5 EA, 12.1, H6

EMISSION TESTING REPORT

ETB TEST NUMBER 71-MM-20

EMISSIONS FROM

WET SCRUBBER SYSTEM

at

REYNOLDS METALS, INC.
TROUTDALE, OREGON

PROJECT OFFICER
FREDERICK MERKER

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR PROGRAMS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT NO. Y-7730-E May 31, 1972

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I. PREFACE

An Emission Test Program was conducted for the Environmental Protection Agency at the Reynolds Metals aluminum reduction Plant in Troutdale, Oregon, from 1 November 71 through 5 November 71 inclusive.

Source sampling was performed in accordance with E.P.A. test methods and procedures at the inlet and outlet of the wet scrubber system which was installed to control atmospheric emissions generated by the aluminum reduction process.

The following samples were taken:

Emission Sample	Test Method
Particulate	EPA #5
Total Nitrogen Oxides	EPA #7
Sulfur Dioxide	EPA #6
Fluorides	EPA

The York Research test crew consisted of the following members:

Louis Terracciano - Project Director
Roger Kniskern - Senior Test Engineer
Robert Epstein - Senior Test Engineer
Richard 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.

II. SUMMARY

The Appendix Section of this report contains all results and data collected and calculated for this series of tests. The particulate emissions are calculated as pounds of total fluoride emitted per ton of process weight. Process weight data was supplied to York by EPA. For convenience, the most pertinent data and results are tabulated below:

TABULAR SUMMARY

PRIMARY SYSTEM

Test No.	Inlet Total F⁻ (lb./ton)
1	27.84
2	29.49
3	22.16

Test No.	Outlet Total F⁻ (lb./ton)
1	58.64
2	8.42
3	157.36

SECONDARY SYSTEM

Test No.	Inlet Total F⁻ (lb./ton)
1	9.09
2	9.52
3	8.55

Test No.	Outlet Total F⁻ (lb./ton)
1	7.45
2	7.01
3	7.43

GASEOUS EMISSIONS

Primary System

SO_2 (ppm)

Test No.	Inlet	Outlet
1	4.3	4.7
2	0.60	4.8
3	2.0	4.4
4	10.1	4.8
5	5.4	-

NO_2 (ppm)*

	Inlet	Outlet
1	-	-
2	-	-
3	-	-
4	-	-
5	-	-

F⁻ (lb./ton Al)

	Inlet	Outlet
1	12.53	3.76
2	12.43	1.33
3	16.47	4.91
4.	-	-

*NOTE: Samples invalid

III. INTRODUCTION

The source test was performed at the Reynolds Metals Primary Aluminum Plant in Troutdale, Oregon from 1 November 71 to 5 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 passed through 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. Three simultaneous samples were taken across the control system using MSA 1106 BH glass fiber 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.

Gaseous fluoride samples were collected in midget impingers using water as the scrubbing solution. Three samples were collected on the inlet and three on the outlet.

*As subsequently published in
Federal Register, Vol. 36, No. 247, December 23, 1971

IV. PROCESS DESCRIPTION

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

V. SAMPLING POINTS

Primary System

The inlet sampling ports were located in a vertical duct, rectangular in cross section with a decreasing taper in the direction of flow (upward at this point). The paramoter of the duct section at the ports is about three and one-half (3 1/2) feet deep by four and one-half (4 1/2) wide. Five (5) ports were located on the long side and designated A through E, port "A" being closest to the wall of the pot room, port "E" the farthest. Ten (10) points were sampled in each port, number one (1) through ten (10), preceeded by the letter designation of the port. Point A-1 being the point in port "A" farthest from the port opening, and A-10 being closest to the opening. All other ports and points were labeled in a similar manner.

The outlet sampling ports were located in a round vertical flue six (6) feet two (2) inches in diameter, two (2) feet nine (9) inches from the top, and approximately thirty seven (37) feet from the nearest constriction upstream of the ports.

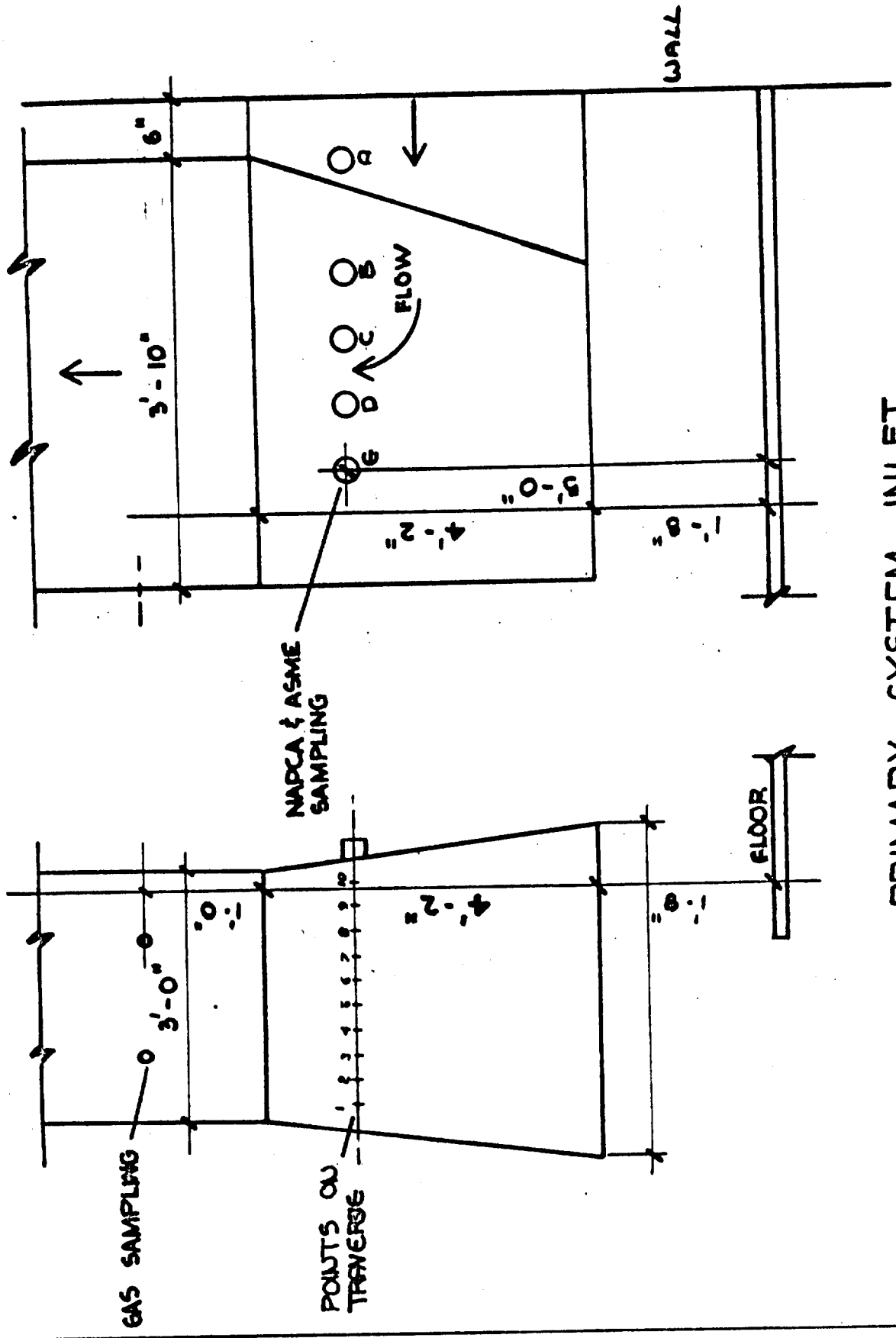
Secondary System

The inlet sampling ports were located in a short horizontal rectangular duct measuring five (5) feet five (5) inches by five (5) feet two (2) inches. One point, one port sampling was used in a port on top of the duct at a point about one-third the way into the duct. This was about two (2) feet eight (8) inches from a large loft area of the pot room upstream, and three (3) feet from the induction fan motor downstream which was located in the gas stream.

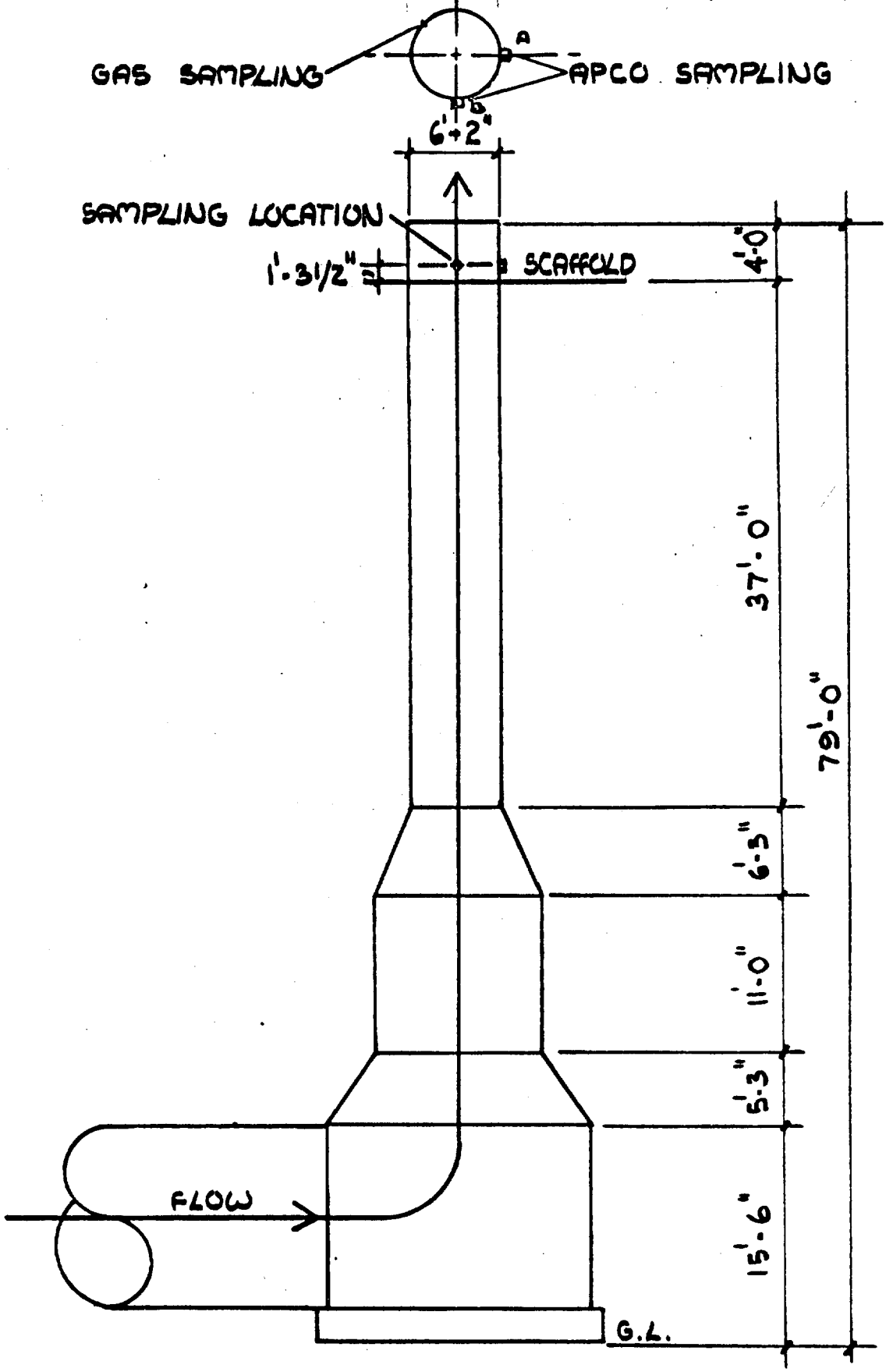
The outlet sampling ports were placed in a round vertical duct, four (4) feet eight (8) inches in diameter. The closest restriction upstream of the ports was nine (9) feet away and the closest downstream restriction was seven (7) feet away. Twenty-four (24) points were sampled in each of two ports. Each point is preceeded by a letter designation corresponding to the port used. Point one (1) is farthest from the port opening and conversely point twenty-four (24) is closest to the port.

REYNOLDS PLANT, TROUTDALE, ORE.

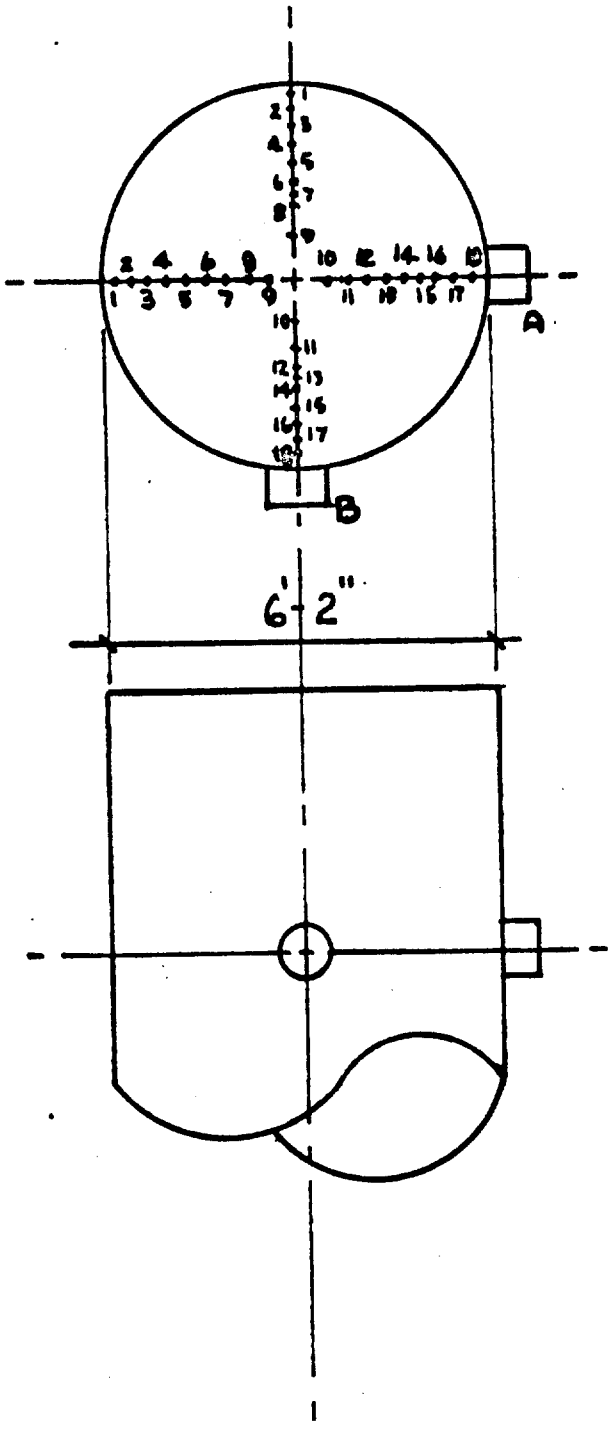
PRIMARY SYSTEM INLET



PRIMARY OUTLET @ REYNOLDS PLANT, TROUTDALE

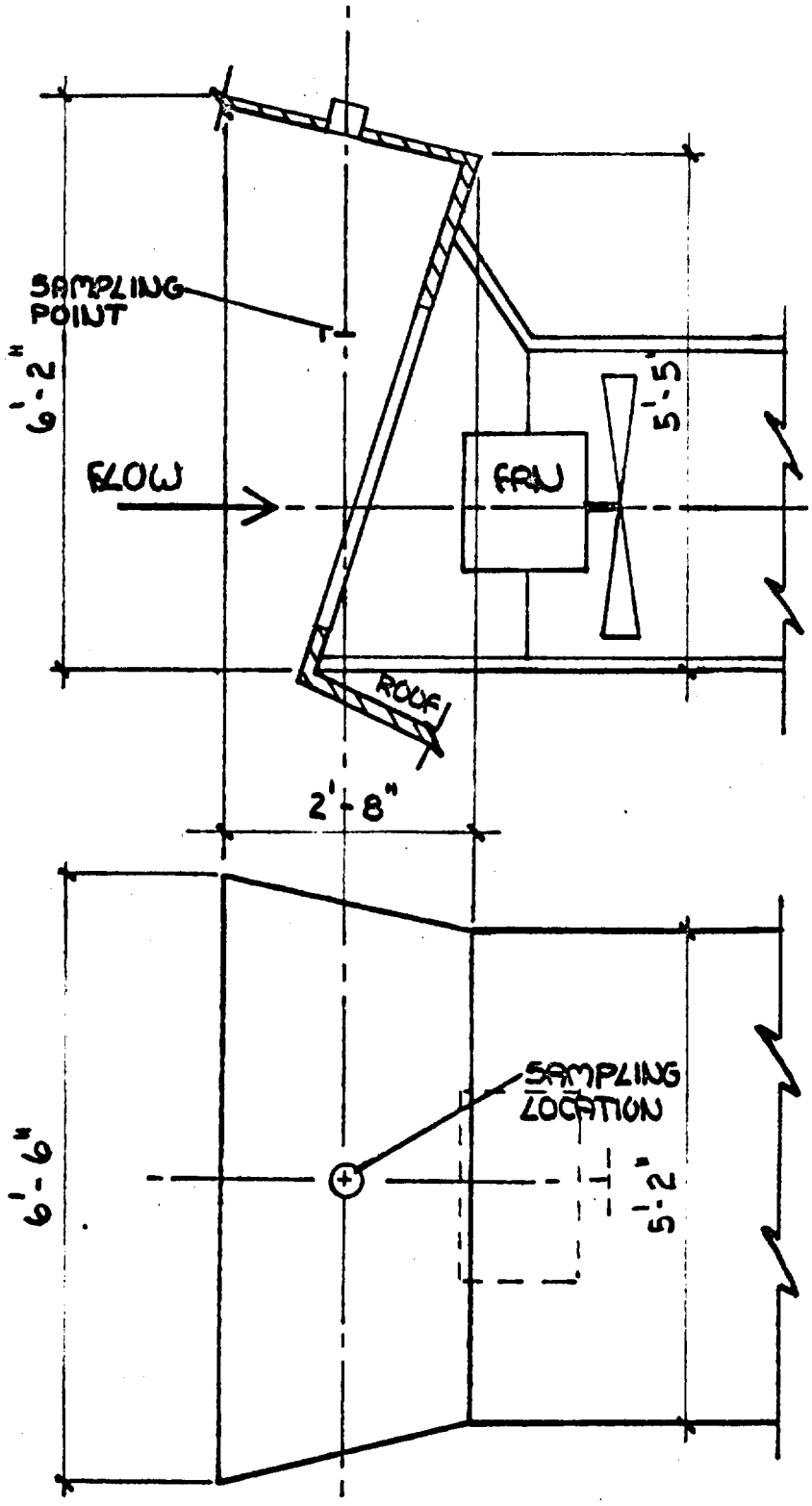


REYNOLDS PLANT
POINTS ON TRAVERSE



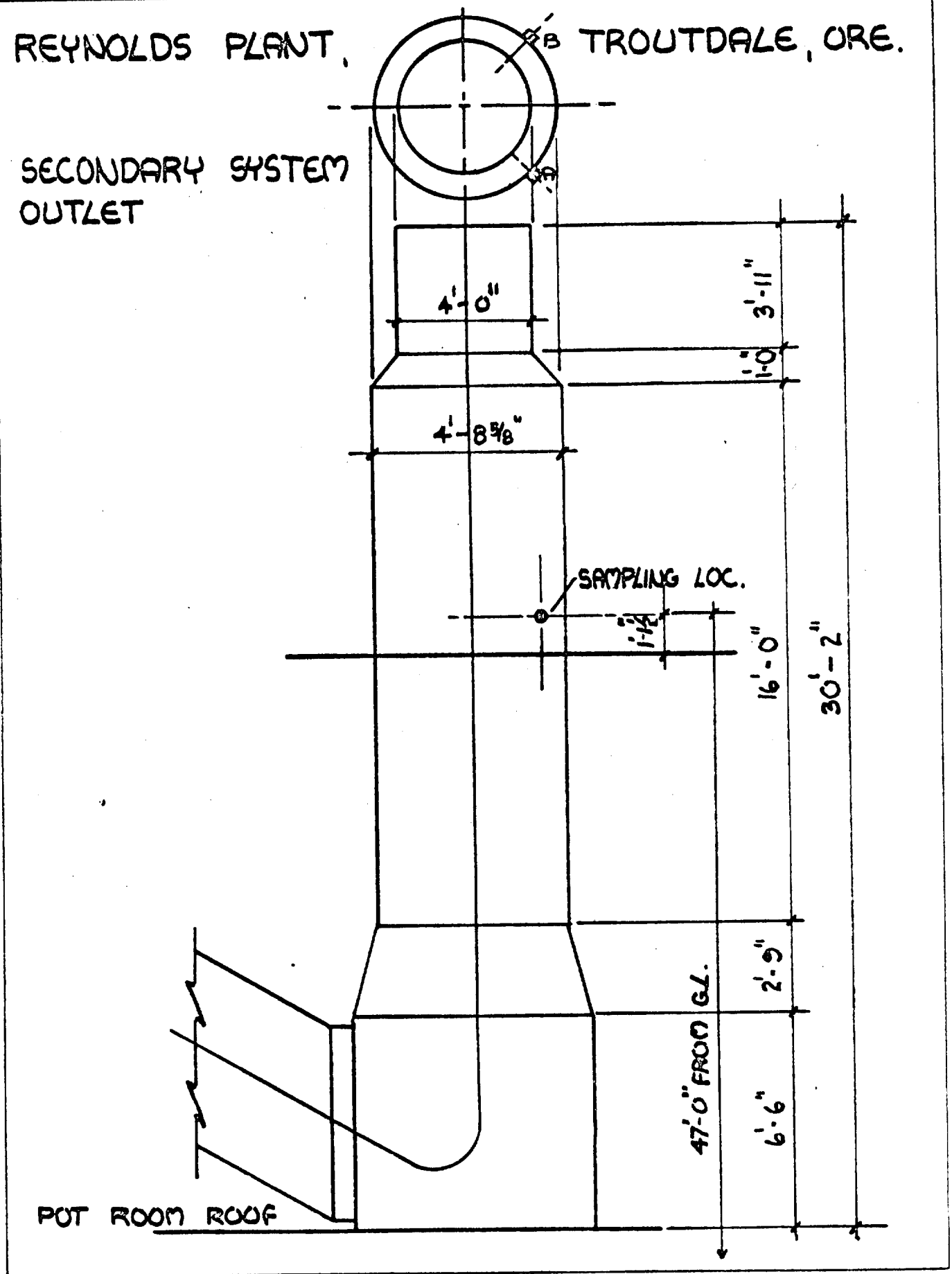
PRIMARY OUTLET

REYNOLDS PLANT, TROUTDALE, OREGON
SECONDARY SYSTEM INLET

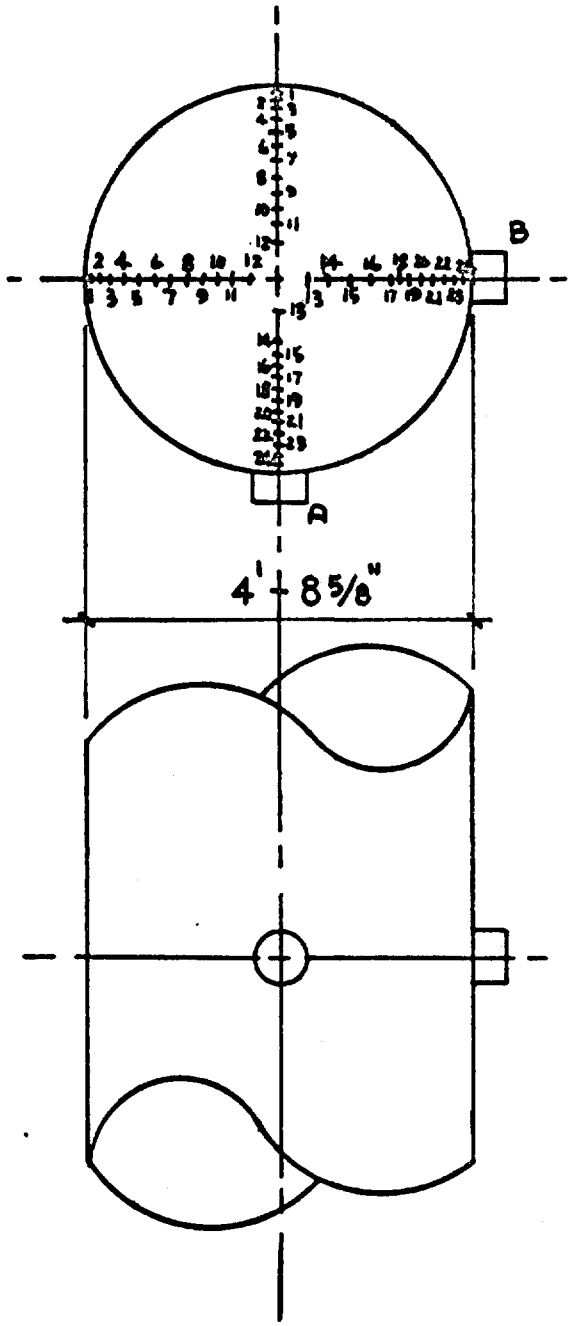


REYNOLDS PLANT, TROUTDALE, ORE.

