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

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

AP42 Section:	11.18
Reference:	11
Title:	*Compliance Report On Particulate, Sulfur Dioxide, Fluoride, And Visual Emissions From Mineral Wool Production, American Rockwool, Inc., Spring Hope, NC, 27882,* J. V. Apicella, Aluminum Company Of America, Alcoa Center, PA, February 1988.

DRAFT/WP
d3006-4/971130
03/30/92 1

Emission Test Report
Review Checklist

Reviewer: Brian Shrager
Review Date: 4/23/92

A. Background Information

1. Facility name: American Rockwool, Inc.

   Location: Spring Hope, NC

2. Source category: Mineral Wool Production

3. Test date: Feb. 3-5, 1988

4. Test sponsor: American Rockwool, Inc.

5. Testing contractor: ALCOA

6. Purpose of test: To determine emission rates for PM, SO_2, and fluorides for the common stack serving two cupolas and their

7. Pollutants measured

   (PM) PM-10 CO (SO_2) NO_x VOC Pb (CO_2)

   Others (list): Fluorides

8. Process overview: On an attached page provide a block diagram of the unit operations and associated air pollution control systems at the facility. Identify process tested with letters from the beginning of the alphabet (A, B, C, etc.) and APC systems with letters from end of alphabet (V, W, X, etc.). Also identify test locations with Arabic numerals (1,2,3, ...). Using the ID symbols from that sketch complete the table below that identifies processes or unit operations tested.

Test ID	Process	Process ID	Emissions tested		APCD (controlled emissions only)
			Uncontrolled	Controlled	
1	Cupola (Charge #1)	A	✓	✓	Baghouse
2	Cupola (Charge #2)	B	✓	✓	Baghouse

B. Process Information

1. Provide a brief narrative description of the process. With as much detail as possible, (e.g., if a furnace or conveyor system is used, identify the type of unit) describe the equipment used for those operations tested. (Note: If process description provided in test report is adequate, attach copy or reproduce here.)

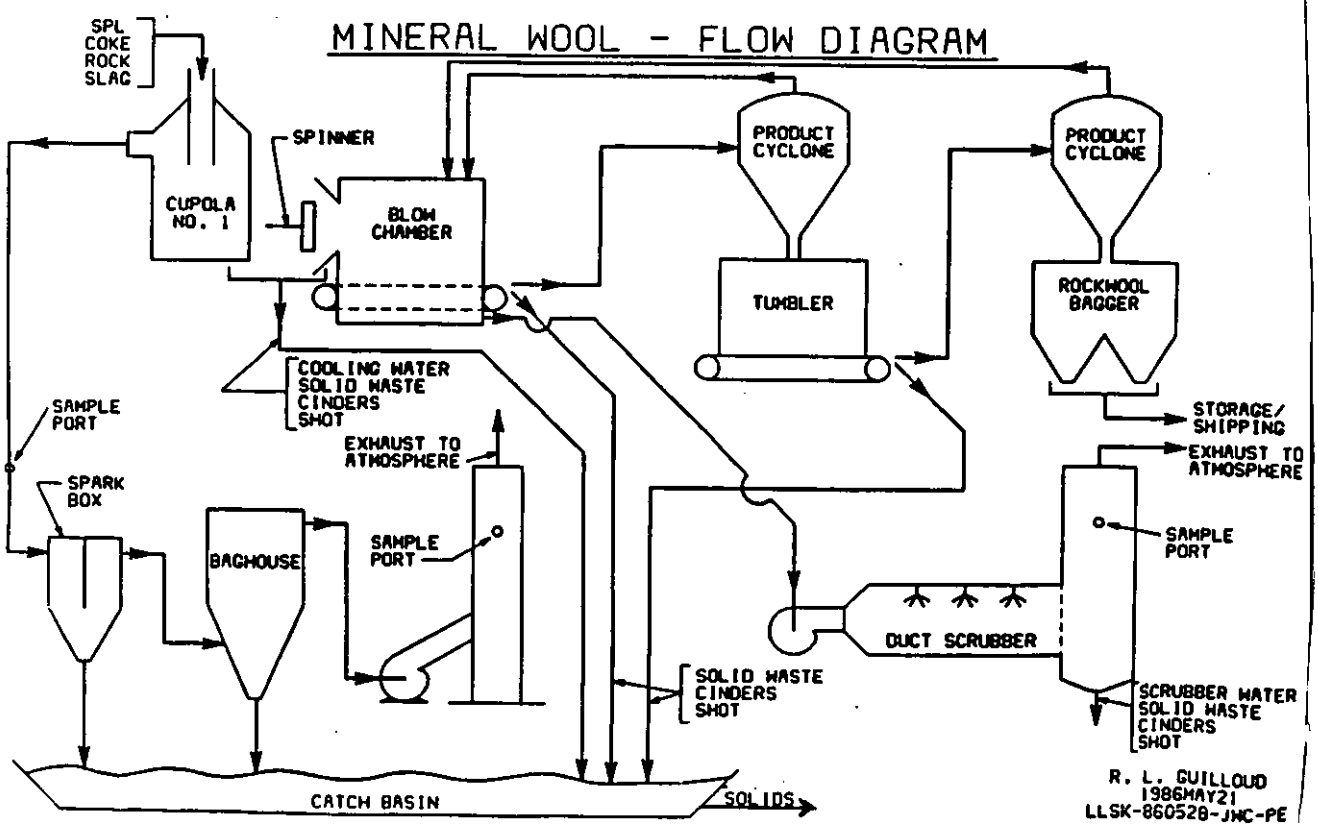
Figure 1 shows how mineral wool is produced at the Spring Hope plant of American Rockwool, Inc. A cupola is used to melt a combination of rock and slag. The molten product which exits the bottom of the cupola is directed onto a horizontal axis spinning disc. The resultant fibers are then collected in a blow chamber where oil is used to control dust. The fibers pass through a tumbler to remove unwanted particles, then to a bagger.

