JOHN SPELLMAN
Governor

DONALD W. MOOS
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
4350-150th Ave. N.E. • Redmond, Washington 98052 • (206) 885-1900

August 31, 1982

Mr. Mark Burnett
Acurex Corporation
485 Clyde Avenue
Mountain View, California 94042

Dear Mr. Burnett:

As you requested, enclosed are copies of some recent tests we have done at primary aluminum production plants.

As you can see, the average particle size for roof monitor emissions is somewhere between 10 and 20 microns. In this size range the impactor that we used is not very accurate. It is safe to say that the average particle size is more than 8 microns.

If you have any questions, please feel free to call.

Sincerely,

OFFICE OF AIR PROGRAMS

J M Willenberg

Jay M. Willenberg, P. E.
Engr. Compliance & Planning Section

JMW:kw

Enc.

These reports are
cited in the ref
12 which was used
in the AP-42 ref
and are the primary
refs for the
EF.

State of Washington Department of Ecology

REFERENCE 3

Summary & Description Pages 1 - 11

See pages 26 - 31

SOURCE TEST

SUMMARY OF EMISSIONS TO ATMOSPHERE

Report No. 82-8

Report Date 4/27/82

Test Date 3/22-26, 1982

Name of plant KAISER ALUMINUM & CHEMICAL CORPORATION

Location of plant MEAD, SPOKANE COUNTY

Person contacted MR. DALE SCHMIDT (509) 466-3300

Type of operation PRIMARY ALUMINUM REDUCTION

Source tested POTLINE 1, ROOM 4

Requesting Agency WDOE INDUSTRIAL SECTION

Purpose MEASURE PARTICULATE AND SO_2 EMISSIONS FOR COMPLIANCE

Applicable Standard WAC 173-415

SUMMARY OF MEASUREMENTS

Pollutant	Measured Emission	Allowable Emission	Emission/Process Factor	Methods
POTLINE 1, Room 4				
Roof Monitor Particulate	0.0060/g/DSCM	7.5 g/kg	8.17 g/kg	EPA Method 1
Primary Control System SO_2	146 ppm		46.5 g/kg	WDOE Method
CARBON BAKING PLANT				
Primary Control System	214 ppm		8.9 g/kg	WDOE Method
Mill Total SO_2			55.4 g/kg	WDOE Method

TEST ENGINEER ALAN T. BUTLER, P.E. ATB

FIELD PERSONNEL

Alan T. Butler

Jay M. Willenberg

LAB ANALYSIS

Test Witnessed by:

ECY 020-1-62
Rev. 1/79

I. Purpose

This test was done for the purpose of measuring particulate, fluoride and sulfur dioxide emissions from the Kaiser, Mead primary aluminum reduction mill. Results will be used in the determination of compliance with WDOE regulations. Particulate and SO_2 results will be reported here, fluoride results will be given in a supplement to this report upon completion of laboratory analyses. This facility was last tested by the WDOE in February 1976 (Stat. Report 76-1).

II. Description of the Unit Tested

Kaiser Aluminum Chemical Corporation's Mead works is a prebake primary aluminum reduction plant. The mill is located approximately 15 miles north of Spokane and is the only major air pollution source for several miles.

The plant has eight potlines, seven of which were in operation at the time of our test, producing 500 megagrams (550 tons) of aluminum per day. Each potline has two potrooms, with an average of 71 operating pots per room. All pots within a line are hooded and served by two manifold systems which dump into a common main manifold. Eight four-sectioned baghouses draw effluent from the common main manifold via forced draft blowers. Aluminum ore is injected into the effluent streams downstream of the fans, forming a fluoride absorbing bed of alumina in each baghouse. The ore and effluent particulate is then collected in the bags. Effluent which escapes from the hooding system, such as may occur during addition of alumina, tapping molten aluminum, or breaking the crust, is carried upward by natural convection and is emitted through the roof monitor.

Coke for the anodes is received by the mill and fed through a rotary kiln. A cyclone is used to control emissions. The coke is then mixed to form an anode paste in the green carbon plant. Emissions from the mixing and handling operations are vented through a baghouse.

The formed anodes are then baked in the anode bake plant, which is normally fired by natural gas. Emissions are controlled by a baghouse, which has the same configuration as those used on the potlines.

Kaiser tests these sources for particulate, fluoride, and SO_2 at regular intervals. EPA Method 14 is used by Kaiser for sampling from the Potroom 4 roof monitor. Rather than setting up samplers on the roof monitor outlet duct, an isokinetic aliquot of the roof monitor effluent is drawn from the roof monitor through seven ducts, which are combined and routed through a single stack to ground level. A single sample, which should be representative of the entire roof monitor, is then collected from the ground level sampling point.

III. Test Procedure

Three 24-hour WDOE Method 13 particulate samples were collected from each of three sampling points, designated A, B, and C, located on the roof monitor of potroom 4. The back halves of the particulate trains were used to collect gaseous fluoride; solid fluoride compounds are caught in the front halves. Fluoride results will be reported upon completion of laboratory analyses.

Twice during each particulate run, velocities were measured near each roof monitor sampling point by an integrating anemometer, using a seven point, one minute per point, traverse. An additional anemometer was attached to the sampling probe at position B, and allowed to run for the entire sampling period. The 24-hour average velocity at each sampling point was calculated by applying a ratio of the short term velocity at each point versus the short term velocity at the center point to the center point 24-hour velocity. A plan view of the Potroom 4 roof monitor, showing sampling and velocity sites and velocity calculations, are given on page 11.

At roof monitor sampling point A, three 24-hour particulate size samples were collected, concurrent with particulate testing.

Six 30 minute WDOE Method 6 SO_2 tests were run: three at the Potroom 4 primary control system inlet, and three at the carbon bake plant baghouse outlet. No SO_2 tests were done at the green carbon plant because results from the previous WDOE test at this location were less than 1 ppm SO_2.

IV. Results

Test results are detailed in Tables 1 through 4 for the Potroom 4 roof monitor, Table 5 for the Potroom 4 primary control system SO_2, and Table 6 for the carbon bake plant SO_2.

Particulate results for the Potroom 4 roof monitor were 0.0060 grains per dry standard cubic meter of effluent, or 12.2 kilograms of particulate per hour, which is 171.1 kilograms per hour when multiplied by the 14 operating potlines. Since 35.86 megagrams per day per potroom of aluminum are produced, the emission/process factor would be 8.17 grams of particulate per kilogram of aluminum produced. It is estimated from the previous test results that the potline baghouse primary control system would add approximately 0.1 g/kg to the emission/process factor.

Particulate size tests indicate that the average particle median diameter is 10 microns or greater. It should be noted that at these relatively large particle diameters, sizing results become less than certain. There is a tendency for the second, and especially the first, impactor stages to collect particles of size ranges rather than specific size cuts. Additionally, there is no real upper limit on the size of the particles caught on the first stage.

SO_2 results for the Potroom 4 primary control system were 146 ppm, or 46.5 grams of SO_2 per kilogram of aluminum produced.

SO_2 results for the carbon bake plant were 214 ppm, or 8.87 g/kg.

When the SO_2 emissions for all significant sources in the mill (potline primary control system and carbon bake plant) are combined, the SO_2 emission/process factor for the entire facility is 55.4 g/kg.

V. Comment

The average process/emission factors for sampling points A, B, and C on the Potline 1, Room 4 roof monitor were 5.85, 7.27 and 11.39 pounds per ton, respectively, over our three day test period. The Method 14 sampling system used by Kaiser to gather particulate data is set up around point A exclusively.

Results from particulate data collected only at point A would be 28 percent below the 8.17 pounds per ton average for all points. Perhaps some work should be done to determine the true magnitude and duration of this bias, and whether some corrective measure should be employed.

ATB:kw

Department of Ecology

Table I

EMISSION TEST DATA SUMMARY (METRIC)

Plant Name: Kaiser Aluminum & Chemical
Address:
City: Mead County: Spokane
State: Washington Zip Code: 99021
NEDS: 49-2060-062-16-04

Source: Potline 1, Room 4 roof monitor
Industry Type: Primary Aluminum Reduction
Unit Capacity: 34 Mg/day/potroom
SCC: 3-03-001-01
Fuel Type:
Tested at Inlet: Outlet: x

Type of Control Equipment:

Reason Tested: Spec. Study: Compliance w/Fed.: State: x Local:
Personnel Present: A. Butler, J. Willenberg

Pollutant Measured: Particulate,
Method: EPA Method 13

Stack Height, m.:
Cross-sectional Area, sq. m.: 446.86 m^2/monitor*
Sampling Location: Diameters Downstream of a Disturbance
Test Number: 82-8

Run Number	1A	1B	1C	Average
Date: Mo., Day, Yr.	3/23/82	3/23/82	3/23/82	
Operating Rate Alum. Mg/day	11.95	11.95	11.95	35.86 *
Gas Composition % CO_2	0.0	0.0	0.0	0.0
% O_2	21.0	21.0	21.0	21.0
% N_2	79.0	79.0	79.0	79.0
% Other				
% H_2O				
Estimated Mole Wt., Wet				
Excess Air, %				
Gas Flow Data				
Gas Pressure, mm. Hg.				
Gas Temp. °C	28	28	28	28
No. of Traverse Points	1	1	1	
Avg. Stack Velocity, AMPS	1.22	1.42	1.94	1.52
Gas Flow Rate, DSCMM	10,600	12,300	12,700	35,600*
Sample Information				
Volume Sampled, DSCM	9.561	8.940	11.962	
Sample Duration, min.	1371.2	1446.0	1436.6	
Nozzle Dia., mm.	12.7	12.7	12.7	
Isokinetic Rate, %	77	59	77	
Results	Particulate			
Conc., g/DSCM ,ppm	0.0036	0.0048	0.0042	0.0042
Emission Rate, kg/hr	2.27	3.56	3.10	9.02 *
Process Factor, g/kg	4.55	7.14	6.40	6.03
Results	Particle Size			
Median diam, microns	24	21	14	20
Emission Rate, kg/hr				
Process Factor, g/kg				
Other Measurements				

Comments: *Roof monitor area of 446.86 m^2 was divided into three zones, A, B and C. Operating, gas flow, and emission rates are totals of A, B and C.

ECY 020-38
Rev. 1/81

Washington Department of Ecology

Table 2
EMISSION
TEST DATA SUMMARY
(METRIC)

Plant Name KAISER ALUMINUM & CHEMICAL
Address
City Mead County Spokane
State Washington Zip Code 99021
NEDS 49-2060-062-16-04

Source Potline 1, Room 4 roof monitor
Industry Type Primary Aluminum Reduction
Unit Capacity 34 Mg/day/potroom
SCC 3-03-001-01
Fuel Type
Tested at Inlet Outlet x

Type of Control Equipment None

Reason Tested: Spec. Study Compliance w/Fed. State x Local
Personnel Present A. Butler, J. Willenberg

Pollutant Measured Particulate
Method EPA Method 13

Stack Height, m.
Cross-sectional Area, sq. m. 446.86 m^2/monitor*
Sampling Location: Diameters Downstream of a Disturbance 1
Test Number 82-8

Run Number	2A	2B	2C	Average
Date: Mo., Day, Yr.	3/24/82	3/24/82	3/24/82	
Operating Rate Alum./Mg/day	11.95	11.95	11.95	35.86*
Gas Composition % CO_2	0.0	0.0	0.0	0.0
% O_2	21.0	21.0	21.0	21.0
% N_2	79.0	79.0	79.0	79.0
% Other				
% H_2O				
Estimated Mole Wt., Wet				
Excess Air, %				
Gas Flow Data				
Gas Pressure, mm. Hg.				
Gas Temp. °C	32	32	32	32
No. of Traverse Points	1	1	1	
Avg. Stack Velocity, AMPS	0.98	1.44	1.47	1.29
Gas Flow Rate, DSCMM	8,400	12,300	12,600	33,300*
Sample Information				
Volume Sampled, DSCM	8.850	13.542	12.523	
Sample Duration, min.	1,266.3	1,256.0	1,277.0	
Nozzle Dia., mm.	12.7	12.7	12.7	
Isokinetic Rate, %	98	103	92	
Results	Particulate			
Conc., [illegible], ppm	0.0075	0.0064	0.0111	0.0083
Emission Rate, kg/[illegible]	3.78	4.73	8.37	16.88*
Process Factor, g/kg	7.60	9.48	16.80	11.29
Results				
Conc., g/DSCM, ppm				
Emission Rate, kg/hr				
Process Factor, g/kg				
Other Measurements				

Comments: *Roof monitor area of 446.86 m^2 was divided into three zones, A, B and C. Operating, gas flow, and emission rates are totals of A, B and C.

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Rev. 1/81

State of Washington Department of Ecology

Table 3

EMISSION

TEST DATA SUMMARY

(METRIC)

Plant Name: Kaiser Aluminum & Chemical
Address:
City: Mead County: Spokane
State: Washington Zip Code: 99021
NEDS:

Source: Potline 1, room 4 roof monitor
Industry Type: Primary Aluminum Reduction
Unit Capacity: 34 Mg/day/potroom
SCC: 3-03-001-01
Fuel Type:
Tested at Inlet: ____ Outlet: X

Type of Control Equipment: None

Reason Tested: Spec. Study ____ Compliance w/Fed. ____ State X Local ____
Personnel Present: A. Butler, J. Willenberg

Pollutant Measured: Particulate Method: EPA Method 13

Stack Height, m.:
Cross-sectional Area, sq. m.: 446.86 m^2/monitor*
Sampling Location: Diameters Downstream of a Disturbance: 1
Test Number: 82-8

Run Number	3A	3B	3C	Average
Date: Mo., Day, Yr.	3/25/82	3/25/82	3/25/82	
Operating Rate Alum. Mg/Day	11.95	11.95	11.95	35.86*
Gas Composition % CO_2	0.0	0.0	0.0	0.0
% O_2	21.0	21.0	21.0	21.0
% N_2	79.0	79.0	79.0	79.0
% Other				
% H_2O				
Estimated Mole Wt., Wet				
Excess Air, %				
Gas Flow Data				
Gas Pressure, mm. Hg.				
Gas Temp. °C	32	32	32	32
No. of Traverse Points	1	1	1	
Avg. Stack Velocity, AMPS	1.16	1.41	1.30	1.29
Gas Flow Rate, DSCMM	10,000	12,100	11,200	33,300*
Sample Information				
Volume Sampled, DSCM	10.086	15.694	15.947	
Sample Duration, min.	1459.0	1475.0	1463.1	
Nozzle Dia., mm.	12.7	12.7	12.7	
Isokinetic Rate, %	81	104	115	
Results	Particulate			
Conc., g/DSCM, ppm	0.0045	0.0036	0.0082	0.0054
Emission Rate, kg/h	2.69	2.59	5.47	10.75
Process Factor, g/kg	5.39	5.20	10.93	7.19
Results				
Conc., g/DSCM, ppm				
Emission Rate, kg/hr				
Process Factor, g/kg				
Other Measurements				

Comments: *Roof monitor area of 446.86 m^2 was divided into three zones, A, B and C. Operating, gas flow, and emission rates are totals of A, B and C.

Washington Department of Ecology

Table 4

EMISSION
TEST DATA SUMMARY
(METRIC)

Plant Name Kaiser Aluminum & Chemical
Address
City Mead County Spokane
State Washington Zip Code
NEDS

Source Potline 1, room 4 roof monitor
Industry Type Primary Aluminum Reduction
Unit Capacity 34 Mg/day/potroom
SCC 3-03-001-01
Fuel Type
Tested at Inlet Outlet x

Type of Control Equipment None

Reason Tested: Spec. Study Compliance w/Fed. State x Local
Personnel Present A. Butler, J. Willenberg

Pollutant Measured Particulate Method EPA Method 13

Stack Height, m.
Cross-sectional Area, sq. m. 446.86/m^2/monitor*
Sampling Location: Diameters Downstream of a Disturbance 1
Test Number 82-8

Run Number	1	2	3	Average
Date: Mo., Day, Yr.	3/23/82	3/24/82	3/25/82	
Operating Rate Alum. Mg/day	35.86	35.86	35.86	35.86
Gas Composition % CO_2	0.0	0.0	0.0	0.0
% O_2	21.0	21.0	21.0	21.0
% N_2	79.0	79.0	79.0	79.0
% Other				
% H_2O				
Estimated Mole Wt., Wet				
Excess Air, %				
Gas Flow Data				
Gas Pressure, mm. Hg.				
Gas Temp. °C	~~28~~	~~32~~	~~32~~	~~31~~
No. of Traverse Points				
Avg. Stack Velocity, AMPS	1.52	1.29	1.29	
Gas Flow Rate, DSCMM	35,600	33,300	33,300	34,100
Sample Information				
Volume Sampled, DSCM				
Sample Duration, min.				
Nozzle Dia., mm.				
Isokinetic Rate, %				
Results	Particulate			
Conc., g/DSCM ,ppm	0.0042	0.0083	0.0054	0.0060
Emission Rate, kg/hr	9.02	16.88	10.75	12.22
Process Factor, g/kg	6.03	11.29	7.19	8.17
Results Median Dia.	Particle Size			
Conc., Microns	20			
Emission Rate, kg/hr				
Process Factor, g/kg				
Other Measurements				

Comments:

ECY 020-38
Rev. 1/81

State of Washington Department of Ecology

Table 5
EMISSION TEST DATA SUMMARY (METRIC)

Plant Name	Kaiser Aluminum & Chemical	Source	Potline 1, room 4 baghouse inlet
Address		Industry Type	~~Primary Aluminum Reduction~~
City	Mead County Spokane	Unit Capacity	~~34 Mg/day/potroom~~
State	Washington Zip Code 99021	SCC	~~3-03-001-01~~
NEDS	49-2060-062-16	Fuel Type	
		Tested at Inlet	Outlet x

Type of Control Equipment: Baghouse

Reason Tested: Spec. Study ______ Compliance w/Fed. ______ State ______ Local ______

Personnel Present: A. Butler, J. Willenberg

Pollutant Measured: SO_2 Method: WDOE Method 6

Stack Height, m.: 15 Cross-sectional Area, sq. m.:

Sampling Location: Diameters Downstream of a Disturbance

Test Number: 82-8

Run Number	1	2	3	Average
Date: Mo., Day, Yr.	3/23/82	3/23/82	3/23/82	
Operating Rate Alum. Mg/day	~~35.86~~	35.86	35.86	35.86
Gas Composition % CO_2	0.0	0.0	0.0	0.0
% O_2	21.0	21.0	21.0	21.0
% N_2	79.0	79.0	79.0	79.0
% Other				
% H_2O				
Estimated Mole Wt., Wet	29.00	29.00	29.00	29.00
Excess Air, %				
Gas Flow Data				
Gas Pressure, mm. Hg.				
Gas Temp., °C	19	18	18	18
No. of Traverse Points $\vec{v}$, (sample)	10 (1)	(1)	10 (1)	
Avg. Stack Velocity, AMPS	16.7		16.5	16.6
Gas Flow Rate, DSCMM	2910	2900	2890	2900
Sample Information				
Volume Sampled, DSCM	.0636	.0546	.0281	
Sample Duration, min.	30.0	30.0	30.0	
Nozzle Dia., mm.				
Isokinetic Rate, %				
Results	SO_2			
Conc., ppm	156	143	141	146
Emission Rate, kg/hr	74.3	67.8	66.1	69.4
Process Factor, g/kg	~~49.7~~	~~45.4~~	~~44.3~~	~~46.5~~
Results				
Conc., g/DSCM, ppm				
Emission Rate, kg/hr				
Process Factor, g/kg				
Other Measurements				

Comments:

ECY 020-38
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Table 6

EMISSION TEST DATA SUMMARY (METRIC)

Plant Name: Kaiser Aluminum & Chemical
Address:
City: Mead County: Spokane
State: Washington Zip Code: 99021
NEDS:

Source: Carbon Baking Plant Baghouse
Industry Type: Primary Aluminum Reduction
Unit Capacity:
SCC: 3-0300105
Fuel Type:
Tested at Inlet: Outlet: x

Type of Control Equipment: Baghouse

Reason Tested: Spec. Study ____ Compliance w/Fed. ____ State x Local ____
Personnel Present: A. Butler, J. Willenberg

Pollutant Measured:
Method: ~~WDOE Method 6~~

Stack Height, m.: 17
Cross-sectional Area, sq. m.: 0.292
Sampling Location: Diameters Downstream of a Disturbance
Test Number: 82-8

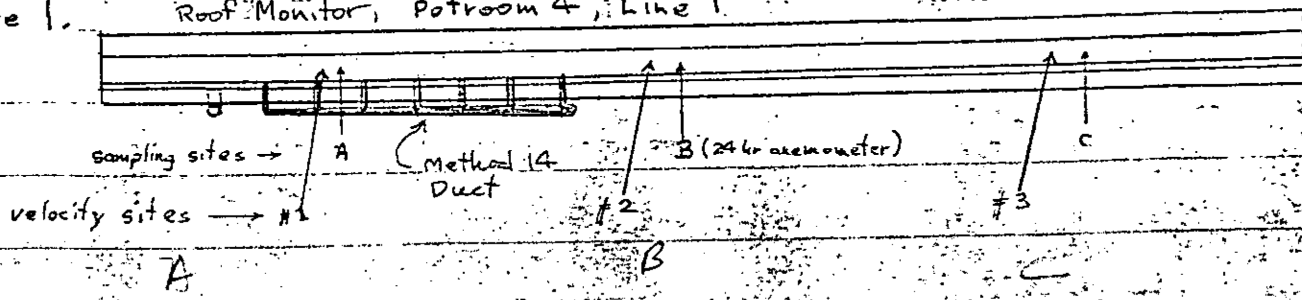
Run Number	4	5	6	Average
Date: Mo., Day, Yr.	3/24/82	3/24/82	3/24/82	
Operating Rate Alum. Mg/day	35.86	35.86	35.86	35.86
Gas Composition % CO_2	0.0	0.0	0.0	0.0
% O_2	21.0	21.0	21.0	21.0
% N_2	79.0	79.0	79.0	79.0
% Other				
% H_2O				
Estimated Mole Wt., Wet				
Excess Air, %				
Gas Flow Data				
Gas Pressure, mm. Hg.				
Gas Temp. °C				
No. of Traverse Points $\vec{v}$, (sample)	16 (1)	16 (1)	16 (1)	
Avg. Stack Velocity, AMPS	24.7	25.1	25.2	25.0
Gas Flow Rate, DSCMM	5,270	5,300	5,320	5,300*
Sample Information				
Volume Sampled, DSCM	.0170	.0160	.0176	
Sample Duration, min.	30.0	30.0	30.0	
Nozzle Dia., mm.				
Isokinetic Rate, %				
Results	SO_2			
Conc., ppm	176	235	231	214
Emission Rate, kg/hr	151	204	201	185*
Process Factor, g/kg	7.24	9.74	9.62	8.87
Results				
Conc., g/DSCM, ppm				
Emission Rate, kg/hr				
Process Factor, g/kg				
Other Measurements				

Comments: *Gas flow and SO_2 emission rates represent total for mill, calculated by multiplying results obtained at the baghouse by 8 operating baghouses.

Kaiser Mead Velocity Calculations

Test 82-8

Figure 1. Roof Monitor, Potroom 4, Line 1



3/23/82

Run 1		$\vec{v}$ site #1	#2	#3
Short Term	$\vec{v}_1$	41.00 m/min	60.71 m/min	72.57 m/min
	$\vec{v}_2$	46.86	41.29	67.29
	$\vec{v}_{ave}$	43.93	51.00	69.93
$\vec{v}$ factor		0.86	1.00	1.37
24hr $\vec{v}$		73.13 estimated	84.90 measured	116.41 estimated

3/24/82

Run 2				
short Term	$\vec{v}_1$	57.57 m/min	84.57 m/min	78.00 m/min
	$\vec{v}_2$	54.00	79.57	89.57
	$\vec{v}_{ave}$	55.79	82.07	83.79
$\vec{v}$ factor		0.68	1.00	1.02
24 hr $\vec{v}$ $\frac{m}{min}$		58.61 estimated	86.22 measured	88.02 estimated

3/25/82

Run 3				
short Term	$\vec{v}_1$	59.00	70.14	60.14
	$\vec{v}_2$	55.14	67.86	57.57
	$\vec{v}_{ave}$	57.07	69.00	63.86
$\vec{v}$ factor		0.83	1.00	0.93
24 hr $\vec{v}$		69.87 estimated	84.49 measured	78.18 estimated

State of Washington
Department of Ecology

Test No. ______
Date 3/23/82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant Kaiser Mead
Sampling Location Point 28 Roof Monitor, potline
Sample Type Part, F⁻
Run Number 1A
Operator B
Ambient Temperature ≈ 40° outside, 83° in r. mon.
Barometric Pressure ______
Static Pressure Atm.
Stack Diameter ______
Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor 6', 47mm,
Nozzle I.D. .50
Assumed Moisture, % Atm
Sample Box Number 3 Meter 2
Water Volume Collected ______ Impingers + ______ Silica Gel = ______ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-268 / 267	

SCHEMAT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFI DIF (ΔH DESIR
	0 8 24	2173.95		.23
	9 38	2174.87		~~26~~
	~~238~~ 233	2228.		
	383	2263		
	1371.2	2511.60		
				20°C
				460°+20°
		$\bar{v}_{ave}$ = 73.13 (estimated)		
F1	34500			
F2	34615			
ΔT = 2min	57.5 m/min			

```
XEQ "M13"
RUN
1A
vm1,ft3?
2,173.9500 run
vm2,ft3?
2,511.6000 run
time,min?
1,371.2000 run
pb,in=29.9201
29.9200 run
()wt,g?
.0341 run
()h2o,g?
0.0000 run
v,m/min?
73.1300 run
area,sqm=148.9500 run
ts,f=83.0000 run
prod,t/d=12.5000
13.1800 run
dn,in=0.5000 run
fh2o=0.000
qs,dscmm=10,592.
vs,dscm=9.561
cp,g/dscm=0.0036
rp,kg/hr=2.27
f,g/kg=4.55
I,%=77.4
```

446.86 m² for entire roof monitor
148.95 m² for each test zone.

13.15 / zone
→ 39.53
≈ 40 T/d / potroom.

Dale Schmidt (509) 466-3300 } 8 lines, 7 oper.
16 potrooms, w/ 14 operating
71 pots

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min. 1	GAS METER READING (V_m), ft^3 2	VELOCITY HEAD (ΔP_s), in. H_2O 3	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED 4	ACTUAL	STACK TEMP (T_s), °F 5	PROBE TEMP °F	SAMPLE BOX TEMP °F 6	IMPINGER TEMP °F OUT	IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F 7	INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
	86017											9837F	
	86000	6057	6099	6162		6226		6268			6287		
	17.0	40	42	63		64		42			19	ave 41.00 m/min	
	6305	6337	6384	6449		6525		6576			6615		
1510	6287	32	47	65		76		51			39	ave 46.86 m/min	
	18												

COMMENTS

ECY 020-71 (Rev 12/78)

Potroom 4 Line 1

State of Washington
Department of Ecology

Test No. 1
Date 3/23/82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant Kaiser Meade
Sampling Location #22
Sample Type Part, F2
Run Number 1B
Operator B
Ambient Temperature
Barometric Pressure
Static Pressure
Stack Diameter
Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor
Nozzle I.D.
Assumed Moisture, %
Sample Box Number ______ Meter
Water Volume Collected ______ Impingers + ______ Silica Gel = ______ ml

	Particulate Weight	
Wash	Filter	Impingers
ID No.	C-104	

```
XEQ "M13"
RUN
1B
vm1,ft3?
1,342.78      run
vm2,ft3?
1,658.51      run
time,min?
1,446.0       run
pb,in=29.9    run
<>wt,g?
.0431         run
<>h2o,g?
0.0           run
v,A/min?
84.9          run
area,sqm=149.0  run
ts,f=83.0     run
prod,t/d=13.2 run
dn,in=0.5     run
fh2o=0.000
qs,dscmm=12,297.
vs,dscm=8,940
cp,g/dscm=0.0048
rp,kg/hr=3.56
f,g/kg=7.14
I,%=59.1
```

24
8
32

TRAVERSE POINT NUMBER	SAMPLING TIME, min. / CLOCK TIME (24 hr clock)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H
0816	~~1342.780~~	1342.78	
921		56.80	
1333		1412	
1600		1444	
32 22	1446.0 min	1658.51	
0822			
			24 hr. accu.
F1	84615		94109.
F2	84709		215012
ΔT=2	47 m/min		$\bar{v}_{ave}$ =

time	
0840	} 23.73 hr or 1424 min
32 24	
84.90 m/min	

83.93

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IMPINGER TEMP °F IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	DRY GAS METER TEMPERATURE INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
	1	2	3		4		5				6	7	
					5805								
	85468	5463			5717		5						
	5463	5518	5579		~~5866~~		~~5886~~				5959	5796	Tot: 428
	5	55	86		.88		83				71	37	60.71 m/min.
													total
	6643	6675	6695		749		803				873	903	289 m/min
	6684	6 32	20		54		54				70	30	41.29 m/min
	29												

COMMENTS

ECY 020-71 (Rev 12/78)

State of Washington
Department of Ecology

Test No. ____
Date 3/23/82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant Kaiser Mead
Sampling Location #2
Sample Type Part, FR
Run Number 1C
Operator AS
Ambient Temperature ≈45°F
Barometric Pressure ____
Static Pressure ____
Stack Diameter ____
Orsat CO_2 ____ O_2 ____ CO ____

Probe Length, Type, Factor 3' SS 47mm.
Nozzle I.D. .50
Assumed Moisture, % 47m.
Sample Box Number 2 Meter 1
Water Volume Collected ____ Impingers + ____ Silica Gel = ____ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-169	
Final			

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELC HE (ΔP_s),
	0820	6445.05	
	+ 38	6457.60	
	+ 312	6544	
	457	6587.2	
	770	6668.00	
	1,430.6	6867.50	
F1	84709		
F2	84835		
ΔT:2	88 m/min	$\bar{v}_{ave}$ = 116.41 m/min (estimated)	

```
XEQ "M13"
RUN
1C
RUN
vm1,ft3?
6,445.05     run
vm2,ft3?
6,867.5      run
time,min?
1,436.6      run
pb,in=29.9   run
()wt,g?
.0499        run
()h2o,g?
0.0          run
v,m/min?
88.0         run
area,sqm=149.0  run
ts,f=83.0    run
prod,t/d=13.2   run
dn,in=0.5    run
fh2o=0.000
qs,dscmm=12,746.
vs,dscm=11.962
cp,g/dscm=0.0042
rp,kg/hr=3.19
f,g/kg=6.40
I,%=76.8
```

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	
	0	2	3	4		5		6			7		
	8 4915			5285									
	88874	4985	5072	5184		5395		5465			5469		
	41	70	113	100		110		70			4.	ave 72.57 m/min	
	~~87~~												
			7095	185		261		343			406		
	80903		7067	90		76		82			63	ave 67.29 m/min	
35	714	975	88										
	11	61											

COMMENTS

ECY 020-71 (Rev 12/78)

State of Washington Department of Ecology

Test No. ____________

Date ____________

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ____________
Sampling Location ____________
Sample Type ____________
Run Number 2C
Operator ____________
Ambient Temperature ____________
Barometric Pressure ____________
Static Pressure ____________
Stack Diameter ____________
Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ____________
Nozzle I.D. ____________
Assumed Moisture, % ____________
Sample Box Number ____________ Meter
Water Volume Collected ______ (Impingers) + ______ (Silica Gel) = ______ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-145	

```
XEQ "M13"
RUN
2C
                RUN
vm1,ft3?
        6,867.89   run
vm2,ft3?
        7,310.14   run
time,min?
        1,277.0    run
pb,in=29.9
                   run
()wt,g?
        .1388      run
()h2o,g?
        0.0        run
v,m/min?
        88.02      run
area,sqm=149.0
                   run
ts,f=90.0
                   run
prod,t/d=13.2
                   run
dn,in=0.5
                   run
fh2o=0.000
qs,dscmm=12,586.
vs,dscm=12.523
cp,g/dscm=0.0111
rp,kg/hr=8.37
f,g/kg=16.80
I,%=91.6
```

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	V $(\Delta P$										
	9 37	6867.89											
	10?.5	6906.02											
	340	7002.5											
	737	7128.5											
	1277	7310.14											
			$\bar{V}_{ave}$ = 88.02 m/min (est)										

Test No. ______

Date 3/27/82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant Kaiser Meat

Sampling Location 2B Potline 4 roof ___ #22

Sample Type 2B

Run Number ______

Operator ______

Ambient Temperature ______

Barometric Pressure ______

Static Pressure ______

Stack Diameter ______

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor 3' SS

Nozzle I.D. .50

Assumed Moisture, % ______

Sample Box Number ______ Meter

Water Volume Collected ______ Impingers + ______ Silica Gel = ______ ml

Particulate Weight

Wash ______ 47mm Filter ______ Impingers ______

ID No. C110

```
XEQ "MI3"
RUN
2B
RUN
vm1,ft3?
1,660.65         run
vm2,ft3?
2,138.88         run
time,min?
1,256.0          run
pb,in=29.9       run
<>wt,g?
.0865            run
<>h2o,g?
0.0              run
v,m/min?
86.22            run
area,sqm=149.0   run
ts,f=90.0        run
prod,t/d=13.2    run
dn,in=0.5        run
fh2o=0.000
qs,dscmm=12,329.
vs,dscm=13.542
cp,g/dscm=0.0064
rp,kg/hr=4.73
f,s/kg=9.48
I,%=102.8
```

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	(
	1002	1660.65	
	1123	1688.70	
	1553	1800	
	22 22	1950	
	0658	2138.88	
	1256.0 min		
Δt=2 min			22½ in/m:
F1	2592		15000
F2	2815		123288
	111.5 m/min		$\bar{v}_{avg}$ = 86.22 m/min

State of Washington
Department of Ecology

Test No. ______

Date 3/24/82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant Kaiser Mead

Sampling Location P.L. 4 room 1 #28

Sample Type Part, Fl

Run Number 2A

Operator B

Ambient Temperature ≈45°

Barometric Pressure ______

Static Pressure ______

Stack Diameter ______

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor 6' SS 47mm

Nozzle I.D. ______

Assumed Moisture, % ______

Sample Box Number ______ Meter ______

Water Volume Collected ______ Impingers + ______ Silica Gel = ______ ml

Particulate Weight

	Wash	47mm Filter	Impingers
ID No.		C-294	
Final			

```
XEQ "M13"
RUN
2A              RUN
vm1,ft3?
   2,511.81     run
vm2,ft3?
   2,824.36     run
time,min?
   1,266.3      run
pb,in=29.9
                run
<>wt,g?
   .0666        run
<>h2o,g?
   0.00         run
v,m/min?
   58.61        run
area,sqm=149.0
                run
ts,f=83.0
   90.0         run
prod,t/d=13.2
                run
dn,in=0.5
                run
fh2o=0.000
qs,dscmm=0.381
vs,dscm=0.050
cp,g/dscm=0.0075
rp,kg/hr=3.78
f,g/kg=7.60
I,%=98.1
```

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELO[CITY] HEA[D] (ΔP_s)
	345	2511.81	
	+94	2535.07	
	362	2602	
	760	2700	
	1266.3	2824.36	
ΔTE 2 min			
F1	87402		24 hr anemom.
F2	87574		152,000
	87 m/min		$\bar{v}_{ave}$ = 58.61 m/min (est.)

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State of Washington
Department of Ecology

Test No. ____
Date 3/25/82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant Kaiser Mead
Sampling Location #28
Sample Type Part, Fl-
Run Number ~~3A~~ 3A
Operator B
Ambient Temperature ____
Barometric Pressure ____
Static Pressure ____
Stack Diameter ____
Orsat CO_2 ____ O_2 ____ CO ____

Probe Length, Type, Factor ____
Nozzle I.D. ____
Assumed Moisture, % ____
Sample Box Number ____ Meter
Water Volume Collected ____ (Impingers) + ____ (Silica Gel) = ____ ml

	Wash	Particulate Weight: Filter	Impingers
ID No.		C-42	

```
XEQ "M13"
RUN
3A                    RUN
va1,ft3?
          2,824.65    run
va2,ft3?
          3,180.84    run
time,min?
          1,459.0     run
pb,in=29.9            run
<>wt,g?
          .0452       run
<>h2o,g?
          0.0         run
v,m/min?
          69.87       run
area,sqm=149.0        run
ts,f=90.0             run
prod,t/d=13.2         run
dn,in=0.5             run
fh2o=0.000
qs,dscmm=9,991.
vs,dscm=10,086
cp,g/dscm=0.0045
rp,kg/hr=2.69
f,g/kg=5.39
I,%=81.4
```

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELO HE (ΔP_s),
	0800	2824.65	
	540	2956	
	1459	3180.84	
	~~0835~~		

$\bar{v}_{ave}$ = 69.87 m/min (est.)

