.10	—	.976	3.50	112	80	22.0	260	50	—	50
27	1755	469.30	—	1.040	3.50	112	80	22.0	270	50	—	50
28	1800	474.70	—	1.080	3.50	112	80	22.0	270	50	—	50
29	1805	479.70	—	1.000	3.50	112	80	22.0	270	50	—	50
30	1810	484.80	—	1.020	3.50	112	80	22.0	275	50	—	50
31	1815	489.70	—	.980	3.50	112	80	22.0	270	50	—	50
32	1820	494.80	—	1.020	3.50	112	79	22.0	270	50	—	50
33	1825	499.80	—	1.000	3.50	112	79	22.0	270	50	—	50
34	1830	504.80	—	1.000	3.50	112	79	22.0	270	50	—	50
35	1835	509.60	—	.960	3.50	112	79	22.0	270	50	—	50
FINAL	1840	514.692	—	1.018	—	—	—	—	—	—	—	—
NET TIME	180 MIN	182.062				107	76					50
							92					

PARTICULATE CLEANUP SHEET

Date: 11/8/71 Plant: HARVEY

Run Number: 1 Location of sample port: SECONDARY OUTLET

Operator: RSE / KC Barometric Pressure: 29.65

Sample Box Number: — Ambient Temperature: 50

Impinger H_2O

Volume after sampling 205 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

Impinger prefilled with 200 ml Extra No. ____ Impinger water residue ____ mg

Volume Collected 5 ml

Impingers and back half of filter, acetone wash: Container No. 5 Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. 7 Extra No. ____ Weight results ____ mg

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

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-144	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	344.9			
Weight before test:	300.0			
Moisture weight collected:	44.9			Moisture Total 49.9 gm
Container Number: 4	1. ____	2. ____	3. ____	4. ____

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY

Run No. 2

Location SECONDARY Outlet

Date 11/9/71

Operator RWK / KC

Sample Box No. —

Meter Box No. —

Meter H 1.89

C Factor —

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F-262

Ambient Temp °F 50

Bar. Press. "Hg 29.47

Assumed Moisture % —

Heater Box Setting, °F 250

Probe Tip Dia., In. —

Probe Length 6'

Probe Heater Setting 65

Avg. ΔP ____ Avg. ΔH 2.40

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				CFM	Actual	Inlet	Outlet					
START	0850	514.768	—	—	2.40	42	42	23.0	250	55	—	50
1	0855	518.88	—	.822	2.40	52	42	23.0	250	55	—	50
2	0900	523.83	—	.830	2.40	66	44	23.0	250	55	—	50
3	0905	527.22	—	.838	2.40	74	47	23.0	250	55	—	50
4	0910	531.42	—	.840	2.40	82	50	23.0	250	55	—	50
5	0915	535.69	—	.854	2.40	88	52	23.0	250	65	—	50
6	0920	539.90	—	.842	2.40	92	58	23.0	250	65	—	50
7	0925	544.20	—	.860	2.40	96	62	23.0	250	65	—	50
8	0930	548.45	—	.850	2.40	98	64	22.0	250	70	—	50
9	0935	552.78	—	.866	2.40	102	66	22.0	250	70	—	50
10	0940	557.12	—	.868	2.40	104	68	22.0	250	70	—	50
11	0945	561.43	—	.862	2.40	104	70	22.0	250	70	—	50
12	0950	565.78	—	.870	2.40	104	72	22.0	250	70	—	50
13	0955	570.12	—	.868	2.40	104	72	22.0	250	70	—	50
14	1000	574.52	—	.880	2.40	104	72	22.0	250	70	—	50
15	1005	579.90	—	876	2.40	104	74	22.0	250	70	—	50

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
				CFM	Actual	Inlet	Outlet					
16	1010	583.27	—	.874	2.40	104	74	22.0	250	70	—	50
17	1015	587.65	—	.876	2.40	106	75	22.0	250	70	—	50
18	1020	592.00	—	.870	2.40	106	75	22.0	250	70	—	50
19	1025	596.37	—	.874	2.40	106	75	22.0	250	70	—	50
20	1030	600.73	—	.872	2.40	106	75	22.0	250	70	—	50
21	1035	605.10	—	.874	2.40	106	75	22.0	250	70	—	50
22	1040	609.46	—	.872	2.40	106	75	22.0	250	70	—	50
23	1045	613.80	—	.868	2.40	106	75	22.0	250	70	—	50
24	1050	618.15	—	.870	2.40	106	75	22.0	250	70	—	50
25	1055	622.50	—	.870	2.40	108	76	22.0	250	70	—	50
26	1100	626.84	—	.868	2.40	108	76	22.0	250	70	—	50
27	1105	631.27	—	.886	2.40	108	77	22.0	250	70	—	50
28	1110	635.58	—	.862	2.40	108	77	22.0	250	70	—	50
29	1115	639.98	—	.880	2.40	108	77	22.0	250	70	—	50
30	1120	644.29	—	.862	2.40	108	77	22.0	250	70	—	50
31	1125	648.75	—	.829	2.40	108	77	22.0	250	70	—	50
32	1130	652.99	—	.848	2.40	108	77	22.0	250	70	—	50
33	1135	657.36	—	.874	2.40	108	78	22.0	250	70	—	50
34	1140	661.79	—	.886	2.40	108	78	22.0	250	70	—	50
35	1145	666.05	—	.852	2.40	108	78	22.0	250	70	—	50
FINAL	1150	670.393	—	.869	—	—	—	—	—	—	—	—
NET TIME	180 MIN	155.625			2.40	99	69					50
							84					

PARTICULATE CLEANUP SHEET

Date: 11/9/71 Plant: HARVEY

Run Number: 2 Location of sample port: SECONDARY OUTLET

Operator: RWK/KC Barometric Pressure: 29.47

Sample Box Number: — Ambient Temperature: 50

Impinger H_2O

Volume after sampling 188 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

Impinger prefilled with 200 ml Extra No. ____ Impinger water residue ____ mg

Volume Collected −12 ml

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

Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. 7

Extra No. ____ Weight results ____ mg

Probe, cyclone, flask, and front half of filter, acetone wash: Container No. 2

Extra No. ____ Weight results ____ mg

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-262	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	344.2				
Weight before test:	300.0				
Moisture weight collected:	44.2				Moisture Total 32.2 gm

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

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730F

PARTICULATE FIELD DATA

Plant HARVEY

Run No. 3

Location SECONDARY OUTLET

Date 11/9/71

Operator RWK / KC

Sample Box No. —

Meter Box No. —

Meter H —

C Factor —

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER F —

Ambient Temp °F 50

Bar.Press. "Hg 29.64

Assumed Moisture % —

Heater Box Setting, °F 250

Probe Tip Dia., In. —

Probe Length 6'

Probe Heater Setting 65

Avg. ΔP ____ Avg. ΔH 2.40

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice Δ H in H_2O CFM	Orifice Δ H in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp °F
START	1400	670.437	—	—	2.40	58	58	22.0	230	55	—	50
1	1405	674.60	—	.833	2.40	62	65	22.0	250	55	—	50
2	1410	678.80	—	.840	2.40	75	68	22.0	260	55	—	50
3	1415	682.98	—	.836	2.40	88	72	22.0	270	55	—	50
4	1420	687.11	—	.974	2.40	92	72	22.0	270	55	—	50
5	1425	691.27	—	.832	2.40	94	72	22.0	270	55	—	50
6	1430	695.44	—	.834	2.40	98	72	22.0	270	55	—	50
7	1435	699.62	—	.836	2.40	108	72	22.0	270	55	—	50
8	1440	703.78	—	.832	2.40	108	74	22.0	280	55	—	50
9	1445	708.30	—	.904	2.40	108	76	22.0	270	55	—	50
10	1450	713.85	—	1.110	2.40	108	78	22.0	270	55	—	50
11	1455	717.20	—	.670	2.40	106	78	22.0	270	55	—	50
12	1500	720.85	—	.730	2.40	106	79	22.0	270	55	—	50
13	1505	725.10	—	.850	2.40	102	78	22.0	270	55	—	50
14	1510	729.25	—	.830	2.40	104	78	22.0	270	55	—	50
15	1515	733.80	—	.910	2.40	108	79	22.0	270	55	—	50

JOB NO. Y-7730F

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O CFM	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
16	1520	739.10	—	.830	2.40	110	80	22.0	270	50	—	55
17	1525	742.30	—	.840	2.45	110	80	22.0	270	50	—	55
18	1530	746.40	—	.820	2.40	110	80	22.0	270	50	—	55
19	1535	751.20	—	.860	2.40	110	80	22.0	270	50	—	55
20	1540	754.65	—	.690	2.40	110	80	22.0	270	50	—	55
21	1545	759.41	—	.952	2.40	110	80	22.0	270	50	—	55
22	1550	763.60	—	.838	2.40	112	84	22.0	270	50	—	55
23	1555	767.85	—	.850	2.40	116	85	22.0	280	50	—	55
24	1600	772.10	—	.850	2.40	114	86	22.0	280	50	—	55
25	1605	776.40	—	.860	2.40	114	86	22.0	280	50	—	55
26	1610	780.20	—	.760	2.40	114	85	22.0	280	50	—	55
27	1615	785.00	—	.960	2.40	114	85	22.0	280	50	—	55
28	1620	789.27	—	.854	2.40	114	85	22.0	280	50	—	55
29	1625	793.55	—	.856	2.40	114	85	22.0	280	50	—	55
30	1630	797.80	—	.850	2.40	114	85	22.0	280	50	—	55
31	1635	802.06	—	.852	2.40	114	85	22.0	280	50	—	55
32	1640	806.30	—	.848	2.40	114	85	22.0	280	50	—	55
33	1645	810.55	—	.740	2.40	114	85	22.0	280	50	—	55
34	1650	814.80	—	.850	2.40	114	85	22.0	280	50	—	55
35	1655	819.00	—	.840	2.40	114	85	22.0	280	50	—	55
FINAL	1700	823.209	—	.842	—	—	—	—	—	—	—	—
NET TIME	40 MIN	152.772				105	79					53
							92					

PARTICULATE CLEANUP SHEET

Date: 11/9/71 Plant: HARVEY

Run Number: 3 Location of sample port: SECONDARY OUTLET

Operator: RWK / KC Barometric Pressure: 29.64

Sample Box Number: — Ambient Temperature: 50

Impinger H_2O

Volume after sampling 204 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

Impinger prefilled with 200 ml Extra No. ____ Impinger water residue ____ mg

Volume Collected 4 ml

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

Extra No. ____ Weight results ____ mg

Dry probe and cyclone catch: Container No. 7

Extra No. ____ Weight results ____ mg

Probe, cyclone, flask, and front half of filter, acetone wash: Container No. 2

Extra No. ____ Weight results ____ mg

Filter Papers and Dry Filter Particulate

Filter Number	Container No.	Filter Number	Container No.
F-	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	356.4				
Weight before test:	300.0				
Moisture weight collected:	56.4				Moisture Total 60.4 gm
Container Number: 4	1.	2.	3.	4.	

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

SUMMARY OF SOURCE EMISSION TEST DATA

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Location of Test HARVEY ALUMINUM JOB NO.

Test Evaluation of ASME PRIMARY INLET

GENERAL DATA				
DATE OF TEST	11-11-71	11-11-71	11-11-71	
TEST NO.	1	2	3	
BAROMETRIC PRESSURE (" H_g)	29.66	29.47	29.57	
STACK PRESSURE (" H_g)	29.20	29.01	29.11	
AREA OF STACK (Sq. Ft.)	2.64	2.64	2.64	
ELAPSED SAMPLING TIME (Min.)	70	85	80	
GAS DATA				
AVERAGE GAS VELOCITY (Ft./Sec.)	56.52	54.80	54.81	
AVERAGE GAS TEMPERATURE (°F)	212	220	225	
GAS FLOW RATE (CFM)	8952.8	8680.3	8681.9	
APPARENT MOLECULAR WGT. (#/Cu.Ft.)	29.16	29.103	29.129	
GAS ANALYSIS, ORSAT BASIS:				
CO_2%	3.5	3.5	3.5	
O_2%	18.6	18.7	18.7	
CO%	0.6	0.0	0.0	
N_2%	77.3	77.8	77.8	
H_2O%	1.268	1.812	1.584	
PARTICULATE CONCENTRATION DATA				
VOLUME OF WATER CONDENSED (cc)	0	4	0	
WATER VAPOR VOLUME, METER CONDITION (CF)	.682	1.145	.877	
VOLUME OF GAS SAMPLED, METER CONDITION (CF)	53.77	65.75	55.35	
TOTAL VOLUME SAMPLED, METER CONDITION (CF)	53.77	65.937	55.35	
VOLUME OF GAS SAMPLED, STACK CONDITION (CF)	70.711	86.894	73.336	
VOLUME OF GAS SAMPLED, STANDARD CONDITION (CF)	54.274	65.493	55.057	
SOLUBLE FLUORIDES (NOZZLE WASH) mg	85.0	58.0	24.0	
INSOLUBLE FLUORIDES (NOZZLE WASH) mg	56.0	93.0	1.2	
SOLUBLE FLUORIDES (THIMBLE, IMPINGERS, IMPINGER WASH) mg	670.0	582.0	643.0	
INSOLUBLE FLUORIDES (THIMBLE, IMPINGERS, IMPINGER WASH) mg	406.0	398.0	398.0	
TOTAL FLUORIDES, mg	1217.0	1131.0	1066.2	
FLUORIDE EMISSION lb/TON TOTAL	38.59	28.57	31.73	

F⁻ EMISSION DATA

Primary Inlet #1

Run No.	Nozzle Soluable F⁻	Nozzle Insoluable F⁻	Thimble Impinger Wash Soluable F⁻	Thimble Impinger Wash Insoluable F⁻	Total	
Date	11/11/71	11/11/71	"/11/71	"/11/71	"/11/71	
mg F⁻	85	56.	670	406	1217	
T_m - Average Gas Meter Temperature, °F	60	60	60	60	60	
Pb - Barometric Pressure - "Hg abs.	29.66	29.66	29.66	29.66	29.66	
V_m - Volume of dry gas sampled @ meter conditions, ft.³	53.77	53.77	53.77	53.77	53.77	
SCFM	6760.	6760.	6760.	6760.	6760.	
lb F⁻/hr	1.40	.922	11.03	6.68	20.03	
Ton Al/hr	0.519	0.519	0.519	0.519	0.519	
lb F⁻/Ton Al	2.70	1.78	21.25	12.87	38.59	

$$\frac{\text{lb F}^-}{\text{hr}} = 7.77 \times 10^{-6} \frac{\text{mg F}^- (T_m + 460)\ \text{SCFM}}{V_m\ P_b}$$