SECONDARY SYSTEM OUTLET



REYNOLDS PLANT
POINTS ON TRAVERSE



SECONDARY OUTLET

PROCESS OPERATING DATA*

	Primary		Secondary	
	Inlet	Outlet	Inlet	Outlet
No. of cells to test Units	14	30	6	6
No. of crust breakings	1 every 45 minutes/cell			
No. of studs replaced	1 anode/cell/8 hrs.			
Weight of Cell	1000 lbs/dry cell			

Process weight tons/hr Primary Inlet =

14 cells x 1000 lbs./dry cell x 1 day/24 hrs. x 1 ton/2000 lbs.= .292 tons/hr.

Process weight tons/hr Primary Outlet =

30 x 1000 x 1/24 x 1/2000 = .625

Process weight ton/hr Secondary Inlet =

6 x 1000 x 1/24 x 1/2000 = .125

Process weight tons/hr Secondary Outlet =

6 x 1000 x 1/24 x 1/2000 = .125

*This is the data supplied by EPA about process operation.

VII. SAMPLING AND ANALYTICAL PROCEDURES

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) and paper (Whatman 541) filter media. In addition, three outlet test runs were performed using membrane (0.45) 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 phenoldisulfonic acid method. A total of six samples were collected - three at the scrubber inlet and three at the 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. 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.

All analysis were conducted by EPA in their own laboratory. Results were transmitted to York Research for calculation of emission rate. The procedures described here are the standard EPA Methods which were used by EPA in analyzing the samples.

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 are 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 300 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 sample at 70°F and 29.92 inches Hg, scf

X = ppm fluoride

$$44.82 = \frac{\frac{530°F}{492°F} \times 22.4 \frac{\text{liters}}{\text{mole}} \times 10^6}{19 \frac{\text{g}}{\text{mole}} \times 10^3 \frac{\text{mg}}{\text{g}} \times 28.32 \frac{\text{liters}}{\text{cu.ft.}}}$$

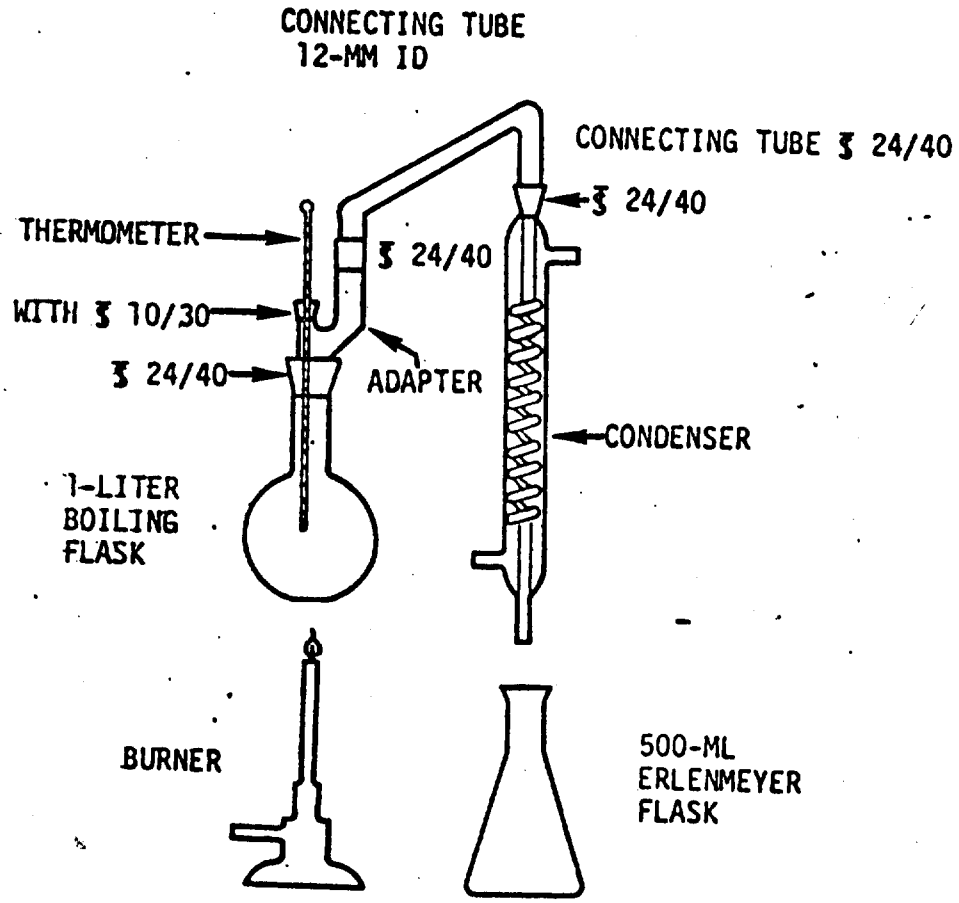


Figure 1. Fluoride distillation apparatus.

E. ASME PARTICULATE EMISSION TESTS

Particulate emission tests were conducted in general accord with ASME Power Test Code PTC-27 and Western Precipitation Company Bulletin WP-50. A diagram of the train is shown in Figure 2 of the Appendix.

The train consists of button hook nozzle, an alundum thimble and probe located within the stack. This is connected to three (3) Greenburg-Smith impingers in an ice bath, followed by a pump and dry gas meter. The first two impingers are each charged with 100 ml of distilled water. Isokinetic conditions are calculated from the nomagraph shown in Figure 4. A metering rate was calculated for each port based on the results of a pitot traverse conducted before the particulate test.

Following sampling, all samples were given to EPA for analysis.

VII. APPENDIX

Preparation:

Jerold W. Grabiner
Environmental Test Engineer

Laboratory Supervision:

Gregory Pantchenko
Chief Chemist

Review:

Louis A. Terracciano
Project Director

Approval:

Abraham J. Kurtz
Vice President Environmental Sciences

SUMMARY SECTION

To facilitate data correlations, 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 entirety in other sections of the Appendix.

TABLE A-I
SUMMARY OF PARTICULATE EMISSIONS USING GLASS FIBER FILTERS

Run No.: Location:		Primary Inlet 1	Primary Outlet	Primary Inlet 2	Primary Outlet	Primary Inlet 3	Primary Outlet
Date:		11/2/71		11/3/71		11/3/71	
CO%		0.0	0.3	0.1	0.0	0.1	0.0
CO_2%		0.0	0.03	0.0	0.03	0.0	0.03
O_2%		21.0	20.9	20.6	20.8	20.6	20.8
Stack Temperature °F		185	98	188	98	204	108
Stack Velocity - ft/min		3670	2250	3730	2246	3672	2250
Stack Flow Rate - SCFM		27500	61600	27600	61200	26200	59500
Fluoride Emission							
Impinger Solution Front Half	gr/SCF	.0067	-	.0059	-	.0061	-
	lb/hr	1.58	-	1.40	-	1.37	-
Back Half	gr/SCF	.0257	.00964	.0276	.00362	.0203	.00341
	lb/hr	6.06	5.11	6.53	1.90	5.93	1.73
Total Soluble Fluoride	gr/SCF	.0324	.00183	.0335	.00913	.0264	.00118
	lb/hr	7.64	9.67	7.92	4.77	5.93	.60
Total Particulate Emission Probe, Cyclone & Filter							
Total Insoluble	gr/SCF	.00495	.0511	.00286	.00088	.00243	.1811
	lb/hr	1.17	26.98	.68	.49	.55	92.34
Total Fluoride	gr/SCF	.0325	.0694	.0364	.0100	.0288	.1929
	lb/hr	8.13	36.65	8.61	5.26	6.47	98.35
Total Fluoride lbs/ton		27.84	58.64	29.49	8.42	22.16	157.36

TABLE A-II
SUMMARY OF PARTICULATE EMISSIONS USING GLASS FIBER FILTERS

Run No.: Location:		Secondary Inlet 1	Secondary Outlet	Secondary Inlet 2	Secondary Outlet	Secondary Inlet 3	Secondary Outlet
Date:		11/4/71	11/4/71	11/5/71	11/5/71	11/5/71	11/5/71
CO%		0.1	0.0	0.0	0.1	0.0	0.1
CO_2%		0.0	0.0	0.0	0.0	0.0	0.0
O_2%		20.8	20.7	20.7	20.7	20.7	20.7
Stack Temperature °F		66	95	52	79	68	90
Stack Velocity-ft/min		920	2550	1020	2500	919	2540
Stack Flow Rate -SCFM		33400	42600	38400	43300	33400	43000
Fluoride Emission							
Back Half	gr/SCF	.00147	.00140	.00167	.00132	.00172	.00136
	lb/hr	.434	.511	.538	.490	.501	.501
Total Soluble Fluoride	gr/SCF	.00283	.00232	.00340	.00222	.00335	.00233
	lb/hr	.803	.847	.115	.824	.969	.859
Total Particulate Emission Probe, Cyclone & Filter							
Total Insoluble Fluoride	gr/SCF	.00015	.00222	.00025	.000127	.00038	.000188
	lb/hr	.033	.0809	.077	.0472	.100	.0692
Total Fluoride	gr/SCF	.00398	.00255	.00361	.00236	.00373	.00252
	lb/hr	1.136	.931	1.190	.876	1.069	.929
Total Fluoride	lbs/ton	9.09	7.45	9.52	7.01	8.55	7.43

TABLE A - III

SUMMARY OF GASEOUS EMISSIONS

Run No.:	1		2		3	
Location:	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Date:	11/3/71	11/5/71	11/3/71	11/5/71	11/3/71	11/5/71
SO_2 ppm	4.3	4.7	0.60	4.8	2.0	4.4
Date:	11/4/71	11/4/71	11/4/71	11/4/71	11/4/71	11/4/71
NO_x ppm	*	*	*	*	*	*
Date:	11/3/71	11/4/71	11/3/71	11/4/71	11/3/71	11/4/71
lb. F^- / Ton Alum. (in water)	12.53	3.76	12.43	1.33	16.47	4.91

*Samples not neutralized with caustic during analytical preparation.

TABLE A - IV

SUMMARY OF GASEOUS EMISSIONS

Run No.:	4		5	
Location:	Inlet	Outlet	Inlet	Outlet
Date:	11/3/71	11/5/71	11/3/71	
SO_2 ppm	10.1	4.8	15.4	-
Date:	11/3/71	11/4/71		
lb. F^- / Ton Alum. (in water)	15.14	4.93	-	-

YORK RESEARCH CORPORATION STAMFORD, CONNECTICUT

EXAMPLE
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}

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

$$52.064 = \frac{17.7 \times 51.449 \left(30.34 + \frac{1.034}{13.6}\right)}{(72 + 460)}$$

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

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

$$.052 = 0.0474 \times 1.1$$

3. % Moisture in stack gas

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

$$.100 = \frac{100 \times .052}{52.064 + .052}$$

4. Mole fraction of dry gas

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

$$.999 = \frac{100 - .052}{100}$$

The Primary Inlet System Test No. 1, water soluble fluoride is used as the example of the sample calculation.

5. Average molecular weight of dry stack gas

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

$$28.84 = (0.0 \times \frac{44}{100}) + (21.0 \times \frac{32}{100}) + 72. \times \frac{28}{100}) + (0.0 \times \frac{28}{100})$$

6. Molecular weight of stack gas

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

$$28.83 = 28.84 \times .999 + 18\ (1 - .999)$$

7. Stack velocity at stack conditions, fpm

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

$$3670 = 4350 \times 24.594 \left[\frac{1}{30.30 \times 28.83}\right]^{1/2}$$

8. Stack gas volume at standard conditions, SCFM

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

$$27,500 = \frac{0.123 \times 3670 \times 1300 \times .99 \times 30.30}{(185 + 460)}$$

9. Percent isokinetic

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

$$94.4 = \frac{1032 \times (185 + 460) \times 52.064}{3670 \times 94 \times 30.30 \times .999 \times (.1875)^2}$$

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

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

$$.0067 = 0.0154 \times \frac{22.7}{52.064}$$

11. Particulate total, gr/SCF

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

$$.0324 = 0.0154 \times \frac{109.5}{52.064}$$

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

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

$$.00556 = \frac{17.7 \times .0067 \times .949 \times .999}{(185 + 460)}$$

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

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

$$.0269 = \frac{17.7 \times .0324 \times .949 \times .999}{(185 + 460)}$$

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

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

$$1.58 = 0.00857 \times .0067 \times 27{,}500$$

15. Particulate - total, lb./hr.

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

$$7.64 = 0.00857 \times .0269 \times 27{,}500$$

16. Particulate emission lbs/ton of process weight

$$C_{az} = C_{ax} \times \frac{1}{\text{Process Weight}} = \text{tons/hr}$$

$$26.16 = 7.64 \times \frac{1}{.292}$$

EXAMPLE GAS CALCULATIONS

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

$$0.0 = \frac{29.63 \times 0.0\ (T_f + 460)}{2.063 \times (22.3 - .3)}$$

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

$$4.3 = \frac{0.7332 \times 2.8 \times (57 + 460)}{30.17 \times 8.40}$$

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

$$2.35 = 7.47 \times 10^{-6} \frac{3.1\ (60 + 460)\ 59500}{(10.02)\ 30.30)}$$

EXAMPLE CALCULATIONS

FLUORIDE EMISSIONS - ASME

$$\frac{\text{mg of sample}}{1} \times \frac{1 \text{ lb.}}{4.54 \times 10^5 \text{ mg}} \times \frac{Q_s \text{ cf/m (stack)}}{V_m \text{ cf (stack)}} \times \frac{60 \text{ min}}{1 \text{ hr}} = \frac{\text{lb.}}{\text{hr.}}$$

$$\frac{63.1}{4.54 \times 10^5} \times \frac{30,910}{73.96} \times \frac{60}{1} = 3.48 \text{ lb/hr.}$$

$$\text{Emission rate in lbs/ton} = 3.48 \text{ lb/hr} \times \frac{1}{\text{Process weight tons/hr}} =$$

11.92

VELOCITY TRAVERSE DATA

CLIENT EPA PAGE 32 OF 47

Location of Test REYNOLDS TROUTDALE, ORE. DATE OF TEST 11/2/71

Conditions PRIMARY OUTLET PRELIMINARY PITOT TEST NO. —

Personnel THEISZ JOB NO. Y-7130E

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

MOLECULAR WGT. — #/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

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

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
1	80	540			.54			
A 2	90	550			.53			
3	90	550			.49			
4	90	550			.47			
5	90	550			.46			
6	95	555			.46			
7	100	560			.38			
8	100	560			.33			
9	100	560			.31			
10	100	560			.27			
11	100	560			.27			
12	100	560			.26			
13	100	560			.24			
14	100	560			.22			
15	100	560			.21			
16	100	560			.19			
17	98	558			.18			
18	98	558			.13			
TOTAL								
READINGS								
AVE.								

VELOCITY TRAVERSE DATA

CLIENT EPA — PAGE 33 OF 147

Location of Test REYNOLDS TROUTDALE, ORE — DATE OF TEST —

Conditions PRIMARY OUTLET PRELIMINARY PITOT — TEST NO. —

Personnel THEISZ — JOB NO. —

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

MOLECULAR WGT. — #/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

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

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
1	90	550			.38			
B 2	90	550			.39			
3	95	555			.35			
4	95	555			.36			
5	95	555			.37			
6	95	555			.42			
7	100	560			.58			
8	100	560			.62			
9	100	660			.62			
10	100	560			.68			
11	100	560			.67			
12	100	560			.66			
13	100	560			.66			
14	100	560			.65			
15	100	560			.63			
16	100	660			.59			
17	100	560			.58			
18	98	558			.39			
TOTAL								
READINGS								
AVE.								

VELOCITY TRAVERSE DATA

CLIENT EPA — PAGE 34 OF 107

Location of Test REYNOLDS METALS — DATE OF TEST 11/4/71

Conditions PRELIMINARY VELOCITY TRAVERSE — TEST NO. —

Personnel SECONDARY OUTLET — JOB NO. Y-7730E

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

MOLECULAR WGT. _____ #/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

$$K = \text{_____} \sqrt{\frac{29.92}{\text{_____}} \times \frac{28.95}{\text{_____}}} = \text{_____}$$

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	90	650			.48			
A 2	90	550			.53			
3	95	665			.57			
4	95	665			.59			
5	95	565			.59			
6	100	560			.61			
7	100	560			.66			
8	100	560			.70			
9	100	560			.75			
10	100	560			.80			
11	100	560			.82			
12	100	560			.64			
13	100	560			.47			
14	100	660			.46			
15	100	560			.48			
16	100	560			.63			
17	100	560			.66			
18	100	560			.64			
19	100	560			.62			
20	100	560			.62			
21	100	560			.66			
22	100	560			.57			
23	100	560			.52			
24	100	560			.33			
TOTAL								
READINGS								
AVE.								

VELOCITY TRAVERSE DATA

CLIENT EPA PAGE 35 OF 147

Location of Test REYNOLDS METALS DATE OF TEST

Conditions PRELIMINARY VELOCITY TRAVERSE TEST NO.

Personnel SECONDARY OUTLET 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	$\sqrt{\Delta p \times T}$	VS Ft/Sec.
B 1	85	545			.48			
2	90	550			.44			
3	100	560			.45			
4	100	560			.44			
5	100	560			.45			
6	100	560			.53			
7	100	560			.58			
8	100	560			.54			
9	100	560			.56			
10	100	560			.02			
11	100	560			.02			
12	100	560			.07			
13	100	560			.26			
14	100	560			.51			
15	100	560			.57			
16	100	560			.62			
17	100	560			.64			
18	100	560			.68			
19	100	560			.67			
20	100	560			.64			
21	100	560			.70			
22	100	560			.68			
23	100	560			.62			
24	100	560			.45			
TOTAL								
READINGS								
AVE.								

TABLE A - IV

SUMMARY OF GASEOUS EMISSIONS

Run No.:	4		5	
Location:	Inlet	Outlet	Inlet	Outlet
Date:	11/3/71	11/5/71	11/3/71	
SO_2 ppm	10.1	4.8	15.4	-
Date:	11/3/71	11/4/71		
lb. F^- / Ton Alum. (in water)	15.14	4.93	-	-

YORK RESEARCH CORPORATION STAMFORD, CONNECTICUT

SOURCE TESTING CALCULATION FORMS

Test No. _____ No. Runs 3

Name of Firm Reynolds Metals

Location of Plant Troutdale, 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	11/2/71	Begin	1530	End	1724
Run No.	2	Date	11/3/71	Begin	0954	End	1154
Run No.	3	Date	11/3/71	Begin	1450	End	1644

PARTICULATE EMISSION DATA

Run No.	1	2	3	
P_b barometric pressure, "Hg Absolute	30.34	30.22	30.17	
P_m orifice pressure drop, "H_2O	1.032	1.082	1.023	
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	51.449	53.940	53.745	
T_m Average Gas Meter Temperature, °F	72	78	94	
V_m Volume of Dry Gas Sampled @ Standard std. conditions, ft.^{3}	52.064	53.770	51.935	
V_w Total H_2O collected, ml., Impingers & Silica Gel.	1.1	5.8	18.1	
V_w gas Volume of Water Vapor Collected ft.^{3} @ Standard Conditions*	.052	.275	.858	

* 70°F, 29.92" Hg.