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State of Washington
Department of Ecology

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Test No. ____
Date 3/25/82

Plant Kaiser
Sampling Location ____
Sample Type ____
Run Number 3B
Operator ____
Ambient Temperature ____
Barometric Pressure ____
Static Pressure ____
Stack Diameter ____
Orsat CO_2 ____ O_2 ____ CO ____

Probe Length, Type, Factor ____
Nozzle I.D. ____
Assumed Moisture, % ____
Sample Box Number ____ Meter ____
Water Volume Collected ____ (Impingers) + ____ (Silica Gel) = ____ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-261	

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	(Δ
	8:08	2139.61	
	17:16	2358	
	0835	2693.84	
	1475 min		
		24 hr amn	
		23288	
		147910	
		$\bar{v}_{ave}$ = 84.49 ft/min	

```
XEQ "M13"
RUN
3B                RUN
vm1,ft3?
  2,139.61        run
vm2,ft3?
  2,693.84        run
time,min?
  1,475.0         run
pb,in=29.9        run
<>wt,g?
  .0561           run
<>h2o,g?
  0.0             run
v,ft/min?
  84.49           run
area,sqm=149.0    run
                  run
ts,f=90.0         run
prod,t/d=13.2     run
dn,in=0.5         run
fh2o=0.000
qs,dscmm=12,081.
vs,dscm=15,694
cp,g/dscm=0.0036
rp,kg/hr=2.59
f,g/kg=5.20
I,%=103.6
```

2-3

State of Washington Department of Ecology

Test No. ____

Date 3/25/82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ____
Sampling Location ____
Sample Type ____
Run Number 3C
Operator ____
Ambient Temperature ____
Barometric Pressure ____
Static Pressure ____
Stack Diameter ____
Orsat CO_2 ____ O_2 ____ CO ____

Probe Length, Type, Factor ____
Nozzle I.D. ____
Assumed Moisture, % ____
Sample Box Number ____ Meter ____
Water Volume Collected ____ Impingers + ____ Silica Gel = ____ ml

	Particulate Weight		
	Wash	Filter	Impingers
ID No.		C-118	

```
XEQ "M13"
RUN
3C
vm1,ft3?
        7,316.6     run
vm2,ft3?
        7,873.78    run
time,min?
        1,463.1     run
pb,in=29.9
                    run
<>wt,g?
        .1301       run
<>h2o,g?
        0.0         run
v,m/min?
        78.18       run
area,sqm=149.0
                    run
ts,f=90.0
                    run
prod,t/d=13.2
                    run
dn,in=0.5
                    run
fh2o=0.000
qs,dscmm=11,179.
vs,dscm=15.947
cp,g/dscm=0.0082
rp,kg/hr=5.47
f,g/kg=10.98
I,%=114.6
```

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	(
	0820	7310.60	
	570	7541	
	1463.1	7873.78	
		$\vec{v}_{ave}$ = 78.18 (est.)	

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Velocities 3/24/82

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IMPINGER TEMP °F IN	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	PUMP VACUUM in. Hg
	1	2	3	4		5		6			7		
#1	7565/7567	7628	7693	7787		7859		7945			7970	ave = 57	.57 m/min
	7567/7572	56	65	94		72		86			25		
	5												
#2 noon	8000/8006	8064	8169	8287		8411		8516			8592		
	6	58	105	118		124		105			76	84.5	7 m/min
#3	8941/8950	9006	9090	9196		9305		9404			9487		
	9	56	84	106		109		99			83	78.00	m/min
#1	9487/9467	9512	9589	9668		9755		9820			7865		
	0	25	77	79		87		65			45	54.00	m/min
#2	9892/9900	9956	10054	0168		0276		0371			0479		
	8	56	98	114		108		95			78	79.57	m/min
#3	0749/0448	0520	0636	0761		0880		0994			0076		
	-1	72	116	125		119		114			82	89.57	m/min
				3/25/82									
#3	1080/1082	1142	1219	1295		1370		1447			1501	ave.	
	2	60	77	76		75		77			54	60.14	m/min
#2	1501/1501	1557	1650	1747		1858		1940			1992	90	
	0	56	93	97		111		82			52	70.14	m/min
#1	1992/1995	2084/2085	2119	2191		2281		2365			2414	59.00	m/min
	3	41	74	75		87		84			49		
3	2414 2404	2442	2534	2660		2760		2845			2887	67.57	m/min
	-10	38	72	126		100		85			42		
2	2887 2897 10	2942 45	3061 119	3155	74	2224	69	3302	78		3362 60	67.86	m/min
1	3369 - 3362	3419	3445	3583		3628		3684			3748	55.14	m/min
	7	50	76	88		45		57			63		

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COMMENTS

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State of Washington
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Test No. ______

Date 3/23/82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant Kaiser Meade

Sampling Location #28

Sample Type Impactor

Run Number 1

Operator JB

Ambient Temperature ≈50°F

Barometric Pressure ______

Static Pressure ______

Stack Diameter ______

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ______

Nozzle I.D. ______

Assumed Moisture, % ______

Sample Box Number ______ Meter ______

Water Volume Collected ______ Impingers + ______ Silica Gel = ______ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		N	
Final			
Tare			
Gain			

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IMPINGER TEMP °F IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	DRY GAS METER TEMPERATURE INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
1142		18.100		ACFM ,239									
	114	46.6											
	259	82.2											
	1330	346.914											
		328.814											
		0.2472	$\left(\frac{760290}{520}\right)$	= .2615									

RUN NO 1 WITH GREASE

IMPACTOR FLOWRATE = 0.261 ACFM IMPACTOR TEMPERATUR

IMPACTOR PRESSURE DROP = 0.4 IN. OF HG STACK TEMPERATURE =

ASSUMED PARTICLE DENSITY = 1.00 GM/CU.CM. STACK PRESSURE = 2

GAS COMPOSITION (PERCENT) CO2 = 0.00 CO = 0

CALC. MASS LOADING = 9.6066E-04 GR/ACF 9.9732E-04 GR

IMPACTOR STAGE	S1	S2	
STAGE INDEX NUMBER	1	2	
D50 (MICROMETERS)	40.51 20	16.68	6.
MASS (MILLIGRAMS)	5.21	6.80	3.
MG/DSCM/STAGE	5.49E-01	7.17E-01	3.
CUM. PERCENT OF MASS SMALLER THAN D50	75.94	44.53	28.
CUM. (MG/ACM) SMALLER THAN D50	1.67E 00	9.79E-01	6.
CUM. (MG/DNCM) SMALLER THAN D50	1.73E 00	1.02E 00	6.
CUM. (GR/ACF) SMALLER THAN D50	7.29E-04	4.28E-04	2.
CUM. (GR/DNCF) SMALLER THAN D50	7.57E-04	4.44E-04	2.
GEO. MEAN DIA. (MICROMETERS)	9.84E 01	2.60E 01	1.
DM/DLOGD (MG/DNCM)	7.12E-01	1.86E 00	8.
DN/DLOGD (NO. PARTICLES/DNCM)	1.43E 03	2.02E 05	1.

NORMAL (ENGINEERING STANDARD) CONDITIONS ARE 21 DEG C AND 760MM HG

AERODYNAMIC DIAMETERS ARE CALCULATED HERE ACCORDING TO THE TASK GR

= —90.0 F = 32.2 C SAMPLING DURATION = ****** MIN

90.0 F = 32.2 C

.92 IN. OF HG MAX. PARTICLE DIAMETER = 239.1 MICROMETERS

)0 N2 = 79.00 O2 = 21.00 H2O = 0.00

)NCF 2.1983E 00 MG/ACM 2.2822E 00 MG/DNCM

3	S4	S5	S6	S7	FILTER
	4	5	6	7	8
5	3.26	1.83	0.98	0.53	
1	1.13	0.71	0.94	0.91	2.44
)E-01	1.19E-01	7.48E-02	9.91E-02	9.59E-02	2.57E-01
1	23.09	19.82	15.47	11.27	
2E-01	5.08E-01	4.36E-01	3.40E-01	2.48E-01	
5E-01	5.27E-01	4.52E-01	3.53E-01	2.57E-01	
2E-04	2.22E-04	1.90E-04	1.49E-04	1.08E-04	
2E-04	2.30E-04	1.98E-04	1.54E-04	1.12E-04	
)E 01	4.44E 00	2.44E 00	1.34E 00	7.18E-01	3.73E-01
1E-01	4.43E-01	2.99E-01	3.63E-01	3.59E-01	8.54E-01
3E 06	9.66E 06	3.93E 07	2.90E 08	1.85E 09	3.14E 10

UP ON LUNG DYNAMICS.

RUN NO 2 WITHOUT GREASE

IMPACTOR FLOWRATE = 0.263 ACFM IMPACTOR TEMPERATUR

IMPACTOR PRESSURE DROP = 0.4 IN. OF HG STACK TEMPERATURE =

ASSUMED PARTICLE DENSITY = 1.00 GM/CU.CM. STACK PRESSURE = 2

GAS COMPOSITION (PERCENT) CO2 = 0.00 CO = 0

CALC. MASS LOADING = 1.2548E-03 GR/ACF 1.3027E-03 GR

IMPACTOR STAGE	S1	S2	S
STAGE INDEX NUMBER	1	2	3
D50 (MICROMETERS)	40.38	16.63	6.
MASS (MILLIGRAMS)	4.97	13.00	3.
MG/DSCM/STAGE	5.27E-01	1.38E 00	4.
CUM. PERCENT OF MASS SMALLER THAN D50	82.33	36.10	22.
CUM. (MG/ACM) SMALLER THAN D50	2.36E 00	1.04E 00	6.
CUM. (MG/DNCM) SMALLER THAN D50	2.45E 00	1.08E 00	6.
CUM. (GR/ACF) SMALLER THAN D50	1.03E-03	4.53E-04	2.
CUM. (GR/DNCF) SMALLER THAN D50	1.07E-03	4.70E-04	2.
GEO. MEAN DIA. (MICROMETERS)	9.83E 01	2.59E 01	1.
DM/DLOGD (MG/DNCM)	6.82E-01	3.58E 00	9.
DN/DLOGD (NO. PARTICLES/DNCM)	1.37E 03	3.93E 05	1.

NORMAL (ENGINEERING STANDARD) CONDITIONS ARE 21 DEG C AND 760MM HG.

AERODYNAMIC DIAMETERS ARE CALCULATED HERE ACCORDING TO THE TASK GR

= 90.0 F = 32.2 C SAMPLING DURATION = ****** MIN

90.0 F = 32.2 C

92 IN. OF HG MAX. PARTICLE DIAMETER = 239.1 MICROMETERS

0 N2 = 79.00 O2 = 21.00 H2O = 0.00

NCF 2.8714E 00 MG/ACM 2.9810E 00 MG/DNCM

	S4	S5	S6	S7	FILTER
	4	5	6	7	8
	3.25	1.83	0.97	0.53	
	1.35	1.98	0.57	0.20	2.21
'E-01	1.43E-01	2.10E-01	6.04E-02	2.12E-02	2.34E-01
	17.64	10.60	8.57	7.86	
E-01	5.06E-01	3.04E-01	2.46E-01	2.26E-01	
)E-01	5.26E-01	3.16E-01	2.55E-01	2.34E-01	
!E-04	2.21E-04	1.33E-04	1.08E-04	9.86E-05	
!E-04	2.30E-04	1.38E-04	1.12E-04	1.02E-04	
E 01	4.43E 00	2.43E 00	1.33E 00	7.15E-01	3.72E-01
3E-01	5.32E-01	8.40E-01	2.21E-01	7.93E-02	7.78E-01
E 06	1.17E 07	1.11E 08	1.78E 08	4.14E 08	2.89E 10

JP ON LUNG DYNAMICS.

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Test No.

Date 3/25/82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant Kaiser

Sampling Location

Sample Type Impactor 3

Run Number

Operator

Ambient Temperature

Barometric Pressure

Static Pressure

Stack Diameter

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor

Nozzle I.D.

Assumed Moisture, %

Sample Box Number

Water Volume Collected ______ (Impingers) + ______ (Silica Gel) = ______ (Meter) ml

	Particulate Weight		
	Wash	Filter	Impingers
		E	
ID No.			
Final			
Tare			
Gain			

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IMPINGER TEMP °F IN	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	PUMP VACUUM in. Hg
	0816	674.212											
	~~[illegible]~~	802											
	525	1030.100											
	1443												
		355.9											
					2607								
		0.2466 CFM $\frac{550}{500}$											

State of Washington Department of Ecology

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Test No. ______

Date ______

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ______

Sampling Location ______

Sample Type LAP PART SIZE

Run Number ______

Operator ______

Ambient Temperature ______

Barometric Pressure ______

Static Pressure ______

Stack Diameter ______

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ______

Nozzle I.D. ______

Assumed Moisture, % ______

Sample Box Number ______ Meter ______

Water Volume Collected ______ (Impingers) + ______ (Silica Gel) = ______ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		A	
Final			
Tare			
Gain			

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IMPINGER TEMP °F IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	DRY GAS METER TEMPERATURE INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
	1016	347.129			.26							60	
	330	429											
	730	528 3											
	1314.0	674.162											
		327.033											
Δt = 2 min													
	F1 8815	0.2489	550	.2632									
	F2 8741		350										

RUN NO 3 WITH GREASE

IMPACTOR FLOWRATE = 0.268 ACFM IMPACTOR TEMPERATUR

IMPACTOR PRESSURE DROP = 0.4 IN. OF HG STACK TEMPERATURE =

ASSUMED PARTICLE DENSITY = 1.00 GM/CU.CM. STACK PRESSURE = 2

GAS COMPOSITION (PERCENT) CO2 = 0.00 CO = 0

CALC. MASS LOADING = 6.8597E-04 GR/ACF 7.1216E-04 GR

IMPACTOR STAGE	S1	S2	
STAGE INDEX NUMBER	1	2	
D50 (MICROMETERS)	40.01	16.48	5.
MASS (MILLIGRAMS)	4.67	3.06	3.
MG/DSCM/STAGE	4.43E-01	2.90E-01	3.
CUM. PERCENT OF MASS SMALLER THAN D50	72.83	55.03	34.
CUM. (MG/ACM) SMALLER THAN D50	1.14E 00	8.64E-01	5.
CUM. (MG/DNCM) SMALLER THAN D50	1.19E 00	8.97E-01	5.
CUM. (GR/ACF) SMALLER THAN D50	5.00E-04	3.78E-04	2.
CUM. (GR/DNCF) SMALLER THAN D50	5.19E-04	3.92E-04	2.
GEO. MEAN DIA. (MICROMETERS)	9.78E 01	2.57E 01	9.
DM/DLOGD (MG/DNCM)	5.70E-01	7.53E-01	7.
DN/DLOGD (NO. PARTICLES/DNCM)	1.16E 03	8.49E 04	1.

NORMAL (ENGINEERING STANDARD) CONDITIONS ARE 21 DEG C AND 760MM HG

AERODYNAMIC DIAMETERS ARE CALCULATED HERE ACCORDING TO THE TASK GR

= 90.0 F = 32.2 C SAMPLING DURATION = ****** MIN

90.0 F = 32.2 C

92 IN. OF HG MAX. PARTICLE DIAMETER = 239.1 MICROMETERS

)0 N2 = 79.00 O2 = 21.00 H2O = 0.00

3NCF 1.5697E 00 MG/ACM 1.6297E 00 MG/DNCM

	S4	S5	S6	S7	FILTER
	4	5	6	7	8
3	3.22	1.81	0.96	0.52	
7	1.37	0.79	0.85	0.89	2.09
9E-01	1.30E-01	7.49E-02	8.06E-02	8.44E-02	1.98E-01
5	26.88	22.28	17.34	12.16	
7E-01	4.22E-01	3.50E-01	2.72E-01	1.91E-01	
8E-01	4.38E-01	3.63E-01	2.83E-01	1.98E-01	
9E-04	1.84E-04	1.53E-04	1.19E-04	8.34E-05	
8E-04	1.91E-04	1.59E-04	1.23E-04	8.66E-05	
2E 00	4.38E 00	2.41E 00	1.32E 00	7.08E-01	3.68E-01
7E-01	4.82E-01	3.00E-01	2.95E-01	3.15E-01	6.58E-01
6E 06	1.09E 07	4.08E 07	2.45E 08	1.70E 09	2.53E 10

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State of Washington Department of Ecology

Test No. 1

Date 3/23/82

SULFUR DIOXIDE DETERMINATION BY ABSORPTION IN PERIOXIDE METHOD 6

SAMPLING LOCATION Kaiser Mead SAMPLE NO. 1

Potline 4, room 1 duct from hoods to baghouse system.

SAMPLING TIME 1237	GAS METER READING ℓ	TEMP (°C)		OPERATING CONDITIONS
0.0	000.00	20°0		
7.0	16.25	19°		
13.3	29.30	19°		
22.0	47.15	19°		
30.0	63.47			
				Operator AB
θ	Vm	Tm		Meter Pressure, Pm ______ mm Hg

Analysis Method Barium perchlorate SO_2 No. 82-3-456

Absorbant Volume: Vab 128 ml

Normality of Standard Reagent Nr .02 N

Aliquot Ratio: $\frac{Vab}{ml\ Aliquot}$, Ra 128/20

Reagent Titration Volume for Blank: Vtb .05 ml

Reagent Titration Volume for Sample: Vts 6.65 ml

Lab. Analyst Nancy Steinfort Date in 3-31-82 Date out 4-2-82

SO_2 Mass Collected, Mso_2 = 32.0 Nr (Vts – Vtb) Ra = 27.03 mg

Volume Sampled, Vs = 63.47 $\frac{(293)}{(Tm+273)}$ 292.25 $\frac{(Pm)}{(760)}$ 760 Vm = 63.63 SDℓ

SO_2 Mass Concentration, $Cmso_2$ = 1000 Mso_2 / Vs = 424.84 mg/m^3

SO_2 Volume Concentration, $Cuso_2$ = 0.367 $Cmso_2$ = 155.92 ppm

Stack Flow Rate, Qs = 2914.78 DSCMM

SO_2 Emission Rate, Rso_2 = 60.0 x 10^{-6} $Cmso_2$ x Qs = 74.30 kg/hr

Calculated by Alan T. Butler Checked by ______

Prod. Rate = 1.49 Mg/hr - potline.

ECY 020-73
Rev. 1/81

Emission/Process Factor = 49.72

State of Washington Department of Ecology

Test No. ______

Date ______

SULFUR DIOXIDE DETERMINATION BY ABSORPTION IN PERIOXIDE METHOD 6

SAMPLING LOCATION #4 Potline

SAMPLE NO. 2

SAMPLING TIME	GAS METER READING ℓ	GAS METER TEMP (°C)		OPERATING CONDITIONS
1330	0.000	18°		
+6	11.3	18°		
10	18.8	18°		
15	28.2	18°		
20	37.25	18°		
25	45.30	18°		
30	54.22			Operator ______
θ	Vm	Tm		Meter Pressure, Pm ______ mm Hg

Analysis Method Barium perchlorate SO_2 No. 82-3-457

Absorbant Volume: Vab 128 ml

Normality of Standard Reagent Nr .02 N

Aliquot Ratio: $\frac{Vab}{ml\ Aliquot}$, Ra 128/20

Reagent Titration Volume for Blank: Vtb .05 ml

Reagent Titration Volume for Sample: Vts 5.25 ml

Lab. Analyst Nancy Steinfort Date in 3-31-82 Date out 4-2-82

SO_2 Mass Collected, M_{SO_2} = 32.0 Nr (Vts – Vtb) Ra = 21.30 mg

Volume Sampled, Vs = $\frac{(293)}{(Tm+273)}$ $\frac{(Pm)}{(760)}$ Vm = 54.59 SDℓ

54.22 18

SO_2 Mass Concentration, C_{mSO_2} = 1000 M_{SO_2} / Vs = 390.15 mg/m³

SO_2 Volume Concentration, C_{uSO_2} = 0.367 C_{mSO_2} = 143.18 ppm

Stack Flow Rate, Qs = 2897.55 DSCMM

SO_2 Emission Rate, R_{SO_2} = 60.0×10^{-6} C_{mSO_2} × Qs = 67.83 kg/hr

Calculated by Alan T. Butler Checked by ______

Prod. Rate = 1.49 Mg/hr. potline

Emission/process factor = 45.39

ECY 020-73
Rev. 1/81

State of Washington
Department of Ecology

Test No. ______

Date 3/23/82

SULFUR DIOXIDE DETERMINATION BY ABSORPTION IN PERIOXIDE METHOD 6

SAMPLING LOCATION Potline 4 Baghouse Inlet

SAMPLE NO. 3

SAMPLING TIME	GAS METER READING ℓ	GAS METER TEMP (°C)		OPERATING CONDITIONS
1422	00.00	18°		
+5	7.61	18°		
+10	13.4	18°		
+15	18.0	17°		
+20	21.8	17°		
+25	25.2	17°		
+30	27.90			Operator ______
θ	Vm	Tm		Meter Pressure, Pm ______ mm Hg

Analysis Method Barium perchlorate SO_2 No. 82-3-458

Absorbant Volume: Vab 102 ml

Normality of Standard Reagent Nr .02 N

Aliquot Ratio: $\frac{Vab}{ml\ Aliquot}$, Ra 102/20

Reagent Titration Volume for Blank: Vtb .05 ml

Reagent Titration Volume for Sample: Vts 3.35 ml

Lab. Analyst Nancy Steinfort Date in 3-31-82 Date out 4-2-82

SO_2 Mass Collected, M_{SO_2} = 32.0 Nr (Vts – Vtb) Ra = 10.77 mg

Volume Sampled, Vs = $\frac{(293)}{(Tm + 273)}$ $\frac{(Pm)}{(760)}$ Vm = 28.14 SDℓ (27.90; 17.5)

SO_2 Mass Concentration, Cm_{SO_2} = 1000 M_{SO_2} / Vs = 382.77 mg/m^3

SO_2 Volume Concentration, Cu_{SO_2} = 0.367 Cm_{SO_2} = 140.48 ppm

Stack Flow Rate, Qs = 2880.31 DSCMM

SO_2 Emission Rate, R_{SO_2} = 60.0 x 10^{-6} Cm_{SO_2} x Qs = 66.15 kg/hr

Calculated by Alan T. Butler Checked by ______

Prod Rate = 1.49 Mg/hr-potline

Emission Process Factor = 44.27

Ave ppm = 146.53

ECY 020-73
Rev. 1/81

State of Washington
Department of Ecology

Test No. ______

Date 3/24/82

SULFUR DIOXIDE DETERMINATION BY ABSORPTION IN PERIOXIDE METHOD 6

SAMPLING LOCATION Carbon Plant @ baghouse plenum ~~between outlet duct 6~~ SAMPLE NO. 4

SAMPLING TIME	GAS METER READING ℓ	TEMP (°C)		OPERATING CONDITIONS
1542	00.00	20		
+5	3.25	21		
10	6.17	22		
15	9.17	22		
20	11.90	22		
25	14.75	22		
30	17.07			Operator ZB
θ	Vm	Tm		Meter Pressure, Pm ______ mm Hg

Analysis Method Barium perchlorate SO_2 No. 82-3-459

Absorbant Volume: Vab 106 ml

Normality of Standard Reagent Nr .02 N

Aliquot Ratio: $\frac{Vab}{ml\ Aliquot}$, Ra 106/20

Reagent Titration Volume for Blank: Vtb .05 ml

Reagent Titration Volume for Sample: Vts 2.45 ml

Lab. Analyst Nancy Steinfort Date in 3-31-82 Date out 4-2-82

SO_2 Mass Collected, M_{SO_2} = 32.0 Nr (Vts − Vtb) Ra = 8.14 mg

Volume Sampled, $V_s = \frac{(293)}{(T_m + 273)} \frac{(P_m)}{(760)} V_m$ = 16.98 SDℓ (17.07) (21.5)

SO_2 Mass Concentration, C_{mSO_2} = 1000 M_{SO_2} / Vs = 479.35 mg/m³

SO_2 Volume Concentration, C_{uSO_2} = 0.367 C_{mSO_2} = 175.92 ppm

Stack Flow Rate, Qs = 5266.08 DSCMM

SO_2 Emission Rate, $R_{SO_2} = 60.0 \times 10^{-6}\ C_{mSO_2} \times Q_s$ = 151.46 kg/hr

Calculated by Alan T. Butler Checked by ______

$$\frac{151.46\ kg/hr}{\left(35.86\frac{Mg}{Potroom\ day}\right)\left(\frac{14\ potrooms}{Mill\ total}\right)\left(\frac{1\ day}{24\ hr}\right)} = \frac{151.46\ kg/hr}{20.918\ Mg/hr} = 7.241\ g/kg$$

Stack diam = 0.6 m.

ECY 020-73
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State of Washington Department of Ecology

Test No. ______

Date 3/24/82

SULFUR DIOXIDE DETERMINATION BY ABSORPTION IN PERIOXIDE METHOD 6

SAMPLING LOCATION ______ SAMPLE NO. 5

SAMPLING TIME	GAS METER READING ℓ	GAS METER TEMP (°C)		OPERATING CONDITIONS
1637	00.00	22		
+5	2.00	22		
10	4.50	22.5		
15	7.40	22.5		
20	10.38	22		
25	13.35	22		
30	16.07			Operator AB
θ	Vm	Tm		Meter Pressure, Pm ______ mm Hg

Analysis Method Barium perchlorate SO_2 No. 82-3-460

Absorbant Volume: Vab 114 ml

Normality of Standard Reagent Nr .02 N

Aliquot Ratio: $\frac{Vab}{ml\ Aliquot}$, Ra 114/20

Reagent Titration Volume for Blank: Vtb .05 ml

Reagent Titration Volume for Sample: Vts 2.85 ml

Lab. Analyst Nancy Steinfort Date in 3-31-82 Date out 4-2-82

SO_2 Mass Collected, Mso_2 = 32.0 Nr (Vts – Vtb) Ra = 10.21 mg

Volume Sampled, Vs = 16.07 $\frac{(293)}{(Tm+273)}$ $\frac{(Pm)}{(760)}$ Vm = 15.95 SDℓ

SO_2 Mass Concentration, $Cmso_2$ = 1000 Mso_2 / Vs = 640.32 mg/m³

SO_2 Volume Concentration, $Cuso_2$ = 0.367 $Cmso_2$ = 235.00 ppm

Stack Flow Rate, Qs = 5302.00 DSCMM

SO_2 Emission Rate, Rso_2 = 60.0 x 10^{-6} $Cmso_2$ x Qs = 203.70 kg/hr

Calculated by Alan T. Butler Checked by ______

9.738 #/kg

ECY 020-73
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Test No. ______

Date 3/23/82

SULFUR DIOXIDE DETERMINATION BY ABSORPTION IN PERIOXIDE METHOD 6

SAMPLING LOCATION Carbon Plant

SAMPLE NO. 6

SAMPLING TIME	GAS METER READING ℓ	GAS METER TEMP (°C)		OPERATING CONDITIONS
1727	00.00	22		
+5	5.45	21.5		
10	8.50	21.5		
15	11.11	21.5		
20	13.54	22		
25	15.67	21.5		
30	17.70			Operator ______
θ	Vm	Tm		Meter Pressure, Pm ______ mm Hg

Analysis Method Barium perchlorate SO_2 No. 82-3-461

Absorbant Volume: Vab 136 ml

Normality of Standard Reagent Nr .02 N

Aliquot Ratio: $\frac{Vab}{ml\ Aliquot}$, Ra 136/20

Reagent Titration Volume for Blank: Vtb .05 ml

Reagent Titration Volume for Sample: Vts 2.60 ml

Lab. Analyst Nancy Steinfort Date in 3-31-82 Date out 4-2-82

SO_2 Mass Collected, Mso_2 = 32.0 Nr (Vts – Vtb) Ra = 11.10 mg

Volume Sampled, Vs = 17.70 $\frac{(293)}{(Tm+273)}$ $\frac{(Pm)}{(760)}$ Vm = 17.60 SDℓ

21.67

SO_2 Mass Concentration, $Cmso_2$ = 1000 Mso_2 / Vs = 630.55 mg/m^3

SO_2 Volume Concentration, $Cuso_2$ = 0.367 $Cmso_2$ = 231.41 ppm

Stack Flow Rate, Qs = 5320.88 DSCMM

SO_2 Emission Rate, Rso_2 = 60.0 x 10^{-6} $Cmso_2$ x Qs = 201.31 kg/hr

Calculated by Alan T. Butler Checked by ______

ECY 020-73
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9.623 g/kg

11.4

Sample Calculation Run 1A

$V_m = 2511.6 - 2173.95 = 337.65\ ft^3 \times \frac{1\ m^3}{35.315\ ft^3} = 9.561\ m^3$

$V_s = V_m = 9.561$ DSCM (Temp. of meter ≈ 20°C)

Particulate wt = 0.0341 g

$$C_p = \frac{.0341\ g}{9.561\ m^3} = 0.0036\ g/m^3$$

$\vec{velocity} = 73.13$ m/min (see velocity calc sheet under Fig. 1)

$$Q_s = \vec{v} \times Area \times \frac{460 + 68°F}{460 + T_s} \overset{20°C}{} = 73.13\ \frac{m}{min} \times 148.95\ m^2 \times \frac{528}{460+83} =$$

$Q_s = 10592\ m^3/min$ ($F_{H_2O} \approx 0.0$)

$$r_p = 0.0036\ \frac{g}{m^3} \times 10592\ \frac{m^3}{min} \times 60\ \frac{min}{hr} \times \frac{1\ kg}{1000\ g} = 2.27\ kg/hr$$

$$\text{Production Rate} = 13.18\ \frac{Ton}{day} \times \frac{1\ day}{24\ hr} \times \frac{.907\ 18\ Mg}{ton} = 0.498\ \frac{Mg}{hr}$$

$$f = \frac{2.27\ kg/hr}{0.498\ Mg/hr} = 4.55\ \frac{kg}{Mg} \equiv 4.55\ g/kg$$

State of Washington Department of Ecology

NWRO **REQUEST FOR ANALYSIS** 38

Date 3/31/82

SOURCE Kaiser Mead Aluminum Mill — REQUESTED BY STAT

LOCATION Mead : COUNTY — COLLECTED BY STAT

DATE WERE (WILL BE) COLLECTED 3/22-25/82 — APPROVED BY ____

SAMPLES WILL ARRIVE: DATE 3/31/82 APPROXIMATE TIME ____ CARRIER ____

PRIORITY: REASONABLY SOON X AS SOON AS POSSIBLE X EMERGENCY ____

ROUTE DATA SUMMARY TO: A. Butler, STAT, NWRO

PROGRAM CODE 020-1-012 ☐ Amb. Mon. ☒ Compliance ☐ Inspection ☐ Class, # ____

☐ Investigation ☐ Survey ☐ Spill ☐ Complaint ☐ Other (describe)

OTHER INFORMATION: Please analyse for ~~[illegible]~~ particulate. Samples are split, ½ to Oly for Fl anal., ½ to NW lab for partic. anal. All samples are 100 ml vol.

Type of Analyses Required	Number of Samples	~~Approx. Range~~ Preweight (g)	~~Preservative Type Used~~ Postweight (g)	*For Lab Use Only* Laboratory Number	Analyst	Date	~~Moist~~ ΔWT (g)
Probe Nozzle Rinses (½ of)	9				RS	4/2/82	
1A		91.4059	91.4063	447			.0004
1B		90.3135	90.3142	448			.0007
1C		96.8277	96.8279	449			.0002
2A		96.7634	96.7642	450			.0008
2B		95.0328	95.0312	451			-.0016
2C		86.0983	86.1102	452			.0119
3A		101.5242	101.5280	453			.0038
3B		96.6667	96.66686	454			.0019
3C		89.2457	89.2483	455			.0031

Fill out as completely as possible. Some Analyses (bacteriological, biological, BOD, etc.) and large [illegible] bers of samples must be scheduled ahead of time. Specific questions should be directed to the An[illegible] supervising the particular analysis desired.

ECY 040-2-62

State of Washington Department of Ecology

NWRD **REQUEST FOR ANALYSIS** 39

Date 3/31/82

SOURCE Kaiser Mead Aluminum Mill REQUESTED BY STAT

LOCATION Mead COUNTY COLLECTED BY STAT

DATE WERE (WILL BE) COLLECTED 3/22-26/82 APPROVED BY

SAMPLES WILL ARRIVE: DATE 3/31/82 APPROXIMATE TIME ______ CARRIER ______

PRIORITY: REASONABLY SOON X AS SOON AS POSSIBLE X EMERGENCY ______

ROUTE DATA SUMMARY TO A. Butler, STAT, NWRO

PROGRAM CODE 020 - 1 - 012 ☐ Amb. Mon. ☒ Compliance ☐ Inspection ☐ Class, # ______

☐ Investigation ☐ Survey ☐ Spill ☐ Complaint ☐ Other (describe)

OTHER INFORMATION: Please analyse filters for: ~~[illegible]~~ Particulate. Note that significant portions of dust catch is loose in container. Therefore, either weigh sample in container then get container empty wt., or get all dust from container. THK

Type of Analyses Required	Number of Samples	Preweight (g)	Postweight (g)	Laboratory Number	Analyst NS	Date 4/1/82	Notes AWT (g)
1A C-267	10	38.1831	38.2164	82-3-437			.0333
1B/C-104		39.8447	39.8864	438			.0417
1C/C-169		38.5171	38.5666	439			.0495
2A/C-~~164~~ 274		37.8250	37.8900	440			.0650
2B/C-110		40.0263	40.1096	441			.0833
2C/C-145		40.0744	40.1894	442			.1150
3A C-42		38.3536	38.3912	443			.0376
3B C-261		38.5979	38.6502	444			.0523
3C/C-118		40.0931	40.2170	445			.1239
Blank / C-168		38.0765	38.0765	446			-0-
Note: C-42 can	LID is correctly labeled,			CAN itself	is incorrectly labeled.		

Fill out as completely as possible. Some Analyses (bacteriological, biological, BOD, etc.) and large n bers of samples must be scheduled ahead of time. Specific questions should be directed to the Ana supervising the particular analysis desired.

State of Washington Department of Ecology

REFERENCE 1

Summary & Description Pages 1- 6

SOURCE TEST

SUMMARY OF EMISSIONS TO ATMOSPHERE

Report No. 82-11

Report Date 6/15/82

Test Date May 18-20 1982

Name of plant ALCOA

Location of plant VANCOUVER

Person contacted KIM THACKRAY

Type of operation PRIMARY ALUMINUM MILL, PREBAKE

Source tested POTLINE 10 ROOF MONITOR

Requesting Agency STAT

Purpose MEASURE PARTICLE SIZE

Applicable Standard NONE

SUMMARY OF MEASUREMENTS

Pollutant	Measured Emission	Allowable Emission	Emission/Process Factor	Methods
Particulate				
Mass Mean Size	11 microns			WDOE Method 22

TEST ENGINEER Jay M. Willenberg, P. E.

FIELD PERSONNEL

Richard Burkhalter

Jay Willenberg

LAB ANALYSIS

Nancy Steinfort

Test Witnessed by:

ECY 020-1-62
Rev. 1/79

I. Purpose

The purpose of the test was to measure the particle size of the emissions from the roof monitor at Alcoa's Vancouver plant. The results will be used for informational purposes.

II. Description of Facility Tested

The Alcoa, Vancouver, facility is a prebake type primary aluminum reduction facility and is located near the Columbia River west of the city of Vancouver.

The plant has five potlines with 65 pots per room and two rooms per line. At the time of our test only two potlines were operating, reducing approximately 133 tons of aluminum per day. Emissions from the pots are collected by hoods and ducted to a reactor baghouse. There are five baghouses per potline and two stacks per baghouse. Prior to the baghouse, the pots effluents are ducted to the reactors where it is passed through a fluid bed of alumina for fluoride removal.

Most secondary emissions are released whenever the pots are drossed, tapped, or more alumina is added. Emissions are carried to the ceiling by convection and released to the atmosphere through roof monitors. No control system is used with the roof monitors which are rectangular vents running the length of the roof of the potroom. On potroom #8, nine small diameter inlet ducts are connected and routed to a single 15" diameter stack located in the courtyard between potrooms #8 and #10. Here samples are drawn for measurement of particulate and fluoride concentrations using EPA Method 14.

III. Test Procedures

Three particle size samples were taken following WDOE Method 22. A University of Washington Mark III Impactor was used to collect all samples over a 50 hour period. Run 1 went from 12:10 to 21:30 on May 18, Run 2 from 21:42 to 12:06 on May 19, and Run 3 from 12:12 to 13:08 on May 20. On Runs #1 and #2 the stainless steel substraits were coated with Apizon H grease to minimize particle bounce and re-entrainment. No grease was used on Run #3. All three samples were taken at a point of near average velocity. Because of low stack temperature (about 90°C) and the low moisture, no heated probe or impingers were used.