F⁻ EMISSION DATA

Primary Inlet #2

Run No.	Nozzle Sol FO	Nozzle InSol FO	Thimple impinger Sol FO	Thimple impinger Insol FO	Total FO	
Date	11/10/71	11/10/71	11/10/71	11/10/71	11/10/71	
mg F⁻	58	93	582	398	1131	
T_m - Average Gas Meter Temperature, °F	60	60	60	60	60	
Pb - Barometric Pressure - "Hg abs.	29.47	29.47	29.47	29.47	29.47	
V_m - Volume of dry gas sampled @ meter conditions, ft.^{3}	65.75	65.75	65.75	65.75	65.75	
SCFM	6540	6540	6540	6540	6540	
lb F⁻/Hr.	.76	1.22	7.63	5.22	14.83	
Ton Al/Hr.	0.519	0.519	0.519	0.519	0.519	
lb F⁻/Ton Al	1.46	2.35	14.70	10.06	28.57	

$$\frac{\text{lb } F^-}{\text{Hr.}} = 7.47 \times 10^{-6} \frac{\text{mg } F^- (T_m + 460)\ \text{SCFM}}{V_m\ P_b}$$

QUALITY CONTROLLED YORK RESEARCH CORPORATION

F⁻ EMISSION DATA

Primary Inlet #3

Run No.	Nozzle Sol F⁻	Nozzle Insol F⁻	Thimble Impinger Sol F⁻	Thimble Impinger Insol F⁻	Total F⁻	
Date	11/11/71	11/11/71	11/11/71	11/11/71	11/11/71	
mg F⁻	24	1.2	643.	378.	1066.2	
T_m - Average Gas Meter Temperature, °F	60	60	60	60	60	
P_b - Barometric Pressure - "Hg abs.	29.57	29.57	29.57	29.57	29.57	
V_m - Volume of dry gas sampled @ meter conditions, ft.³	55.35	55.35	55.35	55.35	55.35	
SCFM	6510	6510	6510	6510	6510	
lb F⁻/Hr.	.37	.02	9.93	6.15	16.47	
Ton Al/Hr.	0.519	0.519	0.517	0.519	0.517	
lb F⁻/Ton Al	.71	.04	19.13	11.84	31.73	

$$\frac{\text{lb } F^-}{\text{Hr.}} = 7.47 \times 10^{-6} \frac{\text{mg } F^- (T_m + 460)\ \text{SCFM}}{V_m\ P_b}$$

QUALITY CONTROLLED YORK RESEARCH CORPORATION

York Research Corporation

ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06904

FIELD TEST DATA

REF. NO. Y- 7730F
PERSONNEL: MAERKER

CLIENT: EPA
LOCATION: HARVEY ALUM.
UNIT: PRIMARY INLET

DATE: 11/11/71
TEST NO. 1
FILTER NO. 6

P. BAR. 29.66
T. AMB. 40
CONDITIONS —

STACK NO. — DIM'N.: 22" DIA.
STACK LOCATION: PRIMARY INLET

TYPE OF TEST: ASME
ABSORB. SOL'N. DIST. H_2O

TEST LOCATION/ TIME	Δ P	Ts	Rm CFM	Tm	METER READING	CO_2	O_2
B14 1016	1.20	200	1.0	50	512.93		
1021	1.20	200	1.02	50	517.93		
1026	1.20	200	1.01	50	523.93		
1031	—	—	—	—	528.10		
A14 1045	0.50	215	desired 0.7 0.62	50	528.10		
1050	.150	215	.72	50	531.20		
1055	150	215	.74	50	534.82		
1100	150	215	.71	50	538.55		
1105	150	215	.66	50	542.12		
1110	150	215	.75	50	545.50		
1115	150	215	.73	50	550.01		
1120	150	215	.65	50	552.92		
1125	150	215	.69	50	556.25		
1130	.150	215	.70	55	559.71		
1135	.150	215	.70	55	563.24		
1140	—	—	—	—	566.70		
		212		51	53.77		

VELOCITY TRAVERSE DATA

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Location of Test PRIMARY INLET DATE OF TEST 11/11/71

Conditions ASME TEST NO. 1

Personnel JOB NO. Y-7730F

Ba. 29.66 " Hg AMBIENT TEMP. 40 °F STACK AREA 2.64 SQ. FT.

MOLECULAR WGT. 29.160 #/CU. FT.

$$V_s = \frac{2.90 \times F_s}{\sqrt{\frac{29.92}{P_s} \times \frac{28.95}{M.Wgt.} \times \Delta P \times T}}$$

Fs = 1.0 FOR STD. PITOT TUBE
Fs = 0.83 FOR TYPE "S" PITOT TUBE

$$K = \frac{2.90 \times .83}{\sqrt{\frac{29.92}{29.20} \times \frac{28.95}{29.16}}} = 2.43$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
B 14	200	660	-6.3	2.43	1.20	792.0	28.14	68.39
A 14	215	675	-6.3	2.43	.50	337.5	18.37	44.64
TOTAL	415	1335						113.03
READINGS	2	2						2
AVE.	208	668						56.52

GAS ANALYSIS

CLIENT EPA

Location of Test PRIMARY INLET

Conditions

DATE OF TEST 11/11/71

TEST NO. 1

JOB NO. Y-7730F

DRY MOLECULAR WEIGHT

	%	Bx	Mx	Bx Mx
CO_2	3.5	.035	44	1.540
O_2	18.6	.186	32	5.952
CO	0.6	.006	28	.168
N_2	77.3	.773	28	21.644

TOTAL 29.304 Mx(d)

TOTAL MOLECULAR WEIGHT

$M = M_x d_1 + M_x(H_2O)$

$M_x d_1 = (100\% - H_2O\%) \times M_x d$

(100% − 1.268) × 29.304

$M_x d_1$ = 28.932

$M_x (H_2O)$ = % H_2O × 18

1.268 × 18

$M_x (H_2O)$ = .228

M = 28.932 + .228 = 29.160

MOLECULAR WGT. OF STACK GAS = 29.160 LB./CU. FT.

TOTAL GAS ANALYSIS [WET]

H_2O _____

CO_2 _____

O_2 _____

CO _____

N_2 _____

1. CALCULATIONS - PER CENT MOISTURE

Client EPA Date of Test 11/11/71

Location of Test PRIMARY INLET Test No. 1

Job No. Y-7730F

V.P. = .3764 in. hg vapor pressure of water at meter temp.

Tm = 511 ° Temperature at meter in degrees absolute

Vm = 53.77 cu.ft. volume of gas as measured by meter

P_B = 29.66 in. Barometric pressure

V_w = 0 cc. volume of water condensed

1. Calculate water vapor volume remaining in metered gas at meter conditions in cu. ft. (M_M)

$$M_M = \frac{V.P. \times Vm}{P_B}$$

$$= \frac{.3764 \times 53.77}{29.66}$$

M_M = .682 c.f.

2. Convert condensate to water vapor volume at meter conditions (V_V)

$$V_V = 0.00267 \frac{Vw \times Tm}{P_B}$$

$$= 0.00267 \frac{\times 0 \times 511}{29.66}$$

Vv = 0 c.f.

3. Calculate the per cent moisture

$$\% = \frac{Vv + MM}{Vv + Vm} \times 100\%$$

$$= \frac{0 + .682}{0 + 53.77} \times 100\% = 1.268\ \%$$

2. CALCULATIONS - VOLUMETRIC

Client EPA Date of Test 11/11/71

Location of Test PRIMARY INLET Test No. 1

Job No. Y-7730F

1. Vw = 0 cc. volume of water condensed

2. Vv + MM = .682 c.f. water vapor volume, meter condition
(see "calculations-percent moisture" sheet)

3. Vm = 53.77 c.f. volume of gas sampled, meter condition

4. Total volume sampled, meter condition

= Vv (volume of water vapor condensed in cubic ft.)+Vm

= 0 + 53.77

= 53.77 cu.ft.

5. Volume of gas sampled, stack condition (Vt)

Tm = 511 ° temperature at meter in degrees absolute

Ts = 672 ° temperature in stack in degrees absolute

$$Vt = \frac{(Vm + Vv) \times Ts}{Tm}$$

$$= \frac{(53.77) \times 672}{511}$$

Vt = 70.711 c.f.

6. Volume of gas sampled, standard conditions* (60°F, 29.90" Hg)

$$Vst = (Vm + Vv) \times \frac{(Pb)}{(29.90")} \times \frac{(520°R)}{(Tm)}$$

$$= (53.77) \times \frac{29.66}{29.90"} \times \frac{520°F}{511} = 54.279 \text{ c.f.}$$

* Standard conditions for New Jersey: 70°F, 29.90" Hg

3. CALCULATIONS - DUST CONCENTRATION

Client EPA Date of Test 11/11/71

Location of Test PRIMARY INLET Test No. 1

Job No. Y-7730F

Wt = _____ Gm. filtered dust weight

Vt = 70.711 c.f. total sampled gas, stack conditions

Vst = 54.279 c.f. total sampled gas, standard conditions

CALCULATION OF GRAINS PER CUBIC FT.

$$\text{Grains/cu.ft.} = \frac{Wt}{Vt} \times 15.43$$

$$= \frac{\quad}{70.711} \times 15.43$$

= _____ grains/cu.ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. (GR)

$$GR = \frac{Wt}{Vst} \times 15.43$$

$$= \frac{\quad}{54.279} \times 15.43$$

GR = _____ grains/std. cu. ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. ADJUSTED TO 12% CO_2 (GR')

$$\frac{GR}{CO_2\%} = \frac{GR'}{12}$$

$$GR' = \frac{12\ GR}{CO_2\%}$$

$$= \frac{12\ x}{\quad}$$

GR' = _____ GR/std. cu. ft.

York Research Corporation

ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06904

FIELD TEST DATA

REF. NO. Y- 7730F
PERSONNEL: MAEKER

CLIENT: HARVEY - THE DALLES
LOCATION: PRIMARY INLET
UNIT: —

DATE: 11/11/71
TEST NO. 2
FILTER NO. 11

P. BAR. 29.47
T. AMB. 40°
CONDITIONS —

STACK NO. — DIM'N.: 22"
STACK LOCATION: —

TYPE OF TEST: ASME
ABSORB. SOL'N. NaOH

TEST LOCATION/ TIME	Δ P	Ts	Rm CFM	Tm	METER READING	CO_2	O_2
B-14 1505	1.10	230	1.02 desired 1.0	55	566.70		
1510	1.10	230	.99	57	571.73		
1515	1.10	230	.98	59	576.70		
1520	1.10	230	.97	60	581.60		
1525	1.10	230	.96	60	586.44		
1530	1.10	230	.93	60	591.23		
1535	1.10	230	.93	60	595.95		
1540	1.10	230	.93	60	600.63		
1545	1.10	230	—	—	605.29		
A-14 1600	0.45	210	0.56 depressed 0.59	52	605.29		
1605	.45	210	.45	52	608.25		
1610	.45	210	.76	52	610.52		
1615	.45	210	.65	55	614.32		
1620	.45	210	.58	55	617.60		
1625	.45	210	.57	55	620.58		
1630	.45	210	.57	55	623.34		
1635	.45	210	.63	55	626.18		
1640	.45	210	.62	55	629.33		
1645	—	—	—	—	632.45		
		220		56	65.75		

VELOCITY TRAVERSE DATA

CLIENT EPA

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Location of Test PRIMARY INLET

DATE OF TEST 11/11/71

Conditions ASME

TEST NO. 2

Personnel

JOB NO. Y-7730F

Ba. 29.47 " Hg

AMBIENT TEMP. 40 °F

STACK AREA 2.64 SQ. FT.

MOLECULAR WGT. 29.103 #/CU. FT.

$$Vs = \frac{2.90 \times Fs}{\sqrt{\frac{29.92}{Ps} \times \frac{28.95}{M.Wgt.} \times \Delta P \times T}}$$

Fs = 1.0 FOR STD. PITOT TUBE
Fs = 0.83 FOR TYPE "S" PITOT TUBE

$$K = \frac{2.90 \times .83}{\sqrt{\frac{29.92}{29.01} \times \frac{28.95}{29.103}}} = 2.44$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	$\sqrt{\Delta p \times T}$	VS Ft/Sec.
B-14	230	690	-6.3	2.44	1.10	759.0	27.55	67.22
A-14	210	670	-6.3	2.44	.45	301.5	17.36	42.37
TOTAL	440	1360						109.59
READINGS	2	2						2
AVE.	220	680						54.80

GAS ANALYSIS

CLIENT EPA

Location of Test PRIMARY INLET

Conditions

DATE OF TEST 11/11/71

TEST NO. 2

JOB NO. Y-7730F

DRY MOLECULAR WEIGHT

	%	Bx	Mx	Bx Mx
CO_2	3.5	.035	44	1.540
O_2	18.7	.187	32	5.984
CO	0.0	.000	28	.000
N_2	77.8	.778	28	21.784

TOTAL 29.308 Mx(d)

TOTAL MOLECULAR WEIGHT

$M = M_x d_1 + M_x(H_2O)$

$M_x d_1 = (100\% - H_2O\%) \times M_x d$

(100% − 1.812) × 29.308

$M_x d_1$ = 28.777

$M_x (H_2O)$ = % H_2O × 18

1.812 × 18

$M_x (H_2O)$ = .326

M = 28.777 + .326 = 29.103

MOLECULAR WGT. OF STACK GAS = 29.103 LB./CU. FT.

TOTAL GAS ANALYSIS [WET]

H_2O _____

CO_2 _____

O_2 _____

CO _____

N_2 _____

1. CALCULATIONS - PER CENT MOISTURE

Client EPA Date of Test 11/11/71

Location of Test PRIMARY INLET Test No. 2

Job No. Y-7730F

V.P. = .4520 in. hg vapor pressure of water at meter temp.