PARTICULATE EMISSION DATA (cont'd)

Run No.	1	2	3	
%M - % Moisture in the stack gas by volume	.100	.509	1.63	
M_d - Mole fraction of dry gas	.999	.995	.984	
% CO_2 / % CO	0.0 / 0.0	0.0 / 0.1	0.0 / 0.1	/
% O_2	21.0	20.6	20.6	
% N_2	79.0	79.3	79.3	
M w d - Molecular weight of dry stack gas	28.84	28.82	28.82	
M W - Molecular weight of stack gas	28.83	28.77	28.64	
ΔP_s - Velocity Head of stack gas, In. H_2O	.949	.996	.940	
T_s - Stack Temperature, °F	185	188	204	
$\sqrt{\Delta P_s X (T_s+460)}$	24.594	25.255	24.799	
P_s - Stack Pressure, "Hg. Absolute	30.30	30.18	30.13	
V_s Stack Velocity @ stack conditions, fpm	3670	3730	3672	
A_s - Stack Area, $in.^2$	1300	1300	1300	
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	27500	27600	26200	
Tt - Net Time of Test, min.	94	94	94	
D_n - Sampling Nozzle Diameter, in.	3/16	3/16	3/16	
%I - Percent isokinetic	94.4	97.1	98.9	
mf - Water Soluble Fluoride Filter & Impinger, mg.	22.7	20.5	20.7	
Mw - Water Soluble Fluoride Water Wash, mg.	86.8	96.5	68.3	
mt - Water Soluble Fluoride, total mg.	109.5	117.0	89.0	
MU - TOTAL INSOLUBLE FLUORIDE mg.	10.3	10.0	8.2	
MV - TOTAL FLUORIDE mg	119.8	127.0	97.2	

PARTICULATE EMISSION DATA (cont'd)

Run No.	1	2	3	
CAL - WATER SOLUBLE FLUORIDE FRONT HALF, gr/SCF	.0067	.0059	.0061	
CAM - WATER SOLUBLE FLUORIDE BACK HALF, gr/SCF	.0257	.0276	.0203	
CAN - TOTAL WATER SOLUBLE FLUORIDE gr/SCF	.0324	.0335	.0264	
CAO - TOTAL INSOLUBLE FLUORIDE, gr/SCF	.00495	.00286	.00243	
CAP - TOTAL FLUORIDE gr/SCF	.0364	.0364	.0288	
CAQ - WATER SOLUBLE FLUORIDE FRONT HALF gr/CF @ STACK CONDITION	.00556	.00484	.00482	
CAR - WATER SOLUBLE FLUORIDE BACK HALF, gr/CF @ STACK CONDITION	.0214	.0226	.0160	
CAS - TOTAL WATER SOLUBLE FLUORIDE gr/CF @ STACK CONDITION	.0269	.0275	.0209	
CAT - TOTAL INSOLUBLE FLUORIDE gr/CF @ STACK CONDITION	.00411	.00210	.00192	
CAU - TOTAL FLOURIDE gr/CF @ STACK CONDITION	.0298	.0299	.0228	
CAV - WATER SOLUBLE FLUORIDE FRONT HALF, lb/hr	1.58	1.40	1.37	
CAW - WATER SOLUBLE FLUORIDE BACK HALF, lb/hr	6.06	6.53	5.93	
CAX - TOTAL WATER SOLUBLE FLUORIDE lb/hr	7.64	7.92	5.93	
CAY - TOTAL INSOLUBLE FLUORIDE lb/hr	1.17	0.68	0.55	
CAZ - TOTAL FLOURIDE lb/hr	8.13	8.61	6.47	

JOB NO. Y-7730E

PARTICULATE FIELD DATA

Plant REYNOLDS METALS TROUTDALE, ORE.

Run No. 1

Location PRIMARY INLET

Date 11/2/71

Operator RWK / 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-244

Ambient Temp °F 50

Bar.Press. "Hg 30.34

Assumed Moisture % 2

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Probe Length 4

Probe Heater Setting 60%

Avg. ΔP Avg. ΔH 1.032

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
A 1	1530	778.951	.71	.78	.78	57	57	2.0	240	61	—	185
2	1532	779.83	.77	.84	.84	57	54	2.0	245	58	—	190
3	1534	780.76	.81	.89	.89	60	52	2.0	210	62	—	190
4	1536	781.80	.83	.90	.90	61	52	2.0	245	56	—	190
5	1538	782.78	.85	.93	.93	63	52	2.5	215	56	—	190
6	1540	783.85	.71	.78	.78	64	52	2.0	240	56	—	180
7	1542	784.83	.56	.62	.62	68	52	2.0	220	56	—	165
8	1544	785.71	.56	.62	.62	69	54	2.0	240	56	—	155
9	1546	786.61	.62	.68	.68	69	54	2.0	215	56	—	140
10	1548	787.45	.65	.71	.71	71	55	2.0	240	56	—	55
FINAL	1550	788.41	—	—	—	—	—	—	—	—	—	—
B 1	1558	788.41	.93	1.00	1.00	65	58	2.5	225	63	—	185
2	1600	789.46	.98	1.05	1.05	68	58	2.5	230	60	—	195
3	1602	790.61	1.05	1.15	1.15	70	58	2.5	235	59	—	195
4	1604	791.75	1.05	1.15	1.15	70	58	3.5	240	60	—	190

JOB NO. Y-7730C

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
C 5	1606	792.85	1.10	1.20	1.20	74	60	4.5	240	60	—	185
6	1608	794.05	1.10	1.20	1.20	73	59	5.5	225	60	—	185
7	1610	795.28	1.10	1.20	1.20	77	60	5.5	240	60	—	190
8	1612	794.42	1.10	1.20	1.20	78	61	6.0	225	60	—	185
9	1614	797.55	1.05	1.15	1.15	80	60	6.0	215	60	—	190
10	1616	798.75	1.15	1.25	1.25	81	61	6.5	225	60	—	165
FINAL	1618	799.925	—	—	—	—	—	—	—	—	—	—
C 1	1620	799.925	.95	1.01	1.01	80	63	6.5	215	60	—	195
2	1622	801.05	.75	.83	.83	81	61	6.0	240	61	—	190
3	1624	802.10	.90	.96	.96	82	62	6.5	220	60	—	190
4	1626	803.08	.71	.78	.78	84	64	6.0	240	60	—	200
5	1628	804.12	1.20	1.28	1.28	84	64	7.5	240	60	—	205
6	1630	805.25	1.15	1.25	1.25	83	66	8.0	240	60	—	205
7	1632	806.45	1.10	1.20	1.20	83	66	8.0	215	60	—	200
8	1634	807.70	.93	1.00	1.00	83	66	7.5	245	60	—	195
9	1636	808.00	.75	.82	.82	89	68	6.0	215	60	—	190
10	1638	809.01	.75	.82	.82	89	68	7.0	215	60	—	180
FINAL	1640	810.04	—	—	—	—	—	—	—	—	—	—
D 1	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	—	—	—
4	1646	810.04	.45	.50	.50	78	68	7.0	240	60	—	200
5	1648	811.70	1.10	1.20	1.20	82	70	9.0	240	65	—	200
6	1650	812.82	1.10	1.20	1.20	85	71	10.5	225	65	—	190
7	1652	813.90	1.20	1.30	1.30	85	71	11.0	240	60	—	190
8	1654	815.11	1.10	1.20	1.20	85	71	11.0	240	60	—	185
9	1656	816.35	.93	1.00	1.00	85	71	10.0	220	60	—	180
10	1658	817.53	.95	1.01	1.01	83	72	10.0	220	60	—	175
FINAL	1700	818.65	—	—	—	—	—	—	—	—	—	—
E 1	1704	818.65	1.05	1.15	1.15	85	73	9.5	200	70	—	195
2	1706	819.84	1.20	1.30	1.30	90	72	11.0	225	67	—	190
3	1708	821.05	1.20	1.30	1.30	93	73	11.5	250	60	—	195
4	1710	822.20	1.20	1.30	1.30	93	73	12.0	260	60	—	190
5	1712	823.48	1.10	1.20	1.20	92	73	12.0	250	60	—	185
6	1714	824.55	1.10	1.20	1.20	96	76	13.0	230	60	—	190
7	1716	825.74	1.00	1.10	1.10	95	75	13.0	240	60	—	185
8	1718	826.90	1.00	1.10	1.10	100	76	13.5	260	60	—	190
9	1720	828.20	1.10	1.20	1.20	101	78	14.0	250	60	—	190
10	1722	829.30	.93	1.00	1.00	100	78	14.0	240	60	—	190
L	1724	830.490	—	—	—	—	—	—	—	—	—	—

NET TIME. 94 MIN. 51.449 80 64

Date: 11/2/71 Plant: REYNOLDS METALS

Run Number: 1 Location of sample port: INLET

Operator: RWK / KC Barometric Pressure: 30.34

Sample Box Number: — Ambient Temperature: 50

Impinger H_2O

Volume after sampling 200 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

Impinger prefilled with 188 ml Extra No. ____ Impinger water residue ____ mg

Volume Collected -12 ml

Impingers and back half of filter, acetone wash: Container No. 2

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-244	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	313.1				
Weight before test:	300.0				
Moisture weight collected:	13.1				Moisture Total 1.1 gm
Container Number: 4	1. ____	2. ____	3. ____	4. ____	

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730E

PARTICULATE FIELD DATA

Plant REYNOLDS METALS, TROUTDALE, ORE

Run No. 2

Location PRIMARY INLET

Date 11/3/71

Operator RWK / 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.

F-257

Ambient Temp °F 45

Bar. Press. "Hg 30.22

Assumed Moisture % 2

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Probe Length 4'

Probe Heater Setting 60%

Avg. ΔP Avg. ΔH 1.082

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	0954	830.460	.84	.91	.91	60	59	4.5	230	65	—	200
2	0956	831.50	.84	.91	.91	60	60	5.5	240	60	—	200
3	0958	832.57	.90	.97	.97	64	60	6.0	220	60	—	195
4	1000	833.65	.95	1.05	1.05	66	60	7.0	240	60	—	190
5	1002	834.80	.93	1.00	1.00	68	60	7.0	230	60	—	195
6	1004	835.91	.75	.83	.83	70	60	6.0	240	60	—	195
7	1006	832.00	.67	.75	.75	72	60	6.0	230	60	—	175
8	1008	837.20	.63	.70	.70	73	61	5.0	230	60	—	170
9	1010	838.90	.63	.70	.70	74	63	6.0	240	60	—	155
10	1012	839.99	.63	.70	.70	74	61	6.0	230	60	—	155
FINAL	1014	840.828	—	—	—	—	—	—	—	—	—	—
B 1	1026	840.828	.93	1.00	1.00	68	64	6.0	220	60	—	200
2	1029	841.84	1.10	1.20	1.20	73	63	7.0	230	60	—	195
3	1030	843.05	1.10	1.20	1.20	74	64	8.5	230	60	—	190
4	1032	844.20	1.15	1.25	1.25	80	67	9.5	240	60	—	190

Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
240	60	—	200
240	60	—	200
230	60	—	200
240	60	—	195
240	60	—	180
240	60	—	175
—	—	—	—
240	60	—	195
225	60	—	190
240	60	—	190
225	60	—	195
250	60	—	190
225	60	—	195
230	60	—	190
240	60	—	180
230	60	—	180
240	60	—	120
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
220	60	—	195
240	60	—	195
240	60	—	195
230	60	—	200
240	60	—	200
240	60	—	190
230	60	—	190
—	—	—	—
240	60	—	190
240	60	—	195
230	60	—	200
240	60	—	200
250	60	—	200
240	60	—	200
230	60	—	190
220	60	—	185
220	60	—	170
230	60	—	170
—	—	—	—

PARTICULATE CLEANUP SHEET

Date: 11/3/71 Plant: REYNOLDS

Run Number: 2 Location of sample port: INLET

Operator: RWK / KC Barometric Pressure: 30.22

Sample Box Number: — Ambient Temperature: 45

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-257	1		

Filter particulate weight _____ mg

Total particulate weight _____ mg

Silica Gel

Weight after test:	317.8				
Weight before test:	300.0				
Moisture weight collected:	17.8				Moisture Total 5.8 gm
Container Number: 4	1.	2.	3.	4.	

Sample Number: _____ Analyze for: _____

Method determination: _____

Comments: _____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730E

PARTICULATE FIELD DATA

Plant REYNOLDS METALS, TROUTDALE, ORE.

Run No. 3

Location PRIMARY INLET

Date 11/3/71

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-127

Ambient Temp °F 65

Bar.Press. "Hg 30.17

Assumed Moisture % 2%

Heater Box Setting, °F 250°

Probe Tip Dia., In. 3/16"

Probe Length 4'

Probe Heater Setting 60%

Avg. ΔP Avg. ΔH 1.023

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
E 1	1450	884.389	1.10	1.15	1.15	71	71	7.5	245	65	—	205
2	1452	885.55	1.10	1.15	1.15	76	72	7.5	240	60	—	200
3	1454	886.75	1.10	1.15	1.15	78	73	8.0	240	60	—	210
4	1456	887.89	1.20	1.30	1.30	81	73	8.5	250	60	—	210
5	1458	889.11	1.30	1.40	1.40	86	74	10.0	220	60	—	215
6	1500	890.41	1.30	1.40	1.40	88	74	10.0	240	60	—	210
7	1502	891.70	1.10	1.15	1.15	91	75	9.0	220	60	—	200
8	1504	892.82	1.20	1.30	1.30	92	74	10.0	250	60	—	200
9	1506	894.10	1.00	1.10	1.10	96	78	9.5	250	60	—	185
10	1508	895.28	.75	.83	.83	97	78	7.5	250	60	—	170
FINAL	1510	896.460	—	—	—	—	—	—	—	—	—	—
D 1	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	—	—	—
4	1514	896.46	.25	.28	.28	91	79	4.0	230	60	—	195

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					
E 5	1516	896.99	1.20	1.30	1.30	94	80	9.5	240	60	—	215
6	1518	898.15	1.20	1.30	1.30	98	80	11.5	250	60	—	220
7	1520	899.45	1.10	1.20	1.20	100	81	11.0	240	60	—	215
8	1522	900.69	1.10	1.20	1.20	102	82	13.5	250	60	—	205
9	1524	902.17	.90	.97	.97	105	82	11.0	240	60	—	205
10	1526	903.12	.85	.92	.92	105	83	10.0	230	60	—	175
FINAL	1528	904.245	—	—	—	—	—	—	—	—	—	—
C 1	1532	904.245	.90	.97	.97	96	84	9.5	250	60	—	215
2	1534	905.34	.93	1.00	1.00	101	85	10.5	220	60	—	210
3	1536	906.46	1.10	1.20	1.20	104	86	14.5	250	60	—	220
4	1538	907.76	1.10	1.20	1.20	105	87	14.5	240	60	—	220
5	1540	909.00	1.10	1.20	1.20	106	86	14.5	250	60	—	220
6	1542	910.24	1.00	1.10	1.10	108	86	14.0	230	60	—	215
7	1544	911.47	1.00	1.10	1.10	110	87	14.0	250	60	—	210
8	1546	912.64	.90	.97	.97	110	87	13.0	230	60	—	210
9	1548	913.74	.70	.78	.78	110	88	11.5	230	60	—	185
10	1550	914.87	.70	.78	.78	110	88	11.0	240	60	—	185
FINAL	1552	915.881	—	—	—	—	—	—	—	—	—	—
B 1	1556	915.881	.87	.95	.95	101	88	11.0	230	60	—	210
2	1558	917.01	.95	1.05	1.05	104	88	13.5	250	60	—	210
3	1600	918.18	1.00	1.10	1.10	106	88	15.0	230	60	—	215
4	1602	919.32	1.10	1.20	1.20	109	88	16.5	240	60	—	215
5	1604	920.69	1.10	1.20	1.20	110	88	17.0	240	60	—	210
6	1606	921.85	1.10	1.20	1.20	111	88	17.0	230	60	—	210
7	1608	923.03	1.20	1.30	1.30	113	89	19.5	250	60	—	215
8	1610	924.43	1.00	1.10	1.10	114	89	18.5	220	60	—	205
9	1612	925.55	.87	.95	.95	116	90	16.0	250	60	—	185
10	1614	926.74	.85	.92	.92	116	90	15.5	225	60	—	150
FINAL	1616	927.840	—	—	—	—	—	—	—	—	—	—
A 1	1624	927.846	.71	.78	.78	100	90	11.5	250	60	—	215
2	1626	928.89	.78	.86	.86	104	90	14.5	250	60	—	215
3	1628	929.91	.80	.87	.87	106	97	15.0	240	60	—	220
4	1630	930.08	.85	.93	.93	108	97	15.5	225	60	—	220
5	1632	932.15	.85	.93	.93	108	98	16.0	220	60	—	220
6	1634	933.10	.71	.78	.78	110	91	15.5	220	60	—	210
7	1636	934.40	.155	.62	.62	112	91	14.5	220	60	—	210
8	1638	935.50	.55	.62	.62	112	92	13.5	250	60	—	180
9	1640	936.20	.57	.64	.64	114	91	13.0	250	60	—	180
10	1642	937.18	.60	.68	.68	114	91	12.5	250	60	—	180
FINAL	1644	938.134	—	—	—	—	—	—	—	—	—	—

102 85

a.1

PARTICULATE CLEANUP SHEET

Date: 11/3/71 Plant: REYNOLDS

Run Number: 3 Location of sample port: INLET

Operator: RWK / KC Barometric Pressure: 30.17

Sample Box Number: — Ambient Temperature: 65

Impinger H_2O

Volume after sampling 201 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

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

Volume Collected 1 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-127	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	317.1				
Weight before test:	300.0				
Moisture weight collected:	17.1				Moisture Total 18.1 gm
Container Number: 4	1. ____	2. ____	3. ____	4. ____	

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

SOURCE TESTING CALCULATION FORMS

Test No. — No. Runs 3

Name of Firm Reynolds Metals

Location of Plant Troutdale, 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 11/2/71 Begin 1530 End 1800

Run No. 2 Date 11/3/71 Begin 1007 End 1238

Run No. 3 Date 11/3/71 Begin 1450 End 1724

PARTICULATE EMISSION DATA

Run No.	1	2	3	
P_b barometric pressure, "Hg Absolute	30.34	30.22	30.17	
P_m orifice pressure drop, "H_2O	1.604	.445	.430	
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	95.82	52.82	52.15	
T_m Average Gas Meter Temperature, °F	72	64	69	
V_m Volume of Dry Gas Sampled @ Standard std. conditions, ft.^{3}	97.10	53.98	52.70	
V_w Total H_2O collected, ml., Impingers & Silica Gel.	72.5	41.0	51.5	
V_w Volume of Water Vapor Collected gas ft.^{3} @ Standard Conditions*	3.437	1.943	2.441	

* 70°F, 29.92" Hg.