The exposed plates were dried at 105°C for four hours, desiccated and weighed to the nearest 0.01 milligrams. The data was computer reduced using the CIDRS program developed by the Southern Research

Institute. A particle size was calculated assuming all particles to be spheres of density 1.00.

IV. Results

As shown in Figure 1, about half the particles measured were less than 10 to 11 microns. This corresponds closely to the 50% cut size in the second stage on the impactor and is in a range where the uncertainty of measurement is large.

The size distribution curve for Run #1 and #2 is slightly different than for Run #3. This may be caused by process change, but more likely caused by the fact that grease was not used on Run #3. It was noticed that there is a large amount of loose material in the first stage on Run #3. Some of the material may have migrated down from the other stages.

JMW:kw

FIG. 1

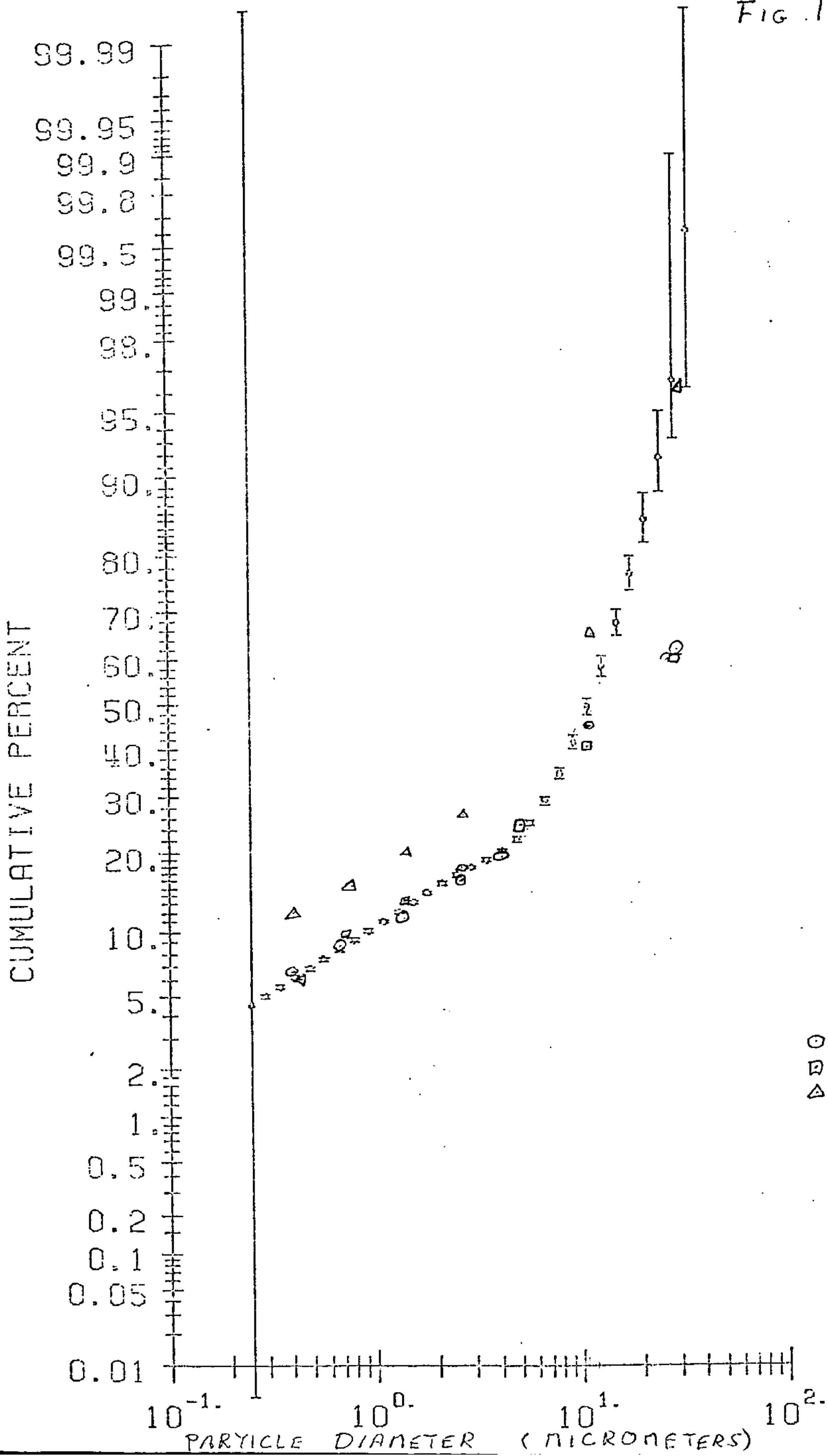
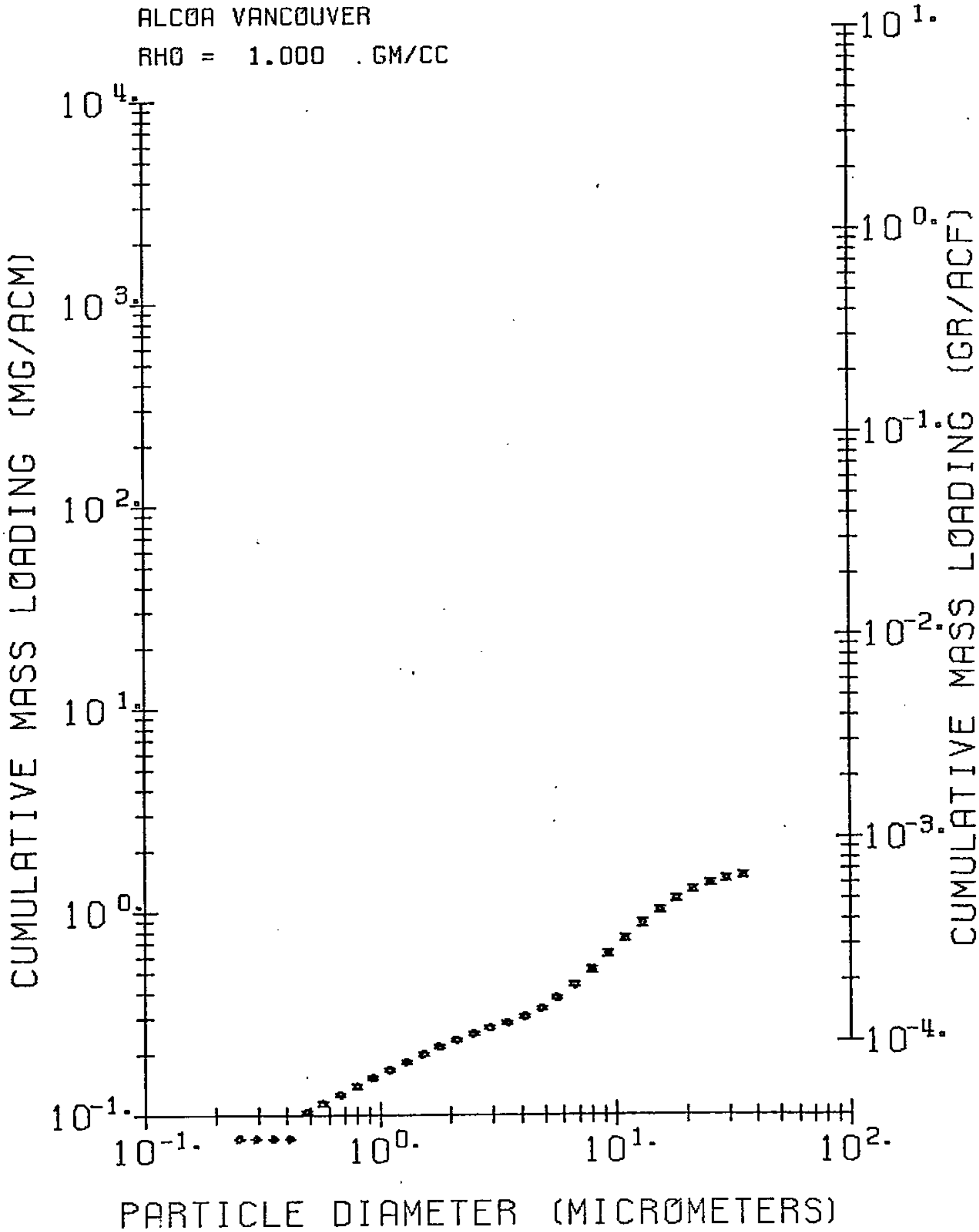
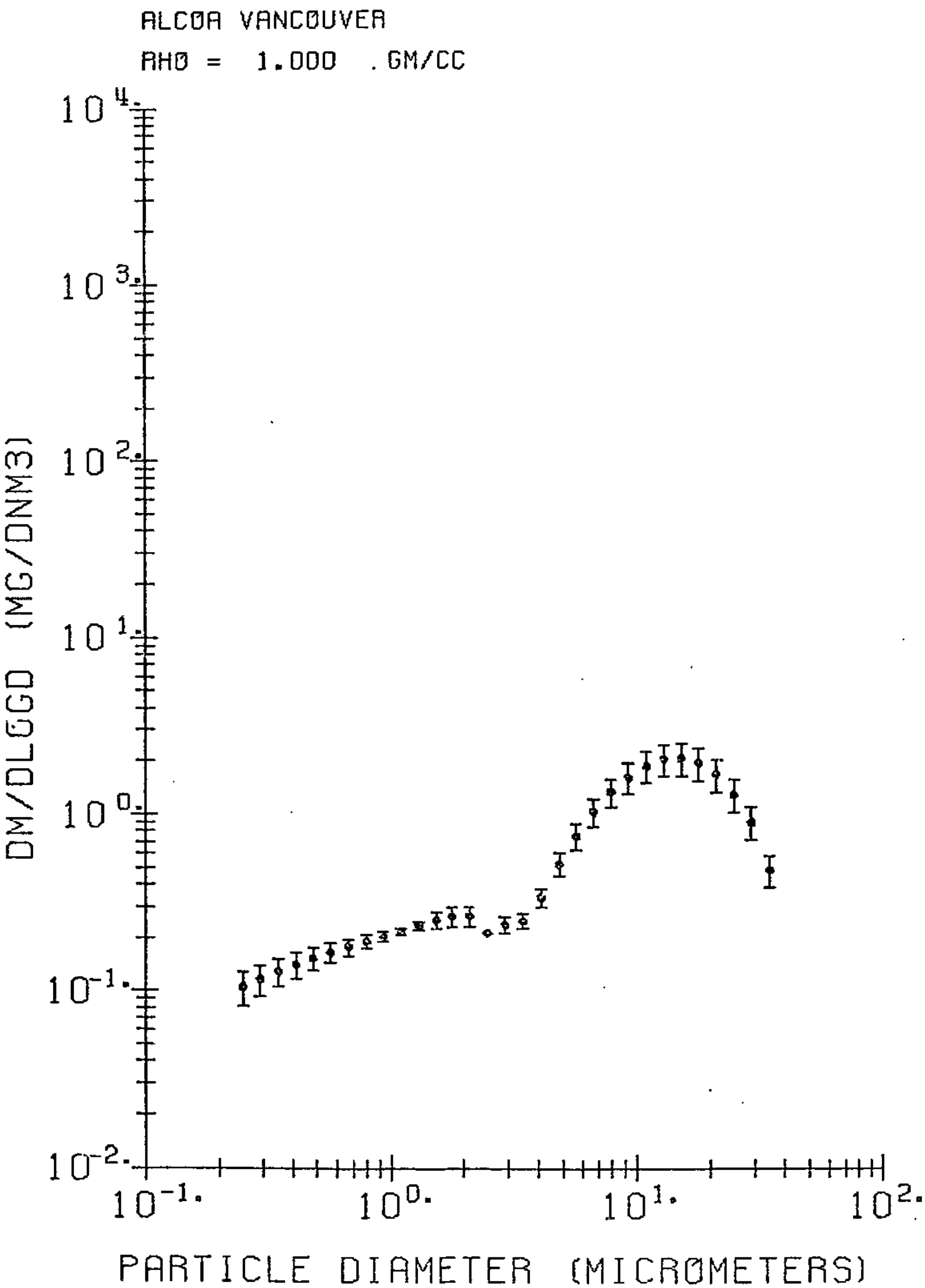

99.99
99.95
99.9
99.8
99.5
99.
98.
95.
90.
80.
70.
60.
50.
40.
30.
20.
10.
5.
2.
1.
0.5
0.2
0.1
0.05
0.01
CUMULATIVE PERCENT
$10^{-1.}$
$10^{0.}$
$10^{1.}$
$10^{2.}$
PARTICLE DIAMETER (MICROMETERS)
Run 1
Run 2
Run 3

FIG 2


ALCOA VANCOUVER
RHO = 1.000 . GM/CC
CUMULATIVE MASS LOADING (MG/ACM)
CUMULATIVE MASS LOADING (GR/ACF)
PARTICLE DIAMETER (MICROMETERS)
$10^{4.}$
$10^{3.}$
$10^{2.}$
$10^{1.}$
$10^{0.}$
$10^{-1.}$
$10^{1.}$
$10^{0.}$
$10^{-1.}$
$10^{-2.}$
$10^{-3.}$
$10^{-4.}$
$10^{-1.}$
$10^{0.}$
$10^{1.}$
$10^{2.}$


ALCOA VANCOUVER
RHO = 1.000 . GM/CC
DM/DLGGD (MG/DNM3)
10^4.
10^3.
10^2.
10^1.
10^0.
10^-1.
10^-2.
10^-1.
10^0.
10^1.
10^2.
PARTICLE DIAMETER (MICROMETERS)

RUN NO 1 WITH GREASE

IMPACTOR FLOWRATE = 0.384 ACFM   IMPACTOR TEMPERATURE = 90.0 F = 32.2 C   SAMPLING DURATION = 558.10 MIN

IMPACTOR PRESSURE DROP = 0.9 IN. OF HG   STACK TEMPERATURE = 90.0 F = 32.2 C

ASSUMED PARTICLE DENSITY = 3.97 GM/CU.CM.   STACK PRESSURE = 29.92 IN. OF HG   MAX. PARTICLE DIAMETER = 40.0 MICROMETERS

GAS COMPOSITION (PERCENT)   CO2 = 0.00   CO = 0.00   N2 = 79.00   O2 = 21.00   H2O = 0.00

CALC. MASS LOADING = 8.7511E-04 GR/ACF   9.0851E-04 GR/DNCF   2.0025E 00 MG/ACM   2.0790E 00 MG/DNCM

IMPACTOR STAGE	S1	S2	S3	S4	S5	S6	S7	FILTER
STAGE INDEX NUMBER	1	2	3	4	5	6	7	8
D50 (MICROMETERS)	16.74	6.86	2.46	1.30	0.71	0.36	0.17	
MASS (MILLIGRAMS)	5.66	2.25	1.91	0.44	0.53	0.34	0.28	0.73
MG/DSCM/STAGE	9.69E-01	3.85E-01	3.27E-01	7.54E-02	9.08E-02	5.82E-02	4.80E-02	1.25E-01
CUM. PERCENT OF MASS SMALLER THAN D50	53.38	34.84	19.11	15.49	11.12	8.32	6.01	
CUM. (MG/ACM) SMALLER THAN D50	1.07E 00	6.98E-01	3.83E-01	3.10E-01	2.23E-01	1.67E-01	1.20E-01	
CUM. (MG/DNCM) SMALLER THAN D50	1.11E 00	7.24E-01	3.97E-01	3.22E-01	2.31E-01	1.73E-01	1.25E-01	
CUM. (GR/ACF) SMALLER THAN D50	4.67E-04	3.05E-04	1.67E-04	1.36E-04	9.73E-05	7.28E-05	5.26E-05	
CUM. (GR/DNCF) SMALLER THAN D50	4.85E-04	3.17E-04	1.74E-04	1.41E-04	1.01E-04	7.56E-05	5.46E-05	
GEO. MEAN DIA. (MICROMETERS)	2.59E 01	1.07E 01	4.11E 00	1.79E 00	9.64E-01	5.04E-01	2.47E-01	1.21E-01
DM/DLOGD (MG/DNCM)	2.56E 00	9.95E-01	7.34E-01	2.73E-01	3.47E-01	1.94E-01	1.50E-01	4.15E-01
DN/DLOGD (NO. PARTICLES/DNCM)	7.11E 04	3.89E 05	5.09E 06	2.29E 07	1.86E 08	7.26E 08	4.79E 09	1.12E 11

NORMAL (ENGINEERING STANDARD) CONDITIONS ARE 21 DEG C AND 760MM HG.

RUN NO 2 WITH GREASE

IMPACTOR FLOWRATE = 0.387 ACFM
IMPACTOR TEMPERATURE = 90.0 F = 32.2 C
SAMPLING DURATION = 364.00 MIN

IMPACTOR PRESSURE DROP = 0.9 IN. OF HG
STACK TEMPERATURE = 90.0 F = 32.2 C

ASSUMED PARTICLE DENSITY = 3.97 GM/CU.CM.
STACK PRESSURE = 29.92 IN. OF HG
MAX. PARTICLE DIAMETER = 40.0 MICROMETERS

GAS COMPOSITION (PERCENT) CO2 = 0.00 CO = 0.00 N2 = 79.00 O2 = 21.00 H2O = 0.00

CALC. MASS LOADING = 6.6704E-04 GR/ACF 6.9250E-04 GR/DNCF 1.5264E 00 MG/ACM 1.5847E 00 MG/DNCM

IMPACTOR STAGE	S1	S2	S3	S4	S5	S6	S7	FILTER
STAGE INDEX NUMBER	1	2	3	4	5	6	7	8
D50 (MICROMETERS)	16.66	6.83	2.45	1.30	0.71	0.35	0.17	
MASS (MILLIGRAMS)	5.94	2.89	2.53	0.68	0.47	0.52	0.48	0.95
MG/DSCM/STAGE	6.51E-01	3.17E-01	2.77E-01	7.45E-02	5.15E-02	5.70E-02	5.26E-02	1.04E-01
CUM. PERCENT OF MASS SMALLER THAN D50	58.92	38.93	21.44	16.74	13.49	9.80	6.57	
CUM. (MG/ACM) SMALLER THAN D50	8.99E-01	5.94E-01	3.27E-01	2.55E-01	2.06E-01	1.51E-01	1.00E-01	
CUM. (MG/DNCM) SMALLER THAN D50	9.34E-01	6.17E-01	3.40E-01	2.65E-01	2.14E-01	1.57E-01	1.04E-01	
CUM. (GR/ACF) SMALLER THAN D50	3.93E-04	2.60E-04	1.43E-04	1.12E-04	9.00E-05	6.60E-05	4.38E-05	
CUM. (GR/DNCF) SMALLER THAN D50	4.08E-04	2.70E-04	1.48E-04	1.16E-04	9.34E-05	6.85E-05	4.55E-05	
GEO. MEAN DIA. (MICROMETERS)	2.58E 01	1.07E 01	4.09E 00	1.78E 00	9.59E-01	5.02E-01	2.46E-01	1.20E-01
DM/DLOGD (MG/DNCM)	1.71E 00	8.18E-01	6.22E-01	2.70E-01	1.97E-01	1.89E-01	1.65E-01	3.46E-01
DN/DLOGD (NO. PARTICLES/DNCM)	4.79E 04	3.24E 05	4.38E 05	2.30E 07	1.07E 08	7.22E 08	5.35E 09	9.56E 10

NORMAL (ENGINEERING STANDARD) CONDITIONS ARE 21 DEG C AND 760MM HG.

RUN NO 3 WITHOUT GREASE

IMPACTOR FLOWRATE = 0.380 ACFM   IMPACTOR TEMPERATURE = 90.0 F = 32.2 C   SAMPLING DURATION = ****** MIN

IMPACTOR PRESSURE DROP = 0.9 IN. OF HG   STACK TEMPERATURE = 90.0 F = 32.2 C

ASSUMED PARTICLE DENSITY = 3.97 GM/CU.CM.   STACK PRESSURE = 29.92 IN. OF HG   MAX. PARTICLE DIAMETER = 40.0 MICROMETERS

GAS COMPOSITION (PERCENT)   CO2 = 0.00   CO = 0.00   N2 = 79.00   O2 = 21.00   H2O = 0.00

CALC. MASS LOADING = 4.3481E-04 GR/ACF   4.5141E-04 GR/DNCF   9.9500E-01 MG/ACM   1.0330E 00 MG/DNCM

IMPACTOR STAGE	S1	S2	S3	S4	S5	S6	S7	FILTER
STAGE INDEX NUMBER	1	2	3	4	5	6	7	8
D50 (MICROMETERS)	16.83	6.90	2.47	1.31	0.72	0.36	0.17	
MASS (MILLIGRAMS)	0.42	4.80	5.41	0.78	0.97	1.02	0.66	1.92
MG/DSCM/STAGE	2.71E-02	3.10E-01	3.50E-01	5.04E-02	6.27E-02	6.59E-02	4.27E-02	1.24E-01
CUM. PERCENT OF MASS SMALLER THAN D50	97.37	67.33	33.48	28.60	22.53	16.15	12.02	
CUM. (MG/ACM) SMALLER THAN D50	9.69E-01	6.70E-01	3.33E-01	2.85E-01	2.24E-01	1.61E-01	1.20E-01	
CUM. (MG/DNCM) SMALLER THAN D50	1.01E 00	6.96E-01	3.46E-01	2.95E-01	2.33E-01	1.67E-01	1.24E-01	
CUM. (GR/ACF) SMALLER THAN D50	4.23E-04	2.93E-04	1.46E-04	1.24E-04	9.80E-05	7.02E-05	5.22E-05	
CUM. (GR/DNCF) SMALLER THAN D50	4.40E-04	3.04E-04	1.51E-04	1.29E-04	1.02E-04	7.29E-05	5.42E-05	
GEO. MEAN DIA. (MICROMETERS)	2.59E 01	1.08E 01	4.13E 00	1.80E 00	9.69E-01	5.08E-01	2.49E-01	1.22E-01
DM/DLOGD (MG/DNCM)	7.22E-02	8.01E-01	7.85E-01	1.83E-01	2.40E-01	2.20E-01	1.34E-01	4.12E-01
DN/DLOGD (NO. PARTICLES/DNCM)	1.99E 03	3.08E 05	5.36E 06	1.51E 07	1.27E 08	8.08E 08	4.17E 09	1.09E 11

NORMAL (ENGINEERING STANDARD) CONDITIONS ARE 21 DEG C AND 760MM HG.

State of Washington
Department of Ecology

Test No. ____________

Date MAY 18, 1982

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ALCOA VANCOUVER

Sampling Location POT ROOM ROOF

Sample Type PART SIZE

Run Number 1

Operator JMW

Ambient Temperature 85°F

Barometric Pressure ____________

Static Pressure ____________

Stack Diameter ____________

Orsat CO_2 ________ O_2 ________ CO ________

Probe Length, Type, Factor ____________

Nozzle I.D. 3/16

Assumed Moisture, % 1%

Sample Box Number ____________ Meter

Water Volume Collected ________ (Impingers) + ________ (Silica Gel) = ________ ml

Particulate Weight

	Wash	Filter	Impingers
ID No:		SET I	
Final			
Tare			
Gain			

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IMPINGER TEMP °F IN	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	PUMP VACUUM in. Hg
	0.0 / 12:10	742.516										66	
	558 / 21:31	944.905											
		202.389											
		$0.36\overset{37}{\cancel{40}}\left(\frac{550}{560}\right)=0.38\overset{36}{\cancel{50}}$											

State of Washington Department of Ecology

Test No. ______

Date MAY 18-19, 82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ALCOA VANCOUVER

Sampling Location POT ROOM ROOF

Sample Type PART SIZE

Run Number 2

Operator JHW

Ambient Temperature 85°F

Barometric Pressure ______

Static Pressure ______

Stack Diameter ______

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ______

Nozzle I.D. 3/16

Assumed Moisture, % 1

Sample Box Number ______ Meter

Water Volume Collected ______ (Impingers) + ______ (Silica Gel) = ______ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		SET K	
Final			
Tare			
Gain			

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	SAMPLING TIME, min. / CLOCK TIME (24 hr clock)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	
	0.0 / 21:42	949.950											
	864 / 12:00	1261.272											
		316.322											
		0.3661 cfm $\left(\frac{550}{520}\right)$		= 0.3872									

State of Washington Department of Ecology

Test No. ____

Date May 19-20, 82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ALCOA VANCOUVER

Sampling Location POT ROOM ROOF

Sample Type PART SIZE

Run Number 3

Operator JMW

Ambient Temperature ____

Barometric Pressure ____

Static Pressure ____

Stack Diameter ____

Orsat CO_2 ____ O_2 ____ CO ____

Probe Length, Type, Factor ____

Nozzle I.D. 3/16

Assumed Moisture, % 1%

Sample Box Number ____ Meter

Water Volume Collected ____ (Impingers) + ____ (Silica Gel) = ____ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		SET C	
Final			
Tare			
Gain			

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	SAMPLING TIME, min.	CLOCK TIME (24 hr clock)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IMPINGER TEMP °F IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	DRY GAS METER TEMPERATURE INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
	0.0	12:12	261.540											
	1994.1	13:08	797.830											
			536.29											

$0.3589 \left(\frac{550}{520}\right) = 0.3796$

State of Washington Department of Ecology

REQUEST FOR ANALYSIS

Date 5-21-82

SOURCE ~~Alcoa~~ ALCOA REQUESTED BY JMW

LOCATION Vancouver USA COUNTY COLLECTED BY STAT

DATE WERE (WILL BE) COLLECTED MAY 18-20 APPROVED BY JMW

SAMPLES WILL ARRIVE: DATE MAY 21 APPROXIMATE TIME .... CARRIER ....

PRIORITY: REASONABLY SOON ✓ AS SOON AS POSSIBLE .... EMERGENCY ....

ROUTE DATA SUMMARY TO: J Wullenborg

PROGRAM CODE 0:2 - 1 - 1:2 ☐ Amb. Mon. ☐ Compliance ☐ Inspection ☐ Class, # ....

☐ Investigation ☐ Survey ☐ Spill ☐ Complaint ☐ Other (describe) ....

OTHER INFORMATION:

weigh impactor plates

Type of Analyses Required	Number of Samples	Prewt(g) ~~Approx. Range~~	Postwt(g) ~~Preservative (Types)~~	For Lab Use Only: Laboratory Number	Analyst	Date	ΔWT (g) ~~Date~~
Set C1		701.70	702.12	82-5-767			0.42
2		1055.94	1060.74	-768	some particulate lost on dish		4.80
3		1060.55	1065.96	-769			5.41
4		1057.94	1058.72	-770			0.78
5		1044.94	1045.91	-771			0.97
6		1059.05	1060.07	-772			1.02
7		1060.58	1061.24	-773			0.66
8		110.81	112.73	-774			1.92
set V1		656.17	661.83	-775			5.66
2		1003.99	1006.24	-776			2.25
3		978.70	980.61	-777			1.91
4		1100.73	1101.17	-778			0.44
5		963.29	963.82	-779			0.53
6		1101.45	1101.79	-780			0.34
7		1094.46	1094.74	-781			0.28
8		108.91	109.64	-782			0.73

Fill out as completely as possible. Some Analyses (bacteriological, biological, BOD, etc.) and large numbers of samples must be scheduled ahead of time. Specific questions should be directed to the Analyst supervising the particular analysis desired.

State of Washington Department of Ecology

REQUEST FOR ANALYSIS

Date

SOURCE Alcoa REQUESTED BY

LOCATION VANCOUVER COUNTY COLLECTED BY

DATE WERE (WILL BE) COLLECTED 5-18 to 20 APPROVED BY

SAMPLES WILL ARRIVE: DATE 5/21 APPROXIMATE TIME CARRIER

PRIORITY: REASONABLY SOON AS SOON AS POSSIBLE EMERGENCY

ROUTE DATA SUMMARY TO:

PROGRAM CODE _ - _ - _ ☐ Amb. Mon. ☐ Compliance ☐ Inspection ☐ Class, #

☐ Investigation ☐ Survey ☐ Spill ☐ Complaint ☐ Other (describe)

OTHER INFORMATION:

Type of Analyses Required	Number of Samples	Prewt ~~Approx. Range~~	Postwt ~~Preservative Type~~	Laboratory Number	For Lab Use Only Analyst	Date	ΔWT ~~Note~~
Set K 1		715.58	721.52	-783			5.94
2		986.58	989.47	-784			2.89
3		1050.10	1052.63	-785			2.53
4		966.54	967.22	-786			0.68
5		1064.92	1065.39	-787			0.47
6		1048.82	1049.34	-788			0.52
7		1088.91	1089.39	-789			0.48
8		108.08	109.03	-790			0.95

Fill out as completely as possible. Some Analyses (bacteriological, biological, BOD, etc.) and large numbers of samples must be scheduled ahead of time. Specific questions should be directed to the Analyst supervising the particular analysis desired.

ECY 040-2-62

State of Washington Department of Ecology

REFERENCE 2

Summary & Description Pages 1-12

See page 33-34

SOURCE TEST

SUMMARY OF EMISSIONS TO ATMOSPHERE

Report No. 82-2A

Report Date 4/5/82

Test Date 2/2-5/82

Name of plant REYNOLDS METALS COMPANY

Location of plant LONGVIEW, WASHINGTON

Person contacted ~~MR. H. S. HAYS (206) 425-2800~~

Type of operation ALUMINUM PRIMARY REDUCTION MILL

Source tested NORTH PLANT POTROOM 52

Requesting Agency WDOE INDUSTRIAL SECTION

Purpose MEASURE PARTICULATE

Applicable Standard

SUMMARY OF MEASUREMENTS

Pollutant	Measured Emission	Allowable Emission	Emission/Process Factor	Methods
ROOF MONITOR Particulate	0.0039 g/DSCM	18.1 kg/hr.	7.20 g/kg	EPA Method 13 & "dry"Method

TEST ENGINEER ALAN T. BUTLER, P.E. AB

FIELD PERSONNEL

ALAN T. BUTLER

JOHN DRABEK

LAB ANALYSIS

MILES KUNTZ

Test Witnessed by:

CHAPTER: 12.1
CD-ROM: Background
FILENAME: L1_00011

AP-42 Background File Documents

ECY 020-1-62
Rev. 1/79

I. Purpose

The purpose of this test was to measure particulate and fluoride emissions from roof monitors of the North Plant of the Reynolds Metals Company, Longview, primary aluminum reduction mill. Correlative purposes of this test were to measure particulate and gas velocity distribution across the roof monitor, and to compare two different methods for measuring fluorides. Fluoride measurements will be reported upon completion of laboratory analyses.

II. Description of the Unit Tested

The Reynolds primary aluminum reduction mill is located in a heavily industrialized area to the south of Longview, Washington. This mill's reduction facilities include two horizontal stud Soderburg (HSS) plants, known as the "North" and "South" plants. The South plant was tested by WDOE in June 1979 (STAT report 79-19A and B).

The North plant (see Figure 1) has three potlines, with a combined capacity of 127,000 Mg/year (140,000 ton/yr.). The total output of the North and South plants is 191,000 Mg/yr (210,000 ton/yr). Each potline has four rows of 168 cells in two potrooms, or two 42-cell rows per potroom for a plant total of 504 cells. The potrooms have sidewall and basement ventilation. This facility was constructed in 1968.

The HSS cells (figures 2 and 3) are elevated slightly above the floor and have total-enclosure hooding with mechanically operated aluminum doors extending the full length of both sides of each cell. Pollutants continuously escape from the top of the cell enclosure and also from the hood doors when they are open. The doors have to be opened frequently to add alumina to the cryolite bath by working the cell, to tap the molten layer from beneath the bath, and to insert and remove studs from the anode block while raising the flexibile current connectors.

Four ducts, two on each end of each cell, pick up the primary exhaust from the top of the cell hooding enclosure and carry it to a manifold duct. One manifold handles primary exhaust from 14 cells, at a flow rate of 100 m^3/min. Figure 1 shows the location of the 36 spray towers that were used for primary pollution control until 1975. Also shown are the wet electrostatic precipitators (ESP's), which are presently used to control primary emissions from the cells. Estimated control efficiency for the North plant primary control system is 90 percent.

All emissions not captured by the total enclosure hood are vented by convection through the secondary system, or roof monitors, which have a zero percent control efficiency. Each potroom has a *roof monitor* which is an 8 foot wide by 1360 foot long hooded opening running down the center of the roof.

There are sampling sites on each ESP stack, and three sites evenly separated on each roof monitor.

III. Test Procedure

Three approximately one-day particulate and fluoride tests were run at the potroom 52 center location and on the final day a particle size test was run at the potroom 52 north location.

Each one day (24 hr) particulate/fluoride test set consisted of four samples, collected by four sampling trains separated by two-foot intervals across the width of the roof monitor. These sampling locations were labeled A through D, and are shown in Figures 4 and 5. Four samplers were used in an attempt to determine differences in particulate. Two different types of particulate/fluoride sampling trains were used. The "front half" or nozzle and filter portions of the trains were identical in configuration, and consisted of a standard 0.500 inch I.D. nozzle followed by a filter-holder containing a pre-weighed 47 mm acetate filter. Particulate concentrations were determined by the particulate weight gains of the filter and a 50% aliquot of the nozzle rinse. The other 50% of the nozzle rinse, as well as the particulate filters, were then sent to the WDOE laboratory for fluoride analysis.

The "back-half" portions of the sampling trains were used to collect gaseous fluoride and differed in configuration. The EPA Method 13 back-half consists of two impingers containing 250 ml of .1N NaOH, followed by a drop-out impinger and a silica gel filled impinger for moisture removal. This is equivalent to EPA Method 13. The dry method for collecting gaseous fluoride involves placement of a second filter holder, containing a treated cellulose filter after the particulate filter. The EPA Method 13 and treated filter gaseous fluoride sampling methods are referred to as the "wet" and "dry" methods, respectively.

An integrating anemometer was used to measure effluent flow rates at each sampling location prior to each sampling run. These short term measurements were then used for setting sampling rates. An additional integrating anemometer was positioned near one of the sampling nozzles and allowed to run the entire sampling period.

Flow rates for the other points during the sampling period were estimated by applying a ratio of the short term velocity measurements to the one long term measurement as shown below:

$$\text{Point "X" long term velocity} = \text{point C longterm velocity} \times \frac{\text{short term point "X" velocity}}{\text{short term point C velocity}}$$

IV. Results

Results are detailed in Tables 1-4. Particulate concentrations averaged 0.0039 grams per dry standard cubic meter of effluent. The particulate emission rate for the entire roof monitor was obtained by totaling the emission rates for sample zones A,B,C and D for each run, then averaging. This was 18.1 kilograms per hour. Since the aluminum output during our sampling was 2.52 megagrams per hour, the average emission/process factor for pot-room 52 was 7.20 gram/kilogram.

Results of the particle size test indicate that approximately 80% of the particulate airborne at the sampling location was greater than 15 microns in diameter.

Sample data comparisons were made between points A,B,C and D and are shown in Figures 4 and 5. Gas flow rates and emission rates tend to progressively decrease, looking from sampling points A through D, as shown in Figure 4. The standard deviation is generally the narrowest at point B, indicating the most consistency.

Future particulate samples could very likely be adequately collected by a single sampler located near points B or C. Samples collected near points A and D may be affected by proximity to dust-laden roof monitor walls, or the open doorway near point D.

Figures 4 and 5 show, however, that, taken over the sample period, for our three sample runs, average results at any one point lie within one standard deviation of the overall average. Therefore, there is no statistical evidence that would actually discount or support any one sampling point over the others.