Tm = 516 ° Temperature at meter in degrees absolute

Vm = 65.75 cu.ft. volume of gas as measured by meter

P_B = 29.47 in. Barometric pressure

V_w = 4 cc. volume of water condensed

1. Calculate water vapor volume remaining in metered gas at meter conditions in cu. ft. (M_M)

$$M_M = \frac{V.P. \times Vm}{P_B}$$

$$= \frac{.4520 \times 65.75}{29.47}$$

M_M = 1.008 c.f.

2. Convert condensate to water vapor volume at meter conditions (V_v)

$$V_v = 0.00267 \frac{Vw \times Tm}{P_B}$$

$$= 0.00267 \times \frac{4 \times 516}{29.47}$$

Vv = .187 c.f.

3. Calculate the per cent moisture

$$\% = \frac{Vv + MM}{Vv + Vm} \times 100\%$$

$$= \frac{.187 + 1.008}{.187 + 65.75} \times 100\% = 1.812\ \%$$

2. CALCULATIONS - VOLUMETRIC

Client EPA Date of Test 11/11/71

Location of Test PRIMARY INLET Test No. 2

Job No. Y-7730F

1. Vw = 4 cc. volume of water condensed

2. Vv + MM = 1.195 c.f. water vapor volume, meter condition
(see "calculations-percent moisture" sheet)

3. Vm = 65.75 c.f. volume of gas sampled, meter condition

4. Total volume sampled, meter condition

= Vv (volume of water vapor condensed in cubic ft.)+Vm

= .187 + 65.75

=65.937 cu.ft.

5. Volume of gas sampled, stack condition (Vt)

Tm = 516 ° temperature at meter in degrees absolute

Ts = 680 ° temperature in stack in degrees absolute

$$Vt = \frac{(Vm + Vv) \times Ts}{Tm}$$

$$= \frac{(65.937) \times 680}{516}$$

Vt = 86.894 c.f.

6. Volume of gas sampled, standard conditions* (60°F, 29.90" Hg)

$$Vst = (Vm + Vv) \times \frac{(Pb)}{(29.90")} \times \frac{(520°R)}{(Tm)}$$

$$= (65.937) \times \frac{29.47}{29.90"} \times \frac{520°F}{516} = 65.493 \text{ c.f.}$$

* Standard conditions for New Jersey: 70°F, 29.90" Hg

3. CALCULATIONS - DUST CONCENTRATION

Client EPA Date of Test 11/11/71

Location of Test PRIMARY INLET Test No. 2

Job No. Y-7730F

Wt = _____ Gm. filtered dust weight

Vt = 86.894 c.f. total sampled gas, stack conditions

Vst = 65.493 c.f. total sampled gas, standard conditions

CALCULATION OF GRAINS PER CUBIC FT.

$$\text{Grains/cu.ft.} = \frac{Wt}{Vt} \times 15.43$$

$$= \frac{\quad}{86.894} \times 15.43$$

= _____ grains/cu.ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. (GR)

$$GR = \frac{Wt}{Vst} \times 15.43$$

$$= \frac{\quad}{65.493} \times 15.43$$

GR = _____ grains/std. cu. ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. ADJUSTED TO 12% CO_2 (GR')

$$\frac{GR}{CO_2\%} = \frac{GR'}{12}$$

$$GR' = \frac{12\ GR}{CO_2\%}$$

$$= \frac{12 \times \quad}{\quad}$$

GR' = _____ GR/std. cu. ft.

York Research Corporation

ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06904

FIELD TEST DATA

REF. NO. Y-7730F
PERSONNEL: LOU & RICH

CLIENT: HARVEY
LOCATION: PRIMARY INLET
UNIT: —

DATE: 11/11/71
TEST NO. 3
FILTER NO. 10

P. BAR. 29.57
T. AMB. 40°
CONDITIONS —

STACK NO. — DIM'N.: 22"
STACK LOCATION: —

TYPE OF TEST: ASME
ABSORB. SOL'N. NaOH

TEST LOCATION/ TIME	Δ P	Ts	Rm CFM	Tm	METER READING	CO_2	O_2
A-14 1910	0.45	210	0.60	48	632.45		
1915	.45	210	.52	52	635.30		
1920	.45	210	.60	52	637.93		
1925	.45	210	.60	53	640.91		
1930	.45	210	.60	54	643.95		
1935	.45	210	.60	54	646.97		
1940	.45	210	.55	56	649.98		
1945	.45	210	.55	56	652.70		
1950	—	—	—	—	655.42		
B-14 1955	1.10	240	Desired 1.0 0.84	59	655.42		
2000	1.10	240	0.95	61	659.60		
2005	1.10	240	.96	61	664.36		
2010	1.10	240	.93	61	669.15		
2015	1.10	240	.94	61	673.81		
2020	1.10	240	.94	63	678.50		
2025	1.10	240	.92	63	683.19		
2030	1.10	240	—	—	687.80		
		225		57	55.35		

VELOCITY TRAVERSE DATA

CLIENT EPA

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Location of Test PRIMARY INLET

DATE OF TEST 11/11/71

Conditions ASME

TEST NO. 3

Personnel

JOB NO.

Ba. 29.57 " Hg

AMBIENT TEMP. 40 °F

STACK AREA 2.64 SQ. FT.

MOLECULAR WGT. 29.129 #/CU. FT.

$$V_s = \frac{2.90 \times F_s}{\sqrt{\frac{29.92}{P_s} \times \frac{28.95}{M.Wgt.} \times \Delta P \times T}}$$

F_s = 1.0 FOR STD. PITOT TUBE
F_s = 0.83 FOR TYPE "S" PITOT TUBE

$$K = \frac{2.90 \times .83}{\sqrt{\frac{29.92}{29.11} \times \frac{28.95}{29.129}}} = 2.43$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
A-14	210	670	-6.3	2.43	.45	301.5	17.36	42.19
B-14	240	700	-6.3	2.43	1.10	770.0	27.75	67.43
TOTAL	450	1370						109.52
READINGS	2	2						2
AVE.	225	685						54.81

GAS ANALYSIS

CLIENT EPA

Location of Test PRIMARY INLET

Conditions

DATE OF TEST 11/11/71

TEST NO. 3

JOB NO. Y-7730F

DRY MOLECULAR WEIGHT

	%	Bx	Mx	Bx Mx
CO_2	3.5	.035	44	1.540
O_2	18.7	.187	32	5.984
CO	0.0	.000	28	.000
N_2	77.8	.778	28	21.784

TOTAL 29.308 Mx(d)

TOTAL MOLECULAR WEIGHT

$M = M_x d_1 + M_x(H_2O)$

$M_x d_1 = (100\% - H_2O\%) \times M_x d$

(100% − 1.584) × 29.308

$M_x d_1$ = 28.844

$M_x (H_2O)$ = % H_2O × 18

1.584 × 18

$M_x (H_2O)$ = .285

M = 28.844 + .285 = 29.129

MOLECULAR WGT. OF STACK GAS = 29.129 LB./CU. FT.

TOTAL GAS ANALYSIS [WET]

H_2O _____

CO_2 _____

O_2 _____

CO _____

N_2 _____

1. CALCULATIONS - PER CENT MOISTURE

Client EPA Date of Test 11/11/71

Location of Test PRIMARY INLET Test No. 3

Job No. Y-7730F

V.P. = .486 in. hg vapor pressure of water at meter temp.

Tm = 517 ° Temperature at meter in degrees absolute

Vm = 55.35 cu.ft. volume of gas as measured by meter

P_B = 29.57 in. Barometric pressure

V_W = 0 cc. volume of water condensed

1. Calculate water vapor volume remaining in metered gas at meter conditions in cu. ft. (M_M)

$$M_M = \frac{V.P. \times Vm}{P_B}$$

$$= \frac{.486 \times 55.35}{29.57}$$

M_M = .877 c.f.

2. Convert condensate to water vapor volume at meter conditions (V_V)

$$V_V = 0.00267 \frac{Vw \times Tm}{P_B}$$

$$= 0.00267 \frac{\times 0 \times 517}{29\,57}$$

Vv = 0 c.f.

3. Calculate the per cent moisture

$$\% = \frac{Vv + MM}{Vv + Vm} \times 100\%$$

$$= \frac{0 + .877}{0 + 55.35} \times 100\% = 1.584\ \%$$

2. CALCULATIONS - VOLUMETRIC

Client EPA Date of Test 11/11/71

Location of Test PRIMARY INLET Test No. 3

Job No. Y-7730F

1. Vw = 0 cc. volume of water condensed

2. Vv + MM = .877 c.f. water vapor volume, meter condition
(see "calculations-percent moisture" sheet)

3. Vm = 55.35 c.f. volume of gas sampled, meter condition

4. Total volume sampled, meter condition

= Vv (volume of water vapor condensed in cubic ft.)+Vm

= 0 + 55.35

= 55.35 cu.ft.

5. Volume of gas sampled, stack condition (Vt)

Tm = 517 ° temperature at meter in degrees absolute

Ts = 685 ° temperature in stack in degrees absolute

$$Vt = \frac{(Vm + Vv) \times Ts}{Tm}$$

$$= \frac{(55.35) \times 685}{517}$$

Vt = 73.336 c.f.

6. Volume of gas sampled, standard conditions* (60°F, 29.90" Hg)

$$Vst = (Vm + Vv) \times \frac{(Pb)}{(29.90")} \times \frac{(520°R)}{(Tm)}$$

$$= (55.35) \times \frac{29.57}{29.90"} \times \frac{520°F}{517} = 55.057 \text{ c.f.}$$

* Standard conditions for New Jersey: 70°F, 29.90" Hg

3. CALCULATIONS - DUST CONCENTRATION

Client EPA Date of Test 11/11/71

Location of Test PRIMARY INLET Test No. 3

Job No. Y-7730F

Wt = _____ Gm. filtered dust weight

Vt = 73.336 c.f. total sampled gas, stack conditions

Vst = 55.057 c.f. total sampled gas, standard conditions

CALCULATION OF GRAINS PER CUBIC FT.

$$\text{Grains/cu.ft.} = \frac{Wt}{Vt} \times 15.43$$

$$= \frac{\quad}{73336} \times 15.43$$

= _____ grains/cu.ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. (GR)

$$GR = \frac{Wt}{Vst} \times 15.43$$

$$= \frac{\quad}{55.057} \times 15.43$$

GR = _____ grains/std. cu. ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. ADJUSTED TO 12% CO_2 (GR')

$$\frac{GR}{CO_2\%} = \frac{GR'}{12}$$

$$GR' = 12\,\frac{GR}{CO_2\%}$$

$$= \frac{12 \times}{\quad}$$

GR' = _____ GR/std. cu. ft.

SUMMARY OF SOURCE EMISSION TEST DATA

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Location of Test PRIMARY OUTLET JOB NO. Y-7730-F

Test Evaluation of ASME

GENERAL DATA				
DATE OF TEST	11-11-71	11-11-71	11-11-71	
TEST NO.	1	2	3	
BAROMETRIC PRESSURE (" H_g)	29.66	29.47	29.59	
STACK PRESSURE (" H_g)	29.66	29.47	29.59	
AREA OF STACK (Sq. Ft.)	7.07	7.07	7.07	
ELAPSED SAMPLING TIME (Min.)	100	90	70	
GAS DATA				
AVERAGE GAS VELOCITY (Ft./Sec.)	17.71	17.78	17.70	
AVERAGE GAS TEMPERATURE (°F)	80	80	75	
GAS FLOW RATE (CFM)	7512.5	7543.7	7508.3	
APPARENT MOLECULAR WGT. (#/Cu.Ft.)	29.109	28.964	28.897	
GAS ANALYSIS, ORSAT BASIS:				
CO_2%	3.5	3.5	3.5	
O_2%	18.7	18.7	18.7	
CO%	0.3	0.0	0.0	
N_2%	77.5	77.8	77.8	
H_2O%	1.759	3.044	3.639	
PARTICULATE CONCENTRATION DATA				
VOLUME OF WATER CONDENSED (cc)	0	18	12	
WATER VAPOR VOLUME, METER CONDITION (CF)	1.227	1.990	1.784	
VOLUME OF GAS SAMPLED, METER CONDITION (CF)	69.77	64.52	48.45	
TOTAL VOLUME SAMPLED, METER CONDITION (CF)	69.77	65.368	49.024	
VOLUME OF GAS SAMPLED, STACK CONDITION (CF)	72.453	67.882	49.486	
VOLUME OF GAS SAMPLED, STANDARD CONDITION (CF)	69.210	64.428	47.600	
SOLUBLE FLUORIDES (NOZZLE WASH) mg	3.6	1.9	5.2	
INSOLUBLE FLUORIDES (NOZZLE WASH) mg	0.9	0.5	1.2	
SOLUBLE FLUORIDES (THIMBLE, IMPINGERS IMPINGER WASH) mg	22.3	31.5	14.0	
INSOLUBLE FLUORIDES (THIMBLE, IMPINGERS IMPINGER WASH) mg	7.0	16.4	23.3	
TOTAL FLUORIDES	33.8	50.3	43.7	
FLUORIDE EMISSION Lbs/TON TOTAL	.877	1.418	1.647	

F⁻ EMISSION DATA

Primary Outlet #1 — Nozzle — Thimble Impinger

Run No.	Sol FO	Insol FO	Sol FO	Insol FO	Total FO	
Date	"/"/71	"/"/71	"/"/71	"/"/71	"/"/71	
mg F⁻	3.6	0.9	22.3	7.0	33.8	
T_m - Average Gas Meter Temperature, °F	60	60	60	60	60	
P_b - Barometric Pressure - "Hg abs.	29.66	29.66	29.66	29.66	29.66	
V_m - Volume of dry gas sampled @ meter conditions, ft.^{3}	69.77	69.77	69.77	69.77	69.77	
SCFM	7170	7170	7170	7170	7170	
lb F⁻/Hr.	.048	.012	.300	.094	.455	
TON Al/Hr.	0.519	0.519	0.519	0.519	0.519	
lb F⁻/TON Al	.092	.023	.578	.181	.877	

$$\frac{\text{lb } F^-}{\text{Hr.}} = 7.47 \times 10^{-6} \frac{\text{mg } F^- (T_m + 460)\ \text{SCFM}}{V_m\ P_b}$$