PARTICULATE EMISSION DATA (cont'd)

	1	2	3	
Run No.				
%M - % Moisture in the stack gas by volume	3.42	3.47	4.43	
M_d - Mole fraction of dry gas	.966	.965	.956	
% CO_2 / % CO	0.03 / 0.8	0.03 / 0.0	0.03 / 0.0	/
% O_2	20.9	20.8	20.8	
% N_2	78.8	79.2	79.2	
M W $_d$ - Molecular weight of dry stack gas	28.84	28.84	28.84	
M W - Molecular weight of stack gas	28.46	28.46	28.36	
ΔP_s - Velocity Head of stack gas, In. H_2O	.433	.430	.421	
T_s - Stack Temperature, °F	98	98	108	
$\sqrt{\Delta P_s X (T_s+460)}$	15.23	15.14	15.12	
P_s - Stack Pressure, "Hg. Absolute	30.32	30.20	30.15	
V_s - Stack Velocity @ stack conditions, fpm	2250	2246	2250	
A_s - Stack Area, $in.^2$	4240	4240	4240	
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	61600	61200	59500	
T_t - Net Time of Test, min.	144	144	144	
D_n - Sampling Nozzle Diameter, in.	1/4	3/16	3/16	
%I - Percent isokinetic	94.3	93.8	94.1	
mf - Water Soluble Fluoride Filter & Impinger, mg.	—	—	—	
Mw - Water Soluble Fluoride Water Wash, mg.	60.8	12.7	11.7	
mt - Water Soluble Fluoride, total mg.	115.5	32.0	40.4	
MU - TOTAL INSOLUBLE FLUORIDE mg.	322	3.1	619.6	
MV - TOTAL FLUORIDE mg	437.5	35.1	660.0	

PARTICULATE EMISSION DATA (cont'd)

Run No.	1	2	3	
CaJ- WATER SOLUBLE FLUORIDE FRONT HALF, gr/SCF	—	—	—	
CAM- WATER SOLUBLE FLUORIDE BACK HALF, gr/SCF	.00964	.00362	.00341	
CAN- TOTAL WATER SOLUBLE FLUORIDE gr/SCF	.01830	.00913	.00118	
CAO- TOTAL INSOLUBLE FLUORIDE, gr/SCF	.05110	.00088	.18110	
CAP- TOTAL FLUORIDE gr/SCF	.0694	.0100	.1929	
CAQ- WATER SOLUBLE FLUORIDE FRONT HALF gr/CF @ STACK CONDITION	—	—	—	
CAR- WATER SOLUBLE FLUORIDE BACK HALF, gr/CF @ STACK CONDITION	.0109	.0041	.0037	
CAS- TOTAL WATER SOLUBLE FLUORIDE gr/CF@ STACK CONDITION	.0207	.0102	.0129	
CAT- TOTAL INSOLUBLE FLUORIDE gr/CF @ STACK CONDITION	.0578	.0010	.1974	
CAU- TOTAL FLOURIDE gr/CF @ STACK CONDITION	.0786	.0113	.2103	
CAV- WATER SOLUBLE FLUORIDE FRONT HALF, lb/hr	—	—	—	
CAW- WATER SOLUBLE FLUORIDE BACK HALF, lb/hr	5.11	1.90	1.73	
CAX- TOTAL WATER SOLUBLE FLUORIDE lb/hr	9.67	4.77	0.60	
CAY- TOTAL INSOLUBLE FLUORIDE lb/hr	26.98	.49	92.34	
CAZ- TOTAL FLOURIDE lb/hr	36.65	5.26	98.35	

JOB NO. Y-7730E

PARTICULATE FIELD DATA

Plant REYNOLDS METALS TROUTDALE, ORE

Run No. 1

Location PRIMARY OUTLET

Date 11/2/71

Operator RAK/GVK

Sample Box No. —

Meter Box No. —

Meter H 1.89

C Factor 1.00

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-253

Ambient Temp °F 55°

Bar.Press. "Hg 30.34

Assumed Moisture % 6

Heater Box Setting, °F 250°

Probe Tip Dia., In. 1/4"

Probe Length 5'

Probe Heater Setting 65

Avg. ΔP ____ Avg. ΔH 1.604

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	1530	327.077	.54	2.10	2.10	56	56	5.0	250	50	—	80
2	1534	329.94	.52	2.00	2.00	61	56	4.5	250	50	—	85
3	1538	332.92	.50	1.90	1.90	68	57	4.5	250	50	—	100
4	1542	335.83	.50	1.90	1.90	72	57	5.0	275	55	—	105
5	1546	338.80	.48	1.85	1.85	75	59	5.5	235	60	—	100
6	1550	341.58	.48	1.85	1.85	76	60	6.0	230	60	—	100
7	1554	344.47	.45	1.75	1.75	77	61	6.0	230	65	—	100
8	1558	347.33	.37	1.45	1.45	78	62	5.5	250	70	—	100
9	1602	349.97	.30	1.15	1.15	78	63	5.0	250	70	—	100
10	1606	352.36	.29	1.13	1.13	77	63	5.0	250	70	—	100
11	1610	354.70	.28	1.09	1.09	75	63	5.0	235	60	—	100
12	1614	357.00	.27	1.05	1.05	75	64	5.0	230	60	—	100
13	1618	359.30	.25	.98	.98	75	64	5.0	230	65	—	100
14	1622	361.41	.24	.93	.93	74	64	5.0	230	62	—	100
15	1626	363.54	.21	.81	.81	74	64	4.5	260	60	—	100
16	1630	365.53	.19	.74	.74	74	64	4.5	275	62	—	100

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	1634	367.44	.16	.63	.63	74	64	4.0	235	65	—	100
18	1638	369.21	.11	.44	.44	72	64	3.0	240	60	—	95
FINAL	1642	370.704	—	—	—	—	—	—	—	—	—	—
B 1	1648	370.704	.34	1.30	1.30	64	62	7.0	240	55	—	85
2	1652	373.13	.33	1.28	1.28	69	63	8.0	240	55	—	80
3	1656	375.60	.33	1.28	1.28	72	63	8.0	225	55	—	85
4	1700	378.10	.34	1.30	1.30	73	63	9.0	225	80	—	90
5	1704	380.50	.37	1.45	1.45	75	63	10.0	225	85	—	100
6	1708	383.08	.40	1.55	1.55	77	63	11.0	230	70	—	100
7	1712	385.75	.55	2.10	2.10	79	63	15.0	240	70	—	100
8	1716	388.75	.60	2.30	2.30	83	63	17.5	250	60	—	100
9	1720	391.88	.66	2.50	2.50	85	65	22.0	240	60	—	100
10	1724	395.15	.66	2.50	2.50	85	64	22.0	250	60	—	100
11	1728	398.45	.66	2.50	2.50	87	65	22.0	250	65	—	100
12	1732	401.62	.68	2.60	2.20	95	67	22.0	240	65	—	100
13	1736	404.80	.66	2.50	2.20	95	67	22.0	230	65	—	100
14	1740	407.90	.65	2.50	2.10	95	70	22.0	220	65	—	110
15	1744	411.10	.66	2.50	2.10	95	70	22.0	225	65	—	110
16	1748	414.14	.60	2.30	2.00	96	71	22.0	225	65	—	105
17	1752	417.10	.59	2.30	2.00	96	76	22.0	240	65	—	105
18	1756	420.15	.35	1.35	1.35	96	74	19.0	255	65	—	105
FINAL	1800	422.897	—	—	—	—	—	—	—	—	—	—
NET TIME	144 min	95.820				79	64					
												98
						72						

PARTICULATE CLEANUP SHEET

Date: 11/3/71 Plant: REYNOLDS

Run Number: 1 Location of sample port: PRIMARY OUTLET

Operator: RAK/GVK Barometric Pressure: 30.24

Sample Box Number: — Ambient Temperature: 55

Impinger H_2O

Volume after sampling 229 ml Container No. 3 Ether-chloroform extraction of impinger water _____ mg

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

Volume Collected 29 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-253	1		

Filter particulate weight _____ mg

Total particulate weight _____ mg

Silica Gel

Weight after test:	344.5				
Weight before test:	300				
Moisture weight collected:	43.5				Moisture Total 72.5 gm
Container Number: 4	1.	2.	3.	4.	

Sample Number: _____ Analyze for: _____

Method determination: _____

Comments: _____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730E

PARTICULATE FIELD DATA

Plant REYNOLDS METALS TROUTDALE, ORE.

Run No. 2

Location PRIMARY OUTLET

Date 11/3/71

Operator RAK / GVK

Sample Box No. —

Meter Box No. —

Meter H 1.89

C Factor 1.00

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-115

Ambient Temp °F 55

Bar.Press. "Hg 30.22

Assumed Moisture % 6

Heater Box Setting, °F 250'

Probe Tip Dia., In. 3/16

Probe Length 5'

Probe Heater Setting 60

Avg. ΔP ____ Avg. ΔH .445

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
B 1	1007	423.816	.38	.39	.39	53	53	0.0	225	50	—	85
2	1011	425.00	.38	.39	.39	56	53	0.0	240	50	—	80
3	1015	426.45	.36	.38	.38	58	54	0.0	240	50	—	80
4	1019	427.87	.37	.39	.39	60	55	0.0	250	50	—	90
5	1023	429.26	.38	.39	.39	62	55	0.0	250	50	—	95
6	1027	430.65	.42	.43	.43	62	56	0.0	250	50	—	100
7	1031	432.10	.57	.57	.57	64	57	0.0	250	50	—	100
8	1035	433.88	.64	.65	.65	67	58	0.0	250	50	—	100
9	1039	435.66	.68	.69	.69	70	58	0.0	250	50	—	100
10	1043	437.48	.72	.73	.73	72	59	0.0	250	50	—	100
11	1047	439.36	.72	.73	.73	73	60	2.0	250	50	—	105
12	1051	441.26	.72	.73	.73	74	60	2.0	250	50	—	105
13	1055	443.15	.72	.73	.73	75	61	2.0	250	50	—	100
14	1059	445.05	.73	.73	.73	76	62	2.0	250	50	—	100
15	1103	446.94	.65	.66	.66	78	63	2.0	250	50	—	100
16	1107	448.77	.33	.54	.54	80	64	2.0	250	50	—	100

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	1111	450.42	.50	.53	.53	80	65	2.0	250	50	—	100
18	1115	452.04	.36	.36	.36	75	65	2.0	250	50	—	100
FINAL	1119	453.432	—	—	—	—	—	—	—	—	—	—
A 1	1126	453.432	.54	.55	.55	62	62	2.0	240	50	—	90
2	1130	455.10	.50	.53	.53	64	62	2.0	230	50	—	80
3	1134	456.71	.47	.48	.48	65	62	2.0	230	50	—	100
4	1138	458.25	.46	.47	.47	66	62	2.0	230	50	—	100
5	1142	459.75	.45	.46	.46	68	62	2.0	235	50	—	100
6	1146	461.26	.48	.49	.49	66	62	3.0	245	50	—	100
7	1150	462.80	.38	.39	.39	66	62	3.0	250	50	—	100
8	1154	464.23	.33	.34	.34	66	62	2.5	250	50	—	100
9	1158	465.55	.31	.31	.31	66	63	2.5	250	50	—	100
10	1202	466.82	.29	.30	.30	66	63	2.5	250	50	—	100
11	1206	468.07	.27	.28	.28	66	63	2.0	255	50	—	100
12	1210	469.28	.25	.26	.26	66	63	2.0	250	50	—	100
13	1214	470.44	.22	.22	.22	66	63	2.0	250	50	—	100
14	1218	471.55	.24	.25	.25	66	64	2.0	250	50	—	100
15	1222	472.71	.21	.21	.21	66	64	2.0	260	50	—	100
16	1226	473.78	.19	.195	.195	67	64	2.0	265	60	—	100
17	1230	474.80	.17	.175	.175	69	65	2.0	265	60	—	100
18	1234	475.78	.10	.105	.105	71	66	2.0	265	60	—	100
FINAL	1238	476.638	—	—	—	—	—	—	—	—	—	—
												98
NET TIME	144 MIN	52.822				67	61					
							64					

PARTICULATE CLEANUP SHEET

Date: 11/3/71 Plant: REYNOLDS

Run Number: 2 Location of sample port: PRIMARY OUTLET

Operator: RAK / GVK Barometric Pressure: 30.22

Sample Box Number: — Ambient Temperature: 55

Impinger H_2O

Volume after sampling 236 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

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

Volume Collected 36 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-115	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	305.0			
Weight before test:	300.0			
Moisture weight collected:	5.0			

Moisture Total 41.0 gm

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

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730E

PARTICULATE FIELD DATA

Plant REYNOLDS METALS TROUTDALE, ORE.

Run No. 3

Location PRIMARY OUTLET

Date 11/3/71

Operator RAK / GVK

Sample Box No. —

Meter Box No. —

Meter H 1.89

C Factor 1.00

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-122

Ambient Temp °F 60°

Bar.Press. "Hg 30.17

Assumed Moisture % 6

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Probe Length 5'

Probe Heater Setting 65

Avg. ΔP ____ Avg. ΔH .430

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					
B 1	1450	476.737	.35	.36	.36	62	63	0.0	250	60	—	105
2	1454	478.20	.35	.36	.36	63	63	0.0	255	55	—	105
3	1458	479.44	.35	.36	.36	66	63	0.0	255	55	—	105
4	1502	480.79	.36	.37	.37	68	64	0.0	275	55	—	105
5	1506	482.18	.37	.38	.38	70	65	0.0	265	55	—	110
6	1510	483.58	.41	.42	.42	71	65	0.0	275	55	—	105
7	1514	485.05	.55	.55	.55	72	66	0.0	260	55	—	110
8	1518	486.66	.62	.63	.63	74	67	2.0	275	55	—	110
9	1522	488.41	.68	.70	.70	76	68	2.5	265	55	—	110
10	1526	490.25	.70	.71	.71	78	68	2.5	260	55	—	110
11	1530	492.06	.70	.71	.71	79	69	2.5	275	55	—	110
12	1534	493.93	.69	.70	.70	79	69	2.5	265	55	—	110
13	1538	495.79	.68	.70	.70	78	70	2.5	260	55	—	110
14	1542	497.67	.70	.71	.71	77	70	3.0	270	55	—	110
15	1546	499.55	.57	.58	.58	77	70	2.5	265	55	—	110
16	1550	501.28	.45	.46	.46	77	70	2.0	265	55	—	110

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	1554	502.84	.37	.38	.38	77	70	2.0	260	60	—	110
18	1558	504.25	.28	.29	.29	77	70	2.0	260	60	—	105
FINAL	1602	505.502	—	—	—	—	—	—	—	—	—	—
A 1	1612	505.502	.54	.55	.55	64	66	3.0	220	60	—	100
2	1616	507.14	.54	.55	.55	66	66	3.0	255	50	—	100
3	1620	508.81	.52	.53	.53	68	66	3.0	250	50	—	105
4	1624	510.44	.48	.49	.49	70	66	3.0	260	50	—	105
5	1628	512.00	.48	.49	.49	71	67	3.0	260	50	—	105
6	1632	513.56	.48	.49	.49	70	66	3.0	250	50	—	105
7	1636	515.12	.38	.39	.39	70	66	3.0	240	60	—	110
8	1640	516.55	.34	.35	.35	70	66	2.5	260	50	—	110
9	1644	517.89	.32	.33	.33	70	66	2.5	255	55	—	110
10	1648	519.72	.27	.27	.27	69	66	2.5	255	55	—	110
11	1652	520.43	.27	.27	.27	69	66	2.0	255	55	—	110
12	1656	521.61	.27	.27	.27	69	66	2.5	240	55	—	110
13	1700	522.81	.26	.265	.265	69	66	2.5	265	55	—	110
14	1704	524.00	.23	.235	.235	67	66	2.5	265	55	—	110
15	1708	525.12	.20	.21	.21	67	66	2.5	265	55	—	110
16	1712	526.19	.15	.155	.155	67	65	2.5	265	55	—	110
17	1716	527.12	.13	.14	.14	67	65	2.5	265	55	—	110
18	1720	528.01	.13	.14	.14	67	65	2.5	265	55	—	110
FINAL	1724	528.891	—	—	—	—	—	—	—	—	—	—
NET TIME	144 MIN	52.154				71	67					108
						69						

PARTICULATE CLEANUP SHEET

Date: 11/3/71 Plant: REYNOLDS

Run Number: 3 Location of sample port: PRIMARY OUTLET

Operator: RAK / GVK Barometric Pressure: 30.17

Sample Box Number: — Ambient Temperature: 60°

Impinger H_2O

Volume after sampling 242 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

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

Volume Collected 42 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-122	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	309.5				
Weight before test:	300.0				
Moisture weight collected:	9.5				Moisture Total 51.5 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 Reynolds Metals

Location of Plant Troutdale, 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	11/4/71	Begin	1452	End	1752
Run No.	2	Date	11/5/71	Begin	0928	End	1228
Run No.	3	Date	11/5/71	Begin	1456	End	1756

PARTICULATE EMISSION DATA

Run No.	1	2	3	
P_b barometric pressure, "Hg Absolute	30.30	30.45	30.34	
P_m orifice pressure drop, "H_2O	1.621	1.982	1.584	
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	124.64	136.06	122.56	
T_m Average Gas Meter Temperature, °F	81	80	88	
V_m Volume of Dry Gas Sampled @ Standard std. conditions, ft.^{3}	124.05	136.45	120.57	
V_w Total H_2O collected, ml., Impingers & Silica Gel.	28.0	15.3	19.1	
V_w Volume of Water Vapor Collected gas ft.^{3} @ Standard Conditions*	1.33	.725	.905	

* 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	1.06	.529	.745	
M_d - Mole fraction of dry gas	.989	.995	.993	
% CO_2 / % CO	0.0 / 0.1	0.0 / 0.0	0.0 / 0.0	/
% O_2	20.8	20.7	20.7	
% N_2	79.1	79.3	71.3	
M W $_d$ - Molecular weight of dry stack gas	28.83	28.83	28.83	
M W - Molecular weight of stack gas	28.71	28.77	28.75	
Δ Ps - Velocity Head of stack gas, In. H_2O	.074	.074	.074	
T_s - Stack Temperature, °F	66	52	68	
$\sqrt{\Delta P_s X (T_s+460)}$	6.241	6.931	6.243	
P_s - Stack Pressure, "Hg. Absolute	30.30	30.45	30.34	
V_s - Stack Velocity @ stack conditions, fpm	920	1020	919	
A_s - Stack Area, $in.^2$	5180	5180	5180	
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	33400	38400	33400	
T_t - Net Time of Test, min.	180	180	180	
D_n - Sampling Nozzle Diameter, in.	3/8	3/8	3/8	
%I - Percent isokinetic	96.5	92.2	93.7	
mf - Water Soluble Fluoride Filter & Impinger, mg.	—	—	—	
Mw - Water Soluble Fluoride Water Wash, mg.	11.8	14.8	13.5	
mt - Water Soluble Fluoride, total mg.	22.8	29.8	26.2	
MU - TOTAL INSOLUBLE FLUORIDE mg.	1.2	2.2	3.0	
MV - TOTAL FLUORIDE Mg	24.0	32.0	29.2	

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	.00147	.00167	.00172	
CAN - TOTAL WATER SOLUBLE FLUORIDE gr/SCF	.00283	.00034	.00335	
CAO - TOTAL INSOLUBLE FLUORIDE, gr/SCF	.00015	.00025	.00038	
CAP - TOTAL FLUORIDE gr/SCF	.00398	.00361	.00373	
CAQ - WATER SOLUBLE FLUORIDE FRONT HALF gr/CF @ STACK CONDITION	—	—	—	
CAR - WATER SOLUBLE FLUORIDE BACK HALF gr/CF @ STACK CONDITION	.00148	.00175	.00174	
CAS - TOTAL WATER SOLUBLE FLUORIDE gr/CF @ STACK CONDITION	.00285	.00036	.00338	
CAT - TOTAL INSOLUBLE FLUORIDE gr/CF @ STACK CONDITION	.00015	.00026	.00038	
CAU - TOTAL FLOURIDE gr/CF @ STACK CONDITION	.0040	.0038	.0038	
CAV - WATER SOLUBLE FLUORIDE FRONT HALF, lb/hr	—	—	—	
CAW - WATER SOLUBLE FLUORIDE BACK HALF, lb/hr	434	538	501	
CAX - TOTAL WATER SOLUBLE FLUORIDE lb/hr	.803	.115	.969	
CAY - TOTAL INSOLUBLE FLUORIDE lb/hr	.033	.077	.100	
CAZ - TOTAL FLOURIDE lb/hr	1.136	1.190	1.069	

JOB NO. 7730 E

PARTICULATE FIELD DATA

Plant REYNOLDS

Run No. 1

Location SECONDARY (INLET)

Date NOV. 4, 1971

Operator

Sample Box No. 556

Meter Box No. 557

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 30.30

Assumed Moisture % 2

Heater Box Setting, °F

Probe Tip Dia., In. 3/8"

Probe Length 3'

Probe Heater Setting

Avg. ΔP Avg. ΔH 1.621

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
X 1	1452	938.181	.08	1.75	1.75	59	60	10.0	200	65		95
2	56	940.9	.06	1.29	1.29	64	60	10.0	225	65		75
3	1500	943.4	.06	1.29	1.29	68	60	10.0	225	65		70
4	04	945.9	.05	1.08	1.08	72	64	10.0	225	65		70
5	08	948.3	.05	1.08	1.08	76	65	10.0	225	65		75
6	12	950.7	.05	1.08	1.08	76	66	9.0	230	65		75
7	16	953.1	.06	1.29	1.29	76	66	9.0	235	65		75
8	20	955.3	.06	1.29	1.29	80	68	9.0	240	65		70
9	24	957.8	.06	1.29	1.29	80	69	9.0	240	65		70
10	28	959.8	.07	1.52	1.52	80	69	10.0	240	65		70
11	32	962.8	.07	1.52	1.52	84	69	11.0	250	65		70
12	36	965.5	.07	1.52	1.52	87	70	12.0	250	65		65
13	40	968.8	.07	1.52	1.52	87	70	12.0	250	65		65
14	44	971.5	.07	1.52	1.52	88	72	12.0	250	65		65
15	48	973.9	.08	1.75	1.75	88	72	13.0	250	65		65
16	52	976.1	.08	1.75	1.75	88	72	13.0	250	65		65

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	1556	979.1	.08	1.75	1.75	90	76	13.0	250	65		65
18	1600	981.8	.08	1.75	1.75	92	76	13.0	250	65		65
19	04	984.6	.08	1.75	1.75	92	76	13.0	250	65		65
20	08	987.5	.08	1.75	1.75	94	76	13.0	250	65		65
21	12	989.9	.08	1.75	1.75	94	78	13.0	250	65		65
22	16	993.5	.08	1.75	1.75	94	78	13.0	250	65		65
23	20	995.9	.08	1.75	1.75	92	78	13.0	250	65		70
24	24	998.8	.08	1.75	1.75	92	78	13.0	250	65		70
25	28	1001.6	.08	1.75	1.75	94	78	13.0	250	65		70
26	32	1005.3	.08	1.75	1.75	94	78	13.0	250	65		65
27	36	1008.4	.08	1.75	1.75	94	78	13.0	250	65		65
28	40	1011.3	.08	1.75	1.75	94	78	13.0	250	65		65
29	44	1014.5	.07	1.50	1.50	94	79	12.5	250	65		60
30	48	1017.1	.07	1.50	1.50	92	79	12.5	250	65		65
31	52	019.3	.09	1.90	1.90	92	79	19.0	250	65		60
32	56	022.2	.08	1.75	1.75	92	79	15.0	250	65		65
33	1700	025.2	.08	1.75	1.75	92	79	15.0	250	60		60
34	04	028.3	.08	1.75	1.75	92	79	15.0	250	60		60
35	08	031.2	.08	1.75	1.75	92	79	15.0	250	60		60
36	12	033.9	.08	1.75	1.75	92	79	15.0	250	60		60
37	16	036.9	.08	1.75	1.75	92	79	15.0	250	60		60
38	20	039.8	.08	1.75	1.75	92	79	15.0	250	60		60
39	24	042.7	.08	1.75	1.75	92	79	15.0	250	60		60
40	28	046.2	.08	1.75	1.75	92	79	15.0	250	60		60
41	32	048.5	.08	1.75	1.75	92	79	15.0	250	60		60
42	36	051.3	.08	1.75	1.75	92	79	15.0	250	60		60
43	40	054.2	.08	1.75	1.75	92	79	15.0	250	60		60
44	44	057.7	.08	1.75	1.75	90	77	15.0	250	60		60
45	48	060.6	.08	1.75	1.75	90	75	15.0	250	60		60
FINAL	52	062.842										
												66
NET TIME	180 MIN.	124.641				87	74					
						81						

PARTICULATE CLEANUP SHEET

Date: 11/4/71 Plant: REYNOLDS METALS

Run Number: 1 Location of sample port: SECONDARY INLET

Operator: KC/RWK Barometric Pressure: 30.30

Sample Box Number: — Ambient Temperature: 50

Impinger H_2O

Volume after sampling 184 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-	1		

Filter particulate weight _____ mg

Total particulate weight _____ mg

Silica Gel

Weight after test:	344.0			
Weight before test:	300.0			
Moisture weight collected:	44.0			

Moisture Total 28 gm

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

Sample Number: _____ Analyze for: _____

Method determination: _____

Comments: _____

JOB NO. 7730 E

PARTICULATE FIELD DATA

Plant REYNOLDS

Run No. #2

Location SECONDARY (INLET)

Date 11/5/71

Operator

Sample Box No. 556

Meter Box No. 557

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-300

Ambient Temp °F 40

Bar.Press. "Hg 30.45

Assumed Moisture % 2

Heater Box Setting, °F 250.