AB:kw

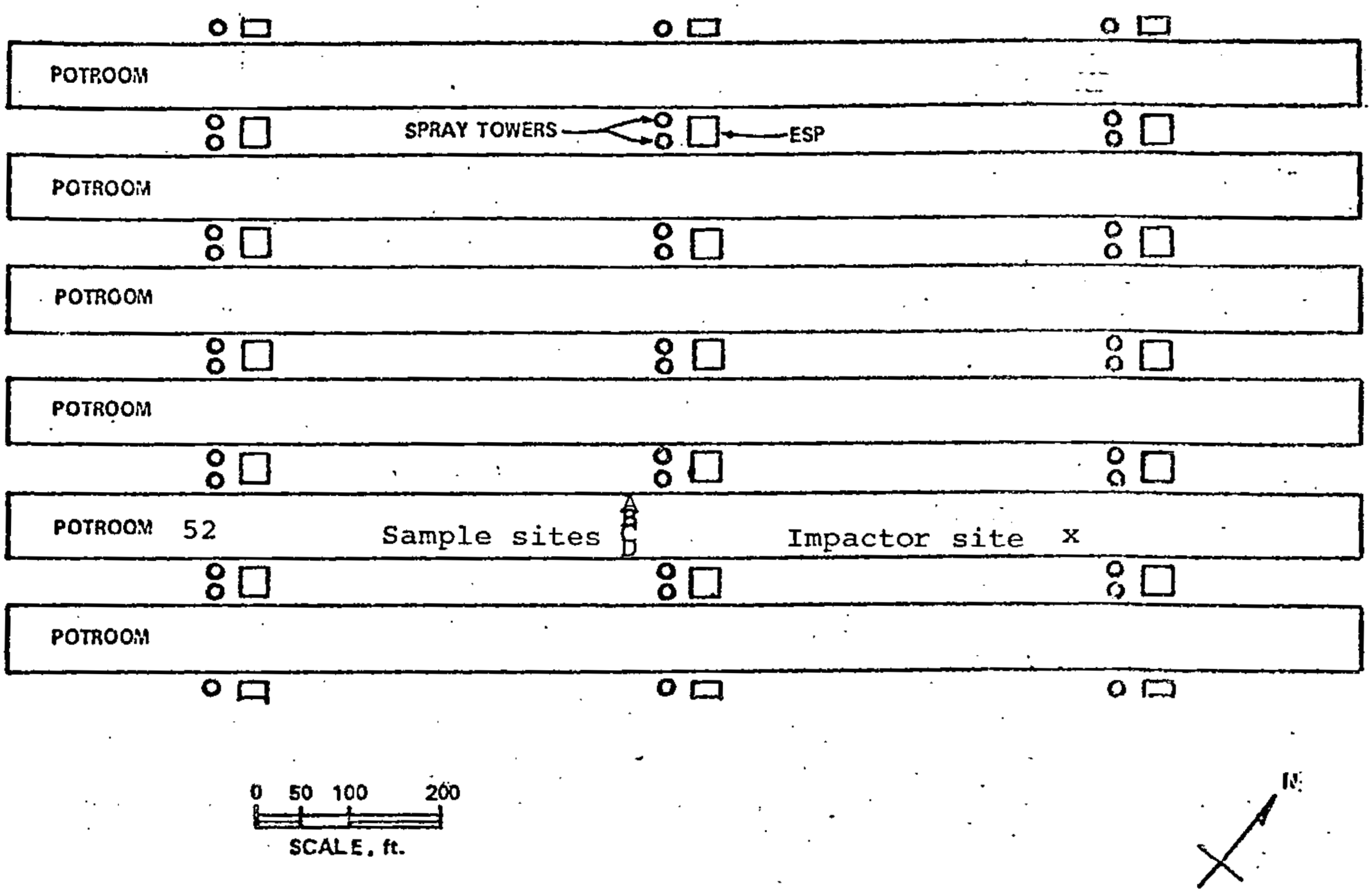


Figure 1 .. Reynolds [illegible]) --north plant (location and position of control equipment not exact).

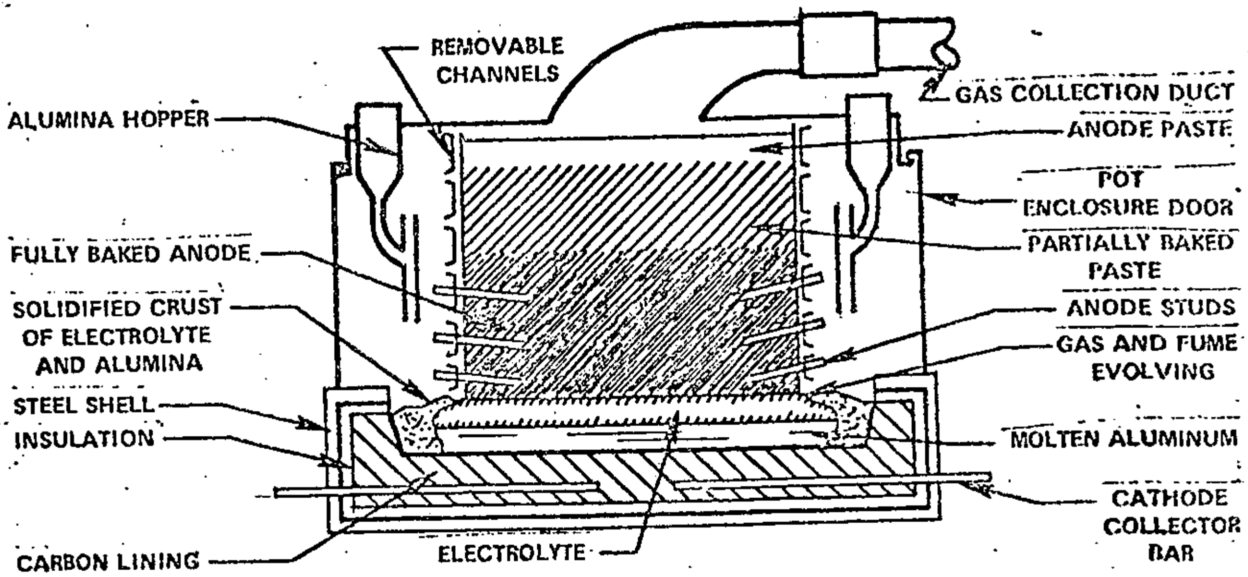


Figure 2. Details of horizontal stud Soderberg reduction cell.[18]

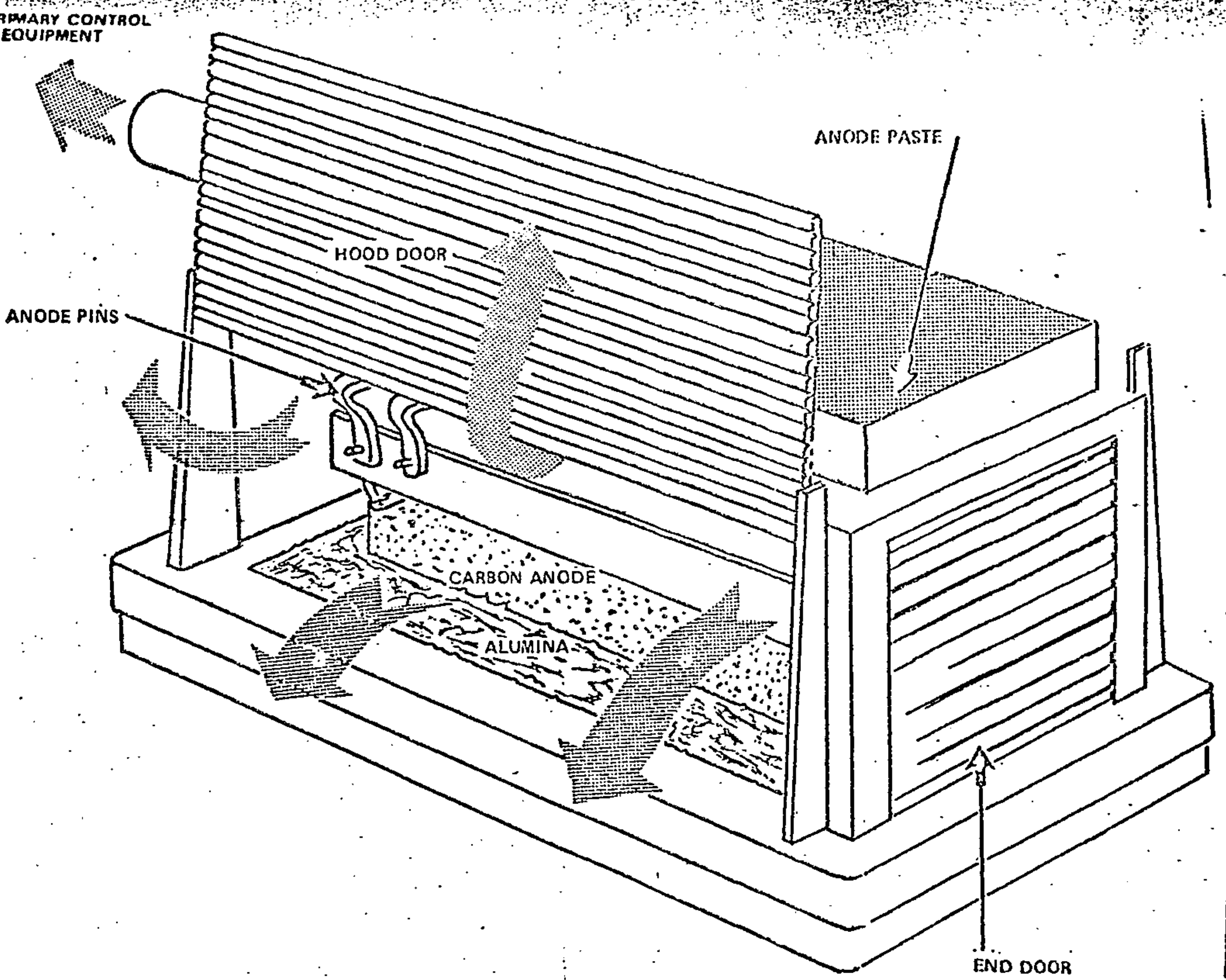


Figure 3. Typical horizontal stud Soderberg cell hooding.

Figure 4. Roof Monitor cross-section; sample data compared to data averages and standard deviations for specified sampling points.

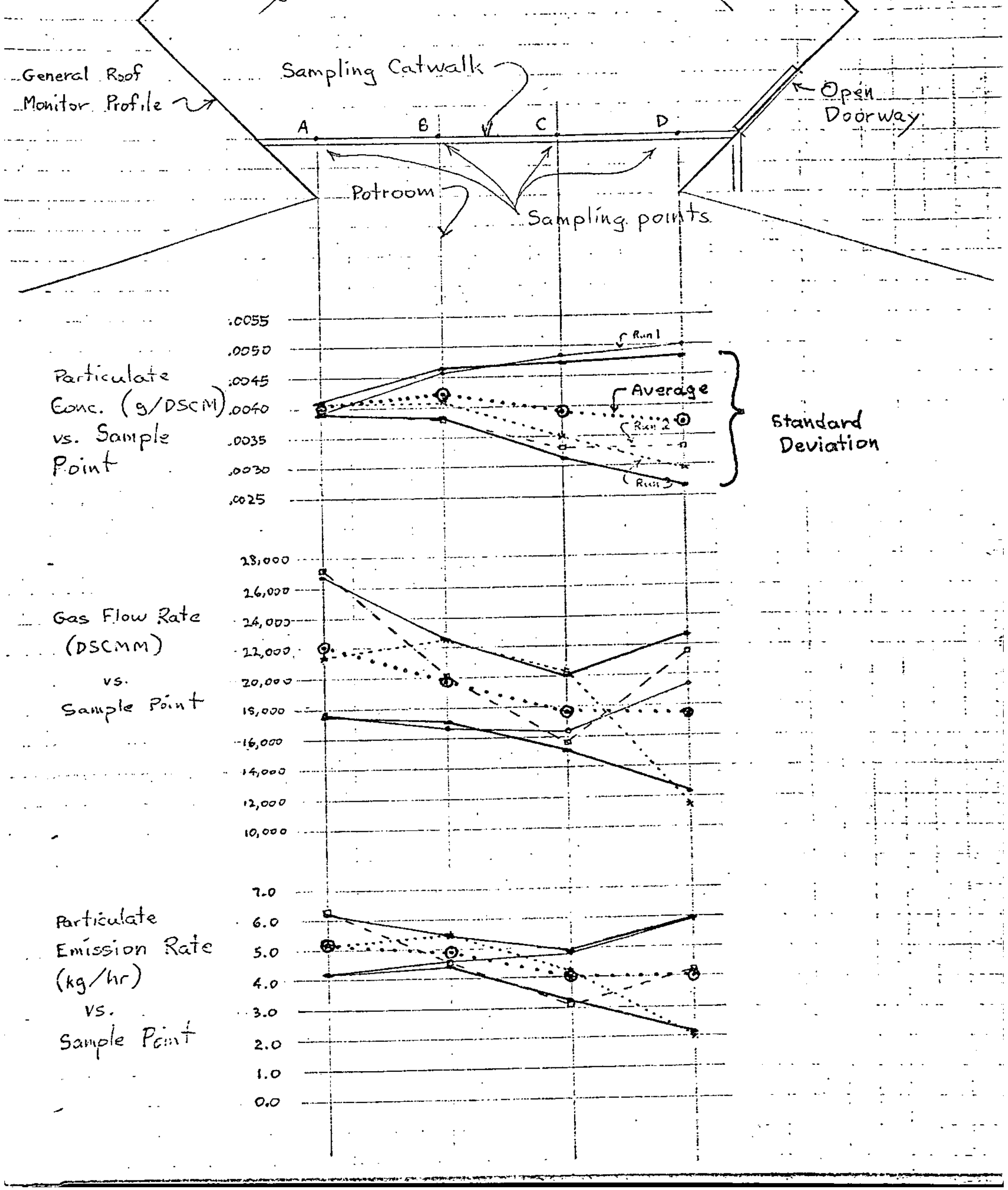
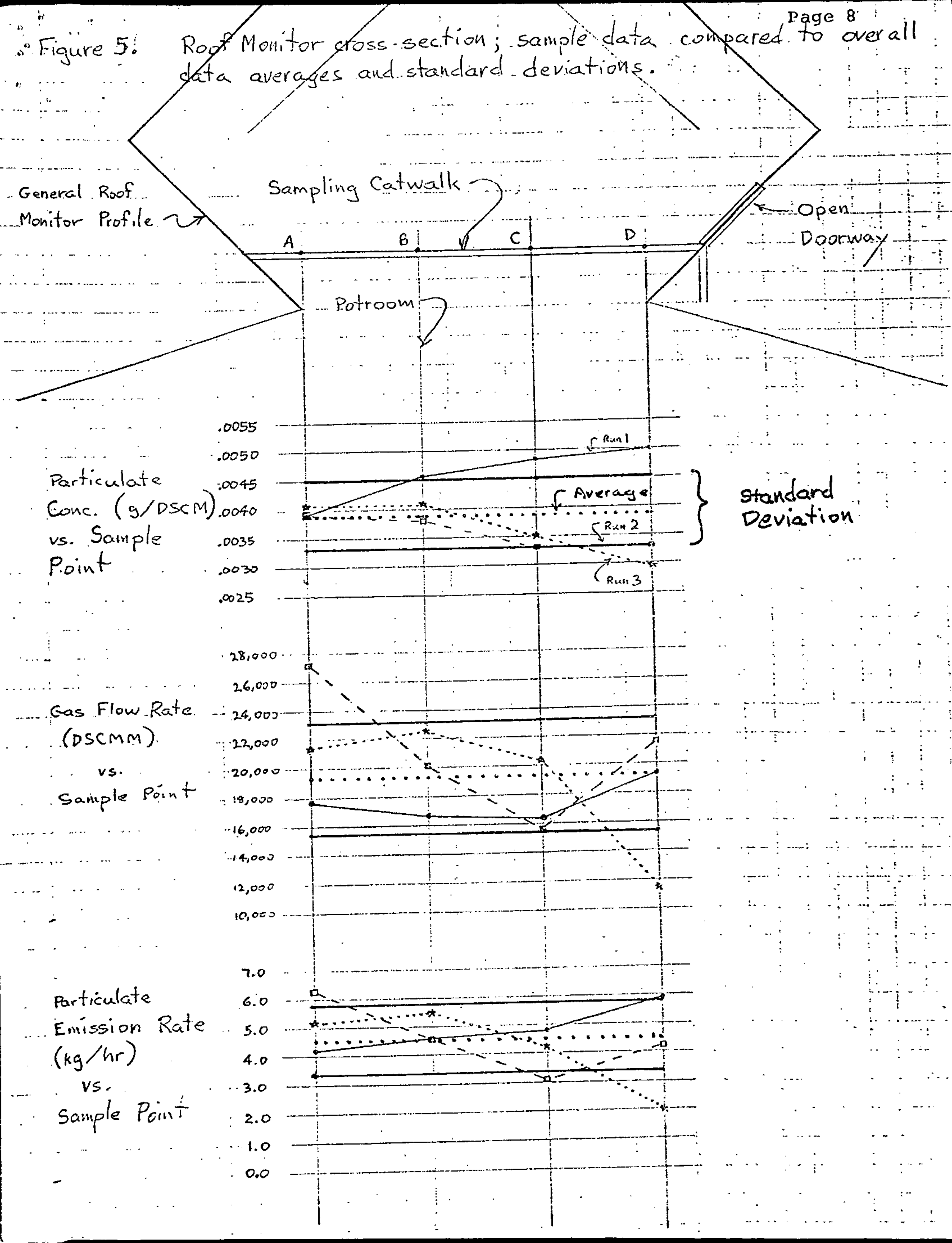


Figure 5: Roof Monitor cross-section; sample data compared to overall data averages and standard deviations.



Department of Ecology

EMISSION TEST DATA SUMMARY (METRIC)

Table 1a

Plant Name ~~REYNOLDS METALS CO.~~
Address P. O. Box 999
City Longview County Cowlitz
State Washington Zip Code 98632
NEDS 49-0480-193-0015

Source Potroom 52 Roof Monitor
Industry Type Aluminum Reduction Mill
Unit Capacity
SCC
Fuel Type
Tested at Inlet Outlet x

Type of Control Equipment

Reason Tested: Spec. Study Compliance w/Fed. State x Local
Personnel Present A. Butler, J. Willenberg

Pollutant Measured Particulate
Method EPA Method 13 and "dry" method

Stack Height, m. Approx. 50
Cross-sectional Area, sq. m. 1011
Sampling Location: Diameters Downstream of a Disturbance Less than 1
Test Number 82-2

Run Number	1A	1B	1C	1D	Run 1 Average
Date: Mo., Day, Yr.	2/1/82	2/1/82	2/1/82	2/1/82	
Operating Rate Alum. Mg/day	0.630	0.630	0.630	0.630	2.518*
Gas Composition % CO_2	0.0	0.0	0.0	0.0	0.0
% O_2	21.0	21.0	21.0	21.0	21.0
% N_2	79.0	79.0	79.0	79.0	79.0
% Other					
% H_2O	0.63	N.A.	0.42	N.A.	0.53
Estimated Mole Wt., Wet					
Excess Air, %					
Gas Flow Data					
Gas Pressure, mm. Hg.	30.40	30.40	30.40	30.40	30.40
Gas Temp. °C	17	17	17	17	17
No. of Traverse Points	1	1	1	1	1
Avg. Stack Velocity, AMPS	1.16	1.07	1.07	1.27	1.14
Gas Flow Rate, DSCMM	17,900	16,700	16,300	19,400	70,300*
Sample Information					
Volume Sampled, DSCM	12.53	11.35	11.99	12.72	
Sample Duration, min.	1262.7	1256.8	1263.8	1251.2	
Nozzle Dia., mm.	12.7	12.7	12.7	12.7	
~~Isokinetic Rate~~, %	111	108	116	105	
Results	Particulate				
Conc., g/DSCM, ppm	0.0039	0.0046	0.0048	0.0050	0.0046
Emission Rate, kg/hr	4.20	4.61	4.68	5.86	19.35*
Process Factor, g/kg	6.67	7.33	7.43	9.31	7.68
Results					
Conc., g/DSCM, ppm					
Emission Rate, kg/hr					
Process Factor, g/kg					
Results					
Conc., g/DSCM, ppm					
Emission Rate, kg/hr					
Process Factor, g/kg					
Other Measurements					

Comments: *Total of runs 1A, 1B, 1C and 1D

Washington Department of Ecology

EMISSION TEST DATA SUMMARY (METRIC)

TABLE 2

Plant Name: REYNOLDS METALS CO.
Address: P. O. Box 999
City: Longview County: Cowlitz
State: Washington Zip Code: 98632
NEDS:

Source: Potroom 52 roof monitor
Industry Type: Aluminum Reduction Mill
Unit Capacity:
SCC:
Fuel Type:
Tested at Inlet: Outlet: x

Type of Control Equipment:

Reason Tested: Spec. Study ____ Compliance w/Fed. ____ State x Local ____
Personnel Present: A. Butler, J. Willenberg

Pollutant Measured: Particulate
Method: EPA Method 13 and "dry" method

Stack Height, m.: Approx. 50
Cross-sectional Area, sq. m.: 1011
Sampling Location: Diameters Downstream of a Disturbance: Less than 1
Test Number: 82-2

Run Number	2A	2B	2C	2D	Average
Date: Mo., Day, Yr.	2/3/82	2/3/82	2/3/82	2/3/82	
Operating Rate Alum.,Mg/day	0.630	0.630	0.630	0.630	2.518*
Gas Composition % CO_2	0.0	0.0	0.0	0.0	0.0
% O_2	21.0	21.0	21.0	21.0	21.0
% N_2	79.0	79.0	79.0	79.0	79.0
% Other					
% H_2O	N.A.	0.24	N.A.	0.38	0.31
Estimated Mole Wt., Wet					
Excess Air, %					
Gas Flow Data					
Gas Pressure, mm. Hg.	30.46	30.46	30.46	30.46	30.46
Gas Temp. °C	13	13	13	13	13
No. of Traverse Points	1	1	1	1	1
Avg. Stack Velocity, AMPS	1.71	1.28	1.00	1.35	
Gas Flow Rate, DSCMM	27,100	20,200	15,800	21,400	Σ84,400*
Sample Information					
Volume Sampled, DSCM	14.64	12.68	10.65	10.54	
Sample Duration, min.	1489.6	1490.3	1489.7	1489.6	
Nozzle Dia., mm.	12.7	12.7	12.7	12.7	
~~Isokinetic Rate, %~~	72	84	90	66	
Results					
Conc., g/DSCM ,ppm	0.0039	0.0038	0.0033	0.0033	0.0036
Emission Rate, kg/hr	6.26	4.58	3.08	4.19	18.12*
Process Factor, g/kg	9.95	7.28	4.90	6.66	7.20
Results					
Conc., g/DSCM , ppm					
Emission Rate, kg/hr					
Process Factor, g/kg					
Results					
Conc., g/DSCM , ppm					
Emission Rate, kg/hr					
Process Factor, g/kg					
Other Measurements					

Comments: *Totals of runs 2A, 2B, 2C and 2D.

Department of Ecology

EMISSION TEST DATA SUMMARY (METRIC)

TABLE 3

Plant Name: REYNOLDS METALS CO.
Address: P. O. Box 999
City: Longview County: Cowlitz
State: Washington Zip Code: 98632
NEDS: 49-0480-193-0015

Source: Potroom 52 roof monitor
Industry Type: Aluminum Reduction Plant
Unit Capacity:
SCC:
Fuel Type:
Tested at Inlet: Outlet: x

Type of Control Equipment:

Reason Tested: Spec. Study Compliance w/Fed. State x Local
Personnel Present: A. Butler, J. Willenberg

Pollutant Measured: Particulate Method: EPA Method 13 and "dry" method

Stack Height, m.: Approx. 50 Cross-sectional Area, sq. m.: 1011
Sampling Location: Diameters Downstream of a Disturbance: Less than 1
Test Number: 82-2

Run Number	3A	3B	3C	3D	Run 3 Average
Date: Mo., Day, Yr.	2/4/82	2/4/82	2/4/82	2/4/82	
Operating Rate Alum., Mg/day	0.630	0.630	0.630	0.630	2.518*
Gas Composition % CO_2	0.0	0.0	0.0	0.0	0.0
% O_2	21.0	21.0	21.0	21.0	21.0
% N_2	79.0	79.0	79.0	79.0	79.0
% Other					
% H_2O	N.A.	.18	N.A.	.29	.24
Estimated Mole Wt., Wet					
Excess Air, %					
Gas Flow Data					
Gas Pressure, mm. Hg.	30.51	30.51	30.51	30.51	30.51
Gas Temp. °C	13	13	13	13	13
No. of Traverse Points	1	1	1	1	
Avg. Stack Velocity, AMPS	1.34	1.41	1.29	0.72	1.19
Gas Flow Rate, DSCMM	21,300	22,300	20,400	11,400	75,300*
Sample Information					
Volume Sampled, DSCM	13.30	14.22	13.04	12.86	
Sample Duration, min.	1449.0	1448.1	1448.7	1448.4	
Nozzle Dia., mm.	12.7	12.7	12.7	12.7	
Isokinetic Rate, %	86.2	87.9	88.0	155	
Results					
Conc., g/DSCM, ppm	0.0041	0.0041	0.0035	0.0029	0.0037
Emission Rate, kg/hr	5.23	5.47	4.22	1.99	16.90*
Process Factor, g/kg	8.29	8.68	6.71	3.16	6.71
Results					
Conc., g/DSCM, ppm					
Emission Rate, kg/hr					
Process Factor, g/kg					
Results					
Conc., g/DSCM, ppm					
Emission Rate, kg/hr					
Process Factor, g/kg					
Other Measurements					

Comments: *Totals of runs 3A, 3B, 3C and 3D

State of Washington Department of Ecology

EMISSION TEST DATA SUMMARY (METRIC)

Plant Name REYNOLDS METALS COMPANY
Address P. O. Box 999
City Longview County Cowlitz
State Wash. Zip Code 98632
NEDS 49-0480-193-0015

Source Potroom 52 roof monitor
Industry Type Aluminum Reduction Mill
Unit Capacity
SCC
Fuel Type
Tested at Inlet ____ Outlet x

Type of Control Equipment

Reason Tested: Spec. Study ____ Compliance w/Fed. ____ State x Local ____
Personnel Present A. Butler, J. Willenberg

Pollutant Measured Particulate
Method EPA Method 13 and "dry" method

Stack Height, m. Approx. 50
Cross-sectional Area, sq. m. 1011
Sampling Location: Diameters Downstream of a Disturbance less than 1
Test Number 82-2

Run Number	Run 1	Run 2	Run 3	Average
Date: Mo., Day, Yr.	3/1/82	3/3/82	3/4/82	
Operating Rate Alum. Mg/day	2.518	2.518	2.518	2.518
Gas Composition % CO_2	0.0	0.0	0.0	0.0
% O_2	21.0	21.0	21.0	21.0
% N_2	79.0	79.0	79.0	79.0
% Other				
% H_2O	0.53	0.31	0.24	0.36
Estimated Mole Wt., Wet				
Excess Air, %				
Gas Flow Data				
Gas Pressure, mm. Hg.	30.40	30.46	30.51	30.46
Gas Temp. °C	14	14	14	14
No. of Traverse Points	4	4	4	
Avg. Stack Velocity, AMPS	1.14	1.34	1.19	1.22
Gas Flow Rate, DSCMM	70,300	84,400	75,300	76,700
Sample Information				
Volume Sampled, DSCM				
Sample Duration, min.				
Nozzle Dia., mm.				
Isokinetic Rate, %				
Results				
Conc., g/DSCM, ppm	0.0046	0.0036	0.0037	0.0039
Emission Rate, kg/hr	19.35	18.12	16.90	18.12
Process Factor, g/kg	7.68	7.20	6.71	7.20
Results				
Conc., g/DSCM, ppm				
Emission Rate, kg/hr				
Process Factor, g/kg				
Other Measurements				

Comments:

ECY 020-38
Rev. 1/81

State of Washington
Department of Ecology

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Test No. ____
Date 2/2/82

Plant Reynolds
Sampling Location Rm 52 Center
Sample Type Part, Fl - Wet
Run Number 1A
Operator JD
Ambient Temperature ____
Barometric Pressure 30.40
Static Pressure ____
Stack Diameter ____
Orsat CO_2 ____ O_2 ____ CO ____

Probe Length, Type, Factor ____
Nozzle I.D. .50
Assumed Moisture, % ____
Sample Box Number ____ Meter
Water Volume Collected ____ Impingers + ____ Silica Gel = 60.50 ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-128	
Final			
Tare			
Gain	.0046	.0444	

.0490

$\bar{V}$ on reverse side

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
		4948.13	c	0.37 FLOW	RATE	63							
8:48		5256.3											
	1262.7	5383.71											
						Calc. Data:							
						F_{H_2O}	= .0063						
	$\bar{V}$ = 69.44	m/min				Q_s	= 17,586		SDC	MM			
						V_s	= 12.5321		DSCM				
	Area 10,880 ft²					C_p	= 0.0039		G/DSCM				
						R_p	= 4.196		KG/HR				
	8' x 1360	Zone area	2,720 ft²			E	= 6.665		G/KG				
						I	= 110.69%						

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL	min	ASFM		OUT	IN	OUTLET $(T_{m_{out}})$, °F m	INLET $(T_{m_{in}})$, °F m/min	
	1 min	1	2								[illegible]		
A		84400 m	84482	82	1.03	1	0.37				87,757	69.44	
B		84482	84558	76	.95	1	0.34				81,336	64.36	
C		84558	84638	80	1.00	1	0.36				85,617	67.75	
D		84638	84728	90	1.13	1	0.40				96,319	76.21	

COMMENTS

ECY 020-71 (Rev 12/78)

$$m \times \frac{1\,ft}{.3048\,m} = ft$$

State of Washington Department of Ecology

Test No. ______

Date ______

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ______

Sampling Location ______

Sample Type part, EF, dry

Run Number 1B

Operator ______

Ambient Temperature ______

Barometric Pressure ______

Static Pressure ______

Stack Diameter ______

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ______

Nozzle I.D. ______

Assumed Moisture, % ______

Sample Box Number ______

Water Volume Collected: ______ Impingers + ______ Silica Gel = 38.97 ml Meter

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-162	
Final			
Tare			
Gain	.0054	.0469	

.0523

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IMPINGER TEMP °F IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	DRY GAS METER TEMPERATURE INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
	1612	378.418		0.34									
	+1000.6	695.300											
	+1256.8	772.890											
						Calc.		Data					
						F_{H_2O}	=	0					
						Q_s	=	16683			SDCMM		
	$\bar{v}$ = 64.36					V_s	=	11.3494			DSCM		
						C_p	=	0.0046			G/DSCM		
						R_p	=	4.613			KG/HR		
						F	=	7.327			G/KG		
						I	=	107.98					

State of Washington
Department of Ecology

Test No. ____________

Date ____________

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ____________

Sampling Location ____________

Sample Type part. fl- ~~dry~~ wet

Run Number 1C

Operator ____________

Ambient Temperature ____________

Barometric Pressure ____________

Static Pressure ____________

Stack Diameter ____________

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ____________

Nozzle I.D. ____________

Assumed Moisture, % ____________

Sample Box Number ____________ Meter ______

Water Volume Collected ______ Impingers + ______ Silica Gel = ~~22.80~~ 38.90 ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-122	
Final			
Tare			
Gain	.0036	.0538	

.0574

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
		9910.96	04200	0.36									
5:45		0237.35	89817			73							
	1263.8	10337.86											
							Calc. Data						
						FH_2O =	0.0042						
						Q_s =	16,300		SDCMM				
	$\bar{v}$ = 64.36					V_s =	11.9947		DSCM				
						C_p =	0.0048		G/DSCM				
						R_p =	4.6802		KG/HR				
						F =	7.4344		G/KG				
						I =	116.15%						

State of Washington
Department of Ecology

Test No. ____________

Date ____________

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ____________

Sampling Location ____________

Sample Type part., flt dry

Run Number 1D

Operator ____________

Ambient Temperature ____________

Barometric Pressure ____________

Static Pressure ____________

Stack Diameter ____________

Orsat CO_2 ________ O_2 ________ CO ________

Probe Length, Type, Factor ____________

Nozzle I.D. ____________

Assumed Moisture, % ____________

Sample Box Number ____________ Meter

Water Volume Collected ________ (Impingers) + ________ (Silica Gel) = ________ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-161	
Final			
Tare			
Gain	.0035	.0606	

.0641

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	
		753.573		0.40									
~~g-95~~		~~337.55~~	-			~~75~~							
	+966	096.100											
	1251.2	1195.786											
							Calc. Data					Average run 1	
							F_{H_2O} = ø						
							Qs = 19,384 SDCMM						
	$\bar{v}$ = 76.21						Vs = 12.7230 DSCM						
							Cp = 0.0050 G/DSCM					0.0096 G/DSCM	
							Rp = 5.8594 KG/HR					19.3486 G/HR (total)	
							F = 9.3075 G/KG					7.6836 G/KG	
							I = 104.65%						

State of Washington
Department of Ecology

Test No. ______

Date 2-2-82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ______

Sampling Location ______

Sample Type part. fl- dry

Run Number 2A

Operator ______

Ambient Temperature ______

Barometric Pressure 30.46

Static Pressure ______

Stack Diameter ______

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ______

Nozzle I.D. ______

Assumed Moisture, % ______

Sample Box Number ______ Meter ______

Water Volume Collected ______ (Impingers) + ______ (Silica Gel) = ______ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-120	
Final			
Tare			
Gain	.0047	.0517	

.0564

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IMPINGER TEMP °F IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	DRY GAS METER TEMPERATURE INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
1525	000.00	773.169			.41								
	1489.6	1281.035											
						Calc	Data						
						FH_2O =	ø						
						Qs =	27,098		SDCMM				
						Vs =	14.6407		DSCM				
						Cp =	0.0037		G/DSCM				
						Rp =	6.2634		KG/HR				
						F =	9.9491		G/KG				
	$\bar{v}$ = 102.74					I =	72.35		%				
						Part. size final					908.17 @ 85 min		
	time	2B anemom.					set N						
	0915	63915											
	0847	72174											

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL	factor			OUT	IN	OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	
		Initial	Final	Diff.									
	A	84726	84819	~~94~~	.41	1.34					102.739		
	B	84819	84887	68	.30	1.00					76.671		
	C	84887	84940	53	.24	0.78					59.803		
	D	84940	84996	56	.25	1.06					81.271		

COMMENTS

ECY 020-71 (Rev 12/78)

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	
		Initial	Final	DiFF.		factor							
	A	84728	84819	~~91~~	.41	1.34					102.739		
	B	84819	84887	68	.30	1.00					.76.671		
	C	84887	84940	53	.24	0.78					59.803		
	D	84940	84996	56	.25	1.06					81.271		

COMMENTS

ECY 020-71 (Rev 12/78)

State of Washington
Department of Ecology

Test No. ______

Date ______

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ______
Sampling Location ______
Sample Type part. fl⁻, wet
Run Number 2B
Operator ______
Ambient Temperature ______
Barometric Pressure ______
Static Pressure ______
Stack Diameter ______
Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ______
Nozzle I.D. ______
Assumed Moisture, % ______
Sample Box Number ______
Water Volume Collected ______ (Impingers) + ______ (Silica Gel) = 22.80 ml (Meter)

Particulate Weight

	Wash	Filter	Impingers
ID No.		178	
Final			
Tare			
Gain	.0047	.0433	

.0480

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
	000.00	5384.42	88834 - Final			55							
	1440.3	5832.15											
						Calc	Data						
						FH_2O =	0.0024						
						Qs =	20,174		SDCMM				
						Vs =	12.6774		DSCM				
	$\bar{v}$ = 76.67					Cp =	0.0038		G/DSCM				
						Rp =	4.5831		KG/HR				
						F =	7.2802		G/KG				
						I =	84.117		%				

State of Washington
Department of Ecology

Test No. ______

Date ______

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ______

Sampling Location ______

Sample Type part., FI, dry

Run Number 2C

Operator ______

Ambient Temperature ______

Barometric Pressure ______

Static Pressure ______

Stack Diameter ______

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ______

Nozzle I.D. ______

Assumed Moisture, % ______

Sample Box Number ______ Meter

Water Volume Collected ______ (Impingers) + ______ (Silica Gel) = ______ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-288	
Final			
Tare			
Gain	.0031	.0316	

.0347

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	
	000.00	196.200			.24								
	1489.7	565.765											
						Calc. Data							
					F_{H_2O}	0							
					Q_s	15.773	DSCMM						
					V_s	10.6538	DSCM						
					C_p	0.0033	G/DSCM						
					R_p	3.0823	KG/HR						
	$\bar{v}$ = 59.80				F'	4.8962	G/KG						
					I	90.45 %							

State of Washington
Department of Ecology

Test No. ______

Date ______

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ______
Sampling Location ______
Sample Type part, F1 wet
Run Number 20
Operator ______
Ambient Temperature ______
Barometric Pressure ______
Static Pressure ______
Stack Diameter ______
Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ______
Nozzle I.D. ______
Assumed Moisture, % ______
Sample Box Number ______ Meter
Water Volume Collected ______ (Impingers) + ______ (Silica Gel) = 30.50 ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		131	
Final			
Tare			
Gain	.0038	.0307	

.0345

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IMPINGER TEMP °F IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	DRY GAS METER TEMPERATURE INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
	000.0	328.49											
	1459.6	694.11											
						Calc Data					Ave. Run 2		
					FH_2O	0.0038							
					Q_s	21.354 DSCMM							
					V_s	10.5401 DSCM							
					C_p	0.0033 G/DSCM					0.0036 G/DSCM		
					R_p	4.1938 KG/HR					18.1226 KG/HR (Total)		
	$\bar{V}$ = 81.27				F	6.6617 G/KG					7.1968		
					I	66.0998 %							

State of Washington
Department of Ecology

Test No. ______
Date 2-4-92

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant Reynolds.
Sampling Location A
Sample Type part, fl, dry
Run Number 3A
Operator J.D.
Ambient Temperature ______
Barometric Pressure 30.51
Static Pressure ______
Stack Diameter ______
Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ______
Nozzle I.D. .50
Assumed Moisture, % Atm.
Sample Box Number ______ Meter ______
Water Volume Collected ______ (Impingers) + ______ (Silica Gel) = ______ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-192	
Final			
Tare			
Gain	.0043	.0502	

.0545

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IN	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	INLET ($T_{m_{in}}$), °F	PUMP VACUUM in. Hg
1057	000.00	281.441											
1107	1449.0	741.668											
						Calc Data							
						FH2O= 0.0000							
						Qs = 21,227 DSCMM							
	72296	v̄ = 80.35				Vs = 13.2978 DSCM							
1107						Cp = 0.0041 G/DSCM							
						Rp = 5.2199 KG/HR							
						F = 8.2917 G/KG							
A	85000	85076	.76	.95	0.34	I = 86.2426%							
B	85076	85156	.80	1.00	.36								
C	75156	85229	.73	.91	.33								
D	85229	85270	.41		.18								

State of Washington
Department of Ecology

Test No. ______________

Date ______________

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ______________

Sampling Location B

Sample Type Part., F(?), Wet

Run Number 3B

Operator J.D.