QUALITY CONTROLLED YORK RESEARCH CORPORATION

F⁻ EMISSION DATA

Primary Outlet #2 — Nozzle — Thimble impinger

Run No.	Sol FO	Insol FO	Sol FO	Insol FO	Total	
Date	11/1/71	11/1/71	11/1/71	11/1/71	11/1/71	
mg F⁻	1.9	0.5	31.5	16.4	50.3	
T_m - Average Gas Meter Temperature, °F	60	60	60	60	60	
P_b - Barometric Pressure - "Hg abs.	29.47	29.47	29.47	29.47	29.47	
V_m - Volume of dry gas sampled @ meter conditions, ft.³	64.52	64.52	64.52	64.52	64.52	
SCFM	7160.	7160	7160.	7160.	7160.	
lb F⁻/Hr.	.028	.007	.461	.240	.736	
Ton Al/Hr.	0.519	0.519	0.519	0.519	0.519	
lb F⁻/Ton Al	.054	.013	.888	.462	1.418	

$$\frac{\text{lb } F^-}{\text{Hr.}} = 7.47 \times 10^{-6} \frac{\text{mg } F^- (T_m + 460)\ \text{SCFM}}{V_m\ P_b}$$

QUALITY CONTROLLED YORK RESEARCH CORPORATION

F⁻ EMISSION DATA

Primary Outlet #3 Nozzle Impinger Thimble

Run No.	Sol FO	Insol FO	Sol FO	Insol FO	Total FO	
Date	11/1/71	11/1/71	11/1/71	11/1/71	11/1/71	
mg F⁻	5.2	1.2	14.0	23.3	43.7	
T_m - Average Gas Meter Temperature, °F	75	75	75	75	75	
P_b - Barometric Pressure - "Hg abs.	29.59	29.59	29.59	29.59	29.59	
V_m - Volume of dry gas sampled @ meter conditions, ft.³	48.45	48.45	48.45	48.45	48.45	
SCFM	7220	7220	7220	7220	7220.	
lb F⁻/Hr.	.102	.023	.274	.456	.855	
Ton Al/Hr.	0.519	0.519	0.519	0.519	0.519	
lb F⁻/Ton Al	.197	.044	.528	.879	1.647	

$$\frac{\text{lb } F^-}{\text{Hr.}} = 7.47 \times 10^{-6} \frac{\text{mg } F^- (T_m + 460)\ \text{SCFM}}{V_m\ P_b}$$

QUALITY CONTROLLED YORK RESEARCH CORPORATION

York Research Corporation

ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06904

FIELD TEST DATA

REF. NO. Y-7730F
PERSONNEL: RSE

CLIENT: EPA
LOCATION: HARVEY ALUMINUM
UNIT: PRIMARY

DATE: 11/11/71
TEST NO. 1
FILTER NO. 5

P. BAR. 29.66
T. AMB. 40°
CONDITIONS —

STACK NO. — DIM'N.: 3'
STACK LOCATION: OUTLET

TYPE OF TEST: ASME
ABSORB. SOL'N. NaOH

TEST LOCATION/ TIME		Δ P	Ts	Rm CFM	Tm	METER READING	CO_2	O_2
POINT #5 1020	1	.10	80	—	—	292.31		
1025	2	.10	80	.31	60	293.90		
1030	3	.10	80	.88	60	298.50		
1035	4	.10	80	1.26	60	304.82		
1040	5	.10	80	.44	60	307.00		
1045	6	.10	80	.90	60	311.50		
1050	7	.10	80	.60	60	314.50		
1055	8	.10	80	.53	60	317.15		
1100	9	.10	80	.81	60	321.20		
1105	10	.10	80	.80	60	325.20		
1110	11	.10	80	.81	60	329.25		
1115	12	.10	80	.75	60	333.00		
1120	13	.10	80	.76	60	336.80		
1125	14	.10	80	.80	60	340.80		
1130	15	.10	80	.76	60	344.40		
1135	16	.10	80	.72	60	348.00		
1140	17	.10	80	.74	60	351.70		
1145	18	.10	80	.67	60	355.05		
1150	19	.10	80	.72	60	358.65		
1155	20	.10	80	.52	60	361.25		
1200	END	.10	80	.36	60	362.08		
NET TIME 100 MIN.			80		60	69.77		

VELOCITY TRAVERSE DATA

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Location of Test PRIMARY OUTLET DATE OF TEST 11/11/71

Conditions _____ TEST NO. 1

Personnel _____ JOB NO. Y-7730F

Ba. 29.66 " Hg AMBIENT TEMP. 40 °F STACK AREA 7.07 SQ. FT.

MOLECULAR WGT. 29.109 #/CU. FT.

$$Vs = \frac{2.90 \times Fs}{\sqrt{\frac{29.92}{Ps} \times \frac{28.95}{M.Wgt.} \times \Delta P \times T}}$$

Fs = 1.0 FOR STD. PITOT TUBE
Fs = 0.83 FOR TYPE "S" PITOT TUBE

$$K = \frac{2.90 \times .83}{\sqrt{\frac{29.92}{29.66} \times \frac{28.95}{29.109}}} = 2.41$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	$\sqrt{\Delta p \times T}$	VS Ft/Sec.
5	80	540	—	2.41	.10	54.0	7.35	17.71
TOTAL	80	540						17.71
READINGS	1	1						1
AVE.	80	540						17.71

GAS ANALYSIS

CLIENT EPA

Location of Test PRIMARY OUTLET

Conditions

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DATE OF TEST 11/11/71

TEST NO. 1

JOB NO. Y-7730F

DRY MOLECULAR WEIGHT

	%	Bx	Mx	Bx Mx
CO_2	3.5	.035	44	1.540
O_2	18.7	.187	32	5.984
CO	.3	.003	28	.084
N_2	77.5	.775	28	21.700

TOTAL 29.308 Mx(d)

TOTAL MOLECULAR WEIGHT

$M = M_x d_1 + M_x(H_2O)$

$M_x d_1 = (100\% - H_2O\%) \times M_x d$

(100% − 1.759) × 29.308

$M_x d_1$ = 28.792

$M_x (H_2O)$ = % H_2O × 18

1.759 × 18

$M_x (H_2O)$ = .317

M = 28.792 + .317 = 29.109

MOLECULAR WGT. OF STACK GAS = 29.109 LB./CU. FT.

TOTAL GAS ANALYSIS [WET]

H_2O _____

CO_2 _____

O_2 _____

CO _____

N_2 _____

1. CALCULATIONS - PER CENT MOISTURE

Client EPA Date of Test 11/11/71

Location of Test PRIMARY OUTLET Test No. 1

Job No. Y-7730F

V.P. = .5218 in. hg vapor pressure of water at meter temp.

Tm = 520 ° Temperature at meter in degrees absolute

Vm = 69.77 cu.ft. volume of gas as measured by meter

P_B = 29.66 in. Barometric pressure

V_w = 0 cc. volume of water condensed

1. Calculate water vapor volume remaining in metered gas at meter conditions in cu. ft. (M_M)

$$M_M = \frac{V.P. \times Vm}{P_B}$$

$$= \frac{.5218 \times 69.77}{29.66}$$

M_M = 1.227 c.f.

2. Convert condensate to water vapor volume at meter conditions (V_v)

$$V_v = 0.00267 \frac{Vw \times Tm}{P_B}$$

$$= 0.00267 \frac{\times 0 \times 520}{29.66}$$

Vv = 0 c.f.

3. Calculate the per cent moisture

$$\% = \frac{Vv + MM}{Vv + Vm} \times 100\%$$

$$= \frac{0 + 1.227}{0 + 69.77} \times 100\% = 1.759\ \%$$

2. CALCULATIONS - VOLUMETRIC

Client EPA Date of Test 11/11/71

Location of Test PRIMARY OUTLET Test No. 1

Job No. Y-7730F

1. Vw = 0 cc. volume of water condensed

2. Vv + MM = 1.227 c.f. water vapor volume, meter condition
(see "calculations-percent moisture" sheet)

3. Vm = 69.77 c.f. volume of gas sampled, meter condition

4. Total volume sampled, meter condition

= Vv (volume of water vapor condensed in cubic ft.)+Vm

= 0 + 69.77

= 69.77 cu.ft.

5. Volume of gas sampled, stack condition (Vt)

Tm = 520 ° temperature at meter in degrees absolute

Ts = 540 ° temperature in stack in degrees absolute

$$Vt = \frac{(Vm + Vv) \times Ts}{Tm}$$

$$= \frac{(69.77) \times 540}{520}$$

Vt = 72.453 c.f.

6. Volume of gas sampled, standard conditions* (60°F, 29.90" Hg)

$$Vst = (Vm + Vv) \times \frac{(Pb)}{(29.90")} \times \frac{(520°R)}{(Tm)}$$

$$= (69.77) \times \frac{29.66}{29.90"} \times \frac{520°F}{520} = 69.210 \text{ c.f.}$$

* Standard conditions for New Jersey: 70°F, 29.90" Hg

3. CALCULATIONS - DUST CONCENTRATION

Client EPA Date of Test 11/11/71

Location of Test PRIMARY OUTLET Test No. 1

Job No. Y-7730F

Wt = _____ Gm. filtered dust weight

Vt = 72.453 c.f. total sampled gas, stack conditions

Vst = 69.210 c.f. total sampled gas, standard conditions

CALCULATION OF GRAINS PER CUBIC FT.

$$\text{Grains/cu.ft.} = \frac{Wt}{Vt} \times 15.43$$

$$= \frac{\quad}{72.453} \times 15.43$$

= _____ grains/cu.ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. (GR)

$$GR = \frac{Wt}{Vst} \times 15.43$$

$$= \frac{\quad}{69.210} \times 15.43$$

GR = _____ grains/std. cu. ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. ADJUSTED TO 12% CO_2 (GR')

$$\frac{GR}{CO_2\%} = \frac{GR'}{12}$$

$$GR' = \frac{12\ GR}{CO_2\%}$$

$$= \frac{12 \times \quad}{\quad}$$

GR' = _____ GR/std. cu. ft.

York Research Corporation

ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06904

FIELD TEST DATA

REF. NO. Y- 7730F
PERSONNEL: RSE

CLIENT: EPA
LOCATION: HARVEY ALUMINUM
UNIT: PRIMARY

DATE: 11/11/71
TEST NO. 2
FILTER NO. 8 + 12

P. BAR. 29.47
T. AMB. 40
CONDITIONS -

STACK NO. - DIM'N.: 3'
STACK LOCATION: OUTLET

TYPE OF TEST: ASME
ABSORB. SOL'N. NaOH

TEST LOCATION/ TIME		Δ P	Ts	Rm CFM	Tm	METER READING	CO_2	O_2
1505	1	.10	80	—	60	362.08		
1510	2	.10	80	.98	60	367.00		
1515	3	.10	80	1.02	60	372.20		
1520	4	.10	80	.82	60	376.26		
1525	5	.10	80	.92	60	380.70		
80 1530	6	.10	80	.68	60	383.90		
FILTER 1535	7	.10	80	.75	60	387.60		
1540	8	.10	80	.82	60	391.70		
1545	9	.10	80	.74	60	395.40		
1550	10	.10	80	.82	60	399.50		
1555	11	.10	80	.90	60	403.00		
1600	12	.10	80	.40	60	405.00		
1605	13	.10	80	.20	60	406.00		
1625	(START)	—	—	—	—	406.00		
1630	14	.10	80	1.00	60	411.00		
FILTER 12 1635	15	.10	80	.93	60	415.65		
1640	16	.10	80	.75	60	419.40		
1645	17	.10	80	.52	60	422.00		
1650	18	.10	80	.46	60	424.30		
1655	END	.10	80	.46	60	426.60		
NET TIME 90 MIN			80		60	64.52		

VELOCITY TRAVERSE DATA

CLIENT EPA PAGE 116 OF 166

Location of Test PRIMARY OUTLET DATE OF TEST 11/11/71

Conditions _____ TEST NO. 2

Personnel _____ JOB NO. Y-7730F

Ba. 29.47 " Hg AMBIENT TEMP. 40 °F STACK AREA 7.07 SQ. FT.

MOLECULAR WGT. 28.964 #/CU. FT.

$$Vs = \frac{2.90 \times Fs}{\sqrt{\frac{29.92}{Ps} \times \frac{28.95}{M.Wgt.} \times \Delta P \times T}}$$

Fs = 1.0 FOR STD. PITOT TUBE
Fs = 0.83 FOR TYPE "S" PITOT TUBE

$$K = \frac{2.90 \times .83}{\sqrt{\frac{29.92}{29.47} \times \frac{28.95}{28.964}}} = 2.42$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °A T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
5	80	540	—	2.42	.10	54.0	7.35	17.78
TOTAL	80	540						17.78
READINGS	1	1						1
AVE.	80	540						17.78

GAS ANALYSIS

CLIENT EPA

DATE OF TEST 11/11/71

Location of Test PRIMARY OUTLET

TEST NO. 2

Conditions

JOB NO. Y-7730F

DRY MOLECULAR WEIGHT

	%	Bx	Mx	Bx Mx
CO_2	3.5	.035	44	1.540
O_2	18.7	.187	32	5.984
CO	0.0	.000	28	.000
N_2	77.8	.778	28	21.784

TOTAL 29.308 Mx(d)

TOTAL MOLECULAR WEIGHT

$M = M_x d_1 + M_x(H_2O)$

$M_x d_1 = (100\% - H_2O\%) \times M_x d$

(100% − 3.044) × 29.308

$M_x d_1$ = 28.416

$M_x (H_2O)$ = % H_2O × 18

3.044 × 18

$M_x (H_2O)$ = .548

M = 28.416 + .548 = 28.964

MOLECULAR WGT. OF STACK GAS = 28.964 LB./CU. FT.

TOTAL GAS ANALYSIS [WET]

H_2O _____

CO_2 _____

O_2 _____

CO _____

N_2 _____

1. CALCULATIONS - PER CENT MOISTURE

Client EPA Date of Test 11/11/71

Location of Test PRIMARY OUTLET Test No. 2

Job No. Y-7730F

V.P. = .5218 in. hg vapor pressure of water at meter temp.