Probe Tip Dia., In. 3/8"

Probe Length 4 ft

Probe Heater Setting 60%

Avg. ΔP Avg. ΔH 1.982

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					
X	0928	062.888	.10	2.1	2.1	50	50	12.0	230	65		50
	32	064.5	.10	2.1	2.1	55	50	12.0	230	65		50
	36	067.3	.10	2.1	2.1	63	50	11.0	235	65		50
	40	070.8	.11	2.35	2.35	74	52	13.0	235	65		50
	44	073.1	.10	2.1	2.1	80	54	13.0	235	65		50
	48	076.2	.10	2.1	2.1	85	58	14.0	235	65		50
	52	079.2	.10	2.1	2.1	88	59	14.0	240	65		50
	56	082.3	.10	2.1	2.1	90	60	14.0	240	65		50
	1000	085.6	.10	2.1	2.1	92	64	14.0	240	65		50
	04	088.7	.11	2.35	2.35	92	65	15.5	225	65		50
	08	092.1	.10	2.1	2.1	94	66	15.0	235	65		50
	12	095.3	.09	1.9	1.9	95	66	14.0	240	65		50
	16	098.5	.10	2.1	2.1	94	70	14.0	245	65		50
	20	101.6	.10	2.1	2.1	95	71	13.0	240	65		50
	24	104.7	.09	1.9	1.9	96	71	13.0	240	65		50
	28	107.7	.09	1.9	1.9	90	71	13.0	240	65		50

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
X	1032	111.1	.09	1.9	1.9	90	70	13.0	240	65		50
	36	114.8	.09	1.9	1.9	85	70	13.0	230	65		50
	40	117.0	.09	1.9	1.9	83	70	13.0	230	65		50
	44	119.5	.09	1.9	1.9	83	70	13.0	225	65		50
	48	123.1	.09	1.9	1.9	83	70	13.0	230	65		50
	52	126.2	.09	1.9	1.9	83	70	13.0	230	65		50
	56	129.2	.09	1.9	1.9	83	70	13.0	230	65		50
	1100	132.4	.09	1.9	1.9	83	70	13.0	230	65		50
	04	135.5	.09	1.9	1.9	83	70	13.0	230	65		50
	08	138.4	.09	1.9	1.9	85	70	13.0	230	65		50
	12	141.7	.09	1.9	1.9	90	70	13.0	235	65		50
	16	144.8	.09	1.9	1.9	92	70	13.0	235	65		50
	20	147.6	.09	1.9	1.9	92	70	13.0	235	65		50
	24	150.5	.09	1.9	1.9	96	72	13.0	235	65		50
	28	153.5	.10	2.1	2.1	97	72	13.0	235	65		50
	32	156.5	.10	2.1	2.1	97	72	13.0	235	65		50
	36	159.6	.10	2.1	2.1	97	72	13.0	240	65		50
	40	162.8	.09	1.9	1.9	97	72	13.0	240	65		50
	44	166.0	.09	1.9	1.9	97	72	13.0	240	65		50
	48	169.7	.09	1.9	1.9	99	75	13.0	240	65		50
	52	172.6	.09	1.9	1.9	100	76	13.0	240	65		50
	56	175.6	.09	1.9	1.9	104	76	13.0	240	65		55
	1200	178.9	.09	1.9	1.9	105	76	13.0	250	65		55
	04	180.7	.09	1.9	1.9	105	76	14.0	250	65		60
	08	183.9	.09	1.9	1.9	105	78	14.0	250	65		60
	12	186.7	.09	1.9	1.9	105	78	14.0	250	65		60
	16	189.5	.09	1.9	1.9	105	78	14.0	250	65		60
	20	192.6	.09	1.9	1.9	104	80	14.0	250	65		60
	24	195.7	.09	1.9	1.9	104	80	14.0	250	65		60
FINAL	28	198.952										
												52
NET TIME 180 MIN						90	69					
						80						

YORK RESEARCH CORPORATION

PARTICULATE CLEANUP SHEET

Date: 11/5/71 Plant: REYNOLDS METALS

Run Number: 2 Location of sample port: SECONDARY INLET

Operator: RWK / KC Barometric Pressure: 30.45

Sample Box Number: — Ambient Temperature: 40

Impinger H_2O

Volume after sampling 182 ml Container No. 3 Ether-chloroform extraction of impinger water _____ mg

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

Volume Collected -18 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-300	1		

Filter particulate weight _____ mg

Total particulate weight _____ mg

Silica Gel

Weight after test:	333.3				
Weight before test:	309.0				
Moisture weight collected:	33.3				Moisture Total 15.3 gm
Container Number: 4	1.	2.	3.	4.	

Sample Number: _____ Analyze for: _____

Method determination: _____

Comments: _____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. 7730 E

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					
X	1600	242.3	.07	1.5	1.5	96	79	8	250	65		70
	04	245.0	.07	1.5	1.5	96	80	8	250	65		70
	08	247.7	.07	1.5	1.5	96	80	8	250	65		70
	12	249.8	.07	1.5	1.5	98	82	8	250	65		70
	16	253.1	.07	1.5	1.5	102	84	8	250	65		70
	20	255.2	.07	1.5	1.5	102	84	8	250	65		70
	24	258.5	.07	1.5	1.5	102	84	8	250	65		70
	28	261.2	.07	1.5	1.5	102	84	8	250	65		70
	32	263.9	.07	1.5	1.5	102	84	8	250	65		70
	36	266.5	.07	1.5	1.5	102	84	8	250	65		70
	40	269.2	.07	1.5	1.5	102	84	8	250	65		65
	44	2718	.07	1.5	1.5	100	84	8	250	65		65
	48	274.4	.07	1.5	1.5	100	84	8	250	65		65
	52	277.1	.08	1.7	1.7	100	84	10	250	65		65
	56	280.0	.09	1.9	1.9	100	84	12	250	65		65
	1700	282.9	.08	1.7	1.7	100	84	11	250	65		65
	04	285.8	.08	1.7	1.7	100	84	11	250	65		65
	08	288.7	.08	1.7	1.7	102	82	11	250	65		60
	12	291.67	.09	1.97	1.97	102	82	12	245	65		55
	16	295.40	.08	1.78	1.78	103	82	11	245	65		60
	20	298.39	.08	1.78	1.78	103	82	11	240	65		60
	24	301.7	.08	1.7	1.7	103	82	11	240	65		60
	28	304.3	.08	1.7	1.7	103	82	11	240	65		60
	32	307.1	.08	1.7	1.7	103	82	11	240	65		60
	36	310.0	.08	1.7	1.7	102	82	11	240	65		60
	40	312.5	.08	1.7	1.7	102	82	11	240	65		60
	44	315.1	.08	1.7	1.7	102	82	11	245	65		60
	48	318.5	.08	1.7	1.7	102	82	11	245	65		60
	52	321.4	.08	1.7	1.7	102	81	11	240	65		60
FINAL	56	323.339										
												68
NET TIME	180 MIN.	122 563				96	80					
							88					

PARTICULATE CLEANUP SHEET

Date: 11/5/71 Plant: REYNOLDS METALS

Run Number: 3 Location of sample port: SECONDARY INLET

Operator: RWK / KC Barometric Pressure: 30.34

Sample Box Number: — Ambient Temperature: 45

Impinger H_2O

Volume after sampling 185 ml Container No. 3 Ether-chloroform extraction of impinger water _____ mg

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

Volume Collected -15 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-			

Filter particulate weight _____ mg

Total particulate weight _____ mg

Silica Gel

Weight after test:	334.1				
Weight before test:	300.0				
Moisture weight collected:	34.1				Moisture Total 19.1 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 Reynolds Metals

Location of Plant Troutdale, 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	11/4/71	Begin	1450	End	1810
Run No.	2	Date	11/5/71	Begin	0920	End	1234
Run No.	3	Date	11/5/71	Begin	1449	End	1803

PARTICULATE EMISSION DATA

Run No.	1	2	3	
P_b barometric pressure, "Hg Absolute	30.30	30.45	30.34	
P_m orifice pressure drop, "H_2O	1.926	1.906	1.943	
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	144.2	140.5	143.0	
T_m Average Gas Meter Temperature, °F	73	62	62	
V_m Volume of Dry Gas Sampled @ Standard std. conditions, ft.^{3}	145.8	145.7	147.8	
V_w Total H_2O collected, ml., Impingers & Silica Gel.	41.2	30.6	34.3	
V_w Volume of Water Vapor Collected gas ft.^{3} @ Standard Conditions*	1.953	1.450	1.626	

* 70°F, 29.92" Hg.

PARTICULATE EMISSION DATA (cont'd)

Run No.	1	2	3	
%M - % Moisture in the stack gas by volume	1.32	.985	1.09	
M_d - Mole fraction of dry gas	.987	.990	.989	
% CO_2 / % CO	0.0 / 0.0	0.0 / 0.1	0.0 / 0.1	/
% O_2	20.7	20.7	20.7	
% N_2	79.3	79.2	79.2	
MW_d - Molecular weight of dry stack gas	28.83	28.83	28.83	
MW - Molecular weight of stack gas	28.69	28.72	28.71	
ΔP_s - Velocity Head of stack gas, In. H_2O	.548	.546	.552	
T_s - Stack Temperature, °F	95	79	90	
$\sqrt{\Delta P_s X (T_s+460)}$	17.26	16.98	17.23	
P_s - Stack Pressure, "Hg. Absolute	30.30	30.45	30.34	
V_s - Stack Velocity @ stack conditions, fpm	2550	2500	2540	
A_s - Stack Area, $in.^2$	2520	2520	2520	
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	42600	43300	43000	
T_t - Net Time of Test, min.	192	192	192	
D_n - Sampling Nozzle Diameter, in.	1/4	1/4	1/4	
%I - Percent isokinetic	91.3	90.1	91.7	
mf - Water Soluble Fluoride Filter & Impinger, mg.	—	—	—	
Mw - Water Soluble Fluoride Water Wash, mg.	13.3	12.5	13.1	
mt - Water Soluble Fluoride, total mg.	22.0	21.0	22.4	
MU - TOTAL INSOLUBLE FLUORIDE mg.	2.1	1.2	1.8	
MV - TOTAL FLUORIDE Mg	24.1	22.3	24.2	

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	.00140	.00132	.00136	
CAN- TOTAL WATER SOLUBLE FLUORIDE gr/SCF	.00232	.00222	.00233	
CAO- TOTAL INSOLUBLE FLUORIDE, gr/SCF	.000222	.000127	.000188	
CAP- TOTAL FLUORIDE gr/SCF	.00255	.00236	.00252	
CAQ- WATER SOLUBLE FLUORIDE FRONT HALF gr/CF @ STACK CONDITION	—	—	—	
CAR- WATER SOLUBLE FLUORIDE BACK HALF, gr/CF @ STACK CONDITION	.00134	.00131	.00131	
CAS- TOTAL WATER SOLUBLE FLUORIDE gr/CF@ STACK CORDITION	.00221	.00220	.00225	
CAT- TOTAL INSOLUBLE FLUORIDE gr/CF @ STACK CONDITION	.000212	.000126	.000182	
CAU- TOTAL FLOURIDE gr/CF @ STACK CONDITION	.00243	.00234	.00243	
CAV- WATER SOLUBLE FLUORIDE FRONT HALF, lb/hr	—	—	—	
CAW- WATER SOLUBLE FLUORIDE BACK HALF, lb/hr	.511	.490	.501	
CAX- TOTAL WATER SOLUBLE FLUORIDE lb/hr	.847	.824	.859	
CAY- TOTAL INSOLUBLE FLUORIDE lb/hr	.0809	.0472	.0692	
CAZ- TOTAL FLOURIDE lb/hr	.931	.876	.929	

JOB NO. Y-7730 C

PARTICULATE FIELD DATA

Plant REYNOLDS

Run No. 1

Location SECONDARY OUTLET

Date 11/4/71

Operator RAK / GVK

Sample Box No.

Meter Box No.

Meter H 1.89

C Factor 1.00

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-133

Ambient Temp °F 50

Bar.Press. "Hg 30.30

Assumed Moisture % 6

Heater Box Setting, °F 250

Probe Tip Dia., In. 1/4"

Probe Length 5'

Probe Heater Setting 65

Avg. ΔP Avg. ΔH 1.926

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	1450	528.993	.48	1.70	1.70	56	56	6.5	225	50		95
2	1454	531.77	.52	1.80	1.80	62	56	6.0	245	50		100
3	1458	534.77	.58	2.00	2.00	69	56	7.0	245	50		95
4	1502	537.80	.60	2.10	2.10	73	57	8.0	230	50		100
5	1506	540.87	.62	2.15	2.15	77	58	8.0	235	50		100
6	1510	543.95	.60	2.10	2.10	78	59	8.0	240	55		100
7	1514	547.03	.55	1.95	1.95	79	60	7.5	225	55		100
8	1518	550.03	.52	1.80	1.80	79	60	7.0	230	55		90
9	1522	552.97	.45	1.60	1.60	77	60	6.0	240	50		90
10	1526	555.82	.28	.98	.98	76	60	3.0	245	50		95
11	1530	558.00	.16	.58	.58	75	60	0.0	250	50		100
12	1534	559.72	.13	.49	.49	74	61	0.0	235	50		100
13	1538	561.30	.35	1.25	1.25	74	61	4.5	250	50		100
14	1542	563.56	.45	1.60	1.60	77	62	6.0	225	50		100
15	1546	566.30	.55	1.95	1.95	80	63	7.5	240	50		100
16	1550	569.25	.65	2.25	2.25	84	64	9.0	250	50		100

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	1554	575.66	.72	2.50	2.50	87	65	10.0	240	50	—	100
18	1558	579.20	.72	2.50	2.50	90	66	10.5	250	50	—	100
19	1602	582.40	.73	2.55	2.55	91	67	10.5	235	50	—	100
20	1606	585.70	.70	2.40	2.40	92	67	10.5	240	50	—	100
21	1610	589.05	.65	2.25	2.25	89	66	10.0	230	50	—	95
22	1614	592.40	.56	2.00	2.00	86	66	9.0	225	50	—	95
23	1618	595.44	.55	1.95	1.95	86	66	8.0	240	50	—	90
24	1622	598.45	.55	1.95	1.95	85	65	8.0	240	50	—	—
FINAL	1626	601.440	—	—	—	—	—	—	—	—	—	
Δ 1	1634	601.440	.45	1.60	1.60	74	64	6.0	240	55	—	90
2	1638	604.13	.45	1.60	1.60	80	65	6.0	240	50	—	90
3	1642	606.80	.50	1.75	1.75	80	65	7.0	245	50	—	90
4	1646	609.60	.55	1.95	1.95	81	64	7.0	240	50	—	90
5	1650	612.57	.60	2.10	2.10	81	64	8.5	245	50	—	85
6	1654	615.53	.65	2.25	2.25	82	64	10.0	235	50	—	90
7	1658	618.68	.68	2.35	2.35	85	64	10.5	245	50	—	95
8	1702	621.90	.72	2.50	250	88	64	11.5	245	55	—	95
9	1706	625.20	.82	2.80	2.80	90	65	13.0	245	55	—	90
10	1710	628.70	.93	3.20	3.20	92	65	20.0	240	55	—	90
11	1714	633.00	.95	3.20	3.20	92	65	21.5	240	60	—	90
12	1718	636.00	.70	2.40	2.40	90	65	14.0	240	55	—	90
13	1722	639.75	.28	1.00	1.00	90	65	5.0	240	55	—	100
14	1726	642.17	.35	1.25	1.25	90	65	7.0	240	55	—	95
15	1730	644.65	.40	1.40	1.40	85	65	8.0	245	55	—	95
16	1734	647.20	.45	1.60	1.60	85	65	8.0	245	55	—	95
17	1738	649.94	.52	1.80	1.80	85	65	9.0	247	55	—	95
18	1742	652.80	.55	1.95	1.95	85	65	9.0	250	50	—	95
19	1746	655.70	.54	1.90	1.90	85	65	10.0	230	50	—	90
20	1750	658.75	.55	1.95	1.95	85	65	10.0	245	50	—	95
21	1754	661.72	.55	1.95	1.95	85	65	10.0	235	50	—	95
22	1758	664.63	.57	2.00	2.00	90	65	10.0	235	50	—	95
23	1802	667.64	.43	1.55	1.55	90	65	10.0	235	50	—	90
24	1806	670.47	.42	1.50	1.50	90	65	10.0	235	50	—	95
FINAL	1810	673.232	—	—	—	—	—	—	—	—	—	—
NET TIME	102 MIN	144.239				82	63					95
							73					

PARTICULATE CLEANUP SHEET

Date: 11/4/71 Plant: REYNOLDS

Run Number: 1 Location of sample port: SECONDARY OUTLET

Operator: RAK / GVK Barometric Pressure: 30.30

Sample Box Number: - Ambient Temperature: 50

Impinger H_2O

Volume after sampling 200 ml Container No. 3 Ether-chloroform extraction of impinger water ____ mg

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

Volume Collected 0 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-133	1		

Filter particulate weight ____ mg

Total particulate weight ____ mg

Silica Gel

Weight after test:	341.2			
Weight before test:	300.0			
Moisture weight collected:	41.2			

Moisture Total 41.2 gm

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

Sample Number: ____ Analyze for: ____

Method determination: ____

Comments: ____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-7730C

PARTICULATE FIELD DATA

Plant REYNOLDS

Run No. 2

Location SECONDARY OUTLETS

Date 11/5/71

Operator RAK / GVK

Sample Box No.

Meter Box No.

Meter H 1.89

C Factor 1.00

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-250

Ambient Temp °F 35

Bar. Press. "Hg 30.45

Assumed Moisture % 6

Heater Box Setting, °F 250

Probe Tip Dia., In. 1/4"

Probe Length 5

Probe Heater Setting 65

Avg. ΔP Avg. ΔH 1.906

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
B 1	0920	673.468	.48	1.70	1.70	42	41	6.0	205	50		70
2	0924	676.10	.46	1.60	1.60	48	41	2.0	215	50		70
3	0928	679.20	.51	1.80	1.80	51	41	2.0	225	50		70
4	0932	681.85	.54	1.90	1.90	55	42	2.0	230	50		70
5	0936	684.70	.55	1.95	1.95	60	43	3.0	235	50		65
6	0940	687.80	.55	1.95	1.95	65	46	3.0	240	50		65
7	0944	690.20	.50	1.75	1.75	68	47	3.0	245	50		60
8	0948	693.35	.45	1.60	1.60	69	49	3.0	245	50		60
9	0952	696.10	.41	1.45	1.45	71	50	2.0	250	50		60
10	0956	698.73	.28	.98	.98	71	50	0.0	250	50		70
11	1000	701.00	.17	.62	.62	64	50	0.0	250	50		70
12	1004	702.74	.20	.71	.71	60	50	0.0	235	50		70
13	1008	704.60	.48	1.70	1.70	60	50	3.0	240	50		70
14	1012	706.80	.56	1.95	1.95	62	50	3.0	240	50		65
15	1016	710.45	.60	2.10	2.10	62	50	3.0	240	50		70
16	1020	713.49	.68	2.30	2.30	68	51	4.0	240	50		75

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	1024	716.48	.70	2.40	2.40	74	52	4.0	240	50		80
18	1028	719.87	.74	2.60	2.60	74	52	4.5	225	50		80
19	1032	723.28	.70	2.40	2.40	73	53	4.5	225	50		85
20	1036	726.55	.68	2.35	2.35	73	53	4.5	225	50		80
21	1040	729.82	.70	2.40	2.40	73	53	4.5	225	50		90
22	1044	733.07	.65	2.25	2.25	73	53	4.5	225	50		85
23	1048	736.25	.58	2.05	2.05	73	56	4.5	225	50		65
24	1052	739.35	.58	2.05	2.05	73	55	4.5	225	50		80
FINAL	1056	742.440										
A 1	1058	742.440	.46	1.65	1.65	68	55	3.0	225	50		75
2	1102	745.20	.50	1.75	1.75	67	55	3.0	215	50		80
3	1106	748.10	.53	1.85	1.85	68	55	3.5	225	50		80
4	1110	751.04	.55	1.90	1.90	67	55	3.5	225	50		80
5	1114	753.95	.60	2.10	2.10	69	55	4.0	225	50		80
6	1118	756.90	.63	2.20	2.20	72	55	4.0	225	50		80
7	1122	760.35	.68	2.35	2.35	74	56	4.0	225	50		80
8	1126	763.26	.75	2.60	2.60	75	56	4.0	235	50		85
9	1130	766.60	.81	2.80	2.80	74	56	4.5	235	50		85
10	1134	770.1	.85	2.95	2.95	76	57	5.5	245	50		85
11	1138	773.75	.77	2.55	2.55	79	58	3.5	250	50		85
12	1142	777.17	.50	1.75	1.75	80	58	2.0	250	50		85
13	1146	780.08	.30	1.08	1.08	77	58	2.5	250	50		85
14	1150	782.50	.35	1.25	1.25	74	58	2.5	250	50		90
15	1154	784.90	.42	1.50	1.50	74	58	4.0	250	50		90
16	1158	787.50	.52	1.80	1.80	75	58	4.0	250	50		90
17	1202	790.36	.58	2.05	2.05	78	59	4.0	235	50		90
18	1206	793.34	.58	2.05	2.05	78	59	4.0	240	50		90
19	1210	796.39	.58	2.05	2.05	80	60	4.0	250	50		90
20	1214	799.07	.54	1.90	1.90	79	60	4.0	250	50		90
21	1218	802.45	.53	1.85	1.85	77	60	4.0	240	55		85
22	1222	805.41	.53	1.85	1.85	77	60	4.0	245	55		85
23	1226	808.37	.45	1.60	1.60	75	57	4.0	225	55		85
24	1230	811.17	.43	1.50	1.50	75	59	4.0	225	55		
FINAL	1234	813.951										
NET TIME	197 MIN.	140.483				70	53					79
						60						

PARTICULATE CLEANUP SHEET

Date: 11/5/71 Plant: REYNOLDS

Run Number: 2 Location of sample port: SECONDARY OUTLET

Operator: RAK/GYK Barometric Pressure: 30.45

Sample Box Number: — Ambient Temperature: 35

Impinger H_2O

Volume after sampling 201 ml Container No. 3 Ether-chloroform extraction of impinger water _____ mg

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

Volume Collected 1 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-250	1		

Filter particulate weight _____ mg

Total particulate weight _____ mg

Silica Gel

Weight after test:	329.6				
Weight before test:	300.0				
Moisture weight collected:	29.6				Moisture Total 30.6 gm
Container Number: 4	1. 29.6	2.	3.	4.	