Ambient Temperature ______________

Barometric Pressure ______________

Static Pressure ______________

Stack Diameter ______________

Orsat CO_2 ________ O_2 ________ CO ________

Probe Length, Type, Factor ______________

Nozzle I.D. ______________

Assumed Moisture, % ______________

Sample Box Number ______________

Water Volume Collected ________ (Impingers) + ________ (Silica Gel) = 19.90 (Meter) ml

	Particulate Weight		
	Wash	Filter	Impingers
ID No.		C-133	
Final			
Tare			
Gain	.0042	.0539	

.0581

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IMPINGER TEMP °F IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	DRY GAS METER TEMPERATURE INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
1057	000.00	5824.40									90		
	1148.1	6316.79				Calc	Data						
						F_{H_2O} =	0.0018						
						Q_s =	22,304 DSCMM						
						V_s =	14.2237 DSCM						
						C_p =	0.0041 G/DSCM						
						R_p =	5.4664 KG/HR						
		$\bar{v}$ = 84.58				F =	8.6831 G/KG						
						I =	87.85 %						

State of Washington
Department of Ecology

Test No. ____________

Date ____________

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ____________

Sampling Location C

Sample Type part, Fl-, dry

Run Number 3C

Operator ____________

Ambient Temperature ____________

Barometric Pressure ____________

Static Pressure ____________

Stack Diameter ____________

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ____________

Nozzle I.D. ____________

Assumed Moisture, % ____________

Sample Box Number ____________ Meter ____________

Water Volume Collected ______ (Impingers) + ______ (Silica Gel) = ______ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C-379	
Final			
Tare			
Gain	.0019	.0431	

.0450

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
1057	0	566.194											
1106	1448.7	1017.655											
		$\bar{v}$ = 77.48											

Calc Data

F_{H_2O} 0

Q_s = 20,390 DSCMM

V_s = 13.0360 DSCM

C_p = 0.0035 G/DSCM

R_p = 4.2231 KG/HR

F = 6.7083 G/KG

I = 88.04 %

State of Washington
Department of Ecology

Test No. ______

Date ______

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ______

Sampling Location D

Sample Type part, #1, wet

Run Number 3D

Operator ______

Ambient Temperature ______

Barometric Pressure ______

Static Pressure ______

Stack Diameter ______

Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ______

Nozzle I.D. ______

Assumed Moisture, % ______

Sample Box Number ______

Water Volume Collected ______ Impingers + ______ Silica Gel = Meter 28.3D ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		C117	
Final			
Tare			
Gain	.0021	.0352	

.0373

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O DESIRED	ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IN	DRY GAS METER TEMPERATURE OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
1057	600.0	694.52											
1–	1445.4	1140.05				55					70		
						Calc. Data						Ave Run 3	
						FH2O =	0.0029						
						Q =	11,420 DSCMM						
						Vs =	12.8648 DSCM						
		$\bar{v}$ = 43.35				Cp =	0.0029 G/DSCM					0.0037 G/DSCM	
						Rp =	1.9866 KG/HR					16.8960 KG/HR (Total)	
Aver						F =	3.1556 G/KG					6.7097 G/KG	
1106	72296					I =	155.1582%						
1107	74175											X̄ Overall Ave	
												0.0039 G/DSCM ±.0006	
												18.1227 KG/HR	
												7.1967 G/KG	

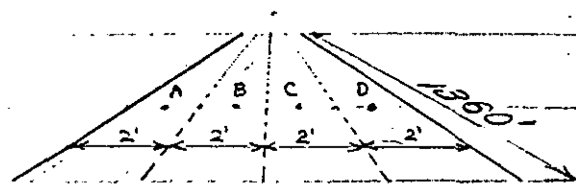
Sample Calculation
Test Run 1A

$$V_s = (5383.71 - 4948.13)\left(\frac{772.16}{760}\right)\left(\frac{293}{290}\right) = 442.57\ ft^3 = 12.53\ m^3$$

$$c_p = \frac{M_p}{V_s} = \frac{0.0490\ g}{12.53\ m^3} = 3.910 \times 10^{-3}\ \frac{g}{m^3}$$

$$F_{H_2O} = \frac{1.315\times10^{-3}\ W_w}{1.315\times10^{-3}\ W_w + V_s} = \frac{1.315\times10^{-3}\times 60}{(1.315\times10^{-3}\times60) + 12.53} = 0.0063$$

$$\vec{V}_{ave} = 69.44\ \frac{m}{min}$$



$$Area_A = (360')(2')\left(\frac{1\ m^2}{10.76\ ft^2}\right) = 252.70\ m^2$$

$$Q = (69.44)(252.70)\left(\frac{772.16}{760}\right)\left(\frac{293}{290.22}\right)(1 - .0063) = 17{,}885.37\ \frac{m^3}{min}$$

$$R_p = \left(3.910\times10^{-3}\ \frac{g}{m^3}\right)\left(17{,}885.37\ \frac{m^3}{min}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{1\ kg}{1000\ g}\right) = 4.196\ \frac{kg}{hr}$$

$$F = \frac{4.196\ g/hr}{kg/hr}$$

$D_n = .50\ inch = 1.27\ cm$

$A_n = 1.27\times10^{-4}\ m^2$

$$I = \frac{12.53\ m^3}{(1.27\times10^{-4}\ m^2)(1-.0063)(69.44\ \frac{m}{min})(1262.7\ min)}\left(\frac{760}{772.16}\right)\left(\frac{290.22}{293}\right) = 1.104$$

or 110.4%

State of Washington
Department of Ecology

REQUEST FOR ANALYSIS

Page 28
Date 2/9/82

SOURCE Reynolds Aluminum REQUESTED BY STAT

LOCATION Longview COUNTY COLLECTED BY STAT

DATE WERE (WILL BE) COLLECTED 2/1-5/82 APPROVED BY

SAMPLES WILL ARRIVE: DATE 2/9/82 APPROXIMATE TIME 1500 CARRIER

PRIORITY: REASONABLY SOON X AS SOON AS POSSIBLE X EMERGENCY

ROUTE DATA SUMMARY TO: A. Butler, STAT, NWRD

PROGRAM CODE 030 - 1 - 012 ☐ Amb. Mon. ☒ Compliance ☐ Inspection ☐ Class, #

☐ Investigation ☐ Survey ☐ Spill ☐ Complaint ☐ Other (describe)

OTHER INFORMATION: Partic. and. Filters. NOTE! Most filters are BROKEN.. please weigh containers full & empty, as well as weighing final filter wt. THANK

	Type of Analyses Required	Number of Samples	~~Approx. Range~~ Can, lid + filter (g)	Preservative Type-Vol. Clean can + lid (g)	Laboratory Number Filter Preweight	Analyst	Date	Notes Filter only (g)
1A	C-128		39.2618	39.1756	.0415 822170	MWK	2/18/82	0.0856
1B	C-162		37.0144	36.9251	.0421			0.0889
1C	C-122		39.7801	39.6866	.0394 822182			0.0935
1D	C-161		37.9524	37.8512	.0403			0.1003
2A	C-120		39.2177	39.1242	.0415			0.0931
2B	C-172		38.7967	38.7086	.0445			0.0856
2C	C-288		38.8095	38.7339	.0437			0.0738
2D	C-131		38.7313	38.6558	.0445			0.0747
3A	C-192		39.3112	39.2171	.0436			0.0946
3B	C-133		39.2187	39.1205	.0440			0.0987
3C	C-379		37.8386	37.7505	.0447			0.0889
3D	C-117		39.6476	39.5713	.0408			0.0765
BLANK	C-167		38.4381	38.3937	.0441			0.0443

Fill out as completely as possible. Some Analyses (bacteriological, biological, BOD, etc.) and large numbers of samples must be scheduled ahead of time. Specific questions should be directed to the Analyst supervising the particular analysis desired.

ECY 040-2-62
Rev. 7/81

State of Washington
Department of Ecology

REQUEST FOR ANALYSIS

Date 2/9/82

SOURCE Reynolds Aluminum REQUESTED BY STAT

LOCATION Longview COUNTY COLLECTED BY STAT

DATE WERE (WILL BE) COLLECTED 2/1-5/82 APPROVED BY

SAMPLES WILL ARRIVE: DATE 2/9/82 APPROXIMATE TIME 1500 CARRIER

PRIORITY: REASONABLY SOON X AS SOON AS POSSIBLE X EMERGENCY

ROUTE DATA SUMMARY TO: A. Butler, STAT, NWRD

PROGRAM CODE 030 - 1 - 032 ☐ Amb. Mon. ☒ Compliance ☐ Inspection ☐ Class, #

☐ Investigation ☐ Survey ☐ Spill ☐ Complaint ☐ Other (describe)

OTHER INFORMATION: Particulate anal. NO2 RINSE samples are all 100ml of 200ml total

Type of Analyses Required	Number of Samples	~~Approx. Range~~ Postweight(g)	~~Preservative Type-Vol.~~ Preweight(g)	For Lab Use Only: Laboratory Number	Analyst	Date	Notes ΔWt(g)
1A		128.1775	128.1729	82-2-158	MMK	2/17/82	0.0046
1B		134.9871	134.9817	to			0.0054
1C		132.0073	132.0037	82-2-169			0.0036
1D		108.5065	108.5030				0.0035
2A		95.5278	95.5231				0.0047
2B		86.9265	86.9218				0.0047
2C		85.9826	85.9795				0.0031
2D		95.0357	95.0319				0.0038
3A		96.8310	96.8267				0.0043
3B		96.7671	96.7629				0.0042
3C		104.4130	104.4111				0.0019
3D		90.3158	90.3137				0.0021

Fill out as completely as possible. Some Analyses (bacteriological, biological, BOD, etc.) and large numbers of samples must be scheduled ahead of time. Specific questions should be directed to the Analyst supervising the particular analysis desired.

ECY 040-2-62

State of Washington
Department of Ecology

Test No. ______

Date 2-4-82

METHOD 5 - PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

Plant ______
Sampling Location ~~[illegible]~~ Vent 21 ~~[illegible]~~ Pot room 3 2
Sample Type part. size
Run Number 1
Operator ______
Ambient Temperature ______
Barometric Pressure 2-5-82 30.49
Static Pressure ______
Stack Diameter ______
Orsat CO_2 ______ O_2 ______ CO ______

Probe Length, Type, Factor ______
Nozzle I.D. ______
Assumed Moisture, % ______
Sample Box Number ______ Meter
Water Volume Collected ______ Impingers + ______ Silica Gel = ______ ml

Particulate Weight

	Wash	Filter	Impingers
ID No.		0	
Final			
Tare			
Gain			

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (ΔP_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O: DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in. H_2O: ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F: OUT	IMPINGER TEMP °F: IN	DRY GAS METER TEMPERATURE: OUTLET $(T_{m_{out}})$, °F	DRY GAS METER TEMPERATURE: INLET $(T_{m_{in}})$, °F	PUMP VACUUM in. Hg
	11:35	908.40				55							<1
	12:01	1341.57									80		
	$\bar{v} = \frac{184492 - 85339}{1466}$		$= 67.64$										
	85267	85339	1		.32								
11:39	85339	84492											

Sample Calculation for Cascade Impactor

Mean Free Path

$$l = 1.04 \frac{\mu}{P_s} \sqrt{1 + 0.00367T}$$

μ = viscosity, poise, 1.8×10^{-4}

P_s = pressure, in. Hg, 30.49

T = Temp, ^0C, 13

$$l = 6.30 \times 10^{-6} \text{ cm}$$

Iterative Solution of D_{50}

$$D_{50} = \left(\frac{2.05 \; \mu \; D_6^3 \; P_6 \; X_6}{C \; \rho_p \; Q_s \; P_s} \right)^{\frac{1}{2}}$$

D_6 = jet diameter for stage 6, .0343 cm

X_6 = number of jets on stage 6, 110

ρ_p = density of particles, 1.0 $\frac{gm}{cc}$

P_6 = pressure on stage mm Hg, ~ 765

C = Cunningham Correction Factor, dimensionless

Q = Volumetric Flow Rate at Stack Conditions
261 cm^3/sec

P_s = Stack Pressure, 774 mm Hg

$$D_{50} = 7.87 \times 10^{-5} \left(\frac{1}{C}\right)^{\frac{1}{2}} \text{ cm}$$

$$C = 1 + \frac{2\ell}{D_{50}}\left(1.23 + .41 \exp\left(\frac{-.44\ D_{50}}{\ell}\right)\right)$$

$$= 1 + \frac{2(6.3 \times 10^{-6})}{D_{50}}\left[1.23 + .41 \exp\left(\frac{-.44\ D_{50}}{6.3 \times 10^{-6}}\right)\right]$$

Trail 1 $D_{50} = .6 \times 10^{-4}$ cm

$C = 1.26$

$D_{50} = .70 \times 10^{-4}$ cm

Trail 2 $D_{50} = .65 \times 10^{-4}$

$C = 1.24$

$D_{50} = .71$

Trail 3 $D_{50} = .71 \times 10^{-4}$

$C = 1.22$

$D_{50} = .71 \times 10^{-4}$

Page 33

URE = 55.0 F = 12.8 C SAMPLING DURATION = 146.60 MIN

= 55.0 F = 12.8 C

30.49 IN. OF HG MAX. PARTICLE DIAMETER = 80.0 MICROMETERS

0.00 N2 = 78.21 O2 = 20.79 H2O = 1.00

GR/DNCF 2.0023E 01 MG/ACM 1.9292E 01 MG/DNCM

S3	S4	S5	S6	S7	FILTER
3	4	5	6	7	8
6.80	3.02	1.65	1.20	0.53	
3.92	1.40	0.65	0.64	1.01	1.71
3.23E 00	1.15E 00	5.35E-01	5.27E-01	8.31E-01	1.41E 00
3.08	17.11	14.33	11.60	7.30	
4.62E 00	3.43E 00	2.87E 00	2.32E 00	1.46E 00	
4.45E 00	3.30E 00	2.77E 00	2.24E 00	1.41E 00	
2.02E-03	1.50E-03	1.25E-03	1.02E-03	6.38E-04	
1.95E-03	1.44E-03	1.21E-03	9.78E-04	6.15E-04	
1.04E 01	4.53E 00	2.23E 00	1.40E 00	7.99E-01	3.77E-01
3.82E 00	3.27E 00	2.03E 00	3.82E 00	2.37E 00	4.68E 00
1.52E 07	6.72E 07	3.50E 08	2.64E 09	8.85E 09	1.66E 11

HG.

1

IMPACTOR FLOWRATE = 0.282 ACFM IMPACTOR TEMPERATURE = 55.0 F

IMPACTOR PRESSURE DROP = 0.5 IN. OF HG STACK TEMPERATURE = 55.0 F =

ASSUMED PARTICLE DENSITY = 1.00 GM/CU.CM. STACK PRESSURE = 30.49 IN. OF

GAS COMPOSITION (PERCENT) CO2 = 0.00 CO = 0.00

CALC. MASS LOADING = 8.7500E-03 GR/ACF 8.4306E-03 GR/DNCF

IMPACTOR STAGE	S1	S2	S3	S4
STAGE INDEX NUMBER	1	2	3	4
D50 (MICROMETERS)	15.38	15.78	6.80	3.[illegible]2
MASS (MILLIGRAMS)	5.14	8.97	3.92	1.4[illegible]
MG/DSCM/STAGE	4.23E 00	7.38E 00	3.23E 00	1.1[illegible]
CUM. PERCENT OF MASS SMALLER THAN D50	78.07	39.80	23.08	17.11
CUM. (MG/ACM) SMALLER THAN D50	1.56E 01	7.97E 00	4.62E 00	3.43
CUM. (MG/DNCM) SMALLER THAN D50	1.51E 01	7.68E 00	4.[illegible]5E 00	3.30
CUM. (GR/ACF) SMALLER THAN D50	6.83E-03	3.48E-03	2.02E-03	1.50
CUM. (GR/DNCF) SMALLER THAN D50	6.58E-03	3.36E-03	1.95E-03	1.44
GEO. MEAN DIA. (MICROMETERS)	3.51E 01	1.56E 01	1.04E 01	4.53
DM/DLOGD (MG/DNCM)	5.91E 00	-6.60E 02	8.82E 00	3.27
DN/DLOGD (NO. PARTICLES/DNCM)	2.61E 05	-3.33E 08	1.[illegible]2E 07	6.72

NORMAL (ENGINEERING STANDARD) CONDITIONS ARE 21 DEG C AND 760MM HG.

AERODYNAMIC DIAMETERS ARE CALCULATED HERE ACCORDING TO MERCER.

Page 34

ATURE = 55.0 F = 12.8 C SAMPLING DURATION = ~~146.60~~ 1466 MIN

RE = 55.0 F = 12.8 C

= 30.49 IN. OF HG MAX. PARTICLE DIAMETER = 80.0 MICROMETERS

= 0.00 N2 = 78.21 O2 = 20.79 H2O = 1.00

3 GR/DNCF 2.0023E 01 MG/ACM 1.9292E 01 MG/DNCM

S3	S4	S5	S6	S7	FILTER
3	4	5	6	7	8
6.72	2.94	1.57	1.12	0.46	
3.92	1.40	0.65	0.64	1.01	1.71
3.23E 00	1.15E 00	5.35E-01	5.27E-01	8.31E-01	1.41E 00
23.08	17.11	14.33	11.60	7.30	
4.62E 00	3.43E 00	2.87E 00	2.32E 00	1.46E 00	
4.45E 00	3.30E 00	2.77E 00	2.24E 00	1.41E 00	
2.02E-03	1.50E-03	1.25E-03	1.02E-03	6.38E-04	
1.95E-03	1.44E-03	1.21E-03	9.78E-04	6.15E-04	
1.03E 01	4.45E 00	2.15E 00	1.33E 00	7.20E-01	3.26E-01
8.75E 00	3.21E 00	1.96E 00	3.62E 00	2.15E 00	4.68E 00
1.54E 07	6.98E 07	3.77E 08	2.94E 09	1.10E 10	2.58E 11

" HG.

K GROUP ON LUNG DYNAMICS.

NOTE: SAMPLE VOLUME TOO LOW BY FACTOR OF 10.

1

IMPACTOR FLOWRATE = 0.282 ACFM correct — IMPACTOR TEMPERATURE = 55.0

IMPACTOR PRESSURE DROP = 0.5 IN. OF HG — STACK TEMPERATURE = 55.0 F =

ASSUMED PARTICLE DENSITY = 1.00 GM/CU.CM. — STACK PRESSURE = 30.49 IN. OF

GAS COMPOSITION (PERCENT) CO2 = 0.00 CO = 0.00

CALC. MASS LOADING = 8.7500E-03 GR/ACF — 8.4306E-03 GR/DNCF

IMPACTOR STAGE	S1	S2	S3	S
STAGE INDEX NUMBER	1	2	3	4
D50 (MICROMETERS)	15.30	15.70	6.72	2.9
MASS (MILLIGRAMS)	5.14	8.97	3.92	1.4
MG/DSCM/STAGE	4.23E 00	7.38E 00	3.23E 00	1.1
CUM. PERCENT OF MASS SMALLER THAN D50	78.07	39.80	23.08	17.1
CUM. (MG/ACM) SMALLER THAN D50	1.56E 01	7.97E 00	4.62E 00	3.4
CUM. (MG/DNCM) SMALLER THAN D50	1.51E 01	7.68E 00	4.45E 00	3.3
CUM. (GR/ACF) SMALLER THAN D50	6.83E-03	3.48E-03	2.02E-03	1.5
CUM. (GR/DNCF) SMALLER THAN D50	6.58E-03	3.36E-03	1.95E-03	1.4
GEO. MEAN DIA. (MICROMETERS)	3.50E 01	1.55E 01	1.03E 01	4.4
DM/DLOGD (MG/DNCM)	5.89E 00	-6.57E 02	8.75E 00	3.2
DN/DLOGD (NO. PARTICLES/DNCM)	2.63E 05	-3.37E 03	1.54E 07	6.9

NORMAL (ENGINEERING STANDARD) CONDITIONS ARE 21 DEG C AND 760MM HG.

AERODYNAMIC DIAMETERS ARE CALCULATED HERE ACCORDING TO THE TASK GROUP ON LUNG

80% > 15μ

REYNOLDS ALUMINUM

PRIMARY METALS DIVISION

1982 MARCH 08

Mr. Alan Butler
Department of Ecology
4350 150th Avenue N.E.
Redmond, WA 98052

The production data for the month of February which is pertinent to the sampling program conducted at the Longview Reduction Plant during the week of February 1 - 5, 1982, has now been compiled. The average production rate per north plant potroom, including room 52 in which your roof ventilator samples were taken, was 66.619 tons per room per day.

Very truly yours,

REYNOLDS METALS COMPANY

Harold S Hays

H. S. Hays
Chemist

CHAPTER: 12.1
CD-ROM: Background
FILENAME: ~~tz~~ L1_00002
AP-42 Background File Documents

REYNOLDS ALUMINUM

Reynolds Metals Company • Richmond Virginia 23261

January 28, 1986

Mr. Dale Harmon
U.S. Environmental Protection Agency
Particulate Technology Branch
MD-61
Research Triangle Park, NC 27711

Dear Mr. Harmon:

Reynolds Metals Company has recently reviewed a draft revision to sections of the Compilation of Air Pollution Emission Factors (AP-42) pertaining to the nonferrous metals industry. Reynolds is the nation's second largest producer of primary aluminum and associated products. Therefore, we have a vital interest in ensuring that Section 7.1, entitled, Primary Aluminum Production of AP-42 have as sound a technical basis as possible. Accordingly, attached to this letter are our suggested changes to the draft revision.

Should you require further clarification or elaboration on any of the issues raised in our comments, please do not hesitate to contact us at (804) 281-4836.

Sincerely,

Kenneth N. Weiss

Kenneth N. Weiss, P.E.
Environmental Engineer
Environmental Control Department

KNW106/stt

Attachment

cc: L. C. Tropea

REYNOLDS METALS COMPANY

Review of Proposed Revisions to AP-42
January 24, 1986

Comments on Source Category Report for The Nonferrous Metals Industry, Chapter 2 - "Primary Aluminum Industry"

3b

1) Section 2.1 - pages 8-11:

The overview of the industry is considerably out-of-date. The U.S. Primary Aluminum industry is in the process of rationalization as high cost smelters are closed, with production moving overseas.

Table 1 lists the status of plants as of November 13, 1985 while Figure 1 shows production trends through November, 1985. Changes in the industry have occured since November. For example, Reynolds Metals Company has announced the permanent shutdown of both its Arkansas primary aluminum reduction plants.

2) Section 2.1.1 - page 11, paragraph 3:

In the Bayer process, alumina precipitates as hydrated aluminum oxide not aluminum as the reports states.

3) Figure 2 - page 12:

It should be noted that anode paste is input to either HSS or VSS reduction cells.

4) Section 2.1.1 - page 11 & 14:

There is a discrepancy between the Fahrenheit temperature ranges presented on the bottom of page 11 and Centigrade temperature ranges presented at the top of page 14.

5) Section 2.1.1 - page 14, paragraph 3:

Steel crucibles lined with refractory are used to withdraw the molten metal not cast iron pots as stated. Additionally, the crucibles may or may not have lids. Finally, it should be noted that only a portion of the molten aluminum is removed from a pot.

6) Section 2.1 - page 14, paragraph 4:

The listed ranges of anode current densities and voltage drops across a single cell are too narrow. Current densities may be substantially greater than 800 amp/ft2 and the voltage drop range should be considerably wider.

7) Section 2.1.1 - page 14, paragraph 5:

The paragraph is no longer necessarily true. The industry has considerably more knowledge than in the past with respect to balancing magnetic fields.

8) Section 2.1.1 - page 15, paragraph 1, sentence 3:

Reynolds is not aware of anyone "cleaning" coke in an anode production plant.

9) Section 2.1.1 - page 15, paragraph 3, sentence 1:

The time for firing manifold burners varies and is not necessarily 40 to 48 hours.

10) Section 2.1.1 - page 17:

Most experts do not consider the tunnel kiln as a viable alternative for baking carbon. In fact, Reynolds believes the one U.S. installation is no longer operated.

11) Section 2.1.1 - page 17, paragraph 4:

Materials besides fine coke are used as blasting grit to treat baked anodes.

12) Section 2.1.1 - page 17, paragraph 6, sentence 1:

Prebake cells may have more anode assemblies per cell than 26 contrary to the report. Reynolds has at least one potline with 28 assemblies per cell.

13) Section 2.1.1 - page 19, paragraph 4, final sentance:

The sentence doesn't make sense. In HSS cells, pitch components are not removed from the gas stream until the stream is treated by fume control equipment.

14) Section 2.1.1 - page 19, paragraph 5, first sentence:

It is not necessarily true that Soderberg cells require more electrical energy to produce a given weight of aluminum than prebake cells.

15) Section 2.1.1 - page 19, paragraph 6:

Reynolds believes the greatest single influence on the trend to prebake cells is probably the fact prebake cells can be built in much larger units than Soderberg cells.

16) Section 2.1.1 - page 21, paragraph 2, sentence 4:

Steel channel perforations for HSS studs need not be 3 inches. Reynolds, for example, utilizes a larger perforation.

17) Section 2.1.2 - page ~~21~~ 24, paragraph ~~6~~ 2, first sentence:

The carbon anode is formed from pitch and calcined petroleum coke. Coal is not an anode constitutent.

19) Section 2.1.2 - page 24, pararaph 4:

The tar fouling problem attributed to HSS pots is substantially overstated. Reynolds operates many HSS cells and fume control equipment without substantial tar fouling problems.

20) Table 2 - page 25:

It should be noted that both wet and dry ESP's are used to control the anode baking process, floating bed wet scrubbers are successfully employed on HSS reduction cells and dry ESP's combined with dry alumina absorption systems are successfully employed on VSS lines.

21) Section 2.1.3 - page 26, paragraph 5:

The statement concerning tar fouling at HSS cells is overstated. Reynolds operates more HSS capacity than any other producer in the United States and nowhere employs venturi scrubbers with either ESPs or dry alumina scrubbers for the purpose of avoiding fouling of the control device with tar. Both WESP's and floating bed scrubbers are used successfuly on our HSS capacity.

22) Table 3 - page 26:

Best available hooding for HSS cells is a range of 85 to 90 percent capture.

Comments on draft Section 7.1 - "Primary Aluminum Production"

1) Page 7.1-1 - second paragraph, final sentence:

Hydrated aluminum oxide is washed to remove sodium hydroxide not "iron oxide, silicon and other impurities" as stated.

2) Figure 7.1-1:

- The schematic fails to mention digestion, silication, evaporation and hydrate settling which are all important steps in the Bayer process.
- No bauxite in the United States is processed in a drying oven before entering ball mills.
- The settling chamber should show red mud tailings as an exit stream.
- The filter prior to the crystallizer should show red mud tailings not red mud "impurities."

3) Table 7.1-1:

- The parameter "current thorough potline" today could have a range of 60,000 to 280,000 amps.

- The parameter "voltage drop per cell" should show a range of 4.0 to 5.2.

- The parameter "current efficiency" has exceeded 90 percent on a regular basis. A range of 85 to 95 percent would be more correct.

4) Page 7.1-4 - paragraph 1, first sentence:

Blending with pitch blinder often takes place in hot oil jacketed mixers as opposed to the stated steam jacketed mixers.

5) 7.1-4 - paragraph 3, sentence 4:

We suggest changing the beginning of the sentence to read: "The cell casing consists of aluminum or steel sheeting, permanent steel skirt and ..."

6) Table 7.1-2:

- The control equipment shown for bauxite grinding apperar to be in error. Reynolds is not aware of any ESPs installed for this service. Reynolds employs either bag collectors or wet scrubbers at its locations and expect emissions in the 0.1 lb/ton range.

3c

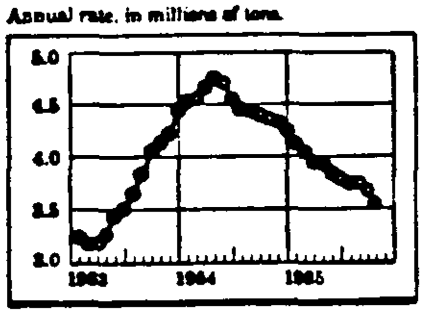
- The 200 lb/ton total paticulate emission rate should be qualified as entering an ESP from a multiclone.

- Reynolds believes that is possible to reduce aluminum hydroxide emissions from calciners equipped with ESP's to below 4.0 lb/ton. In some instances it may be possible to attain emission levels as low as 0.5 lb/ton.

Figure I

Aluminum Production

Annual rate, in millions of tons



ALUMINUM PRODUCTION in the U.S. fell to an annual rate of 3,559,048 tons in November, from a revised 3,697,350 tons in October, the Aluminum Association reports.

from the Wall Street Journal, December 20, 1985

TABLE I (continued)

	Annual capacity July 1, 1985	Current Operating rate
Ormet Corp. (Revere-Consolidated)		
Hannibal, OH	270,000	270,000
Revere Copper & Brass Inc.		
Scottsboro, AL	117,000	0
Reynolds Metals Co.++		
Arkadelphia, AR	68,000	0
Jones Mills, AR	125,000	0
Lake Charles, LA	not operating+	0
Listerhill, AL	202,000	0
Longview, WA	210,000	186,000
Massena, NY	126,000	126,000
Troutdale, OR	130,000	55,000
Reynolds Total.	.861,000+	367,000
Total U.S.		3,474,600
Percent Operating	5,259,000++	66.0%

Note: Aluminum Co. of America and Alcan Aluminum Ltd. figures have been converted from metric tons to short tons, and have been rounded.

• Kaiser Aluminum & Chem. Corp. has reduced the annual rated capacity of the Chalmette, LA smelter by writing down part of the plant's capacity.

+ Reynolds Metals Co. does not include the Lake Charles, LA smelter in its company wide domestic capacity.

++ Total U.S. annual rated capacity has been adjusted to reflect changes listed above.

Source: Compiled by American Metal Market from aluminum company data; revised 11/7/85.

TABLE I

OPERATING RATE AT 66% CAPACITY
FOR ALUMINUM SMELTERS IN U.S.

	Annual capacity July 1, 1985	Current Operating rate
Alcan Aluminum Corp.		
Sebree, KY	180,000	120,000
Alumax Inc.		
Ferndale, WA (Intalco)	280,000	277,000
Frederick, MD (Eastalco)	176,000	132,000
Mt. Holly, SC	200,000	165,000
Alumax Total.	656,000	574,000
Aluminum Company of America+		
Alcoa, TN	220,000	165,000
Anderson County, TX	16,000	0
Badin, NC	127,000	95,300
Massena, NY	226,000	186,000
Rockdale, TX	342,000	266,500
Vancouver, WA	121,000	72,700
Warrick, IN	298,000	253,000
Wenatchee, WA	226,000	221,600
Alcoa Total	1,576,000	1,260,100
Arco Aluminum Co.		
Columbia Falls, MT	180,000	180,000
Commonwealth Aluminum Corp.		
Goldendale, WA	185,000	113,000
Consolidated Aluminum Corp.		
New Johnsonville, TN	144,000	18,000
Kaiser Aluminum & Chemical Corp.		
Chalmette, LA	116,000*	0
Mead, WA	220,000	110,000
Ravensworth, WV	163,000	81,500
Tacoma, WA	81,000	71,000
Kaiser Total	580,000*	262,500
Martin Marietta Aluminum		
The Dalles, OR	90,000	0
National Southwire Aluminum Co.		
Hawesville, KY	190,000	190,000
Noranda Aluminum Co.		
New Madrid, MO	230,000	120,000

CITY OF TOLEDO OHIO

DEPARTMENT OF PUBLIC UTILITIES
ENVIRONMENTAL SERVICES AGENCY
26 MAIN STREET
TOLEDO, OHIO 43605

THOMAS L. KOVACIK
Director

DONALD M. MOLINE
Administrator

Telephone: (419) 693-0350

January 27, 1986

Mr. Dale L. Harmon
Particulate Technology Branch
Gas Cleaning Division
United States Environmental Protection Agency
Air and Energy Engineering Research Lab
Research Triangle Park, North Carolina 27711

Re: "Inhalable Particulate Source Category Report for the Non-Ferrous Industry"

Dear Mr. Harmon:

I received your letter of January 15, 1986, with the subject report enclosed. I do not have any comments on the reports, since I do not have any experience with these industries. When the initial inhalable partiulate survey was completed at this Agency last year, my name was placed under "non-ferrous metals" instead of secondary aluminum processing. I am sorry for the confusion. If you are able to transfer my name, I would appreciate being included under the secondary aluminum category.

If I can be of any other help, feel free to give me a call.

Very truly yours,

Dale J. Krygielski

Dale J. Krygielski
Environmental Engineer

DJK:tf

cc: Donald M. Moline, P.E., Administrator
Toledo Environmental Services Agency

Comment No.	Commenter	Date of Comment	Summary of Comments	Response to Comment
1a, 1b	Ltr from Kaiser Aluminum (J.C.Schwegmann)	1/24/86	1a. The proposed modifications to AP-42 make the document, which already is compromised greatly by over-simplification, into one which is certain to produce serious misconceptions for those it is supposed to help, and, result in agency decisions which will be unnecessarily costly for the regulated community. The so-called emission factors are never identified as what they really are, that is, selected statistical averages of widely fluctuating data points, and, in no way representative of any individual primary aluminum plant in the country. The values in the Emission Factor Tables are a mixture of emission data from different plants, and, in the case of the fine particulate data, are not even the same plants from which the total particulate data are derived. In essence, the factors, as proposed, are not representative of any plant which a state or local agency may be considering for purposes of regulation or for state implementation plans.	The introduction to AP-42 amply explains what emission factors are to represent. They are averages for various facilities of each given kind and are default values for use if individual source data is not available or obtainable. Emission factors are most appropriate for estimating average emissions for numerous like sources in an area or in compiling area-wide emission inventories. However, for regulating specific sources, source-specific data are preferable and recommended.
			If, there is no appropriate data, the agency should either abandon emission factors for that category of industry or develop statistically reliable data on which to base them. The state and local agencies have enough difficulties understanding the characteristics of individual plant emissions without leading them to believe that the emission factors are uniformly representative of any reduction facility, existing or proposed. Use of the emission factors by an agency inevitably leads to unnecessary debate about their specific applicability to either emission limitations or state implementation plans. In the end, industry has to re-educate the state or local agency as to the actual conditions and potential control measures which may be realistically expected to be applied in any specific case(s).	Emission factors are based on the best available data and provide a basis for needed estimates if no other appropriate data are available. EPA strives to improve the basis for these factors as better and newer data are developed. However, development of improved data bases is often hindered by resource limitations. EPA must rely primarily on the affected industries and regulatory state and local agencies to supply new source test information for emission factor development.