Tm = 560 ° Temperature at meter in degrees absolute

Vm = 64.52 cu.ft. volume of gas as measured by meter

P_B = 29.47 in. Barometric pressure

V_w = 18 cc. volume of water condensed

1. Calculate water vapor volume remaining in metered gas at meter conditions in cu. ft. (M_M)

$$M_M = \frac{V.P. \times Vm}{P_B}$$

$$= \frac{.5218 \times 64.52}{29.47}$$

M_M = 1.142 c.f.

2. Convert condensate to water vapor volume at meter conditions (V_V)

$$V_V = 0.00267 \frac{Vw \times Tm}{P_B}$$

$$= 0.00267 \frac{18 \times 520}{29.47}$$

Vv = .848 c.f.

3. Calculate the per cent moisture

$$\% = \frac{Vv + MM}{Vv + Vm} \times 100\%$$

$$= \frac{.848 + 1.142}{.848 + 64.52} \times 100\% = 3.044\ \%$$

2. CALCULATIONS - VOLUMETRIC

Client EPA Date of Test 11/11/71

Location of Test PRIMARY OUTLET Test No. 2

Job No. Y-7730F

1. Vw = 18 cc. volume of water condensed

2. Vv + MM = 1.990 c.f. water vapor volume, meter condition
(see "calculations-percent moisture" sheet)

3. Vm = 64.52 c.f. volume of gas sampled, meter condition

4. Total volume sampled, meter condition

= Vv (volume of water vapor condensed in cubic ft.)+Vm

= .848 + 64.52

=65.368 cu.ft.

5. Volume of gas sampled, stack condition (Vt)

Tm = 520 ° temperature at meter in degrees absolute

Ts = 540 ° temperature in stack in degrees absolute

$$Vt = \frac{(Vm + Vv) \times Ts}{Tm}$$

$$= \frac{(65.368) \times 540}{520}$$

Vt = 67.882 c.f.

6. Volume of gas sampled, standard conditions* (60°F, 29.90" Hg)

$$Vst = (Vm + Vv) \times \frac{(Pb)}{(29.90")} \times \frac{(520°R)}{(Tm)}$$

$$= (65.368) \times \frac{29.47}{29.90"} \times \frac{520°F}{520} = 64.428 \text{ c.f.}$$

* Standard conditions for New Jersey: 70°F, 29.90" Hg

3. CALCULATIONS - DUST CONCENTRATION

Client EPA Date of Test 11/11/71

Location of Test PRIMARY OUTLET Test No. 2

Job No. Y-7730F

Wt = _____ Gm. filtered dust weight

Vt = 67.882 c.f. total sampled gas, stack conditions

Vst = 64.428 c.f. total sampled gas, standard conditions

CALCULATION OF GRAINS PER CUBIC FT.

$$\text{Grains/cu.ft.} = \frac{Wt}{Vt} \times 15.43$$

$$= \frac{\quad}{67.882} \times 15.43$$

= _____ grains/cu.ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. (GR)

$$GR = \frac{Wt}{Vst} \times 15.43$$

$$= \frac{\quad}{64.428} \times 15.43$$

GR = _____ grains/std. cu. ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. ADJUSTED TO 12% CO_2 (GR')

$$\frac{GR}{CO_2\%} = \frac{GR'}{12}$$

$$GR' = \frac{12\ GR}{CO_2\%}$$

$$= \frac{12 \times \quad}{\quad}$$

GR' = _____ GR/std. cu. ft.

York Research Corporation

ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06904

FIELD TEST DATA

REF. NO. Y- 7730F
PERSONNEL: RSE

CLIENT: EPA
LOCATION: HARVEY ALUMINIUM
UNIT: PRIMARY

DATE: 11/11/71
TEST NO. 3
FILTER NO. 4 & 7

P. BAR. 29.59
T. AMB. 40
CONDITIONS —

STACK NO. — DIM'N.: 31
STACK LOCATION: OUTLET

TYPE OF TEST: ASME
ABSORB. SOL'N. NaOH

FILTER 4

TEST LOCATION/ TIME		Δ P	Ts	Rm CFM	Tm	METER READING	CO_2	O_2
1920	1	.10	75	—	70	426.60		
1925	2	.10	75	.94	70	431.30		
1930	3	.10	75	.80	70	435.30		
1935	4	.10	75	.62	70	438.40		
1940	5	.10	75	.88	70	442.85		
1945	6	.10	75	.68	70	446.25		
1950	7	.10	75	.66	70	449.55		
1955	8	.10	75	.68	70	452.95		
2000	END	.10	75	.40	70	454.95		
2010	START	—	—	—	—	454.95		
2015	10	.10	75	.96	70	459.70		
2020	11	.10	75	.90	70	464.20		
2025	12	.10	75	.78	70	468.10		
2030	13	.10	75	.73	70	471.85		
2035	14	.10	75	.52	70	473.45		
2040	END	.10	75	—	70	475.05		
NET TIME	70		75		70	48.45		

VELOCITY TRAVERSE DATA

CLIENT EPA

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Location of Test PRIMARY OUTLET

DATE OF TEST 11/11/71

Conditions

TEST NO. 3

Personnel

JOB NO. Y-7730F

Ba. 29.59 " Hg

AMBIENT TEMP. 40 °F

STACK AREA 7.07 SQ. FT.

MOLECULAR WGT. 28.897 #/CU. FT.

$$V_s = 2.90 \times F_s \sqrt{\frac{29.92}{P_s} \times \frac{28.95}{M.Wgt.} \times \Delta P \times T}$$

F_s = 1.0 FOR STD. PITOT TUBE
F_s = 0.83 FOR TYPE "S" PITOT TUBE

$$K = \frac{2.90 \times .83}{} \sqrt{\frac{29.92}{29.59} \times \frac{28.95}{28.897}} = 2.42$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
5	75	535	—	2.42	.10	53.5	7.31	17.70
TOTAL	75	535						17.70
READINGS	1	1						1
AVE.	75	535						17.70

GAS ANALYSIS

CLIENT EPA

DATE OF TEST 11/11/71

Location of Test PRIMARY OUTLET

TEST NO. 3

Conditions

JOB NO. Y-7730F

DRY MOLECULAR WEIGHT

	%	Bx	Mx	Bx Mx
CO_2	3.5	.035	44	1.540
O_2	18.7	.187	32	5.984
CO	0.0	.000	28	000
N_2	77.8	.778	28	21.784

TOTAL 29.308 Mx(d)

TOTAL MOLECULAR WEIGHT

$M = M_x d_1 + M_x(H_2O)$

$M_x d_1 = (100\% - H_2O\%) \times M_x d$

(100% − 3.639) × 29.308

$M_x d_1$ = 28.241

$M_x (H_2O)$ = % H_2O × 18

3.639 × 18

$M_x (H_2O)$ = .655

M = 28.241 + .655 = 28.897

MOLECULAR WGT. OF STACK GAS = 28.897 LB./CU. FT.

TOTAL GAS ANALYSIS [WET]

H_2O _____

CO_2 _____

O_2 _____

CO _____

N_2 _____

1. CALCULATIONS - PER CENT MOISTURE

Client EPA Date of Test 11/11/71

Location of Test PRIMARY OUTLET Test No. 3

Job No. Y-7730F

V.P. = .7392 in. hg vapor pressure of water at meter temp.

Tm = 530 ° Temperature at meter in degrees absolute

Vm = 48.45 cu.ft. volume of gas as measured by meter

P_B = 29.59 in. Barometric pressure

V_w = 12 cc. volume of water condensed

1. Calculate water vapor volume remaining in metered gas at meter conditions in cu. ft. (M_M)

$$M_M = \frac{V.P. \times Vm}{P_B}$$

$$= \frac{.7392 \times 48.45}{29.59}$$

M_M = 1.210 c.f.

2. Convert condensate to water vapor volume at meter conditions (V_V)

$$V_V = 0.00267 \frac{Vw \times Tm}{P_B}$$

$$= 0.00267 \frac{\times 12 \times 530}{29.59}$$

Vv = .574 c.f.

3. Calculate the per cent moisture

$$\% = \frac{Vv + MM}{Vv + Vm} \times 100\%$$

$$= \frac{.574 + 1.210}{.574 + 48.45} \times 100\% = 3.639\ \%$$

2. CALCULATIONS - VOLUMETRIC

Client EPA Date of Test 11/11/71

Location of Test PRIMARY OUTLET Test No. 3

Job No. Y-7730F

1. Vw = 12 cc. volume of water condensed

2. Vv + MM = 1.784 c.f. water vapor volume, meter condition
(see "calculations-percent moisture" sheet)

3. Vm = 48.45 c.f. volume of gas sampled, meter condition

4. Total volume sampled, meter condition

= Vv (volume of water vapor condensed in cubic ft.)+Vm

= .574 + 48.45

= 49.024 cu.ft.

5. Volume of gas sampled, stack condition (Vt)

Tm = 530 ° temperature at meter in degrees absolute

Ts = 535 ° temperature in stack in degrees absolute

$$Vt = \frac{(Vm + Vv) \times Ts}{Tm}$$

$$= \frac{(49.024) \times 535}{530}$$

Vt = 49.486 c.f.

6. Volume of gas sampled, standard conditions* (60°F, 29.90" Hg)

$$Vst = (Vm + Vv) \times \frac{(Pb)}{(29.90")} \times \frac{(520°R)}{(Tm)}$$

$$= (49.024) \times \frac{29.59}{29.90"} \times \frac{520°F}{530} = 47.600 \text{ c.f.}$$

* Standard conditions for New Jersey: 70°F, 29.90" Hg

3. CALCULATIONS - DUST CONCENTRATION

Client EPA Date of Test 11/11/71

Location of Test PRIMARY OUTLET Test No. 3

Job No. Y-7730F

Wt = _____ Gm. filtered dust weight

Vt = 49.486 c.f. total sampled gas, stack conditions

Vst = 47.600 c.f. total sampled gas, standard conditions

CALCULATION OF GRAINS PER CUBIC FT.

$$\text{Grains/cu.ft.} = \frac{Wt}{Vt} \times 15.43$$

$$= \frac{\quad}{49.486} \times 15.43$$

= _____ grains/cu.ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. (GR)

$$GR = \frac{Wt}{Vst} \times 15.43$$

$$= \frac{\quad}{47.600} \times 15.43$$

GR = _____ grains/std. cu. ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. ADJUSTED TO 12% CO_2 (GR')

$$\frac{GR}{CO_2\%} = \frac{GR'}{12}$$

$$GR' = \frac{12\ GR}{CO_2\%}$$

$$= \frac{12 \times \quad}{\quad}$$

GR' = _____ GR/std. cu. ft.

SO_2 EMISSION DATA

Inlet

RUN NO.	1	2	3	4		
Date	11/9/71	11/9/71	11/9/71	11/9/71		
mg SO_2	16.6	80.1	17.9	59.0		
Tm - Average Gas Meter Temperature, °F	42	49	50	57		
P_b - Barometric Pressure, "Hg abs.	29.47	29.47	29.64	29.64		
V_m - Volume of dry gas sampled @ meter conditions, $ft.^3$	8.39	8.36	8.42	8.41		
ppm SO_2	25.3	124	27.5	91.9		

$$\text{ppm } SO_2 = \frac{0.751 \times \text{mg. } SO_2 \times (Tm + 460)}{P_b \times V_m}$$

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 F

Material Sampled for SO_2 Inlet

Date 11/9/71

Plant Harvy Alm Location The Dalles, Oregon

Bar. Pressure 29.47 "Hg Comments:

Ambient Temp.

Run No. 1

Power Stat Setting

Filter Used: Yes ____ No X

Operator

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
830	179.37		38
840	180.02		38
900	181.42		40
910	182.14		
930	183.57		42
940	184.26		
1000	185.66		44
1010	186.33		46
1030	187.76		

Comments:

Impinger Bucket No.

Meter Box No.

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. X-7730F

Material Sampled for SO_2 Inlet

Date 11/9/71

Plant Harry Alm Location The Dalles, Oregon

Bar. Pressure 29.47 "Hg Comments:

Ambient Temp.

Run No. 2

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
830	213.99		48
840	214.62		48
900	216.08		50
910	216.78		
930	218.16		50
940	218.88		
1000	220.28		
1010	220.92		50
1030	222.35		

Comments:

Impinger Bucket No.

Meter Box No.

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 F

Material Sampled for SO2 Inlet

Date 11/9/71

Plant Harvy Alm. Location The Delles, Oregon

Bar. Pressure 29.64 "Hg Comments:

Ambient Temp.

Run No. 3

Power Stat Setting

Filter Used: Yes No

Operator

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1120	188.40		48
1130	189.14		50
1150	190.51		
1200	191.24		
1220	192.61		50
1230	193.35		52
1250	194.72		
1300	195.40		
1320	196.82.		52

Comments:

Impinger Bucket No.

Meter Box No.

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-7730F

Material Sampled for SO_2 Inlet

Date 11/9/71

Plant Harvy Alm Location The Dalles Oregon

Bar. Pressure 29.64 "Hg Comments:

Ambient Temp.

Run No. 4

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1120	223.00		54
1130	223.74		56
1150	225.14		
1200	225.83		
1220	227.24		
1230	227.97		58
1250	229.32		58
1300	230.01		
1320	231.41.		60

Comments:

Impinger Bucket No.

Meter Box No.

QUALITY CONTROLLED YORK RESEARCH CORPORATION

SO_2 EMISSION DATA

Outlet

RUN NO.	1	2	3	4		
Date	11/11/71	11/11/71	11/11/71	11/11/71		
mg SO_2	71.1	155	107.8	80.5		
T_m - Average Gas Meter Temperature, °F	45	45	45	52		
P_b - Barometric Pressure, "Hg abs.	29.66	29.66	29.47	29.47		
V_m - Volume of dry gas sampled @ meter conditions, $ft.^3$	8.47	8.43	8.40	8.41		
ppm SO_2	107.3	23.5	165	125		

$$\text{ppm } SO_2 = \frac{0.751 \times \text{mg } SO_2 \times (T_m + 460)}{P_b \times V_m}$$

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-7230F

Material Sampled for SO_2 Outlet

Date 11/11/71

Plant Harvy Alm Location The Dalles, Oregon

Bar. Pressure 29.66 "Hg Comments:

Ambient Temp.