Sample Number: _____ Analyze for: _____

Method determination: _____

Comments: _____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y7730 C

PARTICULATE FIELD DATA

Plant REYNOLDS

Run No. 3

Location SECONDARY OUTLET

Date 11/5/71

Operator RAK/GVK

Sample Box No.

Meter Box No.

Meter H 1.89

C Factor 1.00

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

F-113

Ambient Temp °F 40

Bar.Press. "Hg 30.34

Assumed Moisture % 6

Heater Box Setting, °F 250.

Probe Tip Dia., In. 1/4

Probe Length 6'

Probe Heater Setting 65

Avg. ΔP Avg. ΔH 1.943

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	1449	814.055	.51	1.80	1.80	58	53	2.0	185	50		85
2	1453	817.00	.51	1.80	1.80	62	53	2.0	185	50		90
3	1457	819.89	.54	1.90	1.90	65	54	2.5	195	50		85
4	1501	822.83	.57	2.00	2.00	68	55	3.0	200	50		90
5	1505	825.83	.62	2.20	2.20	68	57	3.0	215	50		90
6	1509	828.90	.63	2.20	2.20	68	54	3.0	220	50		90
7	1513	832.19	.68	2.40	2.40	68	54	4.0	230	50		95
8	1517	835.30	.75	2.60	2.60	70	56	4.5	230	50		100
9	1521	838.70	.80	2.80	2.80	71	57	5.0	230	50		100
10	1525	842.40	.85	3.00	3.00	72	57	5.5	225	50		100
11	1529	845.20	.88	3.05	3.05	72	57	5.5	225	50		90
12	1533	849.80	.68	2.40	2.40	72	58	4.0	235	55		90
13	1537	853.10	.42	1.50	1.50	72	58	3.0	235	55		90
14	1541	856.0	.45	1.60	1.60	70	58	3.0	240	55		90
15	1545	858.70	.45	1.60	1.60	70	58	3.0	245	50		90
16	1549	861.42	.50	1.80	1.80	70	58	3.0	250	50		90

JOB NO. Y 7730 C

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	1553	864.28	.56	1.95	1.95	70	58	3.0	245	50		85
18	1557	867.125	.57	2.00	2.00	71	59	3.0	250	55		85
19	1601	870.24	.57	2.00	2.00	72	58	3.0	250	55		85
20	1605	873.28	.58	2.05	2.05	75	60	4.0	250	55		85
21	1609	876.33	.60	2.10	2.10	75	60	4.0	250	50		90
22	1613	879.40	.53	1.55	1.95	75	60	4.0	250	50		90
23	1617	882.40	.47	1.65	1.65	75	60	4.0	250	50		90
24	1621	885.30	.46	1.65	1.65	73	60	4.0	250	50		90
FINAL	1625	888.327										
B 1	1627	888.327	.38	1.35	1.35	66	58	2.5	250	50		90
2	1631	891.00	.39	1.40	1.40	68	58	2.5	240	50		85
3	1635	893.62	.46	1.60	1.60	68	58	2.5	225	50		90
4	1639	896.36	.50	1.75	1.75	68	58	2.5	225	50		90
5	1643	899.20	.52	1.80	1.80	68	56	2.5	225	50		90
6	1647	902.11	.52	1.80	1.80	68	56	2.5	225	50		90
7	1651	905.00	.47	1.65	1.65	67	57	2.5	225	50		90
8	1655	907.80	.47	1.65	1.65	68	57	2.5	215	50		90
9	1659	910.60	.32	1.15	1.15	68	57	2.5	210	50		90
10	1703	913.10	.20	.73	.73	64	55	0.0	210	50		90
11	1707	915.00	.13	.52	.48	62	54	0.4	210	50		90
12	1711	916.60	.23	.82	.82	60	54	0.6	210	50		90
13	1715	918.20	.44	1.55	1.55	60	54	0.0	210	50		90
14	1719	921.15	.55	1.95	1.95	60	54	3.5	210	50		90
15	1723	924.000	.63	2.20	2.20	60	54	4.5	210	50		90
16	1727	927.10	.68	2.40	2.40	62	54	5.0	210	50		90
17	1731	930.35	.70	2.45	2.45	62	54	5.0	210	50		90
18	1735	933.60	.73	2.55	2.55	64	54	5.0	210	50		90
19	1739	937.00	.73	2.55	2.55	64	54	5.0	210	50		90
20	1743	940.45	.73	2.55	2.55	64	54	5.0	210	50		90
21	1747	943.80	.73	2.50	2.50	64	54	6.0	200	50		90
22	1751	947.20	.65	2.30	2.30	64	54	6.0	200	50		90
23	1755	950.55	.58	2.05	2.05	64	54	6.0	200	50		90
24	1759	953.85	.57	2.02	2.02	64	54	6.0	202	50		90
FINAL	1803	957.025										
												90
NET TIME	192 MIN.	143.020				67 62	56					

YORK RESEARCH CORPORATION

PARTICULATE CLEANUP SHEET

Date: 11/5/71

Plant: REYNOLDS

Run Number: 3

Location of sample port: SECONDARY OUTLET

Operator: RAK/GVK

Barometric Pressure: 30.34

Sample Box Number: —

Ambient Temperature: 40

Impinger H_2O

Volume after sampling 204 ml Container No. 3

Impinger prefilled with 200 ml Extra No. _____

Volume Collected 4 ml

Ether-chloroform extraction of impinger water _____ mg

Impinger water residue _____ mg

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-113			

Filter particulate weight _____ mg

Total particulate weight _____ mg

Silica Gel

Weight after test:	330.3				
Weight before test:	300.0				
Moisture weight collected:	30.3				Moisture Total 34.3 gm
Container Number:	4	1.	2.	3.	4.

Sample Number: _____ Analyze for: _____

Method determination: _____

Comments: _____

QUALITY CONTROLLED YORK RESEARCH CORPORATION

SUMMARY OF SOURCE EMISSION TEST DATA

CLIENT EPA — PAGE 84 OF 147

Location of Test REYNOLDS — JOB NO. 1-7230-E

Test Evaluation of ASME - PRIMARY INLET

GENERAL DATA				
DATE OF TEST	11-3-71	11-3-71		
TEST NO.	1	2		
BAROMETRIC PRESSURE (" H_g)	30.22	30.17		
STACK PRESSURE (" H_g)	30.20	30.15		
AREA OF STACK (Sq. Ft.)	9	9		
ELAPSED SAMPLING TIME (Min.)	110	120		
GAS DATA				
AVERAGE GAS VELOCITY (Ft./Sec.)	57.24	57.23		
AVERAGE GAS TEMPERATURE (°F)	180	180		
GAS FLOW RATE (CFM)	30910	30900		
APPARENT MOLECULAR WGT. (#/Cu.Ft.)	28.47	28.31		
GAS ANALYSIS, ORSAT BASIS:				
CO_2%	0.0	0.0		
O_2%	20.6	20.6		
CO%	0.1	0.1		
N_2%	79.3	79.3		
H_2O%	3.31	4.71		
FLUORIDE CONCENTRATION DATA				
VOLUME OF WATER CONDENSED (cc)	0	0		
WATER VAPOR VOLUME, METER CONDITION (CF)	2.069	3.346		
VOLUME OF GAS SAMPLED, METER CONDITION (CF)	62.29	70.99		
TOTAL VOLUME SAMPLED, METER CONDITION (CF)	62.29	70.99		
VOLUME OF GAS SAMPLED, STACK CONDITION (CF)	73.96	82.61		
VOLUME OF GAS SAMPLED, STANDARD CONDITION (CF)	60.74	67.72		
SOLUBLE FLUORIDES (NOZZLE WASH) mg*	2.7	3.5		
SOLUBLE FLUORIDES (THIMBLE, IMPINGERS IMPINGER WASH) mg	53.0	71.0		
INSOLUBLE FLUORIDES (") mg	7.4	18.5		
TOTAL FLUORIDES mg	63.1	93.0		
FLUORIDE EMISSION lb/hr. TOTAL	3.48	4.60		
Fluoride Emission lbs/ton	11.92	15.75		

* INSOLUBLE ASSUMED NEGLIGIBLE SINCE WASH WAS CLEAR

JOB NO. Y-7730 C

PARTICULATE FIELD DATA

Plant REYNOLDS

Run No. 1

Location SECONDARY OUTLET

Date 11/4/71

Operator RAK / GVK

Sample Box No.

Meter Box No.

Meter H 1.89

C Factor 1.00

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-133

Ambient Temp °F 50

Bar.Press. "Hg 30.30

Assumed Moisture % 6

Heater Box Setting, °F 250

Probe Tip Dia., In. 1/4"

Probe Length 5'

Probe Heater Setting 65

Avg. ΔP Avg. ΔH 1.926

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	1450	528.993	.48	1.70	1.70	56	56	6.5	225	50		95
2	1454	531.77	.52	1.80	1.80	62	56	6.0	245	50		100
3	1458	534.77	.58	2.00	2.00	69	56	7.0	245	50		95
4	1502	537.80	.60	2.10	2.10	73	57	8.0	230	50		100
5	1506	540.87	.62	2.15	2.15	77	58	8.0	235	50		100
6	1510	543.95	.60	2.10	2.10	78	59	8.0	240	55		100
7	1514	547.03	.55	1.95	1.95	79	60	7.5	225	55		100
8	1518	550.03	.52	1.80	1.80	79	60	7.0	230	55		90
9	1522	552.97	.45	1.60	1.60	77	60	6.0	240	50		90
10	1526	555.82	.28	.98	.98	76	60	3.0	245	50		95
11	1530	558.00	.16	.58	.58	75	60	0.0	250	50		100
12	1534	559.72	.13	.49	.49	74	61	0.0	235	50		100
13	1538	561.30	.35	1.25	1.25	74	61	4.5	250	50		100
14	1542	563.56	.45	1.60	1.60	77	62	6.0	225	50		100
15	1546	566.30	.55	1.95	1.95	80	63	7.5	240	50		100
16	1550	569.25	.65	2.25	2.25	84	64	9.0	250	50		100

York Research Corporation

ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06904

FIELD TEST DATA

REF. NO. Y- 7730E
PERSONNEL: MAERKER

CLIENT: EPA
LOCATION: REYNOLDS
UNIT: PRIMARY

DATE: 11/3/71
TEST NO. 1
FILTER NO. 1

P. BAR. 30.22
T. AMB. 55°F
CONDITIONS —

STACK NO. — DIM'N.: 36"x36"
STACK LOCATION: INLET

TYPE OF TEST: ASME
ABSORB. SOL'N. .1N NaOH

TEST LOCATION/ TIME		Δ P	Ts	Rm CFM	Tm	METER READING	CO_2	O_2
C-3	0957	.85	180	.63	—	379.01		
C-3	1002	.85	180	.46	—	382.13		
C-3	1007	.85	180	.50	70	384.44		
C-3	1012	.85	180	.53	77	386.78		
C-3	1015	.85	—	—	—	388.65		
A-5	1025	.90	180	.85	75	388.65		
A-5	1030	.90	180	.58	77	392.92		
A-5	1035	.90	180	.43	77	395.85		
A-5	1040	.90	180	.48	80	397.99		
A-5	1045	.90	180	.75	83	400.40		
A-5	1050	.90	180	.62	85	404.14		
A-5	1055	.90	180	.84	85	407.25		
A-5	1100	.90	180	.68	85	411.52		
A-5	1105	.90	180	.59	83	414.92		
A-5	1110	.90	180	.31	80	417.90		
A-5	1113	.90	—	—	—	418.98		
A-5	1120	.90	180	.23	68	418.98		
A-5	1125	.90	180	.69	62	420.15		
A-5	1130	.90	180	.66	80	423.59		
A-5	1135	.90	180	.70	80	426.92		
A-5	1140	.90	180	.40	82	430.40		
A-5	1145	.90	180	.54	80	432.40		
A-5	1150	.90	180	.57	82	435.18		
A-5	1155	.90	180	.62	85	438.03		
A-5	1200	.90	—	—	—	441.30		
NET TIME 110 MIN.			180	.575	79	62.29		

VELOCITY TRAVERSE DATA

CLIENT EPA — PAGE 86 OF 147

Location of Test REYNOLDS PRIMARY INLET — DATE OF TEST 11/3/71

Conditions — — TEST NO. 1

Personnel — — JOB NO. Y-7730E

Ba. 30.22 " Hg — AMBIENT TEMP. 55 °F — STACK AREA 9 SQ. FT.

MOLECULAR WGT. 28.47 #/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

$$K = \frac{2.90 \times .83}{\sqrt{\frac{29.92}{30.20} \times \frac{28.95}{28.47}}} = 2.42$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
A5	180	640		2.42	.90	576.0	24.0	58.08
L3	180	640		2.42	.85	544.0	23.3	56.39
TOTAL	360	1280						114.47
READINGS	2	2						2
AVE.	180	640						57.24

GAS ANALYSIS

PAGE 87 OF 147

CLIENT EPA

DATE OF TEST 11/3/71

Location of Test REYNOLDS PRIMARY INLET

TEST NO. 1

Conditions —

JOB NO. Y-7730E

DRY MOLECULAR WEIGHT

	%	Bx	Mx	Bx Mx
CO_2	0.0	.000	44	0.00
O_2	20.6	.206	32	6.59
CO	0.1	.001	28	.03
N_2	79.3	.793	28	22.20

TOTAL 28.82 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% − 3.31) × 28.82

$M_x d_1$ = 27.87

$M_x (H_2O)$ = % H_2O × 18

3.31 × 18

$M_x (H_2O)$ = .60

M = 27.87 + .60 = 28.47

MOLECULAR WGT. OF STACK GAS = 28.47 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 11/3/71

Location of Test REYNOLDS PRIMARY INLET Test No. 1

Job No. Y-7730E

V.P. = .9989 in. hg vapor pressure of water at meter temp.

Tm = 539 ° Temperature at meter in degrees absolute

Vm = 62.29 cu.ft. volume of gas as measured by meter

P_B = 30.22 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)

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

$$= \frac{.9989 \times 62.29}{30.22}$$

M_M = 2.059 c.f.

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

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

$$= 0.00267 \frac{X\ 0 \times 539}{30.22}$$

Vv = 0 c.f.

3. Calculate the per cent moisture

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

$$= \frac{0 + 2.059}{0 + 62.29} \times 100\% = 3.31\ \%$$

2. CALCULATIONS - VOLUMETRIC

Client EPA Date of Test 11/3/71

Location of Test REYNOLDS - PRIMARY INLET Test No. 1

Job No. Y-7730E

1. Vw = 0 cc. volume of water condensed

2. Vv + MM = 2.059 c.f. water vapor volume, meter condition
(see "calculations-percent moisture" sheet)

3. Vm = 62.29 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 + 62.29

= 62.29 cu.ft.

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

Tm = 539 ° temperature at meter in degrees absolute

Ts = 640 ° temperature in stack in degrees absolute

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

$$= \frac{(62.29) \times 640}{539}$$

Vt = 73.962 c.f.

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

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

$$= (62.29) \times \frac{30.22}{29.90"} \times \frac{520°F}{539} = 60.737 \text{ c.f.}$$

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

3. CALCULATIONS - DUST CONCENTRATION

Client EPA Date of Test 11/3/71

Location of Test REYNOLDS PRIMARY INLET Test No. 1

Job No. Y-7730E

Wt = _____ Gm. filtered dust weight

Vt = 73.962 c.f. total sampled gas, stack conditions

Vst = 60.737 c.f. total sampled gas, standard conditions

CALCULATION OF GRAINS PER CUBIC FT.

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

$$= \frac{\quad}{73.962} \times 15.43$$

= _____ grains/cu.ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. (GR)

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

$$= \frac{\quad}{60.737} \times 15.43$$

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- 7730E
PERSONNEL:

CLIENT: EPA
LOCATION: REYNOLDS
UNIT: PRIMARY

DATE: 11/3/71
TEST NO. 2
FILTER NO. 3

P. BAR. 30.17
T. AMB. 60°
CONDITIONS —

STACK NO. — DIM'N.: 36"x36"
STACK LOCATION: INLET

TYPE OF TEST: ASME
ABSORB. SOL'N. .1N NaOH

TEST LOCATION/ TIME	Δ P	Ts	Rm CFM	Tm	METER READING	CO_2	O_2
A-5 1455	.90	180	.88	85	441.34		
A-5 1500	.90	180	.39	85	445.39		
A-5 1505	.90	180	1.00	87	447.18		
A-5 1510	.90	180	.56	87	452.20		
A-5 1515	.90	180	.91	87	455.01		
A-5 1520	.90	180	.51	90	459.58		
A-5 1525	.90	180	.37	90	462.14		
A-5 1530	.90	180	.49	90	464.01		
A-5 1535	.90	180	.61	90	466.45		
A-5 1540	.90	180	.60	90	469.50		
A-5 1545	.90	180	.38	90	472.52		
A-5 1550	.90	180	.38	90	474.40		
A-5 1555	.90	180	.44	90	476.32		
A-5 1600	.90	180	.90	90	478.50		
A-5 1605	.90	180	.60	92	482.98		
A-5 1610	.90	180	.33	92	485.99		
A-5 1615	.90	180	.75	92	487.66		
A-5 1620	.90	180	.58	92	491.60		
A-5 1625	.90	180	.45	92	494.48		
C-3 1630	.85	180	.98	90	496.73		
C-3 1635	.85	180	.47	90	501.65		
C-3 1640	.85	180	.50	95	503.99		
C-3 1645	.85	180	.54	95	506.50		
C-3 1650	.85	180	.63	95	509.20		
C-3 1655	.85	180	—	95	512.33		
NET TIME 120 MIN.		180	.594	90	70.99		

VELOCITY TRAVERSE DATA

CLIENT EPA — PAGE 92 OF ____

Location of Test REYNOLDS PRIMARY INLET — DATE OF TEST 11/3/71

Conditions — — TEST NO. 2

Personnel — — JOB NO. Y-7730E

Ba. 30.17 " Hg — AMBIENT TEMP. 60 °F — STACK AREA 9 SQ. FT.

MOLECULAR WGT. 28.31 #/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

$$K = \frac{2.90 \times .83}{\sqrt{\frac{29.92}{30.15} \times \frac{28.95}{28.31}}} = 2.42$$

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.
A 5	180	640		2.42	.90	576.0	24.0	58.08
C 3	180	640		2.42	.85	544.0	23.3	56.37
TOTAL	360	1280						114.45
READINGS	2	2						2
AVE.	180	640						57.23

GAS ANALYSIS

PAGE 93 OF 117

CLIENT EPA

DATE OF TEST 11/3/71

Location of Test REYNOLDS PRIMARY INLET

TEST NO. 2

Conditions —

JOB NO. Y-7730E

DRY MOLECULAR WEIGHT

	%	Bx	Mx	Bx Mx
CO_2	0.0	.000	44	0.00
O_2	20.6	.206	32	6.59
CO	0.1	.001	28	.03
N_2	79.3	.793	28	22.20

TOTAL 28.82 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% − 4.71) × 28.82

$M_x d_1$ = 27.46

$M_x (H_2O)$ = % H_2O × 18

4.71 × 18

$M_x (H_2O)$ = .85

M = 27.46 + .85 = 28.31

MOLECULAR WGT. OF STACK GAS = 28.31 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 11/3/71

Location of Test REYNOLDS PRIMARY INLET Test No. 2

Job No. Y-7730E

V.P. = 1.422 in. hg vapor pressure of water at meter temp.

Tm = 550 ° Temperature at meter in degrees absolute

Vm = 70.99 cu.ft. volume of gas as measured by meter

P_B = 30.17 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)

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

$$= \frac{1.422 \times 70.99}{30.17}$$

M_M = 3.346 c.f.

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

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

$$= 0.00267 \frac{\times\ 0\ \times\ 550}{30.17}$$

Vv = 0 c.f.

3. Calculate the per cent moisture

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

$$= \frac{+\ 3.346}{+\ 70.99} \times 100\% = 4.71\ \%$$

2. CALCULATIONS - VOLUMETRIC

Client EPA Date of Test 11/3/71

Location of Test REYNOLDS PRIMARY INLET Test No. 2

Job No. Y-7730E

1. Vw = 0 cc. volume of water condensed

2. Vv + MM = 3.346 c.f. water vapor volume, meter condition
(see "calculations-percent moisture" sheet)

3. Vm = 70.99 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 + 70.99

= 70.99 cu.ft.

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

Tm = 550 ° temperature at meter in degrees absolute

Ts = 640 ° temperature in stack in degrees absolute

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

$$= \frac{(70.99) \times 640}{550}$$

Vt = 82.607 c.f.

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

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

$$= (70.99) \times \frac{30.17}{29.90"} \times \frac{520°F}{550} = 67.724 \text{ c.f.}$$

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

3. CALCULATIONS - DUST CONCENTRATION

Client EPA Date of Test 11/3/71

Location of Test Reynolds Primary Inlet Test No. 2

Job No. Y-7730 E

Wt = _____ Gm. filtered dust weight

Vt = 82.607 c.f. total sampled gas, stack conditions

Vst = 67.724 c.f. total sampled gas, standard conditions

CALCULATION OF GRAINS PER CUBIC FT.

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

$$= \frac{\quad}{82.607} \times 15.43$$

= _____ grains/cu.ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. (GR)

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

$$= \frac{\quad}{67.724} \times 15.43$$

GR = _____ grains/std. cu. ft.