COMMENT LOG FOR NONFERROUS INDUSTRY SOURCE CATEGORY REPORT

Comment No.	Commenter	Date of Comment	Summary of Comments	Response to Comment
1b	Ltr from Kaiser Aluminum (J.C.Schwegmann)	1/24/86	1b. The mathematical analysis presented in this document is a mixture of two data bases, both with respect to the sources of data and the time frame in which separate data bases were collected. The data sets were collected at different times (years apart) from plants of different age, different hooding characteristics, different ore sources, etc., all of which affect not only the total particulates, but, also, the particle size distributions. At the very least, there should be an attempt to consider data from the same plants taken at the same time, and to present the data as sets of ranges rather than an average without acknowledgement that half the plants were higher than the average and half the plants were lower than the average.	Cumulative size-specific factors were generated by application of the particle size distributions to the total particulate emission factor In general, few particle size data sets were available and particle size data were less reliable than the total mass data used to generate the total mass emission factors. Since there are usually subtantially more total loading samples using EPA Method 5, even though they may be from different times and sites, a more representative total mass particulate emission factor can be developed than that which would result from using only source tests with particle size data. We feel that the method used to develop the cumulative size-specific emission factors is the most logical approach. This same procedure was u for development of size-specific emission factors for all source
2a	Ltr from Kennecott (A.M.Trbovich)	1/27/86	2a. Various editorial changes to pages 46, 54, 56, 61, 67, 72, 7.3-4, 7.3-8, 7.3-9 and 7.3-14 should be made.	The editorial changes which have been suggested will be included in the report.
3a-3c	Ltr from Reynolds Aluminum (K. N. Weiss)		3a. Various editorial changes to pages 11, 12, 14, 15, 17, 19, 21, 24, 25, 26, 7.1-1, 7.1-2, 7.1-3 and 7.1-4 should be made.	The editorial changes which have been suggested will be included in the revised report.
			3b. The overview of the industry on pages 8 to 11 is considerably out-of-date. The U.S. Primary Aluminum industry is in the process of rationalization as high cost smelters are closed, with production moving overseas.	The overview of the industry included on pages 8 to 11 will be revised using the information provided by Reynolds Metals Company.
			3c. In table 7.1-2, the control equipment shown for bauxite grinding appear to be in error. Reynolds is not aware of any ESPs installed for this service. Reynolds employs either bag collectors or wet scrubbers at its locations and expert emissions in the 0.1 lb/ton range. The 200 lb/ton emission rate should be qualified as entering an ESP from a multicyclone. Reynolds believes that it is possible to reduce aluminum hydroxide emissions from calciners equipped with ESPs to below 4.0 lb/ton. In some instances it may be possible to attain emission levels as low as 0.5 lb/ton.	The emission factor for ESPs used to control emissions from bauxite grinding will be removed from Table 7.1-2. A footnote will be added to this table stating that the uncontrolled emission factor for aluminum hydroxide calcining represent emissions after a multicyclone. If test data can be provided to show that the 4.0 lb/ton emission factor for an ESP controlling emissions from aluminum hydroxide calcining is too high, the emission factor will be revised.

COMMENT LOG FOR NONFERROUS INDUSTRY SOURCE CATEGORY REPORT

Comment No.	Commenter	Date of Comment	Summary of Comments	Response to Comments
4a	Air Resources Board (Rich Bradley)	4/27/86	4a. The report does not cite any of the work done by Southern Research Institute (SoRI), Birmingham, Alabama. SoRI has had one or more contracts from EPA, Cincinnati to perform particle sizing work on emissions from the nonferrous industry. Particle sizing studies were performed at Reynolds Metals Company, Longview, Washington, Kennecott Corporation, Hayden, Arizona, Phelps Dodge, Ajo and other locations. We recommend that the EPA or the contractor determine the extent of the missing particle sizing data before the proposed emission factors are accepted.	The Cincinnati EPA Laboratory participated in the program to develop IP emission factors for the Nonferrous industry and submitted results of Nonferrous tests funded by them. They have been contacted about this comment and say that the contractor was given all of the particle size results from their nonferrous industry testing.

SEP 3 0 1982

Mr. Lawrence C. Tropea, Jr.
Director of Environmental Control
Environmental Control Department
Reynolds Aluminum
Richmond, Virginia 23261

Dear Mr. Tropea:

As Mr. Arch MacQueen of my staff has recently discussed with Mr. Albee of your office, we generally agree that the changes you propose to Section 7.1 of AP-42 would be improvements that we could readily accept and implement. We appreciate your concerns about this widely used document, and we welcome the opportunity to work with you on improving it. We do have a concern, however, that the revised factors (or formula) be presented in a manner useful to local air pollution control agencies. Therefore, Mr. MacQueen has discussed with Mr. Albee further refinements and wording of the "C," "S" and "K" terms in the equations you proposed, so they can be translated into meaningful relationships with data likely to be available to the local agency personnel.

After receipt of this clarifying information, we will implement the changes you propose, and barring any unforseen problems and delays, we should be able to include them in Supplement 14 to AP-42, scheduled for spring of 1983. I apologize for the earlier confusion on our part that resulted in a breakdown in communications.

Sincerely yours,

Richard G. Rhoads
Director
Monitoring and Data Analysis Division

cc: Arch MacQueen, AMTB

AMTB:SAS:JHSOUTHERLAND:ew:rm.832MU:ext.5585:9/28/82

MIDWEST RESEARCH INSTITUTE
425 Volker Boulevard
Kansas City, Missouri 64110
Telephone (816) 561-0202

June 25, 1970

Ref. 235
(PRIMARY AL IND.- REPORT TO WASHINGTON APC BOARD: OCT, 1969)

Mr. Michael McGraw
National Air Pollution Control Administration
411 West Chapel Hill Street
Durham, North Carolina 27701

Dear Mr. McGraw:

Enclosed is part of the information we are to send you. These are (1) the two stack-sampling results on lime kilns, (2) the report on the primary aluminum industry from the State of Washington, and (3) some figuring we have done on particulate emissions from ready-mix concrete plants.

The two reports from the Mid-Willamette Valley Air Pollution Authority which contain information on air pollution from particleboard and plywood plants are presently not to be found. If and when they appear, we will send copies of them; but probably the quicker route now to their acquisition would be to write the Authority:

Mid-Willamette Valley Air Pollution Authority
2585 State
Salem, Oregon 97301

The report which we used the most is entitled, "Air Pollution Problems in Plywood, Particleboard, and Hardboard Mills in the Mid-Willamette Valley," by Allan Mick and Dean McCargar. Allan Mick is in charge of the Authority.

We were unable to find any further information to identify the source of the thesis, "Coal Refuse Piles--A Burning Problem."

There is also a note in our notes to send phosphate fertilizer data. I am assuming that the data I gave you at your desk in the afternoon covers this. If we should be sending more information on this industry, let me know.

Yours very truly,

Eugene E. Sallee

Eugene E. Sallee
Associate Chemical Engineer

EES:crs
Enclosures

Dr. Indra Jashnani (301) 247-0700, Ext. 367
Martin Marietta Corp.
Env. Center
1450 South Rolling Road
Baltimore, Md. 21227

I will be glad to review and supply data in the following fields:

Have source test data

- Aluminum Industry 7.1, 7.8
- Cement Industry
- Aggregates
- Chemicals
- Refractories
- Materials handling ← No source test data
- Fugitive Emissions
- Industrial boilers, furnaces, and kilns

If you are interested, please let me know.

Daphne
make copy for each on list
file (AP-42)
JHS

Kennecott
10 East South Temple
P.O Box 11248
Salt Lake City, Utah 84147

January 27, 1986

Kennecott

Mr. Dale L. Harmon
Project Manager
Particulate Technology Branch MD-61
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

REFERENCE: Draft Inhalable Particulate Source Category Report For The Nonferrous Industry

Dear Mr. Harmon:

In response to your request for comment on the draft "Inhalable Particulate Source Category Report For The Nonferrous Industry," the following is for your consideration:

- Table 10, p.46 - The majority owner and operator of Chino Mines Company is Kennecott Corporation. Mitsubishi is the minority owner. Listing Chino with the other Kennecott operations may be more appropriate.

- Flash Smelting, p. 54 - The Inco Flash Furnace at Chino Mines Company came on line in late October, 1984. This furnace has completely replaced the two reverbatory furnaces at this plant. Slag from this furnace has a low copper content and is discarded. Conventional converters continue in use.

- Slag Treatment, p. 54 ? 56 - Slag from the Norando process at the Garfield smelter is slowly cooled in large pots. After the slag solidifies, the pot is emptied and the slag is recovered through conventional methods.

- Roaster and Dore Furnace Gas Scrubbing, p. 61 - Wet electrostatic precipitators connected in series with water scrubbers are also used for cleaning dore off-gas.

- Scrubbers, p. 67 - The advent of the Flash Furnace at the Chino Mines Company smelter (Kennecott-Hurley) has eliminated the traditional feed dryer at this plant. Currently, feed is processed through one of two fluid-bed dryer and baghouse systems for preparation prior to smelting.

- Kennecott-Garfield, p. 72 - This data is useful for "green feed" reverberatory furnace systems. However, since this information was collected, the Garfield smelter has been modernized and is now a Noranda reactor system.

- o Paragraph 1, p. 7.3-4 - As noted above, the slag from the Chino Mines Company Flash furnace is low in copper and is discarded.

- o Table 7.3-1, p. 7.3-8 - The sulfur dioxide concentration of the Chino Mines Company Flash furnace is 70%. The gas is diluted and cleaned for acid plant processing.

- o Note b, Table 7.3-2, p. 7.3-9 - Noranda furnace and Flash furnace offgases are also processed through acid plants and are subject to the same collection efficiencies cited for converters and some roasters.

- o Note a, Table 7.3-6, p. 7.3-14 - Fugitive emission factors for Flash furnace smelters and Noranda furnace smelters are probably much less than the reported values, as opposed to slightly less than the reported values. These furnaces represent very recent technology designed, in part, for the efficient capture and cleaning of the process gas stream.

I hope this information will be of value to you. We appreciate the opportunity to comment on this document. Please contact me (801/322-8263), if you have any questions.

Very truly yours,

A. M. Trbovich

AMT:mf

cc: R. A. Malone

KAISER ALUMINUM
& CHEMICAL CORPORATION

January 24, 1986

Mr. Dale L. Harmon, Project Manager
U.S. Environmental Protection Agency
Particulate Technology Branch, MD-61
Research Triangle Park, N.C. 27711

Dear Mr. Harmon:

Kaiser Aluminum & Chemical Corporation (Kaiser Aluminum) wishes to submit the following comments on the proposed "update" to AP-42, Compilation of Air Pollution Emission Factors, especially Section 7., Primary Aluminum Production, as prepared by Acurex Corporation and entitled, "Inhalable Particulate Source Category Report for the Nonferrous Industry".

The proposed modifications to AP-42 make the document, which already is compromised greatly by over-simplification, into one which is certain to produce serious misconceptions for those it is supposed to help, and, result in agency decisions which will be unnecessarily costly for the regulated community. The so-called emission factors are never identified as what they really are, that is, selected statistical averages of widely fluctuating data points, and, in no way representative of any individual primary aluminum plant in the country. The values in the Emission Factor Tables are a mixture of emission data from different plants, and, in the case of the fine particulate data, are not even the same plants from which the total particulate data are derived. In essence, the factors, as proposed, are not representative of any plant which a state or local agency may be considering for purposes of regulation or for state implementation plans.

The mathematical analysis presented in this document is a mixture of two data bases, both with respect to the sources of data and the time frame in which the separate data bases were collected. The data sets were collected at different times (years apart) from plants of different age, different hooding characteristics, different ore sources, etc., all of which affect not only the total particulates, but, also, the particle size distributions. At the very least, there should be an attempt to consider data from the same plants taken at the same time, and to present the data as sets of ranges rather than an average without acknowledgement that half the plants were higher than the average and half the plants were lower than the average.

If, in fact, there is no appropriate data, the agency should either abandon emission factors for that category of industry or develop statistically reliable data on which to base them. The state and local agencies have enough difficulties understanding the characteristics of individual plant

300 LAKESIDE DRIVE, OAKLAND CALIFORNIA 94643

Mr. Dale L. Harmon, EPA
January 24, 1986

emissions without leading them to believe that the emission factors are uniformly representative of any reduction facility, existing or proposed. Use of the emission factors by an agency inevitably leads to unnecessary debate about their specific applicability to either emission limitations or state implementation plans. In the end, industry has to re-educate the state or local agency as to the actual conditions and potential control measures which may be realistically expected to be applied in any specific case(s).

Kaiser Aluminum appreciates the opportunity to comment in the development of the emission factor information. In spite of the critical nature of these comments, Kaiser Aluminum respects the need to provide guidance to the state and local agencies and the difficulties experienced by EPA and it's contractors in obtaining good data from which to develop that guidance. It is suggested that even less-than-perfect data can be used appropriately if the information is presented as ranges which clearly tell the user that emission sources in this category are variable and need to be considered on a case-by-case basis.

Sincerely yours,

J. C. Schwegmann, PhD
Manager, Air Services
Corporate Environmental Affairs

jcs

cc: C. B. Brown - 828 KB
Dr. Jack Goldman, The Aluminum Association
P. H. Fournet - Baton Rouge 70821
B. P. Leber - Newark 43056
L. M. Rapp - Baton Rouge 70821
R. J. Schlager - CFT 94566
R. H. Watts - 1239 KB

CHAPTER: 12.1
CD-ROM: Background
FILENAME: L1-00014

AP-42 Background File Documents

7.1

Source Testing Report

Barmet Industries, Inc.
Uhrichsville, Ohio

Prepared for:

Air Surveillance Branch
Surveillance and Analysis Division
United States Environmental Protection Agency
Region V

James W. Davison
Air Sampling Supervisor

Peter J. Marks
Project Manager

February 1975

Contract No. 68-02-0240

Prepared by
Roy F. Weston, Inc.
Environmental
Scientists and Engineers
West Chester, Pennsylvania

W.O. 300-56

Ref 3

PREFACE

The Emission Source Sampling Program detailed in this report was conducted by Roy F. Weston, Inc. pursuant to a task order issued by Region V of the United States Environmental Protection Agency, conforming to the terms of EPA Contract No. 68-02-0240. Mr. James W. Davison, Air Sampling Supervisor, directed the Weston field team staffed by the following personnel:

Allan R. Daly	Robert A. Lyon
Barry L. Jackson	Jeffrey D. O'Neill

Approved for Roy F. Weston, Inc.

P. J. Marks

Peter J. Marks
Project Manager

18 February 1975
Date

SUMMARY

The Environmental Protection Agency, Region V[1], retained Roy F. Weston, Inc. to conduct particulate emission compliance and contaminant removal efficiency testing of furnaces at the Barmet Industries, Inc. plant in Uhrichsville, Ohio. The testing involved the two scrubbers and the one baghouse that controls the emissions from the dross aluminum recovery furnaces. The salt recovery washer/dryer outlet stack, an uncontrolled source of emissions, was also tested for compliance. Engineering observations of unit efficiency and plant operation were included in the study, along with conclusions and recommendations.

The sampling train employed for collection of the particulate and gaseous contaminants was the EPA Method 5 Train, modified to include an alundum thimble filter ahead of the primary filter, plus wet impingement utilizing impingers containing distilled water followed by impingers containing 5-percent N_aOH as approved by the Ohio EPA and EPA Region V.

Particulate mass rate results of the 10 test runs, as defined by EPA Method 5 Procedures, are summarized as follows:

Test Run	Location	Pounds/Hour Inlet	Pounds/Hour Outlet	Percent Removal	Allowable Particulate Emissions lbs/hr
1	Scrubber No. 2	58.52	56.47	3.5	9.10
2	Scrubber No. 2	90.38	97.86	- -	9.53
3	Scrubber No. 1	76.75	36.17	52.9	6.96
4	Scrubber No. 1	71.72	44.95	37.3	6.57
5	Baghouse	42.29	4.84	88.6	7.30
6	Baghouse	41.59	4.63	88.9	7.20
7	Baghouse	45.48	3.26	92.8	7.70
8	Dryer	- -	15.09	- -	2.11
9	Dryer	- -	10.03	- -	2.07
10	Dryer	- -	8.99	- -	2.42

[1]The Field Support Section, Air Surveillance Branch, Surveillance and Analysis Division

BARMET INDUSTRIES, INC.
UHRICHSVILLE, OHIO

ALUMINUM RECOVERY PROCESS
FUME COLLECTION SYSTEM

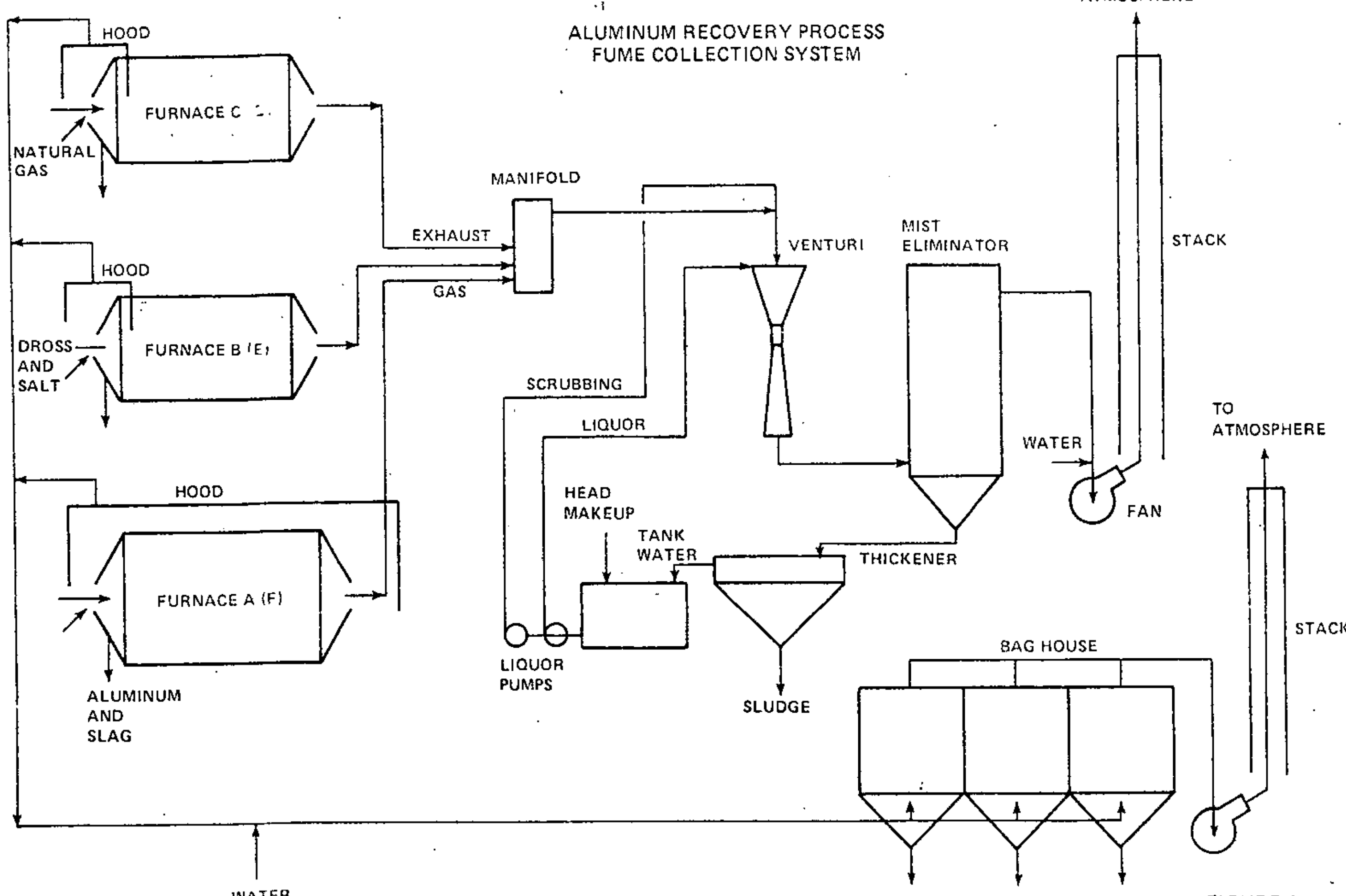


FIGURE 1

WESTON

W.O. 30056

APPENDIX A

SUMMARY OF TEST RESULTS

Table A-1

Preliminary Velocity Traverse
Scrubber Number One

	Inlet	Outlet
Date	10/24/74	10/24/74
Barometric Pressure, in Hg	30.10	30.10
Moisture, % by volume	3.0	13.0
Molecular Weight, Dry Stack Gas	29.0	29.0
Mole Fraction, Dry Stack Gas	0.97	0.87
Molecular Weight, Wet Stack Gas	28.7	27.6
Stack Area, $in.^2$	1256	1520
Static Pressure, in Hg	-0.04	+0.01
Stack Pressure Absolute, in Hg	30.06	30.09

Traverse	Velocity Head in H_2O (Avg.)	Stack Temp. °F.	Average $\sqrt{\text{Velocity x Temp. °R.}}$	Stack Gas Velocity FPM[1]	Stack Gas Volume SCFM
Inlet	0.37	425.	17.90	2650.	13490.
Outlet	0.15	125.	9.04	1360.	11420.

[1] Stack Conditions

Table A-2

Preliminary Velocity Traverse
Scrubber Number Two

	Inlet	Outlet
Date	10/21/74	10/21/74
Barometric Pressure, in Hg	30.45	30.45
Moisture, % of Volume	3.1	10.0
Molecular Weight, Dry Stack Gas	29.0	29.0
Mole Fraction Dry Gas	0.968	0.901
Molecular Weight, Wet Stack Gas	28.64	27.91
Stack Area, $in.^2$	1256.6	1735
Static Pressure, in Hg	-0.04	+0.01
Stack Pressure Absolute, in Hg	30.41	30.46

Traverse	Velocity Head in H_2O (Avg.)	Stack Temp. °F.	Average $\sqrt{\text{Velocity} \times \text{Temp. °R.}}$	Stack Gas Velocity FPM[1]	Stack Gas Volume SCFM
Inlet	0.49	405	20.71	3050.	16050.
Outlet	0.27	115	12.46	1860.	18970.

[1] Stack Conditions

Table A-3

Preliminary Velocity Traverse
Baghouse

	Inlet	Outlet
Date	10/27/74	10/27/74
Barometric Pressure, in Hg	30.05	30.05
Moisture, % by Volume	5.0	5.0
Molecular Weight, Dry Stack Gas	29.0	29.0
Mole Fraction Dry Gas	0.95	0.95
Molecular Weight, Wet Stack Gas	28.45	28.45
Stack Area, $in.^2$	908	1809
Static Pressure, in Hg	-0.09	+0.02
Stack Pressure Absolute, in Hg	29.96	30.07

Traverse	Velocity Head in H_2O (Avg.)	Stack Temp. °F.	Average $\sqrt{\text{Velocity} \times \text{Temp. °R.}}$	Stack Gas Velocity[1] FPM	Stack Gas Volume SCFM
Inlet	0.40	265	17.03	2510.	11020.
Outlet	0.20	220	11.68	1720.	16060.

1 Stack Conditions.

Table A-4

Preliminary Velocity Traverse
Dryer Outlet

Date	10/30/74
Barometric Pressure, in Hg	30.15
Moisture, % by Volume	6.0
Molecular Weight, Dry Stack Gas	29.0
Mole Fraction Dry Gas	.94
Molecular Weight, Wet Stack Gas	28.34
Stack Area, $in.^2$	1017
Stack Pressure, in Hg	0.00
Stack Pressure Absolute, in Hg	30.15

Velocity Head in H_2O (Avg.)	Stack Temp ^oF.	Average $\sqrt{\text{Velocity x Temp. } ^oR.}$	Stack Gas Velocity FPM[1]	Stack Gas Volume SCFM
0.03	180.	4.38	640.	3570

[1] Stack Conditions.

Table A-5

Particulate Emissions Data
Scrubber Number One

		Inlet		Outlet	
Run No.		3	4	3	4
Date		10/26/74	10/27/74	10/26/74	10/27/74
Time - 24 Hour Clock		1000-1345	1025-1355	1000-1345	1025-1355
D_n	Sampling Nozzle Diameter, in.	0.188	0.188	0.25	0.25
T_t	Net Time of Test, min.	170.	150.	170.	150.
P_b	Barometric Pressure, in Hg Absolute	30.15	30.05	30.15	30.05
P_m	Average Orifice Pressure Drop, in. H_2O	0.31	0.32	0.61	0.68
V_m	Volume of Dry Gas Sampled, cu.ft. at Meter Conditions	54.47	49.72	70.40	66.55
T_m	Average Gas Meter Temperature, ^oF.	65.78	79.02	70.76	86.03
$V_{m_{std}}$	Volume of Dry Gas Sampled, cu. ft. at Standard Conditions*	55.33	49.10	70.89	64.93
V_w	Total H_2O Collected, ml, impingers and silica gel	30.	30.	202.	120.

* 70^o F., 29.92 in H_2O, dry basis

		Inlet		Outlet	
		3	4	3	4
V_{wgas}	Volume of Water Vapor Collected, scf	1.42	1.42	9.58	5.67
% M	Percent Moisture in the Stack Gas by Volume	2.54	2.81	11.90	8.05
% CO_2		1.0	1.0	0.8	0.8
% O_2		18.4	18.4	18.2	18.2
% CO		0.2	0.2	0.2	0.2
% N_2		80.4	80.4	80.8	80.8
MW_d	Molecular Weight of Dry Stack Gas	28.88	28.88	28.84	28.84
MW	Molecular Weight of Wet Stack Gas	28.61	28.57	27.55	27.97
C_p	Pitot Tube Coefficient	0.85	0.85	0.85	0.85
ΔP	Average Velocity Head of Stack Gas, in.H_2O	0.378	0.383	0.175	0.195
T_s	Average Stack Temperature, ^oF.	423.4	338.5	114.7	110.
N_p	Net Sampling Points	48.	48.	12.	12.
P_{st}	Static Pressure of Stack, in. Hg	-0.04	-0.04	+0.02	+0.02
P_s	Stack Pressure, in.Hg Absolute	30.11	30.01	30.17	30.07
V_s	Stack Velocity at Stack Conditions, fpm	2710.	2620.	1500.	1580.

		Inlet		Outlet	
		3	4	3	4
A_s	Stack Area, sq. in.	1257.	1257.	1521.	1521.
Q_s	Dry Stack Gas Volume at Standard Conditions, SCFM	13910.	14780.	12940.	14320.
Q_a	Stack Gas Volume at Stack Conditions, ACFM	23630.	22840.	15800.	16670.
% I	Percent Isokinetic	105.6	99.95	99.5	93.3
M_e	Particulate, mg, EPA-5	2307.7	1805.3	1501.4	1544.3
M_t	Particulate, mg, Total	2940.3	1992.6	1605.3	1564.4
I_c	% Impinger Catch	21.5	9.4	6.5	1.3
C_{es}	Particulate, gr/scf, EPA-5	0.6423	0.5662	0.3620	0.3663
C_{ts}	Particulate, gr/scf, Total	0.8184	0.6250	0.3487	0.3710
C_{ea}	Particulate, gr/acf, EPA-5	0.3779	0.3663	0.2672	0.3147
C_{ta}	Particulate, gr/acf, Total	0.4814	0.4043	0.2856	0.3188
PMR_e	Particulate, lb/hr, EPA-5	76.75	71.72	36.17	44.95

		Inlet		Outlet	
		3	4	3	4
PMR_t	Particulate, lb/hr, Total	97.56	38.67	79.16	45.54
M_{ec}	Particulate, lb/ton Charge EPA-5	34.74	16.41	35.51	22.26
M_{tc}	Particulate, lb/ton Charge Total	44.27	17.54	39.20	22.55
M_c	Charge Mass, lbs.	16900	13800	16900	13800
M_m	Metal Production, lbs.	3550	6820	3550	6820
	Dross Source Furnace F	Davenport	Howmet	Davenport	Howmet
	Heat Number	F187	F193	F187	F193

Table A-6

Particulate Emissions Data
Scrubber Number Two

Test Location		Inlet		Outlet	
Run No.		1	2	1	2
Date		10/23/74	10/24/74	10/23/74	10/24/74
Time - 24 Hour Clock		1015-1420	1044-1355	1015-1420	1105-1355
D_n	Sampling Nozzle Diameter, in.	0.188	0.188	0.188	0.188
T_t	Net Time of Test, min.	180	150	180	150
P_b	Barometric Pressure, in. Hg absolute	30.34	30.10	30.34	30.10
P_m	Average Orifice Pressure, in. H_2O	0.41	0.54	0.28	0.29
V_m	Volume of Dry Gas Sampled, cu. ft. at Metric Conditions	63.60	61.97	46.84	44.10
T_m	Average Gas Meter Temperature, °F.	79.1	82.4	69.4	74.0
V_{mstd}	Volume of Dry Gas Sampled, cu. ft. at Standard Conditions*	63.45	60.95	47.58	44.03
V_w	Total H_2O Collected, ml, Impingers and Silica Gel	40	38	180	137

* 70° F., 29.92 in. Hg, Dry Basis

		Inlet		Outlet	
		1	2	1	2
$V_{W_{gas}}$	Volume of Water Vapor Collected, scf	1.90	1.80	8.53	6.49
%M	Percent Moisture in the Stack Gas by Volume	2.9	2.9	15.2	12.85
M_d	Mole Fraction of Dry Gas	.971	.971	.848	.872
% CO_2		1.4	1.2	1.2	1.0
% O_2		17.8	18.0	18.6	18.0
% CO		0.4	0.4	0.4	0.4
% N_2		80.4	80.4	79.8	80.6
MW_d	Molecular Weight of Dry Stack Gas	28.94	28.91	28.93	28.88
MW	Molecular Weight of Wet Stack Gas	28.61	28.60	27.29	27.48
C_p	Pitot Tube Coefficient	0.85	0.85	0.85	0.85
ΔP	Average Velocity Head of Stack Gas, in. H_2O	0.43	0.27	0.25	0.63
T_s	Average Stack Temperature, ° F.	438.3	406.5	120.3	123.3
N_p	Net Sampling Points	32.	32.	12.	12.
P_{st}	Static Pressure on Stack, in.Hg	-0.04	-0.12	+0.02	+0.02
P_s	Stack Pressure, in.Hg Absolute	30.30	29.98	30.36	30.12

		Inlet		Outlet	
		1	2	1	2
V_s	Stack Velocity at Stack Conditions, fpm	2880.	3464.	1800.	1900.
A_s	Stack Area, sq. in.	1257.	1257.	1734.	1734.
Q_s	Dry Stack Gas Volume at Standard Conditions, SCFM	14580.	17990.	17070.	18210.
Q_a	Stack Gas Volume at Stack Conditions, ACFM	25120.	30220.	21720.	22840.
% I	Percent Isokinetic	109.1	101.9	96.4	100.4
M_e	Particulate, mg, EPA-5	1929.5	2320.1	1192.6	1792.8
M_t	Particulate, mg, Total	2193.1	2755.5	1223.2	1819.5
I_c	% Impinger Catch	12.0	15.8	2.5	1.5
C_{es}	Particulate, gr/scf, EPA-5	0.4683	0.5862	0.3860	0.6271
C_{ts}	Particulate, gr/scf, Total	0.5323	0.6962	0.3959	0.6364
C_{ea}	Particulate, gr/acf, EPA-5	0.2716	0.3489	0.3033	0.4998
C_{ta}	Particulate, gr/acf, Total	0.3087	0.4144	0.3111	0.5072

		Inlet		Outlet	
		1	2	1	2
PMR_e	Particulate, lb/hr, EPA-5	58.52	90.[illegible]	56.47	97.86
PMR_t	Particulate, lb/hr, Total	66.51	107.34	57.92	99.32
M_{ec}	Particulate, lb/ton Charge, EPA-5	15.58	25.67	15.03	27.79
M_{tc}	Particulate, lb/ton Charge, Total	17.71	30.49	15.42	28.21
M_c	Charge Mass, lb.	28800	22300	28800	22300
M_m	Metal Production, lb.	7100	5160	7100	5160
	Dross Source Furnace A Furnace D	 Conalco Crusher	 Conalco Crusher	 Conalco Crusher	 Conalco Crusher
	Heat Number	A 637 B 785	A 633 B 778	A 637 B 785	A 633 B 778

Table A-7

Particulate Emissions Data
Baghouse

Test Location		Inlet			Outlet		
Run No.		5	6	7	5	6	7
Date		10/28/74	10/29/74	10/30/74	10/28/74	10/29/74	10/30/74
Time - 24 Hour Clock		1012-1350	1000-1400	1030-1345	1012-1352	1000-1350	1030-1342
D_n	Sampling Nozzle Diameter, in.	0.188	0.188	0.188	0.25	0.25	0.25
T_t	Net Time of Test, min.	190	225	195	186	216	192
P_b	Barometric Pressure, in. Hg Absolute	30.05	30.10	30.15	30.05	30.10	30.15
P_m	Average Orifice Pressure, in. H_2O	0.47	.40	0.40	0.79	0.69	0.69
V_m	Volume of Dry Gas Sampled, cu. ft.	73.81	81.42	70.18	87.57	98.87	88.80
T_m	Average Gas Meter Temperature, ^{o} F.	87.9	89.3	80.1	73.1	80.5	78.1
V_{mstd}	Volume of Dry Gas Sampled, cu.ft., at standard conditions*	71.73	79.04	69.41	87.54	97.62	88.22
V_w	Total Water Collected, ml, Impingers and Silica Gel	59.	64.	59.	127.	76.	66.

* 70^{o} F., 29.92 in. Hg., Dry Basis

		Inlet			Outlet		
		5	6	7	5	6	7
V_{wgas}	Volume of Water Vapor Collected, SCF	2.80	3.03	2.80	6.02	3.60	3.13
% M	Percent Moisture in the Stack Gas by Volume	3.75	3.70	3.87	6.43	3.55	3.43
M_d	Mole Fraction of Dry Gas	0.96	0.96	0.96	0.94	0.96	0.97
% CO_2		0.2	0.2	0.2	0.2	0.2	0.2
% O_2		18.4	19.0	19.4	18.4	19.2	19.4
% CO		0.4	0.4	0.2	0.4	0.2	0.2
% N_2		81.0	80.4	80.2	81.0	80.4	80.2
MW_d	Molecular Weight of Dry Stack Gas	28.75	28.79	28.80	28.75	28.79	28.80
MW	Molecular Weight of Wet Stack Gas	28.35	28.41	28.38	28.06	28.41	28.43
C_p	Pitot Tube Coefficient	0.85	0.85	0.85	0.85	0.85	0.85
ΔP	Average Velocity Head of Stack Gas, in. H_2O	.493	0.414	0.412	0.237	0.203	0.203
T_s	Average Stack Temperature, $^{\circ}$F.	244.2	239.0	239.5	213.9	209.4	208.1
N_p	Net Sampling Points	48.	48.	48.	36.	36.	36.

		Inlet			Outlet		
		5	6	7	5	6	7
P_{st}	Static Pressure of Stack, in.Hg	-0.09	-0.09	-0.09	+0.02	+0.01	+0.01
P_s	Stack Pressure, in.Hg Absolute	29.96	30.01	30.01	30.07	30.11	30.16
V_s	Stack Velocity at Stack Conditions, fpm	2760.	2520.	2515.	1870.	1710.	1710.
A_s	Stack Areas, sq. in.	908.	908.	908.	1809.6	1809.6	1809.6
Q_s	Dry Stack Gas Volume at Standard Conditions, ACFM	12620.	11630.	11610.	17340.	16490.	16590.
Q_a	Stack Gas Volume at Stack Conditions, ACFM	17390.	15880.	15850.	23440.	21450.	21480.
% I	Percent Isokinetic	97.6	98.5	100.0	99.8	100.8	101.8
M_e	Particulate, mg, EPA-5	1821.4	2141.5	2060.4	185.2	207.5	131.4
M_t	Pariteulate, mg, Total	2107.8	2503.6	2543.2	374.8	533.2	292.2
I_c	% Impinger Catch	13.6	14.4	19.0	50.6	61.1	55.0
C_{es}	Particulate, gr/scf EPA-5	0.3910	0.4172	0.4571	0.0326	0.0327	0.0229

		Inlet			Outlet		
		5	6	7	5	6	7
C_{ts}	Particulate, gr/scf, Total	0.4525	0.4878	0.5643	0.0659	0.0841	0.0510
C_{ea}	Particulate, gr/acf, EPA-5	0.2836	0.3055	0.3346	0.0241	0.0251	0.0177
C_{ta}	Particulate, gr/acf, Total	0.3282	0.3572	0.4130	0.0488	0.0646	0.0394
PMR_e	Particulate, lb/hr, EPA-5	42.29	41.59	45.48	4.84	4.63	3.26
PMR_t	Particulate, lb/hr, Total	48.94	48.62	56.14	9.80	11.89	7.25
M_{ec}	Particulate, lb/ton Charge, EPA-5	9.81	7.34	7.90	1.12	0.82	0.57
M_{tc}	Particulate, lb/ton Charge, Total	11.36	8.58	9.75	2.27	2.10	1.26
M_c	Charge Mass, lb.	31600.	42500.	38400.	31600.	42500.	38400.
M_m	Metal Production, lb.	4770.	8320.	9580.	4770.	8320.	9580.