Run No. 1

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
0940	233.01		
0950	233.72		
1010	235.16		
1020	235.84		
1040	237.21		
1050	237.92		
1110	239.34		
1120	240.01		
1140	241.48		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 F

Material Sampled for SO_2 Outlet

Date 11/11/71

Plant Harvey Alm Location The Dalles, Oregon

Bar. Pressure 29.66 "Hg Comments:

Ambient Temp.

Run No. 2

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1030	201.41		
1040	202.12		
1100	203.50		
1110	204.20		
1130	205.62		
1140	206.31		
1200	207.78		
1210	208.44		
1230	209.84		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

GAS SAMPLING FIELD DATA

JOB NO. Y-7730F

Material Sampled for SO_2 Outlet

Date 11/11/71

Plant Harvy Alm Location The Delles Oregon

Bar. Pressure 29.47 "Hg Comments:

Ambient Temp.

Run No. 3

Power Stat Setting

Filter Used: Yes ____ No X

Operator

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1250	207.19		42
1300	207.84		44
1320	209.25		44
1330	209.93		
1350	211.32		
1400	212.01		
1420	213.43		
1430	214.17		
1450	215.59		48

Comments:

Impinger Bucket No.

Meter Box No.

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-773CF

Material Sampled for SO_2 Outlet

Date 11/11/71

Plant Harry Alm Location The Dalles, Oregon

Bar. Pressure 29.47 "Hg Comments:

Ambient Temp.

Run No. 4

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1250	244.55		50
1300	245.23		52
1320	246.68		52
1330	247.37		
1350	248.76		
1400	249.44		
1420	250.88		
1430	251.54		
1450	252.96		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

F⁻ EMISSION DATA

INLET

Run No.	1	2	3	4	5	6
Date	11/8	11/8	11/8	11/8	11/8	11/8
mg F⁻	34.224	79.010	37.323	70.088	45.342	72.479
T_m - Average Gas Meter Temperature, °F	41	48	47	51	41	49
P_b - Barometric Pressure - "Hg abs.	29.65	29.65	29.65	29.65	29.65	29.65
V_m - Volume of dry gas sampled @ meter conditions, ft.^{3}	8.08	8.36	7.58	7.50	7.51	7.50
SCFM	6878	6878	6878	6878	6878	6878
lb F⁻/Hr.	3.68	8.32	4.33	8.27	5.24	8.52
TON Al/Hr.	.519	.519	.519	.519	.519	.519
lb F⁻/TON Al	7.09	16.03	8.34	15.93	10.10	16.42

$$\frac{\text{lb } F^-}{\text{Hr.}} = 7.47 \times 10^{-6} \frac{\text{mg } F^- (T_m + 460)\ SCFM}{V_m\ P_b}$$

GAS SAMPLING FIELD DATA

JOB NO. Y-7730-F

Material Sampled for Inlet HF in H_2O

Date 11/8/71

Plant Harvy Alum Location The Dalles, Oregon

Bar. Pressure 29.65 "Hg Comments:

Ambient Temp.

Run No. 1

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
10.45	154.86		40
1055	155.93		
1105	156.26		
1115	157.87		40
1125	158.63		
1135	159.42		
1145	160.91		
1155	161.88		
1200	162.94		42

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 F

Material Sampled for Inlet HF in H_2O

Date 1/8/71

Plant Harvy Alum. Location The Dalles, Oregon

Bar. Pressure 29.65 "Hg Comments:

Ambient Temp.

Run No. 2

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1045	190.03		46
1055	191.70		
1105	192.62		48
1115	193.38		
1125	194.28		48
1135	195.91		
1145	196.41		
1155	197.89		
1200	198.39		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

GAS SAMPLING FIELD DATA

JOB NO. Y-7730F

Material Sampled for Inlet HF in H_2O

Date 11/8/71

Plant Harvy Alm. Location The Delles, Oregon

Bar. Pressure 29.65 "Hg Comments:

Ambient Temp.

Run No. 3

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1325	163.00		46
1335	164.08		
1345	165.19		48
1355	166.23		
1405	167.19		
1415	168.26		
1425	169.38		
1435	170.26		
1440	170.58		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 F

Material Sampled for Inlet HF in H_2O

Date 11/8/71

Plant Harvy Alm Location The Dalles, Oregon

Bar. Pressure 29.65 "Hg Comments:

Ambient Temp.

Run No. 4

Power Stat Setting

Filter Used: Yes ____ No X

Operator

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1325	198.30		50
1335	199.28		
1345	200.31		52
1355	201.36		
1405	202.43		
1415	203.61		
1425	204.42		
1435	205.38		
1440	205.85		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. X-7730F

Material Sampled for Inlet HF in H_2O

Date 11/8/71

Plant Harvy Alm Location The Dalles Oregon

Bar. Pressure 29.65 "Hg Comments:

Ambient Temp.

Run No. 5

Power Stat Setting

Filter Used: Yes ____ No X

Operator

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1515	171.75		40
1525	172.76		
1535	173.41		
1545	174.83		42
1555	175.72		
1505	176.28		
1515	177.39		
1525	178.49		
1530	179.26		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YOCO RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 P

Material Sampled for Inlet HF in H_2O

Date 1/8/71

Plant Harvy Alum Location The Delles, Oregon

Bar. Pressure 29.65 "Hg Comments:

Ambient Temp.

Run No. 6

Power Stat Setting

Filter Used: Yes ____ No X

Operator

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1515	205.96		48
1525	206.81		
1535	207.66		50
1545	208.26		
1555	209.35		50
1605	210.42		
1615	211.68		
1625	212.86		
1630	213.46		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36' (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

F⁻ EMISSION DATA

OUTLET

Run No.	1	2	3	4		
Date	11/11	11/11	11/11	11/11		
mg F⁻	7.871	8,260	6.877	6.600		
T_m - Average Gas Meter Temperature, °F	44	50	43	49		
P_b - Barometric Pressure - "Hg abs.	29.66	29.47	29.59	29.59		
V_m - Volume of dry gas sampled @ meter conditions, ft.³	7.50	7.92	10.00	10.02		
SCFM	7097	7097	7097	7097		
lb F⁻/Hr.	.945	.957	1620	1601		
TON Al/Hr.	.519	.519	.519	.519		
lb F⁻/TON Al	1.82	1.84	1.19	1.16		

$$\frac{\text{lb } F^-}{\text{Hr.}} = 7.47 \times 10^{-6} \frac{\text{mg } F^- (T_m + 460)\ \text{SCFM}}{V_m\ P_b}$$

GAS SAMPLING FIELD DATA

JOB NO. Y-7730F

Material Sampled for Outlet HF in H_2O

Date 11/11/71

Plant Harvy Alm Location Dellas, Oregon

Bar. Pressure 29.66 "Hg Comments:

Ambient Temp.

Run No. 1

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1545	216.91		
1555	217.60		44
1615	219.00		
1625	219.72		
1645	221.14		
1655	221.82		44
1715	223.20		
1725	223.40		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. X-7230 F

Material Sampled for Outlet HF in H_2O

Date 11/11/71

Plant Harvey Alm Location The Dalles, Oregon

Bar. Pressure 29.47 "Hg Comments:

Ambient Temp.

Run No. 2

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1545	253.10		
1555	253.71		50
1515	255.14		
1525	255.82		
1545	257.21		
1555	257.94		
1615	259.32		
1625	260.02		50

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. X-7730 E

Material Sampled for Outlet HF in H_2O

Date 11/11/71

Plant Harry Alm Location The Dalles Oregon

Bar. Pressure 29.59 "Hg Comments:

Ambient Temp.

Run No. 3

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
0630	226.90		42
0640	227.72		44
0700	229.43		
0710	230.71		44
0730	232.23		
0740	233.48		
0800	235.64		
0810	236.90		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-7230F

Material Sampled for Outlet HF in H_2O

Date 11/11/71

Plant Harry Alum Location The Dalles Oregon

Bar. Pressure 29.59 "Hg Comments:

Ambient Temp.

Run No. 4

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
0630	263.00		48
0640	264.58		50
0700	266.52		
0710	267.36		
0730	269.16		
0740	270.21		
0800	272.98		
0810	273.02		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730-P ORSAT FIELD DATA

Location Primary Inlet/Outlet Comments:

Date 11/11/21

Time A.M.

Operator RSE

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
INLET			
1	3.4	22.2	22.6
2	3.4	21.8	22.6
3	3.6	22.4	23.0
OUTLET			
1	3.2	22.2	22.8
2	3.8	22.6	22.8
3	3.6	21.8	22.0

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7230-F ORSAT FIELD DATA

Location Primary Inlet / Outlet Comments:

Date 11/11/71

Time P.M.

Operator RSE

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
INLET			
1	3.4	18.8	18.8
2	3.4	18.4	18.4
3	3.6	18.8	18.8
OUTLET			
1	3.2	19.0	19.0
2	3.8	18.8	18.8
3	3.6	18.2	18.2

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730-F ORSAT FIELD DATA

Location Secondary - Inlet Comments:

Date 11/8/71

Time

Operator RSE

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
1	0.0	20.6	20.6
2	0.0	20.6	20.6
3	0.0	20.6	20.6

QUALITY CONTROLLED YORK RESEARCH CORPORATION

ORSAT FIELD DATA

JOB NO. Y-7730-F

Location Secondary - INLET/OUTLET Comments:

Date 11/9/71

Time

Operator RSE

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
INLET			
1	0	20.8	20.8
2	0	21.0	21.0
3	0	20.8	20.8
OUTLET			
1	0	20.5	20.6
2	0	20.6	20.6
3	0	20.6	20.6

QUALITY CONTROLLED YORK RESEARCH CORPORATION

IV. GENERAL SAMPLING METHODS - APPARATUS AND PROCEDURE

PARTICULATE SAMPLING TRAIN - APCO METHOD

Apparatus

The sampling apparatus consisted of a 5 foot probe, cyclone, filter, four impingers, dry gas meter, vacuum pump and flow meter as shown in Figure 1. The stainless steel, button-hook type probe tip (1) was connected by a stainless steel coupling (2) with asbestos packing to the probe. The probe (3) consisted of 5/8 inch outside diameter medium-wall pyrex glass tube with a ground glass joint on one end. The glass probe was logarithmically wound from the entrance end with 26-gauge nickel-chromium wire. During sampling, the wire was connected to a variable transformer to maintain a gas temperature of 250°F in the probe. The wire wound glass tube was wrapped with fiber glass tape and encased in a 1-inch-OD stainless steel tube for protection. The end of the steel tube that does not have the balljoint protruding has a nut welded to it for connection to the stainless steel coupling used to attach the nozzle. The probe connects to a cyclone and flask (4). The cyclone connects to a very coarse fritted glass filter holder (5), which holds a tared glass fiber filter. The cyclone, flask, and filter were contained in an electrically heated enclosed box (6), which is thermostatically maintained at a minimum temperature of 250°F to prevent water condensation. Attached to the heated box was an ice bath (7) containing four impingers connected in series with glass balljoints. The first impinger (8) receives the gas stream from the filter. This impinger is of the Greenburg-Smith design modified by replacing the tip with a 1/2 inch ID glass tube extending to 0.5 inch from the bottom of the flask. This impinger was initially filled with 100 milliliters of distilled water. The second impinger (9) is a Greenburg-Smith impinger with tip, and also filled with 100 milliliters of distilled water. The third impinger (10), which was left dry, is a Greenburg-Smith impinger modified like the first. The fourth impinger (11) is also a Greenburg-Smith type modified like the first and contained dry silica gel.

From the fourth impinger (11) the effluent stream flows through a check valve (13); flexible rubber vacuum tubing (14); vacuum gauge (15); a needle valve (16); a leakless vacuum pump (17), rated at 4 cubic feet per minute at 0 inches of mercury gauge pressure and 0 cubic feet per minute at 26 inches of mercury gauge pressure, and connected in parallel with a by-pass valve (18); and a dry gas meter rated at .1 cubic foot per revolution