Large, spherical particles (shot), produced by the spinning head, are conveyed to a pit under the cupola using a small flow of water. Occasionally unwanted slag is tapped from the bottom of the cupola directly into the pit containing the "shot".

Emissions from the cupola are controlled by a spark box and baghouse. All air from the material collection and handling portions of the operation is scrubbed by a water spray system.

The plant utilizes two cupolas each equipped with its own fume control system. After being collected by the fume control system, the gases are passed through their respective spark box and baghouse. After exiting the baghouse the gas streams are combined into a common stack before being emitted to the atmosphere.

FIGURE 1



2. For each process tested list feedstock materials and products. Indicate if activity factors are for feed (F) rate or product (P) rate.

Process ID	Feedstock materials	Products	Basis for activity factor	F/P
A	Coke, Slag, Rock, Lime, Steel	Mineral Wool	Feed	F
B	Coke, SPL, Rock, Slag, Lime, Steel	Mineral Wool	Feed	F

Basis for data: Pg. 3
(Indicate page/table Nos. in test report)

3. For each process or operation tested and each test run note process capacity and operating rate during test.

Process ID	Capacity	Units	Test run	Process rate	Units
A			1	13.09	tons feed/hr
			2		
			3		
			4		
B			1	13.45	tons feed/hr
			2		
			3		
			4		
			1		
			2		
			3		
			4		
			1		
			2		
			3		
			4		

Basis for data: Pg. 3 (Add numbers for all feed materials) x 3.6 $\frac{\text{charges}}{\text{hr}}$ x 2 cupolas

C. Air Pollution Control Systems Tested

1. For each air pollution control system pollution control system identified in A.8, note the following

ID	Type of APCD	Manufacturer	Model No.
Z	Baghouse		

Note: Be as specific as possible in identifying APCD. For example, indicate "pulse jet fabric filter" rather than simply "fabric filter."

2. For each system identified above, provide a narrative description. For fugitive systems describe capture techniques as well as the removal techniques (use a separate page if necessary)

3. Using the attached parameter list for guidance complete the table below. (Use additional pages as needed.)

APCD ID	Parameter	Units	Readings			
			Run 1	Run 2	Run 3	Run 4
Z						
Type of APCD: Baghouse						
Type of APCD:						
Type of APCD:						

D. Sampling and Analysis Methods

1. Complete the following table

Test location	Pollutant	S & A method	Reference/ conditional method	Deviations noted
1,2	PM	Method 5	(Y)/N	Y/N
	Fluorides	ALCOA Method 4075A	Y/(N)	Y/N
	SO_2	40 CFR Part 60 Appendix A	(Y)/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N

2. **If a method used was not a reference or conditional method, provide a narrative discussion including any data manipulation needed to make results correspond to reference or conditional method results.**

Method 4075A was approved by EPA and the State of NC.