	Inlet			Outlet		
	5	6	7	5	6	7
Dross Source						
Furnace A	Conalco	Conalco	Conalco	Conalco	Conalco	Conalco
Furnace B	Crusher	Crusher	Tyroller Chunks	Crusher	Crusher	Tyroller Chunks
Furnace F	Howmet	Howmet	Howmet	Howmet	Howmet	Howmet
Heat Number	A 661 B 821 F 199	A 667 B 829 F 205	A 673 B 839 F 211	A 661 B 821 F 199	A 667 B 829 F 205	A 673 B 839 F 211

Table A-8

Particulate Emissions Data
Dryer

Test Location			Outlet	
Run No.		8	9	10
Date		10/31/74	10/31/74	10/31/74
Time		0930-1035	1105-1214	1320-1425
D_n	Sampling Nozzle Diameter, in.	0.50	0.50	0.50
T_t	Net Time of Test, min.	60.	60.	60.
P_b	Barometric Pressure, in.Hg Absolute	30.10	30.10	30.10
P_m	Average Orifice Pressure Drop, in H_2O	0.94	0.91	0.90
V_m	Volume of Dry Gas Sampled, cu. ft. at Meter	31.70	30.75	31.10
T_m	Average Gas Meter Temperature, °F.	71.21	81.04	84.92
V_{mstd}	Volume of Dry Gas Sampled, Cu.Ft. at Standard Conditions*	31.87	30.35	30.45
V_w	Total Water Collected, ml, Impingers and Silica Gel	21.	23.	23.

* 70° F., 29.92 in Hg, Dry Basis

		Outlet		
		8	9	10
V_{wgas}	Volume of Water Vapor Collected, scf*	1.00	1.09	1.09
% M	Percent Moisture in the Stack Gas by Volume	3.04	3.47	3.46
Md	Mole Fraction of Dry Gas	0.97	0.97	0.97
% CO_2		0.0	0.0	0.0
% O_2		20.4	20.4	20.4
% CO		0.0	0.0	0.0
% N_2		79.6	79.6	79.6
MW_d	Molecular Weight of Dry Stack Gas	28.82	28.82	28.82
MW	Molecular Weight of Wet Stack Gas	28.49	28.44	28.45
C_p	Pitot Tube Coefficient	0.85	0.85	0.85
ΔP	Average Velocity Head of Stack Gas, in. H_2O	0.015	0.014	0.014
T_s	Average Stack Temperature, ^oF.	100.8	83.3	90.0

* 70° F., 29.92 in Hg, Dry Basis

		Outlet		
		8	9	10
N_p	Net Sampling Points	12.	12.	12.
P_{st}	Static Pressure of Stack, In.Hg	+0.002	+0.001	+0.001
P_s	Stack Pressure, In.Hg Absolute	30.10	30.10	30.10
V_s	Stack Velocity at Stack Condition, fpm	420.	400.	400.
A_s	Stack Area, sq.in.	1017.9	1017.9	1017.9
Q_s	Dry Stack Gas Volume at Standard Conditions, SCFM	2760.	2640.	2660.
Q_a	Stack Gas Volume at Stack Conditions, ACFM	2990.	2820.	2840.
% I	Percent Isokinetic	99.6	98.9	98.7
M_e	Particulate, mg, EPA-5	1319.9	873.3	779.5
M_t	Particulate, mg, Total	1321.1	874.8	784.9
I_c	% Impinger Catch	.09	0.17	0.69
C_{es}	Particulate, gr/scf, EPA-5	0.6378	0.4431	0.3942
C_{ts}	Particulate, gr/scf, Total	0.6384	0.4439	0.3970

		Outlet		
		8	9	10
C_{ea}	Particulate, gr/acf, EPA-5	0.5880	0.4159	0.3689
C_{ta}	Particulate, gr/acf, Total	0.5885	0.4166	0.3714
PMR_e	Particulate, lb/hr, EPA-5	15.09	10.03	8.99
PMR_t	Particulate, lb/hr, Total	15.10	10.04	9.05
M_{ec}	Particulate, lb/ton Charge	40.55	27.85	19.75
M_{tc}	Particulate, lb/ton Charge	40.59	27.90	19.89
M_c	Charge Mass, lb.	744.	720.	910.

[illegible] Oct/21-31/74
West Chester, PA

	lb/T(chg)		Chg wt, T	
1	15.58	x	14.4	= 224.35
2	25.67	x	11.15	286.22
3	34.74	x	8.45	= 293.55
4	16.41	x	6.90	113.23
	23.1 av.		40.90	917.35
1	17.71	x	14.4	255.02
2	30.49	x	11.15	339.96
3	44.27	x	8.45	374.08
4	17.54	x	6.90	121.03
				1090.10

front half catch
22.43 lb/T chg
81.07 lb/T metal
34.75 lb/T dross

Total catch
26.65 lb/T chg
96.34 lb/T metal
41.29 lb/T Dross

metal produced 11.315 T
Dross charged 26.40

Baghouse - for Furnace hoods

Front half, lb/T chg

9.81	x	15.80	=	155.00
7.34	x	21.25	=	155.98
7.90	x	19.20	=	151.68
av. 8.35		56.25		462.65

Total Catch lb/T chg	Dross	
11.86	8.8	179.49
8.58	9.35	182.33
9.75	13.2	187.20
	31.35	549.01

front half
8.22 lb/T chg
40.82 lb/T metal
14.76 lb/T dross

Total catch
9.76 lb/T chg
48.43 lb/T metal out
17.51 lb/T dross

metal produced 11.355 Tons
Dross Charged 31.35 Tons

Dryer Emissions

3 Tests

TEST:	8	9	10
lb/hr	15.04	10.03	[illegible]
lb/T dry	40.55	27.90	19.89
[illegible] wt, lb	744	720	710

CHAPTER: 12.1
CD-ROM: Background
FILENAME: L1_00015

AP-42 Background File Documents

TESTING OF ABATEMENT EQUIPMENT FOR ANODE BAKING FURNACE NO. 5

by

R. S. ALVAREZ
C. H. ROSS

ALUMINUM COMPANY OF AMERICA
ROCKDALE, MILAM COUNTY, TEXAS

1979 MAY 21

Ref 6.

TABLE OF CONTENTS

ABSTRACT

New Source Performance Standard emissions tests were completed on the new anode baking furnace at the Aluminum Company of America's plant near Rockdale, Texas. Both the Alcoa 446 reactor (primary abatement device) and the Alcoa 446 alumina regenerator were tested and the results added together to determine total emissions from the system. Testing was done in accordance with EPA Methods 1, 2, 3, and 5 and Alcoa Method 4075A. Method 4075A was approved by EPA and the Texas Air Control Board and is described in Section IV, Analytical Technique.

Results of the tests were:

Total Fluoride	- .03 lbs/equivalent ton Al
HF	- .02 lbs/equivalent ton Al
Total Suspended Particulates	- .41 lbs/equivalent ton Al
CO Concentration (Reactor Effluent)	- .03%
CO Concentration (Regenerator Effluent)	- .07%

The Standard of Performance for fluoride emissions from new anode baking facilities associated with primary aluminum reduction plants is 0.1 lbs F^-/ton aluminum equivalent. It was concluded that emissions from the new anode baking furnace were compliant with this standard.

I. INTRODUCTION

On September 14, 1976, a permit was issued to the Aluminum Company of America to construct a new anode baking furnace at its plant near Rockdale, Texas. Construction of the new facility began during the week ending October 8, 1976, and the Environmental Protection Agency and the Texas Air Control Board were notified of this event on November 19, 1976. Construction was completed and the initial fires in the furnace were started on December 19, 1977. The furnace reached full production status on February 22, 1978.

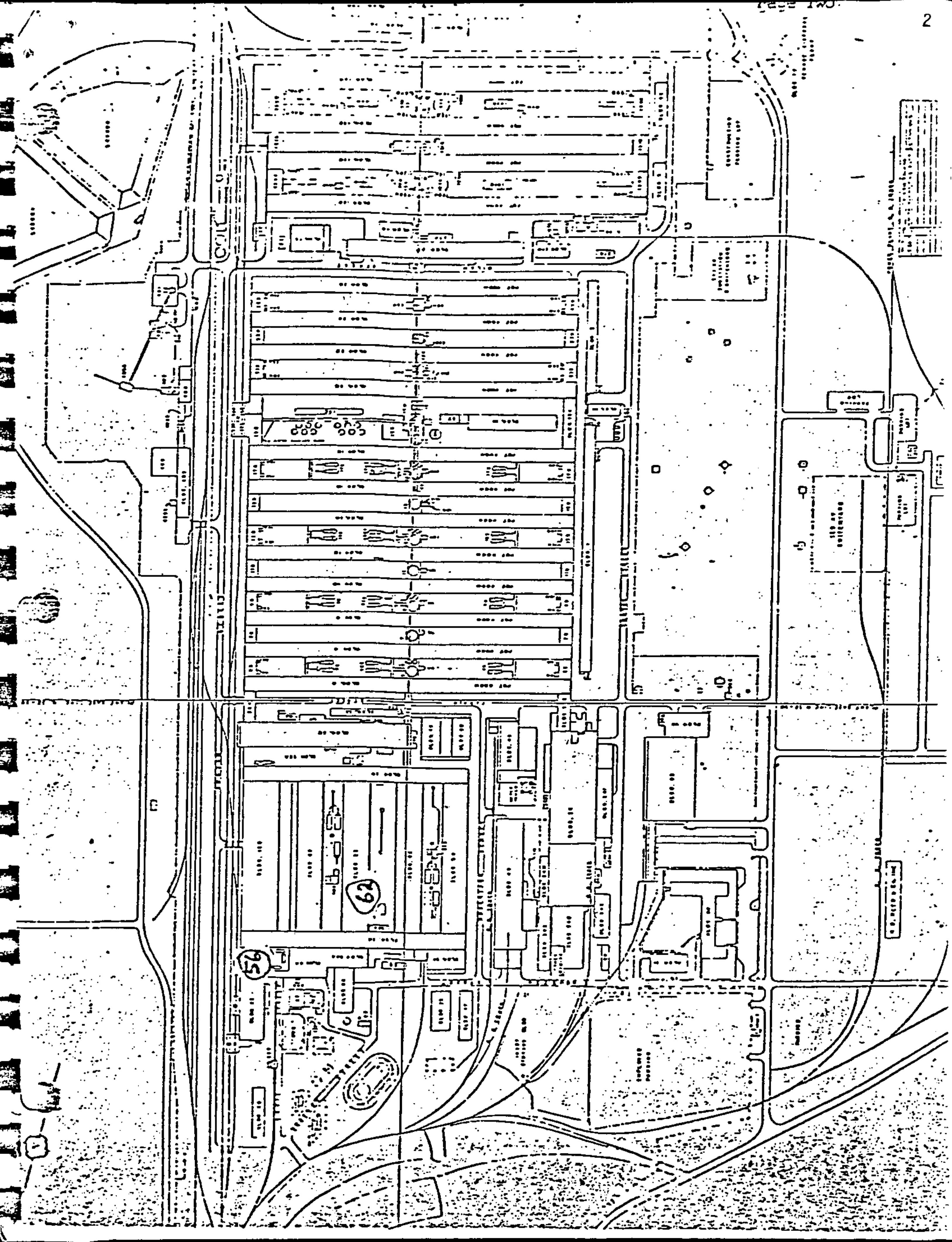
On March 16, 1978, a Pretesting Meeting was held at the Rockdale plant to review procedures to be used in N.S.P.S. emissions testing of the new facility. Representatives of EPA, the Texas Air Control Board, and Alcoa participated.

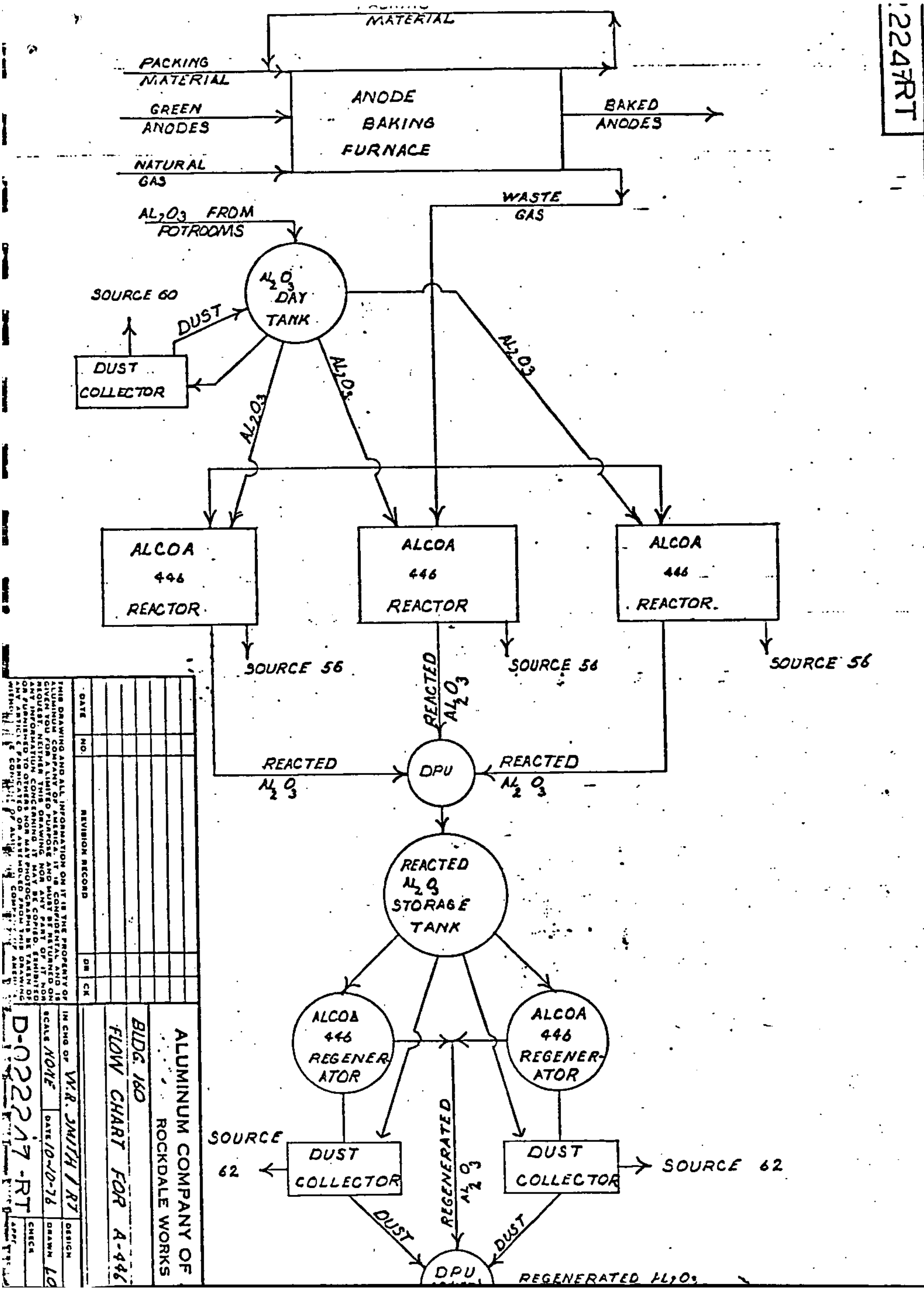
Initial testing of the facility was conducted on six consecutive days from 1978 May 15-21. Results of these tests were reported to the Environmental Protection Agency and the Texas Air Control Board on 1978 August 29. Subsequent to these tests, an amendment to Permit C4476 allowing a production increase in the new furnace was granted by the Texas Air Control Board. Issuance of an Operating Permit was held up pending results of emissions tests at the higher production rate.

Re-testing of the facility was conducted on nine days from January 29-March 5, 1979, and was witnessed by Mr. M. H. Pointer of the Texas Air Control Board Source Evaluation Section. Actual testing was performed by Alcoa process engineering technicians J. R. Brown, K. A. Tharp, D. J. Orsag, W. L. Young, G. L. Crowell, and A. S. Youngblood. Mr. Jeff Bishop, Alcoa Environmental Lab, assisted.

Preparation and unloading of the sample trains and sample analysis was performed by Messrs. C. H. Ross and N. Martinez of the Rockdale Works Analytical Lab. Messrs. E. B. Parker and R. S. Alvarez participated in the planning and coordinating of the tests. Mr. Alvarez performed calculations and assembled data used in preparing this report.

On the following pages are a plant map showing location of the emissions sources, a schematic drawing of the anode baking process and related abatement equipment, and a description of the anode baking process.


62


PACKING MATERIAL
PACKING MATERIAL
GREEN ANODES
NATURAL GAS
ANODE BAKING FURNACE
BAKED ANODES
WASTE GAS
AL_2O_3 FROM POTROOMS
AL_2O_3 DAY TANK
SOURCE 60
DUST
DUST COLLECTOR
AL_2O_3
AL_2O_3
AL_2O_3
ALCOA 446 REACTOR
ALCOA 446 REACTOR
ALCOA 446 REACTOR
SOURCE 56
SOURCE 56
SOURCE 56
REACTED AL_2O_3
REACTED AL_2O_3
REACTED AL_2O_3
DPU
REACTED AL_2O_3 STORAGE TANK
ALCOA 446 REGENERATOR
ALCOA 446 REGENERATOR
SOURCE 62
SOURCE 62
DUST COLLECTOR
DUST COLLECTOR
REGENERATED AL_2O_3
DUST
DUST
DPU
REGENERATED AL_2O_3
ALUMINUM COMPANY OF AMERICA
ROCKDALE WORKS
BLDG. 160
FLOW CHART FOR A-446
IN CHG OF W.R. SMITH / RT
SCALE NONE
DATE 10-10-76
D-022247-RT

DESCRIPTION OF PROCESS

Green carbon anodes weighing approximately 630 pounds each are placed in the pits of the baking furnace, covered with packing material to conserve heat and prevent burning, and baked at approximately 1150°C using natural gas fuel. Volatiles are driven off and enter the furnace exhaust where they are burned. The exhaust gas is collected in ducts and transported to the Alcoa A-446 reactor. Alumina is used to absorb pollutants before the gas is exhausted to the atmosphere. The reacted alumina goes to the regenerator and then to the potrooms.

After baking, packing material is removed and the baked anodes are taken from the pits, cleaned and sent on to the anode assembly area. Packing material is reused with a small quantity of new material being introduced to make up losses incurred through spillage and burning.

II. PROCEDURE

Emissions points associated with the anode baking furnace are Source 56 (Alcoa 446 Reactor) and Source 62 (Alcoa 446 Alumina Regenerator.) Both sources were tested for particulate and gaseous fluoride, and total particulate.

Tests on the Alcoa 446 Reactor which complied with the 100% ±10% isokinetic rule were completed on January 29 (test #1), February 1 (test #3), and February 10 (test #8.) The method used was 4075A which was previously approved by the EPA and TACB. The equipment consisted of the RAC unit, the sample nozzle with the attached pitot tube, and the thimble and filter located as close to the sample point as possible - it was inside the stack and the heating system was not used. A detailed description of the method and equipment are presented in the analytical technique section.

Tests on the Alcoa 446 regenerator were obtained using two methods. The tests for gaseous and particulate fluoride were made using Method 4075A on the following dates: February 5 (test #5), February 8 (test #6), and February 9 (test #7.) Alumina conveying problems prevented the tests being made on consecutive days. The total particulate tests for the Alcoa 446 regenerator were made using EPA Method 5 on March 1 (test #11), March 2 (test #12), and March 5 (test #13.) The intentions were to use Method 4075A for particulate and gaseous fluoride as well as total particulate; but the filter did not withstand the environment and showed loss in weight, consequently particulate tests required EPA Method 5.

Orsat samples were obtained for each test. On each reactor test six samples were obtained - two from each stack - one per port. On each regenerator test two Orsat samples were obtained - two per port. The samples were delivered to the laboratory immediately after they were obtained for analysis.

The following outline describes the method used to operate the sampling train for all tests:

I. Pre-Sampling Checks

A. Manometers were leveled and zeroed
B. Pitot lines were leak-checked
C. Measured stack pressure at null position and recorded angle from axial centerline of duct at less than 10 degrees
D. Leak-checked sampling train; a stop watch was used

II. During-Sampling Checks

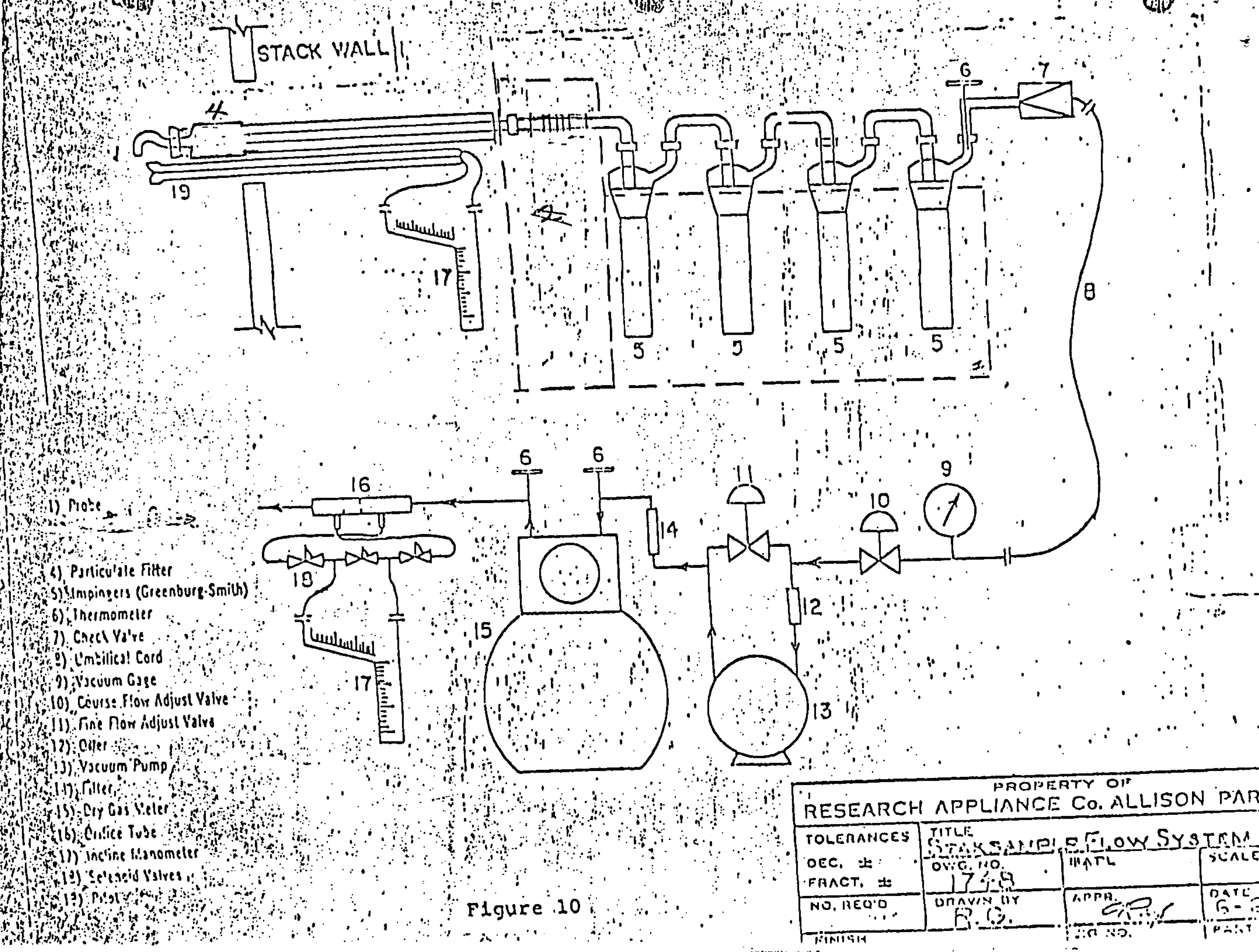
A. Vacuum leak-checked when sample train broken
B. All shut-down and start-up times were noted

III. Post-Sampling Checks

A. Sample train was leak-tested as required after each test. No leak greater than .02 ft^3/min was present
B. Pitot leak-checked
C. Field data sheets completely filled out

The sample trains were handled with care at all times, including when transported to and from the laboratory. Analytical techniques are described in Section IV. Data and calculations are shown in Section V.

Anode production was determined by using the average number of anodes baked during the test days and multiplying that number by the average weight. Average weight was determined by weighing twelve of the anodes taken from the furnace each day during the test.



STACK WALL
4
19
17
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11
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13
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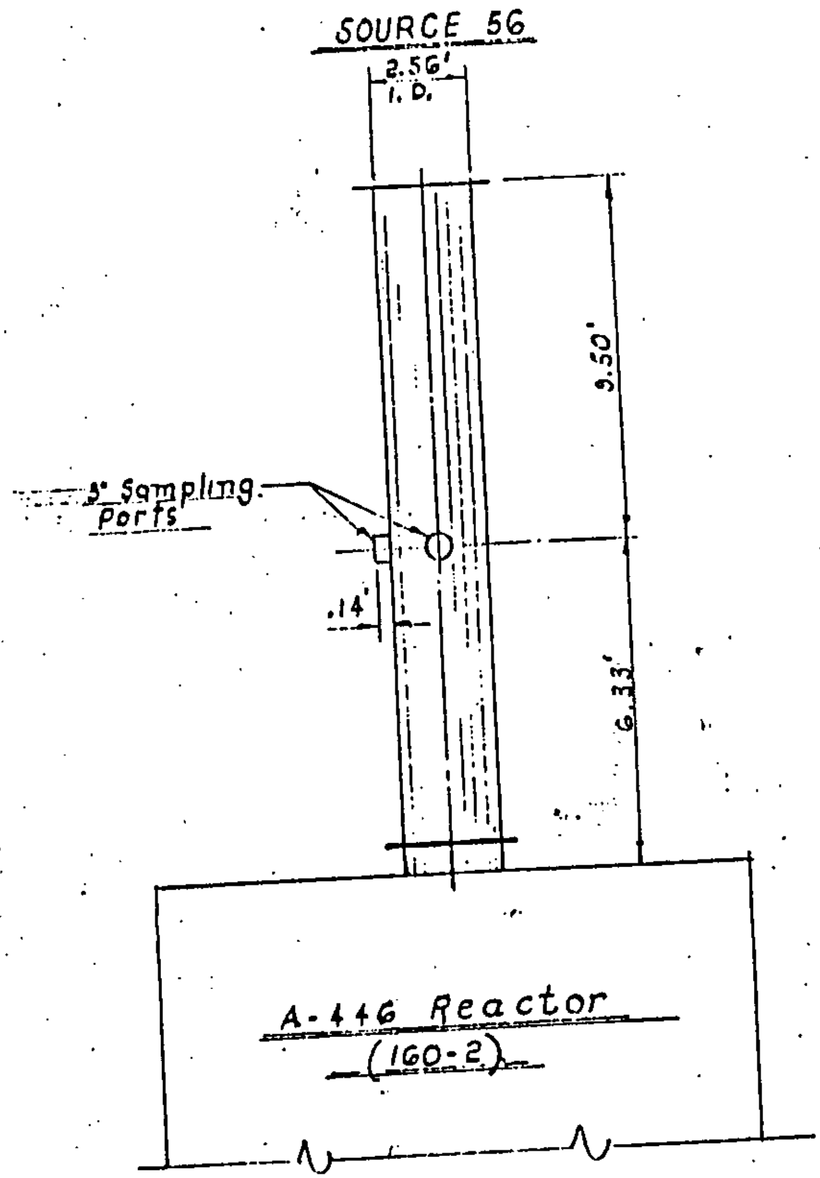
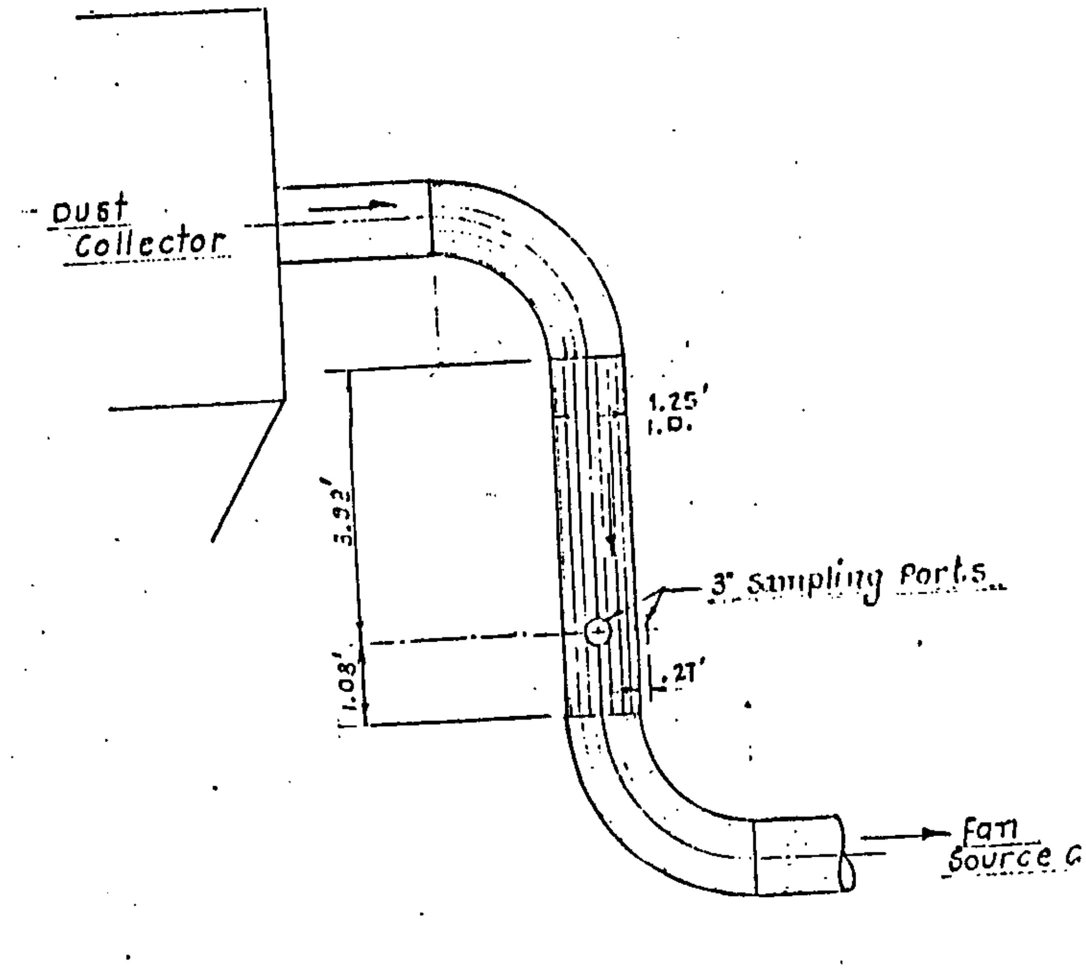
15
16
18
17
1) Probe
4) Particulate Filter
5) Impingers (Greenburg-Smith)
6) Thermometer
7) Check Valve
8) Umbilical Cord
9) Vacuum Gage
10) Course Flow Adjust Valve
11) Fine Flow Adjust Valve
12) Oiler
13) Vacuum Pump
14) Filter
15) Dry Gas Meter
16) Orifice Tube
17) Incline Manometer
18) Solenoid Valves
PROPERTY OF
RESEARCH APPLIANCE Co. ALLISON PARK
TOLERANCES
DEC. ±
FRACT. ±
NO. REQ'D
FINISH
TITLE
STAKSAMPLR FLOW SYSTEM
DWG. NO.
1748
DRAWN BY
B.G.
MAT'L
APPR.
SCALE
DATE

Figure 10



DIMENSIONS SHOWN TYPICAL FOR EAST, WEST & CENTER STACKS



A-446 REGENERATOR DUST COLLECTOR

DETAILS ON SAMPLING PORTS

Traverse Point Number	Distance From Reference Point To Nozzle: Reactor	Regenerator
1	.36"	.29"
2	.96	.97 **
3	1.68 *	1.71
4	2.40	2.57
5	3.24	3.63
6	4.08	5.14
7	4.92	9.38
8	6.00	10.89
9	7.08	11.95
10	8.40	12.81
11	9.96	13.55 **
12	12.24	14.23
13	18.48	
14	20.76	
15	22.32	
16	23.64	
17	24.72	
18	25.80	
19	26.64	
20	27.48	
21	28.32	
22	29.04 *	
23	29.76	
24	30.36	

* Two outside points dropped; First and last point tested for six (6) minutes

** Outside points dropped; First and last point tested for 20 minutes

III. RESULTS AND CONCLUSIONS

Results

Emissions testing yielded the following results.

Pollutant	Emissions Rate - Lbs/Day (Alcoa 446 Reactor + Alcoa 446 Regenerator)
Total Fluoride	12.43
HF	10.24
Total Suspended Particulate	193.03

Orsat analysis of the reactor and the regenerator effluent revealed the following concentrations of carbon monoxide.

Reactor - .03%
Regenerator - .07%

All sampling rates during the test were well within 100 ±10% isokinetic as shown below.

Test No.	% Isokinetic Reactor	% Isokinetic Regenerator
1	108.86	
3	106.86	
8	103.50	
4		104.03
5		105.47
7		105.60
11		106.03
12		105.42
13		102.46

Operating conditions of the Alcoa 446 system during the test period were as follows.

A-446 Reactor

CONFIDENTIAL

	Inlet Gas Temp. °F	Fan Amps	Δ P (Bed) Inches H_2O	Δ P (Bag) Inches H_2O	Bed Temp. °F	Alumina Feed Rate Lbs/Hr
Average	338	407.4	25.15	4.5	188.5	660
Range	340-450	390-430	24.1-27.0	4.2-5.1	150-215	-

CONFIDENTIAL

A-446 Regenerator

	Bed Temp. °F	Dust Collector ΔP, Inches H_2O	Alumina Feed Rate (Lbs/Hr)
Average	1017	.93	800
Range	930-1100	.8-1.0	-

The average weight of the 108 anodes checked during the testing was 612.4 pounds. During tests 1,3,4,6,7, and 8, 777.5 pieces of carbon were baked per day. During tests 11,12, and 13, 648 pieces of carbon were baked per day. The equivalent weight of aluminum for tests 1,3,4,6,7 and 8 is 476.14 ton/day and for tests 11,12, and 13 the equivalent ton of Al/day yields 396.84.

Emissions expressed in lbs/eq. ton Al produced are listed below.

Pollutant	Emissions (Lbs/Eq.Ton Al)
Total Fluorides	.026
HF	.021
Total Suspended Particulate	.404

Conclusion

The applicable fluoride emissions standard for new anode baking furnaces associated with primary aluminum smelters is 0.1 lb F^- per equivalent ton of aluminum produced. (Subpart S, Section 60.193(3)). Results of the emissions tests described in this report indicate that emissions from the new anode baking furnace at the Aluminum Company of America, Rockdale Works, are compliant with that regulation.

STAPPA/ALAPCO

7.1

#101 10/28/86

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

SOURCE TEST REPORT:

85-14

KAISER ALUMINUM AND CHEMICAL CORPORATION

TACOMA, WASHINGTON

POTLINE #4

EMISSIONS OF ORGANIC AROMATIC COMPOUNDS

SEPTEMBER 24-26, 1985

7.11.92

Directed to use general info but no emission factors

Ref 4

Source Test 85-14
Kaiser, Tacoma
Sept. 24-26, 1986

I. PURPOSE

The purpose of the test was to measure emission of toxic organic aromatic compounds from a Soderberg primary aluminum plant. The results will be used in the Department of Ecology's Air Toxics program.

II. FACILITY TESTED

The Kaiser Tacoma Works produces about 200 tons of primary aluminum a day from three Soderberg aluminum potlines. Line #4 is the newest of the three and produces about half of the total production was tested.

Aluminum is produced in electrolytic cells that that are twenty to thirty feet on a side. Each pot line has about one hundred pots. The pots are completely hooded, with moveable doors. The exhaust from each pot is ducted to a central primary air pollution control system that controls emissions of both particulate and fluoride. Emissions that escape the primary control system are vented out the pot room roof monitors.

III. TEST PROCEDURE

Samples were taken from the primary air pollution control device, a baghouse, and the roof monitors. A modified EPA Method 5 sampling train was used to collect the organics. For the baghouse the sampling train consisted of a standard Method 5 train except that a water jacketed cooling condenser and a water jacketed XAD-2 absorbent module were added after the heated filter. The absorbent was maintained below 70 degrees. The sampling duration was between four and five hours.

Roof monitor samples were taken in a similar manner except that the filter was not heated and that each sample was taken over about a twenty-four hour period.

The samples were analyzed by Engineering-Science for Priority Pollutant using base neutral EPA Procedure 625.