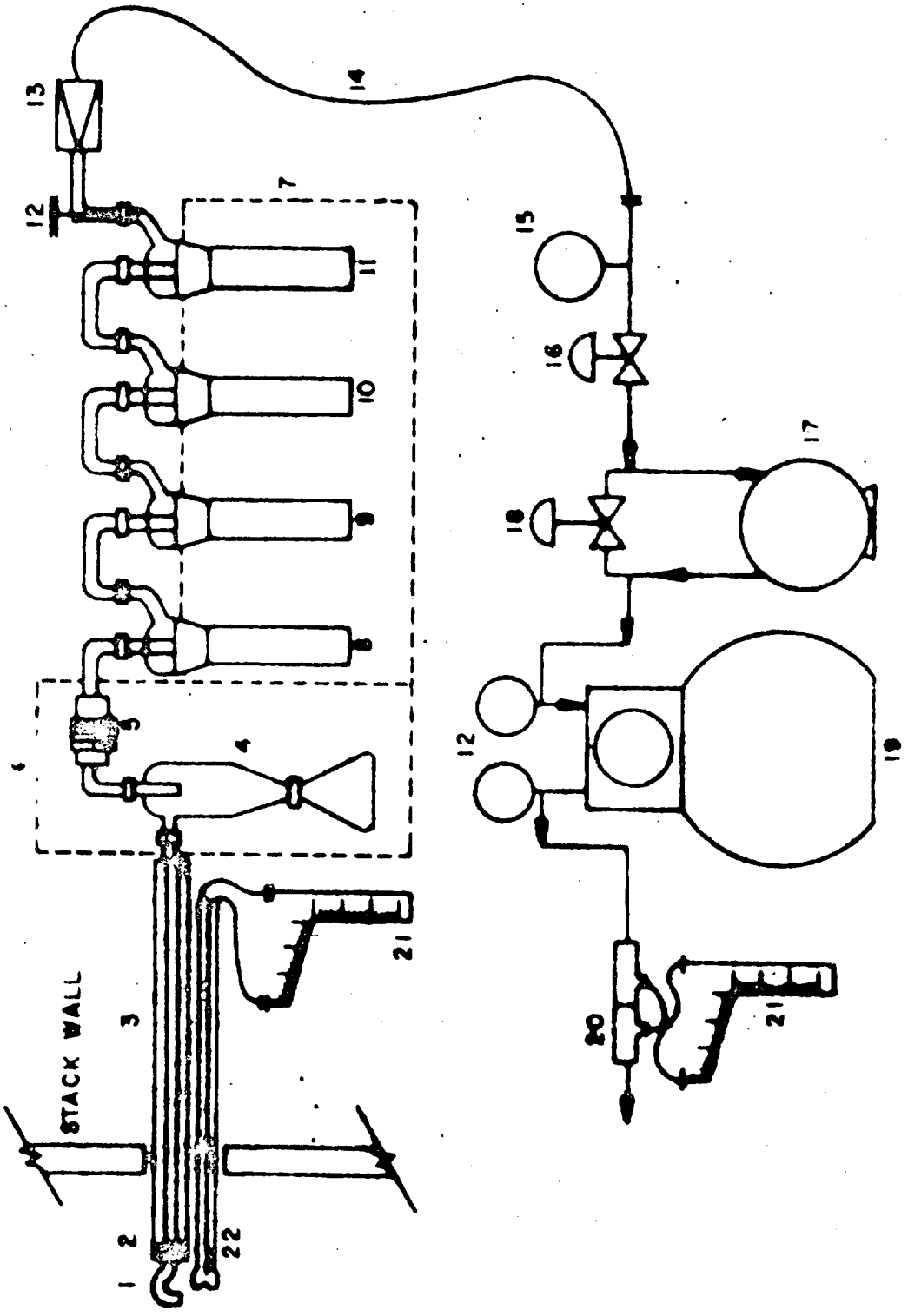


FIGURE 1
PARTICULATE SAMPLING TRAIN

(19). A calibrated orifice (20) completes the train and was used to measure instantaneous flow rates. The three thermometers (12) are dial type with a range of 25° to 125°F. A fourth thermometer in the heated portion of the box has a range up to 500°F. The dual manometer (21) across the calibrated orifice is an inclined-vertical type graduated in hundredths of an inch of water from 0 to 1.0 inch and in tenths from 1 to 10 inches.

Moisture

The percent moisture was assumed to be 2% at the inlet and 6% at the outlet by the Federal Project Officer.

SO_2 Sampling

The sampling apparatus consisted of the following components arranged and illustrated schematically in Figure 3; (1) glass wool filter, (2) an electrically heated glass probe, (3) a coarse frit midget impinger, (4) fiber glass filter, (5,6,7) three midget impingers, (8) ice bath, (9) a silica gel tube drier, (10) vacuum gauge, (11) valve, (12) a leakless pump with by-pass valve, (13) a dry gas meter, (14) a rotometer and (15) a pitot tube with manometer.

The probe was made of a 3 foot length medium wall from Pyrex tubing wound with 26-gauge Nichrome heating wire. The front end included a two-inch long expansion for insertion of the glass wool filter. The wire was connected to a variable transformer which allows the voltage and hence the heat input to be controlled. The wire was covered with a fiber glass insulation tape.

The probe connects to a coarse frit midget bubbler containing 15 ml of 80% isopropanol and three midget impingers, the first two of which contained 15 ml of 3% H_2O_2 each with the third left dry, connected in series. The chamber near the bubbler outlet was stuffed with fine glass wool. An ice bath was provided for the bubbler and impingers. Attached to the outlet of the third impinger was a drying tube filled with silica gel of the indicator type. A by-pass valve was provided for the leakless pump and a vacuum gauge and needle valve were installed at the inlet of the pump. The dry gas meter had a sensitivity of 0.001 cubic foot and was fritted with thermometers on the meter inlet and outlet.

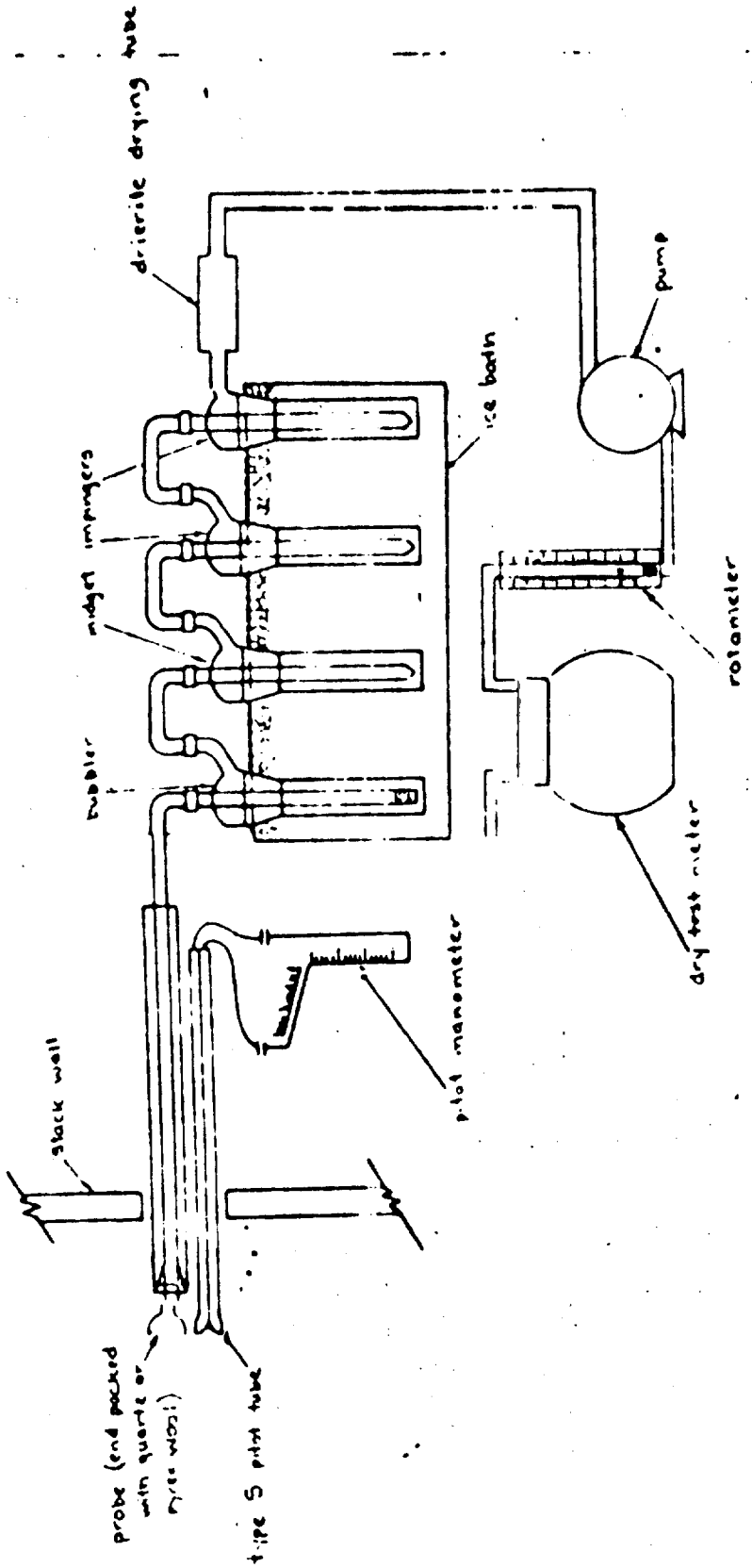

desiccate drying tube
midget impingers
bubbler
ice bath
pump
rotameter
dry test meter
pitot manometer
stack wall
probe (end packed with quartz or pyrex wool)
type S pitot tube

FIGURE 3

ASME Gas Sampling Equipment

The particulate sampling train was arranged as illustrated in Figure 2. The sampling nozzle extracts a uniform sample of gas and particulate from the gas stream. The proper nozzle size is a function of the velocity of the flue gas and the sampling rate to be maintained.

The gas sample next passes through a paper thimble mounted in a thimble holder. The thimble and holder are inserted in the stack to prevent condensation in the thimble. The gas now passes through a stainless steel sampling probe.

Upon discharge from the probe, the sample gas next enters the three Greenburg-Smith impingers. The first two impingers contained 100 Ml of H_2O, while the third impinger was operated dry. The impingers were maintained in a wet ice bath. The purpose of the impingers was to trap particulate matter smaller than 1 micron and to condense any vapors present in the sample gas.

The sample gas then passes through a vacuum pump and gas regulating valve to a Sprague Dry Gas Meter and is exhausted. All connections were made using heavy rubber tubing checked for tightness by blocking the sampling nozzle, and carefully applying suction; if the meter does not creep, the system is tight.

A calibrated type "S" Pitot Tube was attached to the probe and connected to an inclined manometer with a sensitivity of 0.01 in H_2O.

Oxides of Nitrogen

Samples were collected by grab sampling, using evacuated flasks containing a dilute solution of hydrogen peroxide and sulfuric acid. The hydrogen peroxide oxidizes the lower oxides of nitrogen (with the exception of nitrous oxides) to nitric acid. The resultant solution was then evaporated to dryness and treated with phenoldixulfonic acid reagent and ammonium hydroxide. The yellow trialkali salt of 6-nitro-1-phenol-2, 4-disulfonic acid is formed, which was then measured colorimetrically.

CO_2, O_2, CO by Orsat

Integrated samples for CO_2 and O_2 were collected over a 60 minute period as per Section 5.2 of the General Procedure.

HARVEY THE DALLES LOG

11-8-71 - Monday

0700 - Arrived at Harvey Plant
1045-1200 - Inlet HF Test 1
Inlet HF Test 2
1325-1440 - Inlet HF Test 3
Inlet HF Test 4
1515-1630 - Inlet HF Test 5
Inlet HF Test 6
1540-1840 - Inlet and Outlet Test 1

2000 - Returned to Motel

11-9-71 - Tuesday

0700 - Arrived at Plant
0850-1150 - Inlet/Outlet Particulate Test 2 secondary
1405-1705 - Inlet/Outlet Particulate Test 3 secondary
0830-1030 - SO_2 and SO_3 Inlet Test 1
SO_2 and SO_3 Inlet Test 2
1120-1320 - SO_2 and SO_3 Inlet Test 3
SO_2 and SO_3 Inlet Test 4

1500 - Returned to Motel

11-10-71 - Wednesday - No work

11-11-71 - Thursday

0940-1140 - SO_2 and SO_3 Outlet Test 1
1030-1230 - SO_2 and SO_3 Outlet Test 2
1250-1450 - SO_2 and SO_3 Outlet Test 3
SO_2 and SO_3 Outlet Test 4
1545-1725 - Outlet HF Test 1
Outlet HF Test 2
1430-2010 - Outlet HF Test 3
Outlet HF Test 4
1000-1135 - Inlet/Outlet Primy Test 1
1500-1655 - Inlet/Outlet Primy Test 2
1910-2100 - Inlet/Outlet Primy Test 3
1015-1200 - Inlet/Outlet ASME Primy Test 1
1505-1655 - Inlet/Outlet ASME Primy Test 2
1910-2040 - Inlet/Outlet ASME Primy Test 3