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

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

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

$$= 12 \times \quad$$

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

SUMMARY OF SOURCE EMISSION TEST DATA

CLIENT EPA PAGE ___ OF ___

Location of Test REYNOLDS METALS JOB NO. 1-2231-F

Test Evaluation of ASME - PRIMARY OUTLET

GENERAL DATA				
DATE OF TEST	11-3-71	11-3-71		
TEST NO.	1	2		
BAROMETRIC PRESSURE (" H_g)	30.22	30.17		
STACK PRESSURE (" H_g)	30.20	30.15		
AREA OF STACK (Sq. Ft.)	29.45	29.45		
ELAPSED SAMPLING TIME (Min.)	160	120		
GAS DATA				
AVERAGE GAS VELOCITY (Ft./Sec.)	37.99	38.16		
AVERAGE GAS TEMPERATURE (°F)	100	105		
GAS FLOW RATE (CFM)	67130	67400		
APPARENT MOLECULAR WGT. (#/Cu.Ft.)	28.24	28.34		
GAS ANALYSIS, ORSAT BASIS:				
CO_2%	.03	.03		
O_2%	20.80	20.80		
CO%	—	—		
N_2%	79.17	79.17		
H_2O%	5.56	4.65		
PARTICULATE CONCENTRATION DATA				
VOLUME OF WATER CONDENSED (cc)	43	33		
WATER VAPOR VOLUME, METER CONDITION (CF)	6.15	4.02		
VOLUME OF GAS SAMPLED, METER CONDITION (CF)	108.60	84.89		
TOTAL VOLUME SAMPLED, METER CONDITION (CF)	110.66	86.45		
VOLUME OF GAS SAMPLED, STACK CONDITION (CF)	114.13	91.30		
VOLUME OF GAS SAMPLED, STANDARD CONDITION (CF)	107.11	84.79		
SOLUBLE FLUORIDES (NOZZLE WASH) mg	1.1	1.9		
SOLUBLE FLUORIDES (THIMBLE, IMPINGERS IMPINGER WASH) mg	186.0	87.0		
INSOLUBLE FLUORIDES (") mg	430.0	280.0		
TOTAL FLUORIDES mg	617.1	368.9		
FLUORIDES EMISSION lbs/hr.	47.97	35.99		
Fluorides Emission lbs/Ton	76.75	57.58		

York Research Corporation

ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06904

FIELD TEST DATA

JF. NO. Y- 7730E
PERSONNEL: RSE

CLIENT: EPA
LOCATION: REYNOLDS
UNIT: PRIMARY

DATE: 11/3/71
TEST NO. 1
FILTER NO. 2

P. BAR. 30.22
AMB. 55°
ONDITIONS —

STACK NO. — DIM'N.: 73.5" DIA.
STACK LOCATION: OUTLET

TYPE OF TEST: ASME
ABSORB. SOL'N. .1N NAOH

TEST LOCATION/ TIME	Δ P	Ts	Rm CFM	Tm	METER READING	CO_2	O_2
ART 1021	.44	100	.70	—	097.15		
1026	.44	100	.71	60	100.70		
1031	.44	100	.68	80	104.10		
1036	.44	100	.68	80	107.50		
1041	.44	100	.68	82	110.90		
1046	.44	100	.70	82	114.40		
1051	.44	100	.70	82	117.90		
1056	.44	100	.69	84	121.35		
1101	.44	100	.69	84	123.80		
1106	.44	100	.70	84	127.30		
1111	.44	100	.70	84	130.65		
1116	.44	100	.72	84	134.25		
1121	.44	100	.72	84	137.85		
1126	.44	100	.70	84	141.35		
1131	.44	100	.70	84	143.85		
1136	.44	100	.69	84	147.30		
1141	.44	100	.69	84	150.75		
1146	.44	100	.68	84	154.10		
1151	.44	100	.68	84	157.55		
1156	.44	100	.68	84	160.95		
1201	.44	100	.69	84	164.40		
1206	.44	100	.70	84	167.90		
1211	.44	100	.70	84	171.40		
1216	.44	100	.78	84	174.30		
1221	.44	100	.80	84	178.30		
1226	.44	100	.78	84	182.20		
1231	.44	100	.68	84	186.00		
1236	.44	100	.68	84	189.40		
1241	.44	100	68	84	192.80		

York Research Corporation

ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06904

FIELD TEST DATA

REF. NO. Y- 7730E
PERSONNEL: RSE

CLIENT: EPA
LOCATION: REYNOLDS
UNIT: PRIMARY

DATE: 11/3/71
TEST NO. 1
FILTER NO. 2

P. BAR. 30.22
T. AMB. 55°
CONDITIONS —

STACK NO. — DIM'N.: 73.5" DIA.
STACK LOCATION: OUTLET

TYPE OF TEST: ASME
ABSORB. SOL'N. .1N NaOH

TEST LOCATION/ TIME	Δ P	Ts	Rm CFM	Tm	METER READING	CO_2	O_2
1246	.44	100	.68	84	195.40		
1251	.44	100	.60	84	198.40		
1256	.44	100	.72	84	202.00		
1301	.44	100	.75	—	205.75		
NET TIME 160 MIN	.44	100	70	83	108.60		

VELOCITY TRAVERSE DATA

CLIENT EPA — PAGE 1?? OF ???

Location of Test REYNOLDS PRIMARY OUTLET — DATE OF TEST 11/3/71

Conditions — — TEST NO. 1

Personnel — — JOB NO. Y-7730E

Ba. 30.22 " Hg — AMBIENT TEMP. 55 °F — STACK AREA _____ SQ. FT.

MOLECULAR WGT. 28.24 #/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

$$K = 2.90 \times .83 \sqrt{\frac{29.92}{30.20} \times \frac{28.95}{28.24}} = 2.42$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °Ā T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	$\sqrt{\Delta p \times T}$	VS Ft/Sec.
10	100	560	-.25	2.42	.44	246.4	15.70	37.99
TOTAL								
READINGS								
AVE.								

GAS ANALYSIS

CLIENT EPA

Location of Test REYNOLDS PRIMARY OUTLET

Conditions —

PAGE 101 OF [illegible]

DATE OF TEST 11/3/71

TEST NO. 1

JOB NO. Y-7730E

DRY MOLECULAR WEIGHT

	%	Bx	Mx	Bx Mx
CO_2	.03	.0003	44	.01
O_2	20.80	.208	32	6.66
CO	0.00	.00	28	.00
N_2	79.17	.7917	28	22.17

TOTAL 28.84 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% − 5.56) × 28.84

$M_x d_1$ = 27.24

$M_x (H_2O)$ = % H_2O × 18

5.56 × 18

$M_x (H_2O)$ = 1.00

M = 27.24 + 1.00 = 28.24

MOLECULAR WGT. OF STACK GAS = 28.24 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 11/3/71

Location of Test REYNOLDS PRIMARY OUTLET Test No. 1

Job No. Y-7730E

V.P. = 1.138 in. hg vapor pressure of water at meter temp.

Tm = 543 ° Temperature at meter in degrees absolute

Vm = 108.60 cu.ft. volume of gas as measured by meter

P_B = 30.22 in. Barometric pressure

V_w = 43 cc. volume of water condensed

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

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

$$= \frac{1.138 \times 108.60}{30.22}$$

M_M = 4.090 c.f.

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

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

$$= 0.00267 \frac{\times 43 \times 543}{30.22}$$

Vv = 2.063 c.f.

3. Calculate the per cent moisture

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

$$= \frac{2.063 + 4.090}{2.063 + 108.60} \times 100\% = 5.56\ \%$$

2. CALCULATIONS - VOLUMETRIC

Client EPA Date of Test 11/3/71

Location of Test REYNOLDS PRIMARY OUTLET Test No. 1

Job No. Y-7730E

1. Vw = 43 cc. volume of water condensed

2. Vv + MM = 6.153 c.f. water vapor volume, meter condition
(see "calculations-percent moisture" sheet)

3. Vm = 108.60 c.f. volume of gas sampled, meter condition

4. Total volume sampled, meter condition

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

= 2.063 + 108.60

= 110.663 cu.ft.

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

Tm = 543 ° temperature at meter in degrees absolute

Ts = 560 ° temperature in stack in degrees absolute

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

$$= \frac{(110.663) \times 560}{543}$$

Vt = 114.128 c.f.

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

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

$$= (110.663) \times \frac{30.22}{29.90"} \times \frac{520°F}{543} = 107.110 \text{ c.f.}$$

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

3. CALCULATIONS - DUST CONCENTRATION

Client EPA Date of Test 11/3/71

Location of Test REYNOLDS PRIMARY OUTLET Test No. 1

Job No. Y-7730E

Wt = _____ Gm. filtered dust weight

Vt = 114.128 c.f. total sampled gas, stack conditions

Vst = 107.110 c.f. total sampled gas, standard conditions

CALCULATION OF GRAINS PER CUBIC FT.

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

$$= \frac{\quad}{114.128} \times 15.43$$

= _____ grains/cu.ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. (GR)

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

$$= \frac{\quad}{107.110} \times 15.43$$

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- 7730E
PERSONNEL: RSE
MAERKER

CLIENT: EPA
LOCATION: REYNOLDS
UNIT: PRIMARY

DATE: 11/1
TEST NO. 2
FILTER NO. 9

P. BAR. 30.17
T. AMB. 50°
CONDITIONS —

STACK NO. — DIM'N.: 73.5" DIA.
STACK LOCATION: OUTLET

TYPE OF TEST: ASME
ABSORB. SOL'N. .1N NaOH

TEST LOCATION/ TIME	Δ P	Ts	Rm CFM	Tm	METER READING	CO_2	O_2
START 1325	.44	105	.93	74	205.76		
1330	.44	105	.57	72	210.41		
1335	.44	105	.78	76	213.28		
1340	.44	105	.71	76	216.74		
1345	.44	105	.71	78	220.31		
1350	.44	105	.71	78	223.85		
1355	.44	105	.70	75	227.40		
1400	.44	105	.69	75	230.90		
1405	.44	105	.71	74	234.35		
1410	.44	105	.69	74	237.88		
1415	.44	105	.69	74	241.35		
1420	.44	105	.70	75	244.82		
1425	.44	105	.69	75	248.30		
1430	.44	105	.71	75	251.76		
1435	.44	105	.69	75	255.28		
1440	.44	105	.71	75	258 72		
1445	.44	105	.70	75	262 26		
1450	.44	105	.65	75	265.45		
1455	.44	105	1.09	75	270.90		
1500	.44	105	.42	75	273.00		
1505	.44	105	.75	75	276.78		
1510	.44	105	.69	75	280.22		
1515	.44	105	.71	75	283.77		
1520	.44	105	.70	75	287.27		
END 1525	.44	105	.71	75	290.74		
NET TIME 120 MIN.	.44	1.05	.71	75	84.89		

VELOCITY TRAVERSE DATA

CLIENT EPA PAGE 104 OF ____

Location of Test REYNOLDS PRIMARY OUTLET DATE OF TEST 11/3/71

Conditions ____ TEST NO. 2

Personnel ____ JOB NO. Y-7730E

Ba. 30.17 " Hg AMBIENT TEMP. 50 °F STACK AREA 29.45 SQ. FT.

MOLECULAR WGT. 28.34 #/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

$$K = \frac{2.90 \times .83}{\sqrt{\frac{29.92}{30.15} \times \frac{28.95}{28.34}}} = 2.42$$

POINT NO.	STACK TEMP. °F	STACK TEMP. °R T = F + 460	STATIC PRESS. Abs.	K	Δp	Δp × T	√Δp × T	VS Ft/Sec.
10	105	565	-.25	2.42	.44	248.6	15.77	38.16
TOTAL								
READINGS								
AVE.								

GAS ANALYSIS

CONTROLLED YORK RESEARCH CORPORATION

CLIENT EPA

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Location of Test REYNOLDS PRIMARY OUTLET

DATE OF TEST 11/3/71

Conditions —

TEST NO. 1

JOB NO. Y-7730E

DRY MOLECULAR WEIGHT

	%	Bx	Mx	Bx Mx
CO_2	.03	.0003	44	.01
O_2	20.80	.2080	32	6.66
CO	.00	.0000	28	.00
N_2	79.17	.7917	28	22.17

TOTAL 28.84 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% − 4.65) × 28.84

$M_x d_1$ = 27.50

$M_x (H_2O)$ = % H_2O × 18

4.65 × 18

$M_x (H_2O)$ = .84

M = 27.50 + .84 = 28.34

MOLECULAR WGT. OF STACK GAS = 28.34 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 11/3/71

Location of Test REYNOLDS PRIMARY OUTLET Test No. 2

Job No. Y-7730E

V.P. = .875 in. hg vapor pressure of water at meter temp.

Tm = 535 ° Temperature at meter in degrees absolute

Vm = 84.89 cu.ft. volume of gas as measured by meter

P_B = 30.17 in. Barometric pressure

V_W = 33 cc. volume of water condensed

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

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

$$= \frac{.875 \times 84.89}{30.17}$$

M_M = 2.462 c.f.

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

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

$$= 0.00267 \frac{\times 33 \times 535}{30.17}$$

Vv = 1.562 c.f.

3. Calculate the per cent moisture

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

$$= \frac{1.562 + 2.462}{1.562 + 84.89} \times 100\% = 4.65\ \%$$

2. CALCULATIONS - VOLUMETRIC

Client EPA Date of Test 11/3/71

Location of Test REYNOLDS PRIMARY OUTLET Test No. 2

Job No. Y-7730E

1. Vw = 33 cc. volume of water condensed

2. Vv + MM = 4024 c.f. water vapor volume, meter condition
(see "calculations-percent moisture" sheet)

3. Vm = 84.89 c.f. volume of gas sampled, meter condition

4. Total volume sampled, meter condition

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

= 1.562 + 84.89

= 86.452 cu.ft.

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

Tm = 535 ° temperature at meter in degrees absolute

Ts = 565 ° temperature in stack in degrees absolute

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

$$= \frac{(86.452) \times 565.}{535}$$

Vt = 91.300 c.f.

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

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

$$= (86.452) \times \frac{30.17}{29.90"} \times \frac{520°F}{535} = 84.787 \text{ c.f.}$$

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

3. CALCULATIONS - DUST CONCENTRATION

Client EPA Date of Test 11/3/71

Location of Test REYNOLDS PRIMARY OUTLET Test No. 2

Job No. Y-7730E

Wt = _____ Gm. filtered dust weight

Vt = 91.300 c.f. total sampled gas, stack conditions

Vst = 84.787 c.f. total sampled gas, standard conditions

CALCULATION OF GRAINS PER CUBIC FT.

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

$$= \frac{\quad}{91.300} \times 15.43$$

= _____ grains/cu.ft.

CALCULATION OF GRAINS PER STANDARD CUBIC FT. (GR)

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

$$= \frac{\quad}{84.787} \times 15.43$$

GR = _____ grains/std. cu. ft.

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

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

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

$$= 12 \times$$

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

NO_x EMISSION DATA

RUN NO.	Inlet 1	Inlet 2	Inlet 3	Outlet 1	Outlet 2	Outlet 3	
Date	11/4/71	11/4/71	11/4/71	11/4/71	11/4/71	11/4/71	
mg NO_2	0.0	0.0	0.0	0.0	0.0	0.0	
T_f - Flask Temperature, °F							
V_f - Flask Volume, liters	2.063	2.086	2.090	2.073	2.081	2.076	
P_i - Initial Flask Vacuum, "Hg.	22.3	22.7	22.8	22.0	22.0	22.1	
P_f - Final Flask Vacuum, "Hg.	0.3	0.3	0.5	0.1	0.2	0.4	
ppm NO_2	0.0	0.0	0.0	0.0	0.0	0.0	

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

OXIDES OF NITROGEN FIELD DATA

JOB NO. Y-7730 E

Date 11/4/71

Plant Reynolds Metals

Sample Collected By ET

Run No. 1-3

Power Stat Setting

Field Data

Inlet

Clock Time					
Flask Number	1	6	10		
Volume of flask less correction (liter)	2.063	2.086	2.090		
Pressure before sampling in Hg.	22.3	22.7	22.8		
Pressure after sampling in Hg.	0.3	0.3	0.5		
Flask temperature, °F					

Remarks:

OXIDES OF NITROGEN FIELD DATA

JOB NO. Y-7730 F

Date 11/4/71

Plant Reynolds Metals

Sample Collected By ET

Run No. 1-3

Power Stat Setting

Field Data

Outlet

Clock Time					
Flask Number	9	25	3		
Volume of flask less correction (liter)	2.073	2.081	2.076		
Pressure before sampling in Hg.	22.0	22.0	22.1		
Pressure after sampling in Hg.	0.1	0.2	0.4		
Flask temperature, °F					

Remarks:

SO_2 EMISSION DATA

Inlet

RUN NO.	1	2	3	4	5	
Date	11/3/71	11/3/71	11/3/71	11/3/71	11/3/71	
mg SO_2	2.8	0.4	1.3	6.5	3.5	
T_m - Average Gas Meter Temperature, °F	57	52	60	62	64	
P_b - Barometric Pressure, "Hg abs.	30.17	30.22	30.22	30.22	30.22	
V_m - Volume of dry gas sampled @ meter conditions, $ft.^3$	8.410	8.45	8.38	8.38	8.37	
ppm SO_2	4.3	0.60	2.0	10.1	5.4	

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

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 E

Material Sampled for SO_2 Inlet

Date 11/3/71

Plant Reynolds Metal Location Portland, Oregon

Bar. Pressure 30.17 mm Hg "Hg Comments:

Ambient Temp.

Run No. 1 Port A

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1645	174.53		56
1655	175.26		58
1715	176.68		
1725	177.34		
1745	178.74		
1755	179.49		
1815	180.86		
1825	181.53		
1845	182.93		

Comments:

Impinger Bucket No.

Meter Box No.

GAS SAMPLING FIELD DATA

JOB NO. Y-7730-E

Material Sampled for SO_2 Inlet

Date 11/3/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.22 "Hg Comments:

Ambient Temp.

Run No. 2 Port A

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
0830	182.92		48
0840	183.67		
0900	185.01		52
0910	185.74		
0930	187.19		
0940	187.86		
1000	189.28		54
1010	189.97		
10 30	191.37		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 E

Material Sampled for SO_2 Inlet

Date 11/3/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.22 "Hg Comments:

Ambient Temp.

Run No. 3 Port B

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
0830	117.82		58
0840	118.56		
0900	119.91		
0910	120.68		
0930	122.07		60
0940	122.73		62
1000	122.10		
1010	124.84		
1030	126.20		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 E

Material Sampled for SO_2 Inlet

Date 11/3/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.22 "Hg Comments:

Ambient Temp.

Run No. 4 Port A

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1125	192.22		60
1135	192.98		62
1155	194.31		
1205	195.08		
1225	196.49		62
1235	197.14		62
1255	198.53		
1305	199.21		62
1325	200.60		

Comments:

Impinger Bucket No.

Meter Box No.

GAS SAMPLING FIELD DATA

JOB NO. X-7730 E

Material Sampled for SO_2 Inlet

Date 11/3/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.22 "Hg Comments:

Ambient Temp.

Run No. 5 Port B

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1125	127.13		60
1135	127.87		
1155	129.25		64
1205	129.94		
1225	131.32		64
1235	132.01		65
1255	133.40		66
1305	134.17		
1325	135.50.		

Comments:

Impinger Bucket No.

Meter Box No.

SO_2 EMISSION DATA

Outlet

RUN NO.	1	2	3	4		
Date	11/5/71	11/5/71	11/5/71	11/5/71		
mg SO_2	3.1	3.2	2.9	3.2		
T_m - Average Gas Meter Temperature, °F	53	56	54	53		
P_b - Barometric Pressure, "Hg abs.	30.45	30.45	30.34	30.39		
V_m - Volume of dry gas sampled @ meter conditions, $ft.^3$	8.40	8.46	8.45	8.41		
ppm SO_2	4.7	4.8	4.4	4.8		

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

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-7230 E

Material Sampled for SO_2 Outlet

Date 11/5/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.45 "Hg Comments:

Ambient Temp.

Run No. 1 Port A

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
0840	137.32		48
0850	138.01		50
0910	139.48		
0920	140.12		
0940	141.51		56
0950	142.26		
1010	143.64		
1020	144.32		
1040	145.72.		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 E

Material Sampled for SO_2 Outlet

Date 11/5/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.45 "Hg Comments:

Ambient Temp.

Run No. 2 Port B

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
0840	172.03		54
0850	172.71		56
0910	174.16		
0920	174.82		
0940	176.21		58
0950	176.91		
1010	178.36		
1020	179.02		
1040	180.49 .		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

GAS SAMPLING FIELD DATA

JOB NO. Y-7730E

Material Sampled for SO_2 Outlet

Date 11/5/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.39 "Hg Comments:

Ambient Temp.

Run No. 3 Port A

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1120	146.28		52
1130	146.96		54
1150	148.31		58
1200	149.08		
1220	150.46		60
1230	151.12		50
1250	152.54		
1300	153.24		
1320	154.73		

Comments:

Impinger Bucket No.

Meter Box No.

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 E

Material Sampled for SO_2 Outlet

Date 11/5/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.34 "Hg Comments:

Ambient Temp.

Run No. 4 Port B

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1120	180.58		
1130	181.26		
1150	182.64		
1200	183.32		
1220	184.73		
1230	185.42		
1250	186.85		
1300	187.53		
1320	188.99		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

F⁻ EMISSION DATA

Run No.	1	2	3	4		
Date	11-3-71	11-3-71	11-3-71	11-3-71		
mg F⁻	8.2	7.9	10.9	9.7		
T_m - Average Gas Meter Temperature, °F	60	69	60	68		
P_b - Barometric Pressure - "Hg abs.	30.17	30.17	30.17	30.17		
V_m - Volume of dry gas sampled @ meter conditions, $ft.^3$	7.55	7.47	7.65	7.52		
SCFM	26200	26200	26200	26200		
lb F⁻/hr	3.66	3.63	4.81	4.42		
Ton Al/hr	.292	.292	.292	.292		
lb F⁻/Ton Al	12.53	12.43	16.47	15.14		

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

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 E

Material Sampled for Inlet HF in H_2O

Date 11/3/71

Plant Reynolds Metals Location Portland Oregon

Bar. Pressure 30.17 "Hg Comments:

Ambient Temp.

Run No. 1 Port A

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1400	201.32		58
1410	202.38		60
1430	204.82		
1440	205.37		
1500	207.41		61
1510	208.12		
1515	208.87		62

Comments:

Impinger Bucket No.

Meter Box No.