Source Test 85-14
Kaiser, Tacoma

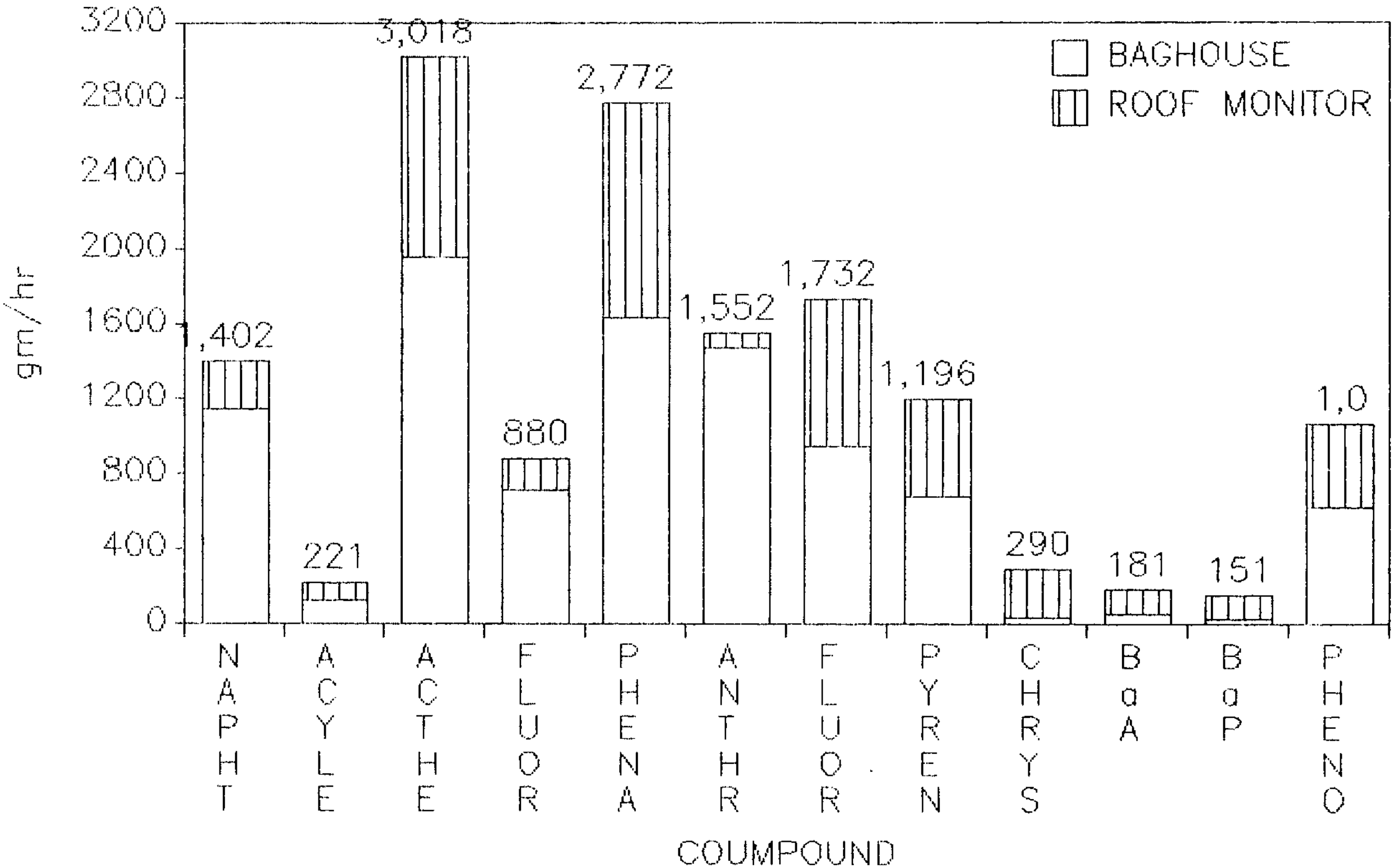
IV. RESULTS

The results are summarized in Tables 1-3 and Figure 1 and compare well to levels reported in the literature. The amount of Benzo(a)Pyrene (BaP) is considerably more than has been measured by Ecology in the past. The difference may be attributable to better sampling, collection and analysis procedures for the current test.

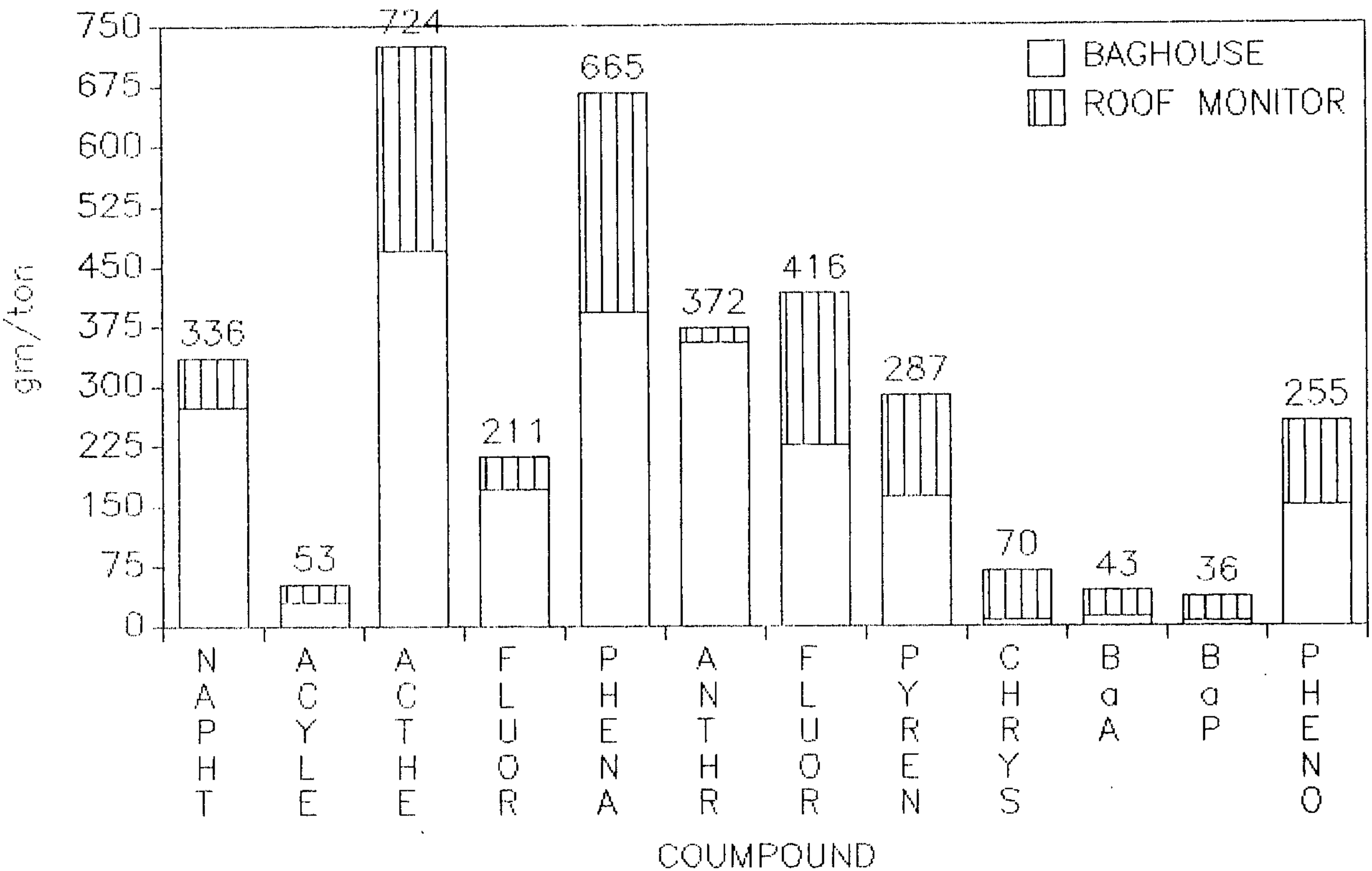
The primary air pollution control system collected and removed most of the PNA's. The air pollution control system is designed to collect 80 to 90% of the emissions and is designed to remove particulate and fluoride. Hence a pollutant would be uncontrolled if the baghouse emissions were five to ten times the roof monitor emissions. For the lighter compounds such as naphthalene and anthracene this is the case. For the heavier PNA's such as BaP the reverse is true, suggesting that the pollution control equipment removed the compound. The efficiency of removal appears to be a function of the molecular weight or the vapor pressure of the compound, with the removal efficiency of the heavier PNA's such as BaP quite high.

which pollutant(s) ?

KAISER TACOMA
PNA EMISSION RATES



KAISER TACOMA
PNA EMISSION FACTORS



KAISER, TACOMA
PNA EMISSIONS
Potline 4

TABLE 1
EMISSION RATE, gm/hr

	BAGHOUSE	ROOF	TOTAL
NAPHTHALENE	1,143	258	1,402
ACENAPHTHYLENE	125	96	221
ACENAPHTHENE	1,957	1,060	3,018
FLUORENE	709	170	880
PHENANTHRENE	1,633	1,139	2,772
ANTHRACENE	1,472	80	1,552
FLUORANTHENE	941	791	1,732
PYRENE	677	519	1,196
CHRYSENE	32	259	290
BENZO A ANTHRACEME	50	131	181
BENZO A PYRENE	26	125	151
PHENOL	622	438	1,060
TOTAL	9,387	5,066	14,454

TABLE 2
EMISSION FACTOR, gm/ton

	BAGHOUSE	ROOF	TOTAL
NAPHTHALENE	274	62	336
ACENAPHTHYLENE	30	23	53
ACENAPHTHENE	470	254	724
FLUORENE	170	41	211
PHENANTHRENE	392	273	665
ANTHRACENE	353	19	372
FLUORANTHENE	226	190	416
PYRENE	162	125	287
CHRYSENE	8	62	70
BENZO A ANTHRACEME	12	31	43
BENZO A PYRENE	6	30	36
PHENOL	149	105	255
TOTAL	2,253	1,216	3,469

	BAG HOUSE			ROOF MONITOR	
RUN NUMBER	1	2	3	11	12
START VOLUME,CF	395.20	528.18	8,673.14	2,368.48	3,183.32
FINNISH VOLUME	527.83	673.64	8,804.80	3,181.05	4,040.05
SAMPLE	132.63	145.46	131.66	812.57	856.73
SAMPLE VOLUME CM	3.75	4.11	3.72	22.95	24.20
	MASS COLLECTED, mg				
NAPHTHALENE	1.60	8.20	6.50	1.00	1.30
ACENAPHTHYLENE	0.15	0.88	0.75	0.68	0.16
ACENAPHTHENE	3.19	17.00	8.00	8.00	1.23
FLUORENE	0.99	6.00	3.21	0.99	0.51
PHENANTHRENE	1.10	7.80	14.00	7.00	3.00
ANTHRACENE	2.60	17.00	2.00	0.28	0.43
FLUORANTHENE	0.58	8.60	4.40	3.90	3.10
PYRENE	0.46	6.10	3.20	2.40	2.20
CHRYSENE	0.02	0.23	0.20	1.10	1.20
BENZO A ANTHRACENE	0.20	0.23	0.27	0.61	0.55
BENZO A PYRENE	0.02	0.15	0.20	0.88	0.21
PHENOL	1.02	3.90	3.90	3.00	0.83

KAISER, TACOMA
PNA EMISSIONS
SAMPLE DATA

	1	2	3	AVERAGE	11	12	AGERAGE	TOTAL
CONCENTRATION, ug/CM								
NAPHTHALENE	427.05	1,995.60	1,747.68	1,390.11	43.57	53.72	48.64	
ACENAPHTHYLENE	40.04	214.16	201.66	151.95	29.62	6.61	18.12	
ACENAPHTHENE	851.44	4,137.22	2,150.99	2,379.88	348.52	50.82	199.67	
FLUORENE	264.24	1,460.20	863.09	862.51	43.13	21.07	32.10	
PHENANTHRENE	293.60	1,898.25	3,764.24	1,985.36	304.96	123.96	214.46	
ANTHRACENE	693.96	4,137.22	537.75	1,789.64	12.20	17.77	14.98	
FLUORANTHENE	154.81	2,092.95	1,183.05	1,143.60	169.91	128.09	149.00	
PYRENE	122.78	1,484.53	860.40	822.57	104.56	90.90	97.73	
CHRYSENE	5.34	55.97	53.77	38.36	47.92	49.58	48.75	
BENZO A ANTHRACENE	53.38	55.97	72.60	60.65	26.57	22.73	24.65	
BENZO A PYRENE	5.34	36.50	53.77	31.87	38.34	8.68	23.51	
PHENOL	272.25	949.13	1,048.61	756.66	130.70	34.30	82.50	
EMISSION RATE, gm/hr								TOTAL
NAPHTHALENE	351.25	1,641.40	1,437.48	1,143.38	231.34	285.24	258.29	1,401.67
ACENAPHTHYLENE	32.93	176.15	165.86	124.98	157.31	35.11	96.21	221.19
ACENAPHTHENE	700.31	3,402.90	1,769.21	1,957.47	1,850.72	269.88	1,060.30	3,017.78
FLUORENE	217.34	1,201.02	709.90	709.42	229.03	111.90	170.46	879.88
PHENANTHRENE	241.49	1,561.33	3,096.12	1,632.98	1,619.38	658.25	1,138.81	2,771.79
ANTHRACENE	570.79	3,402.90	442.30	1,472.00	64.78	94.35	79.56	1,551.56
FLUORANTHENE	127.33	1,721.47	973.07	940.62	902.23	680.19	791.21	1,731.83
PYRENE	100.99	1,221.04	707.68	676.57	555.22	482.71	518.97	1,195.54
CHRYSENE	4.39	46.04	44.23	31.55	254.47	263.30	258.89	290.44
BENZO A ANTHRACENE	43.91	46.04	59.71	49.89	141.12	120.68	130.90	180.78
BENZO A PYRENE	4.39	30.03	44.23	26.22	203.58	46.08	124.83	151.04
PHENOL	223.92	780.66	862.49	622.36	694.02	182.12	438.07	1,060.43
EMISSION FACTOR, gm/ton								14,453.93
NAPHTHALENE	84.30	393.94	345.00	274.41	55.52	68.46	61.99	336.40
ACENAPHTHYLENE	7.90	42.28	39.81	30.00	37.75	8.43	23.09	53.09
ACENAPHTHENE	168.08	816.70	424.61	469.79	444.17	64.77	254.47	724.27
FLUORENE	52.16	288.25	170.38	170.26	54.97	26.86	40.91	211.17
PHENANTHRENE	57.96	374.72	743.07	391.92	388.65	157.98	273.32	665.23
ANTHRACENE	136.99	816.70	106.15	353.28	15.55	22.64	19.09	372.37
FLUORANTHENE	30.56	413.15	233.54	225.75	216.53	163.25	189.89	415.64
PYRENE	24.24	293.05	169.84	162.38	133.25	115.85	124.55	286.93
CHRYSENE	1.05	11.05	10.62	7.57	61.07	63.19	62.13	69.71
BENZO A ANTHRACENE	10.54	11.05	14.33	11.97	33.87	28.96	31.42	43.39
BENZO A PYRENE	1.05	7.21	10.62	6.29	48.86	11.06	29.96	36.25
PHENOL	53.74	187.36	207.00	149.37	166.56	43.71	105.14	254.50
TOTAL								3,468.94

State of Washington Department of Ecology

Kaiser - Tac
Tox.ics
Baghouse & Roof Monitor

TEST NO. 82-14
DATE Sept 24, 25 & 26 1985

METHOD 5—
PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

PLANT KAISER
SAMPLING LOCATION ~~32B~~ 32II
SAMPLE TYPE Tox
RUN NUMBER 1 OPERATOR JMW
AMBIENT TEMPERATURE 60
BAROMETRIC PRESSURE
STATIC PRESSURE
STACK DIAMETER Area ft²

PROBE LENGTH, TYPE, FACTOR 3/16 Glass
NOZZLE I.D. 3/16
ASSUMED MOISTURE, % 5
SAMPLE BOX NUMBER 1 METER 2
WATER VOLUME COLLECTED -27.8 (Impingers) + 41.7 (Silica Gel) = 13.9 ml
ORSAT CO_2 O_2 CO

PARTICULATE WEIGHT

	WASH	FILTER	IMPINGERS
I.D. NO.			
FINAL			
TARE			
GAIN			

TRAVERSE POINT NUMBER	SAMPLING TIME, min. / CLOCK TIME (24 hr. clock)	GAS METER READING (V_m), ft³	VELOCITY HEAD (P_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (H), in. H_2O DESIRED	ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IN	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	INLET ($T_{m\,in}$), °F	PUMP VACUUM in. Hg
	1025	5395.2	17 22	10		186		66	65		72	72	
	1125		18										
	260	8527.83	20										
			20										
			18										
			17			141							

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr. clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (P_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (H), in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET $(T_{m_{out}})$, °F	INLET $(T_{m_{in}})$, °F	

COMMENTS

State of Washington Department of Ecology

TEST NO. 82-14

DATE 9/24-25-26/85

METHOD 5—
PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

PLANT KAISER

SAMPLING LOCATION Baghouse

SAMPLE TYPE

RUN NUMBER 2 OPERATOR JMW

AMBIENT TEMPERATURE 66

BAROMETRIC PRESSURE

STATIC PRESSURE

STACK DIAMETER ______ Area ______ ft^2

PROBE LENGTH, TYPE, FACTOR 3 Glass 796

NOZZLE I.D. 3/16

ASSUMED MOISTURE, % 5

SAMPLE BOX NUMBER ______ METER ______

WATER VOLUME COLLECTED 1.0 (Impingers) + 36.6 (Silica Gel) = 37.6 ml

ORSAT CO_2 ______ O_2 ______ CO ______

PARTICULATE WEIGHT

	WASH	FILTER	IMPINGERS
I.D. NO.			
FINAL			
TARE			
GAIN			

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr. clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (P_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (H), in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET ($T_{m_{out}}$), °F	INLET ($T_{m_{in}}$), °F	
1024	0.0	8528.18	22	10.4		186		64	48	61	102.94	81	5
	95	8576	22	10.4		202		90	50		105	116	
	210	8638.8	21	10.4				93	52		115	117	
227	274	8673.61	2										

ECL-943-

Add-2

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr. clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (P_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (H), in. H_2O)		STACK TEMP (T_S), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET ($T_{m_{out}}$), °F	INLET ($T_{m_{in}}$), °F	

COMMENTS

State of Washington Department of Ecology

TEST NO. 82-14
DATE 9-26-85

METHOD 5— PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

PLANT Kaiser
SAMPLING LOCATION Baghouse
SAMPLE TYPE ~~part.~~
RUN NUMBER 3 OPERATOR J.D
AMBIENT TEMPERATURE 52
BAROMETRIC PRESSURE
STATIC PRESSURE
STACK DIAMETER ______ Area ______ ft^2

PROBE LENGTH, TYPE, FACTOR 3' glass
NOZZLE I.D. 3/16
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER ______ METER ______
WATER VOLUME COLLECTED 6.1 (Impingers) + 35.0 (Silica Gel) = 41.1 ml
ORSAT CO_2 ______ O_2 ______ CO ______

PARTICULATE WEIGHT

	WASH	FILTER	IMPINGERS
I.D. NO.			
FINAL			
TARE			
GAIN			

TRAVERSE POINT NUMBER	SAMPLING TIME, min. / CLOCK TIME (24 hr. clock)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (P_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (H), in. H_2O DESIRED	ACTUAL	STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F OUT	IN	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	INLET ($T_{m\,in}$), °F	PUMP VACUUM in. Hg
	0	8673.14	23	11		186		67	50		~~[illegible]~~ 86	90	5
	15	681.30	23	11		196		71	50		84	92	
	30	689.2	23	11		233		73	47		115	92	6
	53	717.6	23	11		190		77	50		102	95	
	1-5	8795	23	11		190		86	54		106	105	
	246.0	8804.80						92	56		114	113	

ECL-943-

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr. clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft³	VELOCITY HEAD (P_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (H), in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg.
				DESIRED	ACTUAL				OUT	IN	OUTLET ($T_{m_{out}}$), °F	INLET ($T_{m_{in}}$), °F	

COMMENTS

State of Washington
Department of Ecology

TEST NO. ____
DATE ____

METHOD 5—
PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

PLANT KAISER
SAMPLING LOCATION Roof
SAMPLE TYPE FWD
RUN NUMBER 12 OPERATOR ____
AMBIENT TEMPERATURE ____
BAROMETRIC PRESSURE 29.60
STATIC PRESSURE ____
STACK DIAMETER ____ Area ____ ft²

PROBE LENGTH, TYPE, FACTOR ____
NOZZLE I.D. ____
ASSUMED MOISTURE, % ____
SAMPLE BOX NUMBER ____ METER ____
WATER VOLUME COLLECTED ____ (Impingers) + ____ (Silica Gel) = ____ ml
ORSAT CO_2 ____ O_2 ____ CO ____

PARTICULATE WEIGHT

	WASH	FILTER	IMPINGERS
I.D. NO.			
FINAL			
TARE			
GAIN			

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr. clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft³	VELOCITY HEAD (P_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (H), in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET ($T_{m_{out}}$), °F	INLET ($T_{m_{in}}$), °F	
1137	0.0	3183.32											
	120	3255											
	260	3243											
	1344	3959											
1127	1430	4040.05											

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr. clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft³	VELOCITY HEAD (P_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (H), in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET ($T_{m_{out}}$), °F	INLET ($T_{m_{in}}$), °F	

COMMENTS

State of Washington Department of Ecology

TEST NO. 82-14

DATE

METHOD 5—
PARTICULATE SAMPLING WITH A HEATED FILTER WITH IMPINGER

PLANT KAISER

SAMPLING LOCATION ROOF

SAMPLE TYPE PN4

RUN NUMBER 11 OPERATOR JMV

AMBIENT TEMPERATURE

BAROMETRIC PRESSURE

STATIC PRESSURE

STACK DIAMETER Area ft^2

PROBE LENGTH, TYPE, FACTOR

NOZZLE I.D.

ASSUMED MOISTURE, %

SAMPLE BOX NUMBER METER

WATER VOLUME COLLECTED ___ (Impingers) + ___ (Silica Gel) = ___ ml

ORSAT CO_2 O_2 CO

PARTICULATE WEIGHT

	WASH	FILTER	IMPINGERS
I.D. NO.			
FINAL			
TARE			
GAIN			

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (P_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (H), in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET ($T_{m_{out}}$), °F	INLET ($T_{m_{in}}$), °F	
	0 0112 45	2368.48		20									
1:4	1190	2444.3											
	200	2495											
	1380												
	1390	3181.05											

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr. clock) / SAMPLING TIME, min.	GAS METER READING (V_m), ft^3	VELOCITY HEAD (P_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (H), in. H_2O		STACK TEMP (T_s), °F	PROBE TEMP °F	SAMPLE BOX TEMP °F	IMPINGER TEMP °F		DRY GAS METER TEMPERATURE		PUMP VACUUM in. Hg
				DESIRED	ACTUAL				OUT	IN	OUTLET ($T_{m_{out}}$), °F	INLET ($T_{m_{in}}$), °F	

COMMENTS

ENGINEERING-SCIENCE

RESEARCH AND DEVELOPMENT LABORATORY • 600 BANCROFT WAY • BERKELEY, CALIFORNIA 94710 • 415/841-7353

Priority Pollutant Analysis
Base Neutrals - EPA 625

Date Received 10/4/85
Date Reported 11/20/85

P.O. No. --
Job No. 46921.00
Page 1 OF 3

For: Engineering-Science, Fairfax   Attn: Jon Bolstad
Address:

Lab No:		853009	853010	853011	853012
Source of Sample: Kaiser		Run 1 *	Run 2 •	Run 3 •	Run 11 *
Date Collected:		--	--	--	--
Time Collected:		--	--	--	--
Compound	Units	ANALYTICAL RESULTS			
1,3-Dichlorobenzene	mg	<0.02	<0.2	<0.2	<0.2
1,4-Dichlorobenzene	mg	<0.02	<0.2	<0.2	<0.2
Hexachloroethane	mg	<0.02	<0.2	<0.2	<0.02
1,2-Dichlorobenzene	mg	<0.02	<0.2	<0.2	<0.2
Nitrobenzene	mg	<0.02	<0.2	<0.2	<0.2
Hexachlorobutadiene	mg	<0.02	<0.2	<0.2	<0.2
1,2,4-Trichlorobenzene	mg	<0.02	<0.2	<0.2	<0.2
Isophorone	mg	<0.02	<0.2	<0.2	<0.2
Naphthalene	mg	1.60	8.2	6.5	1.0
2-Chloronaphthalene	mg	<0.02	<0.2	<0.20	<0.20
Acenaphthylene	mg	0.15	0.88	0.75	0.68
Acenaphthene	mg	3.19	17	8.0	8.0
Dimethyl phthalate	mg	<0.020	<0.2	<0.20	<0.20
2,6-Dinitrotoluene	mg	<0.02	<0.2	<0.2	<0.2
Fluorene	mg	0.99	6.0	3.21	0.99
2,4-Dinitrotoluene	mg	<0.02	<0.2	<0.2	<0.2
Diethylphthalate	mg	<0.02	<0.2	<0.2	<0.2
Hexachlorobenzene	mg	<0.02	<0.2	<0.2	<0.2

RECEIVED
DEC 2 1985
ENGINEERING SCIENCE

Priority Pollutant Analysis
Base Neutrals - EPA 625
(continued)

Date Received 10/4/85
Date Reported 11/20/85

P.O. No. --
Job No. 46921.00

For Engineering-Science, Fairfax   Attn: Jon Bolstad
Address

Lab No:		853009	853010	853011	853012
Source of Sample: Kaiser		Run 1 •	Run 2 *	Run 3 •	Run 11 •
Date Collected:		--	--	--	--
Time Collected:		--	--	--	--
Compound	Units	ANALYTICAL RESULTS			
Phenanthrene	mg	1.1	7.8	14	7
Anthracene	mg	2.6	17	2.0	0.28
Dibutyl phthalate	mg	<0.02	<0.3	<0.4	<0.4
Fluoranthene	mg	0.58	8.6	4.4	3.9
Pyrene	mg	0.46	6.1	3.2	2.4
Butyl benzyl phthalate	mg	<0.020	<0.15	<0.20	<0.20
Bis(2-ethylhexyl) phthalate	mg	<0.020	<0.15	<0.20	<0.20
Chrysene	mg	<0.020	0.23	<0.20	1.10
Benzo(a)anthracene	mg	<0.020	0.23	0.27	0.61
Di-n-octylphthalate	mg	<0.020	<0.15	<0.20	<0.20
Benzo(b)fluoranthene	mg	<0.020	<0.15	<0.20	<0.20
Benzo(k)fluoranthene	mg	<0.020	<0.15	<0.20	<0.20
Benzo(a)pyrene	mg	<0.020	<0.15	<0.20	0.88
Indeno(1,2,3-c,d)pyrene	mg	<0.040	<0.30	<0.40	<0.40
Dibenzo(a,h)anthracene	mg	<0.040	<0.30	<0.40	<0.40
Benzo(ghi)perylene	mg	<0.040	<0.30	<0.40	<0.40

Priority Pollutant Analysis
Acid Extractables and PCBs - EPA 625

Date Received 10/4/85
Date Reported 11/20/85

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Job No. 46921.00
Page 3 OF 3

For: Engineering-Science, Fairfax   Attn: Jon Bolstad
Address

Lab No:		853009	853010	853011	853012
Source of Sample: Kaiser		Run 1 •	Run 2 •	Run 3 *	Run 11 *
Date Collected:		--	--	--	--
Time Collected:		--	--	--	--
Compound	Units	ANALYTICAL RESULTS			
2-Chlorophenol	mg	<0.02	<0.15	<0.20	<0.20
2-Nitrophenol	mg	<0.02	<0.15	<0.20	<0.20
Phenol	mg	1.02	3.9	3.9	3.0
2,4-Dimethylphenol	mg	<0.02	<0.15	<0.20	<0.20
2,4-Dichlorophenol	mg	<0.02	<0.15	<0.20	<0.20
2,4,6-Trichlorophenol	mg	<0.02	<0.15	<0.20	<0.20
4-Chloro-3-methylphenol	mg	<0.02	<0.15	<0.20	<0.20
2,4-Dinitrophenol	mg	<0.02	<0.15	<0.20	<0.20
2-Methyl-4,6-Dinitrophenol	mg	<0.04	<0.15	<0.20	<0.20
Pentachlorophenol	mg	<0.08	<0.30	<0.40	<0.40
4-Nitrophenol	mg	<0.08	<0.30	<0.40	<0.40

• NAD-2 Plus Probe Wash

James H. Morin

ENGINEERING-SCIENCE

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Priority Pollutant Analysis
Base Neutrals - EPA 625

Date Received 10/4/85
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P.O. No. --
Job No. 46921.00
Page 1 OF 3

For: Engineering-Science, Fairfax   Attn: Jon Bolstad
Address:

Lab No:		853013	853014	853016	853018
Source of Sample: Kaiser		Run 12 * --	Blank XAD-2 --	Run 2 1st Impinger	Blank Wash --
Date Collected:		--	--	--	--
Time Collected:		--	--	--	--
Compound	Units	ANALYTICAL RESULTS			
1,3-Dichlorobenzene	mg	<0.03	<0.001	<0.001	<0.001
1,4-Dichlorobenzene	mg	<0.03	<0.001	<0.001	<0.001
Hexachloroethane	mg	<0.03	<0.001	<0.001	
1,2-Dichlorobenzene	mg	<0.03	<0.001	<0.001	<0.001
Nitrobenzene	mg	<0.03	<0.001	<0.001	<0.001
Hexachlorobutadiene	mg	<0.03	<0.001	<0.001	<0.001
1,2,4-Trichlorobenzene	mg	<0.03	<0.001	<0.001	<0.001
Isophorone	mg	<0.03	<0.001	<0.001	<0.001
Naphthalene	mg	1.3	<0.001	<0.001	<0.001
2-Chloronaphthalene	mg	<0.03	<0.001	<0.001	<0.001
Acenaphthylene	mg	0.16	<0.001	<0.001	<0.001
Acenaphthene	mg	1.23	<0.001	<0.001	<0.001
Dimethyl phthalate	mg	<0.03	<0.001	<0.001	<0.001
2,6-Dinitrotoluene	mg	<0.03	<0.001	<0.001	<0.001
Fluorene	mg	0.51	<0.001	<0.001	<0.001
2,4-Dinitrotoluene	mg	<0.03	<0.001	<0.001	<0.001
Diethylphthalate	mg	<0.03	<0.001	<0.001	<0.001
Hexachlorobenzene	mg	<0.03	<0.001	<0.001	<0.001

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Priority Pollutant Analysis
Base Neutrals - EPA 625
(continued)

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Job No. 46921.00
Page 2 OF 3

For Engineering-Science, Fairfax   Attn: Jon Bolstad
Address

	853013	853014	853016	853018
Lab No:	853013	853014	853016	853018
Source of Sample: Kaiser	Run 12	Blank	Run 2	Blank
	*	XAD-2	1st	Wash
	--	--	Impinger	--
Date Collected:	--	--	--	--
Time Collected:	--	--	--	--

Compound	Units	ANALYTICAL RESULTS			
Phenanthrene	mg	3.0	<0.001	<0.001	<0.001
Anthracene	mg	0.43	<0.001	<0.001	<0.001
Dibutyl phthalate	mg	<0.034	<0.001	0.008	0.023
Fluoranthene	mg	3.1	<0.001	<0.001	<0.001
Pyrene	mg	2.2	<0.001	<0.001	<0.001
Butyl benzyl phthalate	mg	<0.03	<0.001	<0.001	<0.001
Bis(2-ethylhexyl) phthalate	mg	<0.03	<0.001	<0.001	<0.001
Chrysene	mg	1.2	<0.001	<0.001	<0.001
Benzo(a)anthracene	mg	0.55	<0.001	<0.001	<0.001
Di-n-octylphthalate	mg	<0.03	<0.001	<0.001	<0.001
Benzo(b)fluoranthene	mg	0.46	<0.001	<0.001	<0.001
Benzo(k)fluoranthene	mg	<0.03	<0.001	<0.001	<0.001
Benzo(a)pyrene	mg	0.21	<0.001	<0.001	<0.001
Indeno(1,2,3-c,d)pyrene	mg	<0.068	<0.002	<0.002	<0.002
Dibenzo(a,h)anthracene	mg	<0.068	<0.002	<0.002	<0.002
Benzo(ghi)perylene	mg	<0.068	<0.002	<0.002	<0.002

Priority Pollutant Analysis
Acid Extractables and PCBs - EPA 625

Date Received 10/4/85
Date Reported 11/20/85

P.O. No. --
Job No. 46921.00
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For: Engineering-Science, Fairfax   Attn: Jon Bolstad
Address

Lab No:		853013	853014	853016	853018
Source of Sample: Kaiser		Run 12	Blank	Run 2	Blank
		*	XAD-2	1st	Blank
		--	--	Impinger	--
Date Collected:		--	--	--	--
Time Collected:		--	--	--	--
Compound	Units	ANALYTICAL RESULTS			
2-Chlorophenol	mg	<0.03	<0.001	<0.001	<0.001
2-Nitrophenol	mg	<0.03	<0.001	<0.001	<0.001
Phenol	mg	0.83	<0.001	0.08	<0.001
2,4-Dimethylphenol	mg	<0.03	<0.001	<0.001	<0.001
2,4-Dichlorophenol	mg	<0.03	<0.001	<0.001	<0.001
2,4,6-Trichlorophenol	mg	<0.03	<0.001	<0.001	<0.001
4-Chloro-3-methylphenol	mg	<0.03	<0.001	<0.001	<0.001
2,4-Dinitrophenol	mg	<0.03	<0.001	<0.001	<0.001
2-Methyl-4,6-Dinitrophenol	mg	<0.03	<0.001	<0.001	<0.001
Pentachlorophenol	mg	<0.068	<0.002	<0.002	<0.002
4-Nitrophenol	mg	<0.068	<0.002	<0.002	<0.002

* NAD-2 Plus Probe Wash

James H. Morris

CHAPTER: 12.1
CD-ROM: Background
FILENAME: L1_00019

AP-42 Background File Documents

7.1
Ref #3

PARTICULATE SOURCE COMPOSITION LIBRARY DEVELOPMENT

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Project Officer

William Hamilton

PREPARED FOR MONITORING AND DATA ANALYSIS DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

December 1982

TABLE 65. PARTICULATE COMPOSITION OF ALUMINUM FOUNDRY

Specie	Percent by weight $\leq$ 2μm	$\geq$ 2μm	$\leq$ 10μm	$\geq$ 10μm	TSP (i.e., $\leq$ 30μm)
VC[a]	13.0		13.0		
NVC[b]					
TC[c]	13.0		13.0		
NO_3^-	0.6		0.6		
$SO_4^=$	16.0		16.0		
F					
Na					
Mg					
Al					
Si					
P					
S					
Cl	11.0		11.0		
K	0.6		0.6		
Ca	3.0		3.0		
Sc					
Ti	d		d		
V					
Cr	d		d		
Mn	0.6		0.6		
Fe	6.0		6.0		
Co	d		d		
Ni	0.6		0.6		
Cu	d		d		
Zn	d		d		
As					
Se					
Br					
Rb					
Sr					
Sc					
Li					
Sn	d		d		
Sb					
Cs					
Ba					
Be					
Pb	d		d		
Cd					

[a]Volatilizable carbon.

[b]Nonvolatizable carbon.

[c]Total carbon.

[d]Contributes <0.1% to total mass.

[e]$\leq$ 1 μm.

Source: Reference 22.

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Attachment 2

Breakdown of Total Sulfur
Dioxide Emissions from Prebake
Aluminum Reduction Plant

Anode Bake Plant

Uncontrolled SO_2 Emissions(1) = 40(C)(S)(1-.01K) lb/ton
= 20(C)(S)(1-.01K) kg/Mg

Where,

C = Anode consumption* during electrolysis, lb anode consumend/lb Al produced

S = Percent sulfur in anode before baking

K = Percent of total ~~plant~~ sulfur dioxide emissions released from prebake reduction cells **

Prebake Reduction Cell

Uncontrolled SO_2 Emissions = 0.4(C)(S)(K) lb/ton

= 0.2(C)(S)(K) kg/Mg

Where,

C = Anode consumption* during electroylsis, lb anode consumed/lb Al produced
S = Percent sulfur in anode before baking
K = Percent of total ~~plant~~ sulfur dioxide emissions released from prebake reduction cells **

* combined weight of coke and pitch in anode paste before baking

** To be estimated for each plant. (Use 80% otherwise, Reference 10)

(1)Does not account for fuel burning emissions.