2400 - Returned to Motel

PROJECT PARTICIPANTS

Frederick Moerker - Federal Project Officer

Louis A. Terracciano - Project Director

Roger A. Kniskern - Senior Test Engineer

Robert S. Epstein - Senior Test Engineer

Richard W. Kling - Senior Test Engineer

Geoffrey Knobel - Test Engineer

Kenneth Crepeau - Test Engineer

Erwin Theisz - Test Chemist

APPENDIX B

Sampling Train Figures

PARTICULATE SAMPLING TRAIN

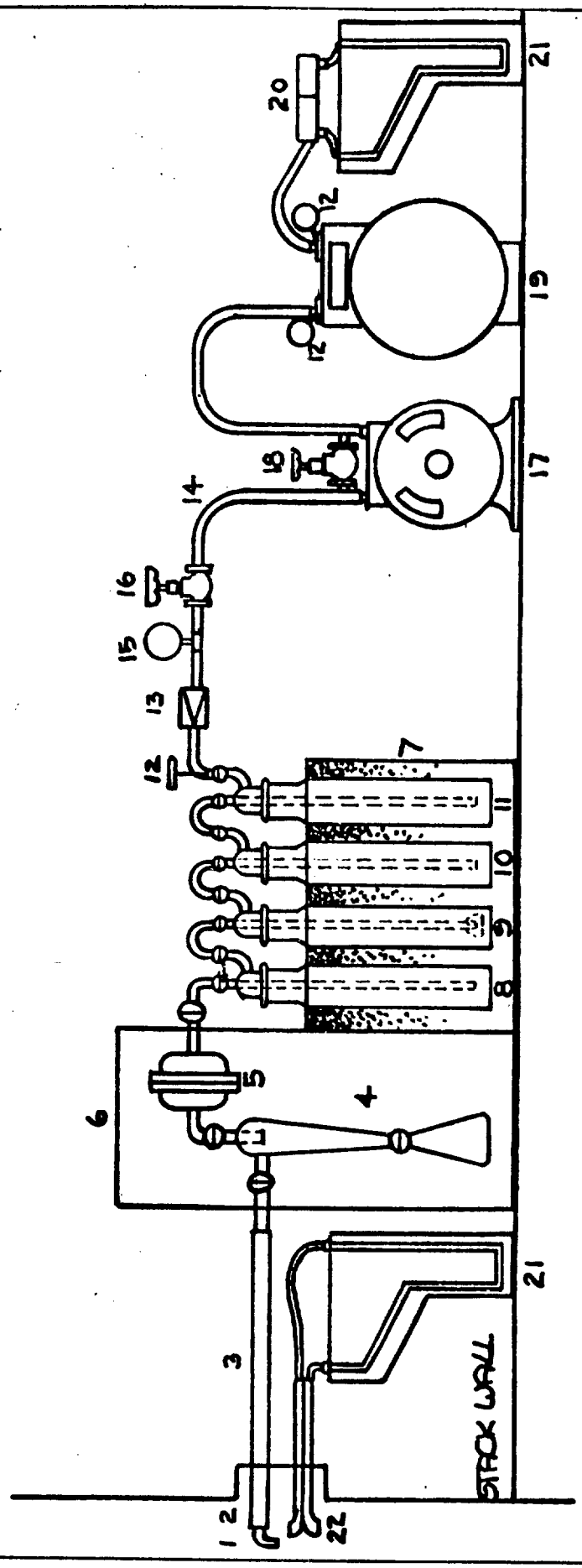
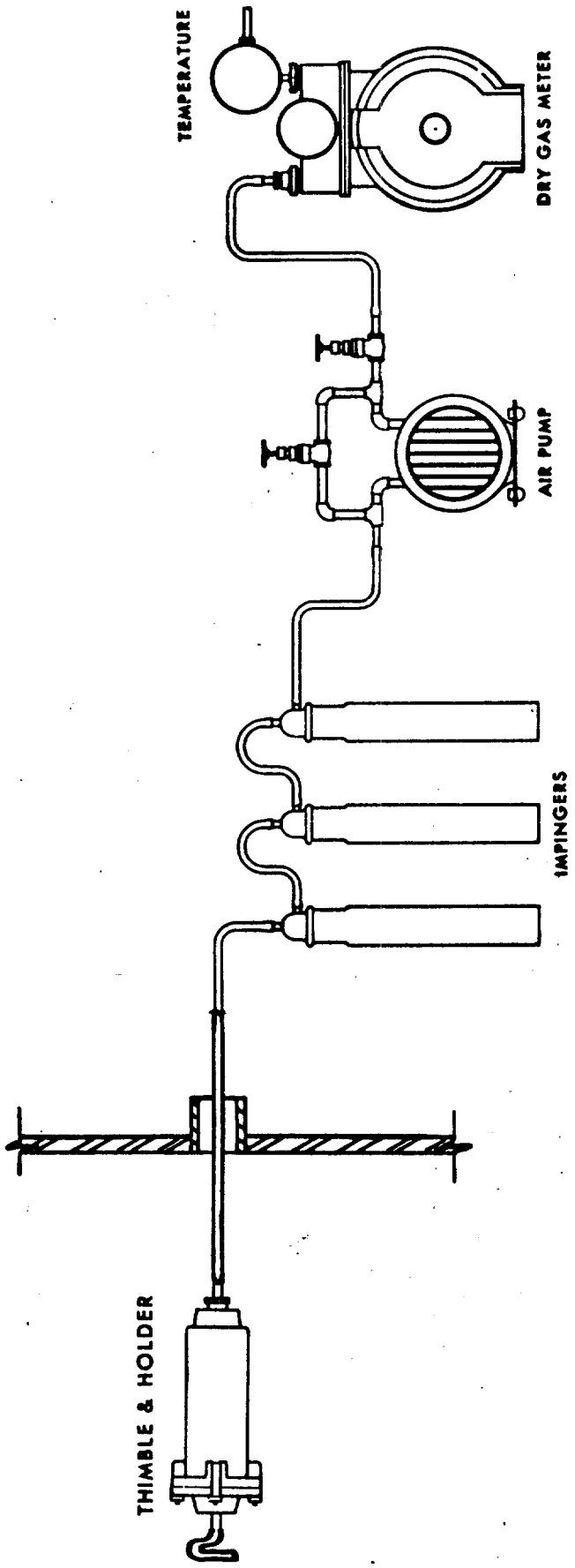


FIGURE #1



SAMPLING TRAIN

ASME PARTICULATE TRAIN

Figure #2

SO_2 SAMPLING TRAIN

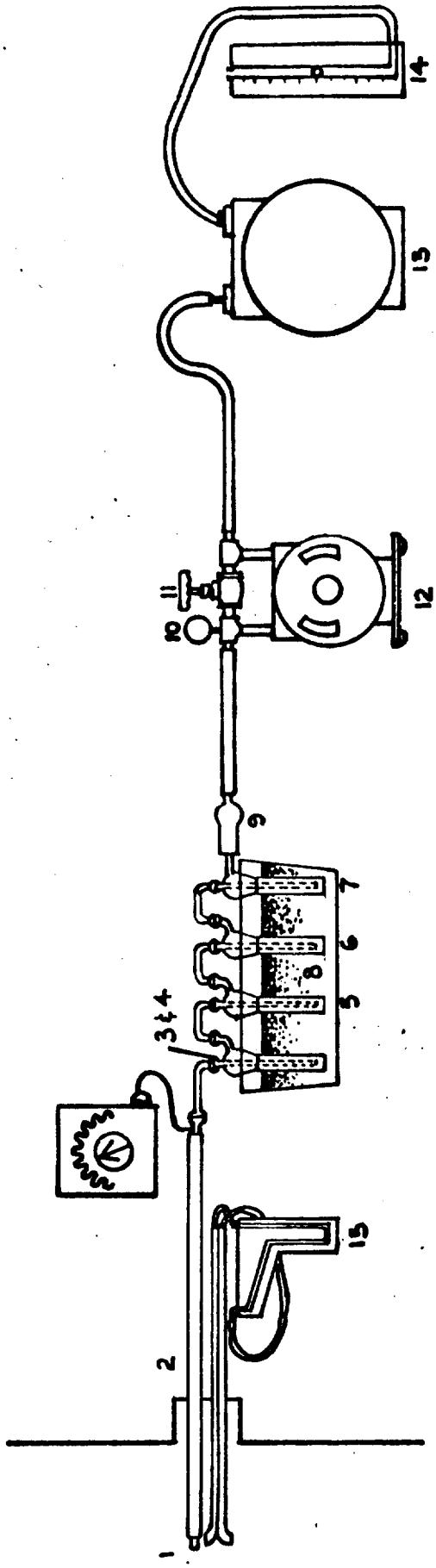
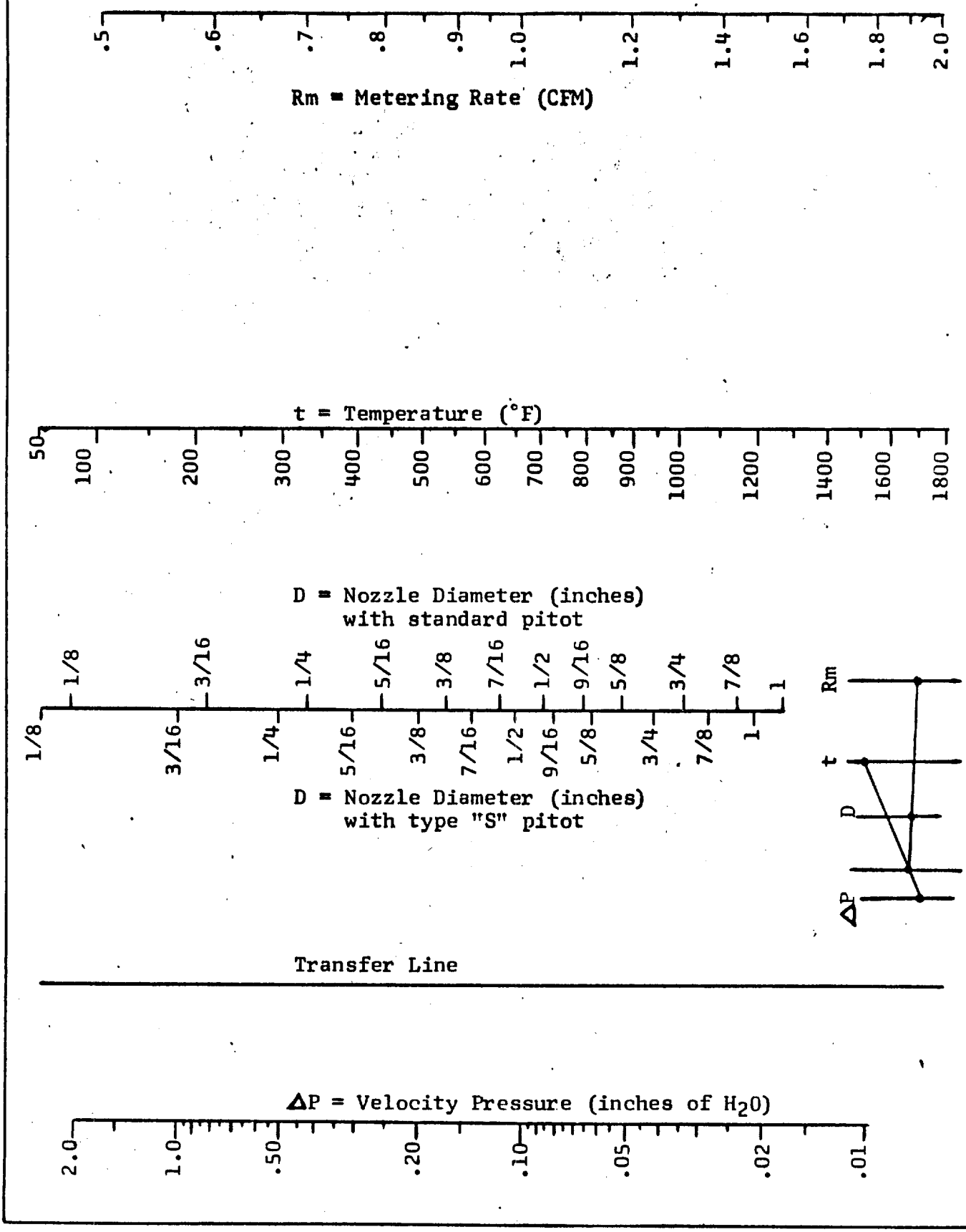


FIGURE #3


.5 .6 .7 .8 .9 1.0 1.2 1.4 1.6 1.8 2.0
Rm = Metering Rate (CFM)
t = Temperature (°F)
50 100 200 300 400 500 600 700 800 900 1000 1200 1400 1600 1800
D = Nozzle Diameter (inches)
with standard pitot
1/8 3/16 1/4 5/16 3/8 7/16 1/2 9/16 5/8 3/4 7/8 1
D = Nozzle Diameter (inches)
with type "S" pitot
Rm
t
D
ΔP
Transfer Line
ΔP = Velocity Pressure (inches of H2O)
2.0 1.0 .50 .20 .10 .05 .02 .01

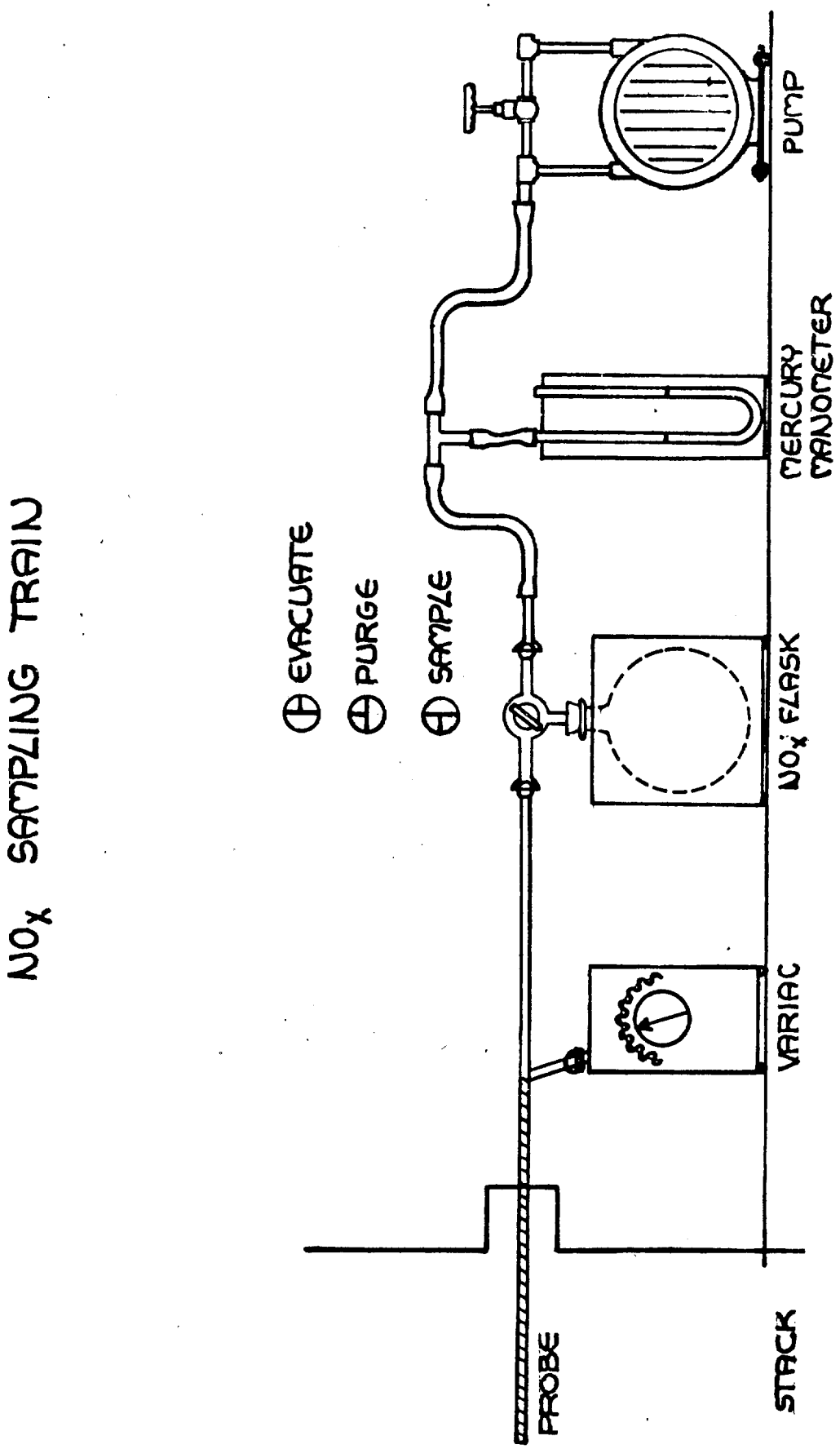

NOx SAMPLING TRAIN
⊕ EVACUATE
⊕ PURGE
⊕ SAMPLE
PUMP
MERCURY MANOMETER
NOx FLASK
VARIAC
PROBE
STACK

Figure #5