GAS SAMPLING FIELD DATA

JOB NO. Y-7230 E

Material Sampled for Inlet HF in H_2O

Date 11/3/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.17 "Hg Comments:

Ambient Temp.

Run No. 2 Port B

Power Stat Setting

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1400	206.21		67
1410	207.32		68
1420	208.56		
1430	209.42		70
1440	210.57		
1450	211.34		
1500	212.31		
1510	213.24		
1515	213.68		70

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 E

Material Sampled for Inlet HF in H_2O

Date 11/3/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.17 "Hg Comments:

Ambient Temp.

Run No. 3 Port A

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1555	208.97		60
1605	209.82		61
1615	210.73		
1625	211.61		60
1635	212.58		
1645	213.21		60
1655	214.81		
1705	215.70		
1710	216.62.		60

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 E

Material Sampled for Inlet HF in H_2O

Date 11/3/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.17 "Hg Comments:

Ambient Temp.

Run No. 4 Port B

Power Stat Setting

Filter Used: Yes No X

Operator E T

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1555	203.77		67
1605	204.68		68
1615	205.72		
1625	206.61		
1635	207.24		
1645	208.36		
1655	209.99		68
1705	210.61		
1710	211.29		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

F^- EMISSION DATA

Run No.	1	2	3	4		
Date	11-4-71	11-4-71	11-4-71	11-4-71		
mg F^-	3.1	1.1	4.1	4.1		
T_m - Average Gas Meter Temperature, °F	60	58	52	56		
P_b - Barometric Pressure - "Hg abs.	30.30	30.30	30.30	30.30		
V_m - Volume of dry gas sampled @ meter conditions, $ft.^3$	10.02	10.06	10.04	10.09		
SCFM	59500	59500	59500	59500		
lb F^-/hr	2.35	0.83	3.07	3.08		
Ton Al/hr	.625	.625	.625	.625		
lb F^-/Ton Al	3.76	1.33	4.91	4.93		

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

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 E

Material Sampled for Outlet HF in H_2O

Date 11/4/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.30 "Hg Comments:

Ambient Temp.

Run No. 1 Port A

Power Stat Setting —

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1240	216.75		60
1250	217.84		
1310	219.84		60
1320	220.71		
1340	222.43		
1350	223.18		
1410	225.40		
1420	226.77		60

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 E

Material Sampled for Outlet HF in H_2O

Date 11/4/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.30 "Hg Comments:

Ambient Temp.

Run No. 2 Port B

Power Stat Setting

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1240	251.46		58
1250	252.58		58
1310	254.69		
1320	255.22		
1340	257.36		
1350	258.20		
1410	260.86		
1420	261.46		58

Comments:

Impinger Bucket No.

Meter Box No.

GAS SAMPLING FIELD DATA

JOB NO. Y-7730E

Material Sampled for Outlet HF in H_2O

Date 11/4/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.30 "Hg Comments:

Ambient Temp.

Run No. 3 Pint A

Power Stat Setting —

Filter Used: Yes ____ No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1500	226.88		
1510	227.80		
1530	229.17		
1540	230.80		
1600	232.72		
1610	233.83		
1630	235.47		
1640	236.92		

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

GAS SAMPLING FIELD DATA

JOB NO. Y-7730 E

Material Sampled for Outlet HF in H_2O

Date 11/4/71

Plant Reynolds Metals Location Portland, Oregon

Bar. Pressure 30.30 "Hg Comments:

Ambient Temp.

Run No. 4 Port B

Power Stat Setting —

Filter Used: Yes No X

Operator ET

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1500	261.55		58
1510	262.49		
1530	264.29		
1540	265.17		
1600	267.43		56
1610	269.39		
1630	270.47		
1640	271.64		56

Comments:

Impinger Bucket No.

Meter Box No.

NCAP 36 (12/67)

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. 7730 E

ORSAT FIELD DATA

Location INLET & OUTLET Comments:

Date 11/2/71

Time ———

Operator R B

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
INLET (FYRITE) 1	0	21.0	21.0
2	0	21.0	21.0
3	0	21.0	21.0
OUTLET 1	0	20.8	21.2
2	0	21.0	21.2
3	0	20.8	21.0

JOB NO. 7730 E

ORSAT FIELD DATA

Location INLET & OUTLET Comments:

Date 11/3/71

Time

Operator RE

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
INLET 1	0	20.8	20.8
2	0	20.8	20.6
3	0	20.1	20.1
OUTLET 1	0.1	20.9	20.6
2	0	20.6	20.6
3	0	20.8	20.6

JOB NO. 7730E

ORSAT FIELD DATA

Location INLET & OUTLET Comments:

Date 11/4/71

Time

Operator RE

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

JOB NO. 7730 E

ORSAT FIELD DATA

Location INLET & OUTLET Comments:

Date 11/5/71

Time

Operator RE

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

APPENDIX A

TEST LOG

REYNOLDS METALS
EVENTS LOG

October 28-39, 1971 Thursday - Friday	York Research Project Director met with management and technical plant personnel to establish liaison, scaffolding requirements and other pertinent items.
November 1, 1971 Monday	Balance of test team arrives to begin testing.
November 2, 1971 Tuesday	Set up sampling equipment and preliminary velocity traverses. Conducted Particulate tests 1 on the inlet and outlet.
November 3, 1971 Wednesday	Conducted pitot traverse on primary system. Inlet SO_2 and SO_3 Test 2 Port A, 3 Port B Inlet SO_2 and SO_3 Test 4 Port A, 5 Port B Inlet HF Test 1 Port A Inlet HF Test 2 Inlet HF Test 3 Inlet HF Test 4 Port #2 Inlet Primary Port #2 Outlet Primary Port #3 Inlet Primary Port #3 Outlet Primary ASME Inlet Test 1 Primary ASME Inlet Test 2 Primary ASME Outlet Test 1 Primary ASME Outlet Test 2 Primary
November 4, 1971 Thursday	Conducted pitot traverse. Inlet Test 1 Secondary Outlet Test 1 Secondary Outlet HF Test 1 Outlet HF Test 2 Outlet HF Test 3 Outlet HF Test 4

November 5, 1971
Friday

Inlet Test 2 Secondary
Outlet Test 2 Secondary
Inlet Test 3 Secondary
Outlet Test 3 Secondary
Outlet Test 1 - SO_2 and SO_3
Outlet Test 2 - SO_2 and SO_3
Outlet Test 3 - SO_2 and SO_3
Outlet Test 4 - SO_2 and SO_3

Clean up equipment and pack for return to home base.

APPENDIX B

SAMPLING TRAIN FIGURES

PARTICULATE SAMPLING TRAIN

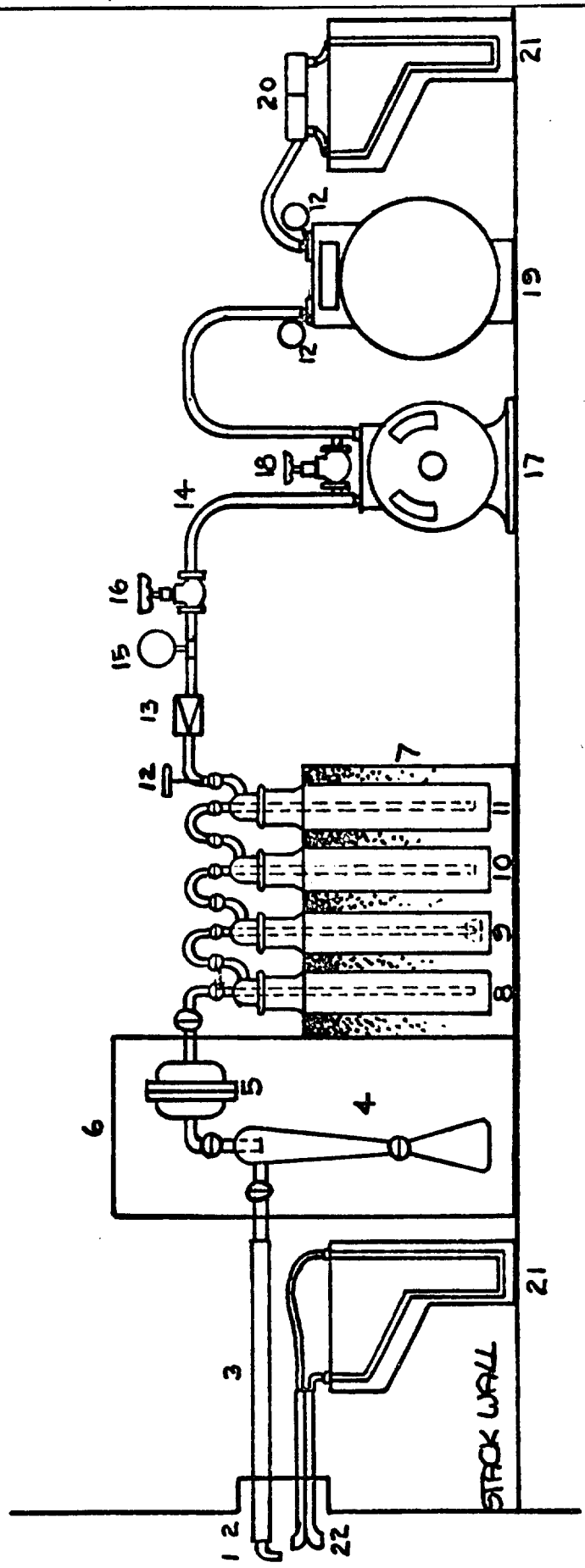
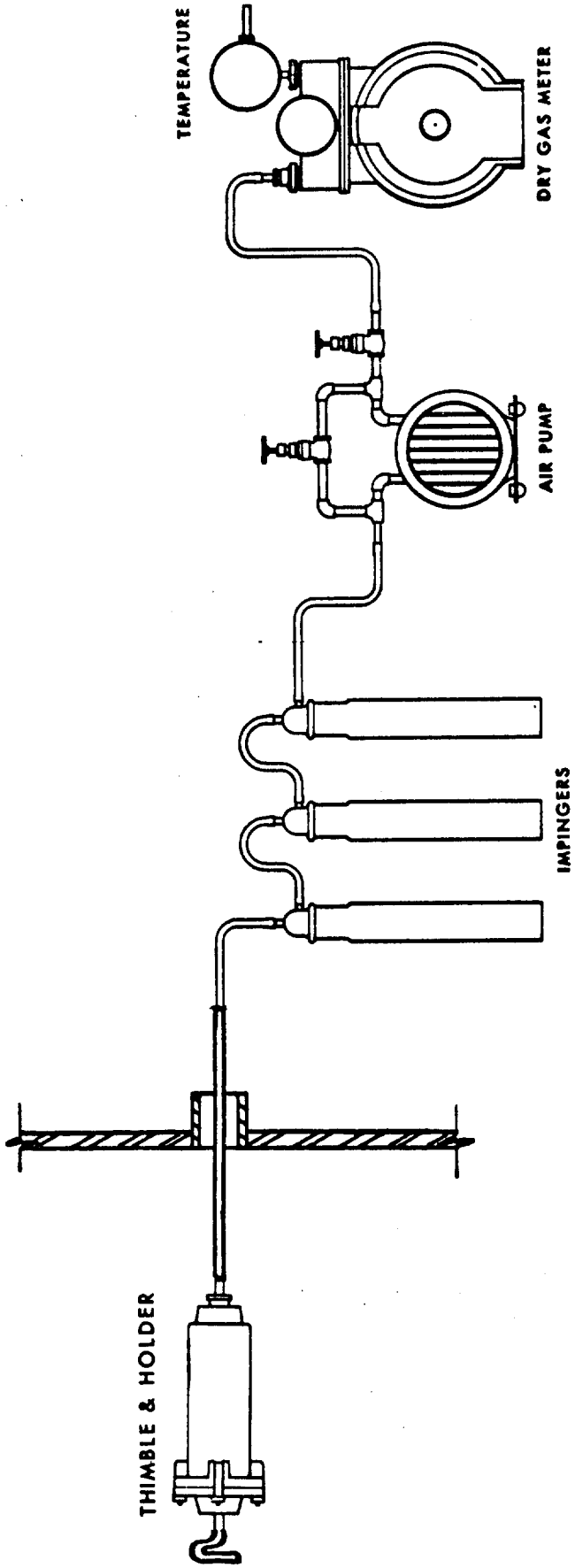


FIGURE #1

ASME PARTICULATE TRAIN



SAMPLING TRAIN

FIGURE 2

SO_2 SAMPLING TRAIN

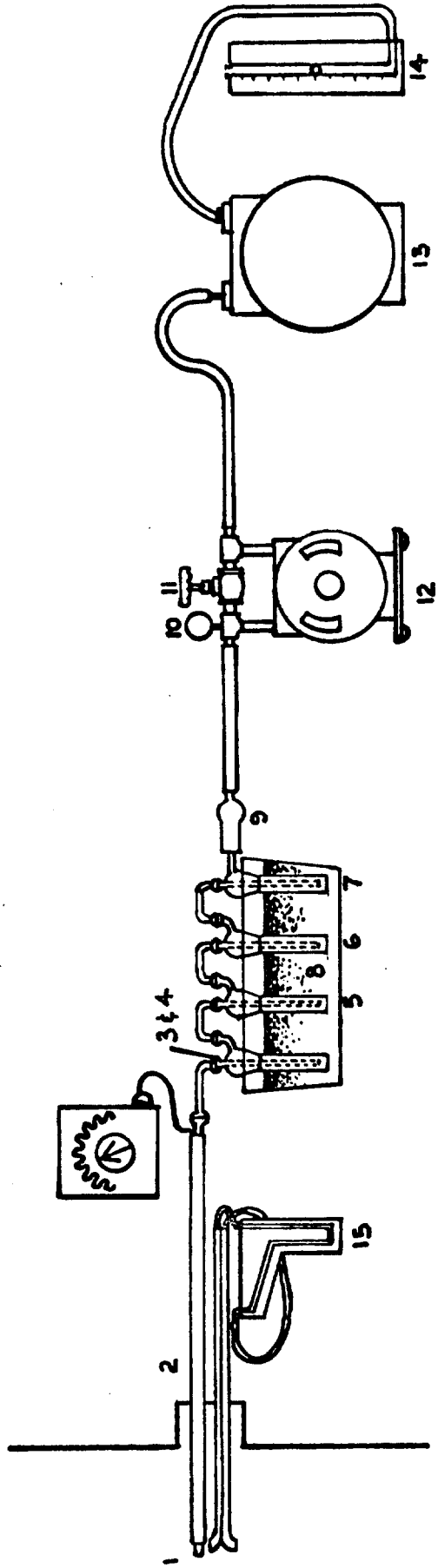


FIGURE #3

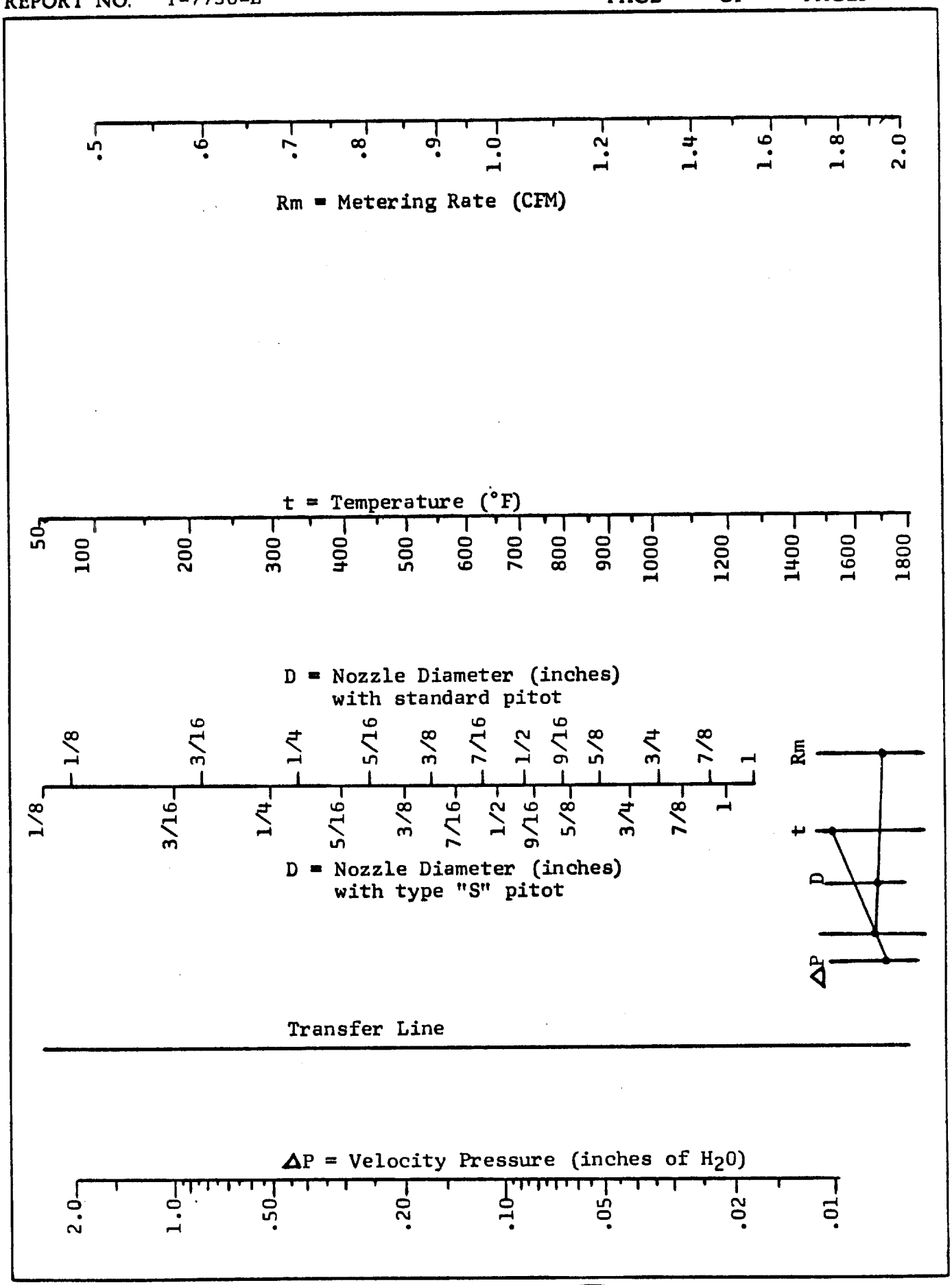
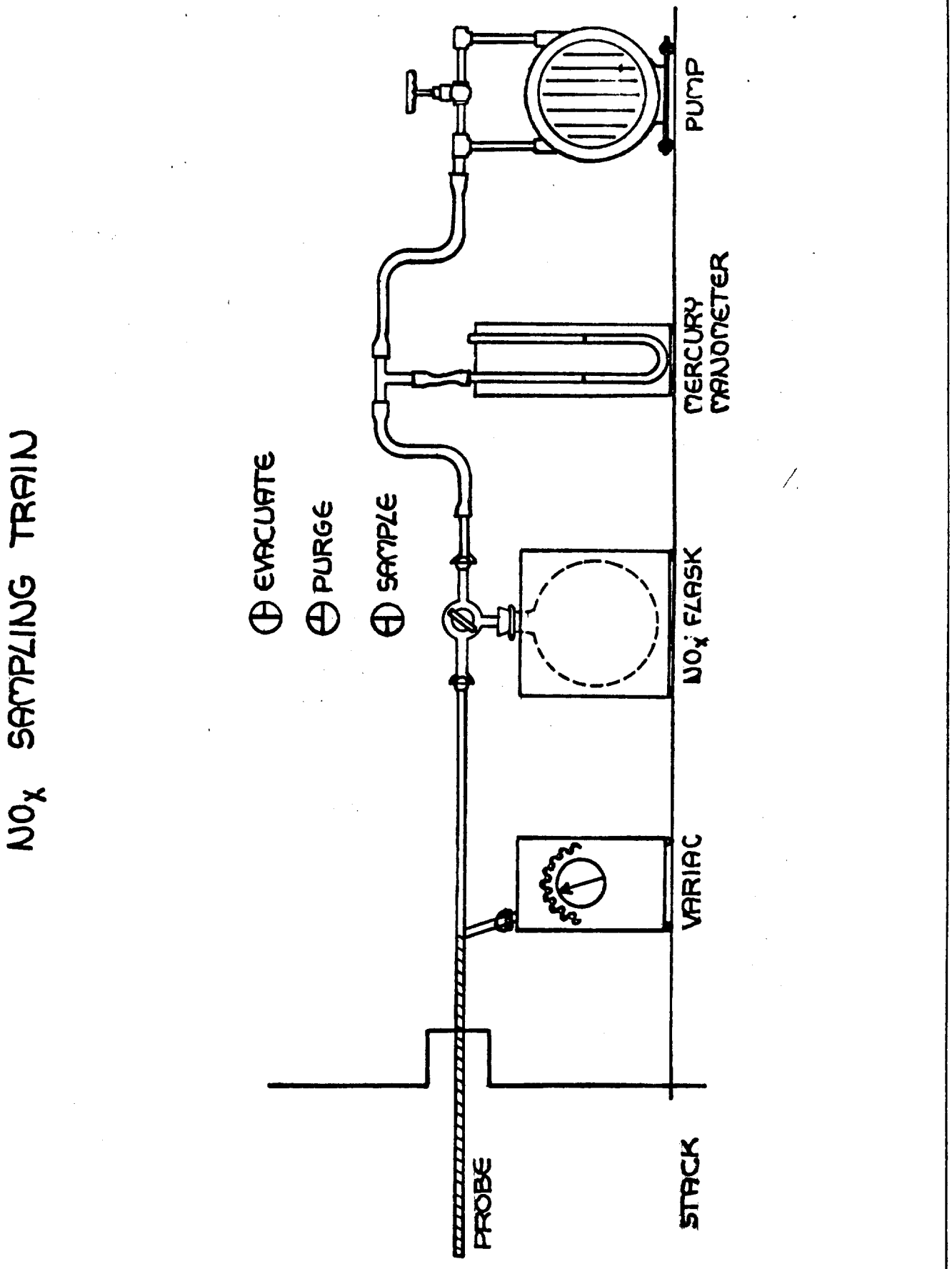


FIGURE 4
NOMAGRAPH FOR ASME TEST


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