3. **Describe any deviations identified above.**

Method 4075A moisture determinations were used for some Method 5 calculations. In reference to EPA method 3, Fyrites were substituted for an Orsat analysis. While this is acceptable for CO_2, it was justified for O_2 because the exhaust was mostly ambient air not combustion air, and the tests only required percent O_2 for molecular weight calculations. Reading Fyrites to an accuracy within one-half percent introduces negligible error into the molecular weight and ensuing calculations.

E. Emission Data Documentation

1. Tabulate the following stack gas data from the test report. (Use additional pages as needed.)

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
*1	Stack temperature	°F	89	84	89	
	Moisture	% BY VOL.	2	0.9	2	
	Oxygen	% BY VOL.	19	19	19	
	Volumetric flow, actual	ACFM	50,500	50,060	48,450	
	Volumetric flow, standard	DSCFM	48,160	48,730	45,790	
	Percent isokinetic					
	Pollutant concentration:					
	CO_2	% BY VOL.	2	2	2	
*2	Stack temperature	°F	77	80	87	79
	Moisture	% BY VOL	2	2	1.4	2
	Oxygen	% BY VOL	19	19.5	19	19
	Volumetric flow, actual	ACFM	47,570	47,270	47,340	46,480
	Volumetric flow, standard	DSCFM	46,360	45,870	45,630	45,180
	Percent isokinetic					
	Pollutant concentration:					
	CO_2	% BY VOL	2	2	2	2
	Stack temperature					
	Moisture					
	Oxygen					
	Volumetric flow, actual					
	Volumetric flow, standard					
	Percent isokinetic					
	Pollutant concentration:					

* Method 5/6 Results
Method 4075A was done @ same time (for fluorides) and yielded similar results.

2. Tabulate pollutant mass flux rates

Test ID	Pollutant	Units	Mass flux rates			
			Run 1	Run 2	Run 3	Run 4
1	PM	lb/hr	2.9	2.1	1.6	
	SO2	lb/hr	169.9	131.4	130.9	
	Fluorides	lb/hr	0.28	0.20	0.19	
	*CO2	lb/hr	6762	6842	6429	
	Gaseous Fluor.	lb/hr	0.08	0.06	0.06	
	Part. Fluorides	lb/hr	0.21	0.14	0.13	
2	PM	lb/hr	3.6	3.5	4.5	3.2
	SO2	lb/hr	104.5	118.6	100.3	120.6
	Fluorides	lb/hr	0.7	0.82	0.93	0.98
	CO2	lb/hr	6509	6440	6406	6343
	Gaseous Fluorides	lb/hr	0.08	0.05	0.03	0.05
	Part. Fluorides	lb/hr	0.63	0.77	0.91	0.93

* % BY VOL x DSCFM x 0.1170 lb/CF x 60

3. Present example emission factor calculations below.

TEST 1

PM $(2.9+2.1+1.6) \div 3$ lbs/hr $\div$ 13.09 tons/hr $= 0.168 \frac{\text{lbs}}{\text{ton feed}}$

4. Tabulate emission factors

Process	Pollutant	Units	Average emission factor	
			Uncontrolled	Controlled
A	PM	lbs/ton feed		0.168
	SO_2	lbs/ton feed	11.0	
	CO_2	lbs/ton feed	510	
	Gaseous Fluorides	lbs/ton feed	5.09 E-03	
	Part. Fluorides	lbs/ton feed		0.0122
	Total Fluorides	lbs/ton feed	0.0171	
B	PM	lbs/ton feed		0.275
	SO_2	lbs/ton feed	8.25	
	CO_2	lbs/ton feed	478	
	Gaseous Fluorides	lbs/ton feed	3.90 E-03	
	Part. Fluorides	lbs/ton feed		0.0602
	Total Fluorides	lbs/ton feed	0.0638	

ATTACHMENT A
APCD PARAMETERS

Type of APCD	Parameters
Fabric filter	Cleaning mechanism Bag type Cleaning frequency Air to cloth ratio (A/C) Pressure drop Inlet temperature
ESP	Type (wet or dry) Number of fields Rapping cycle (if dry) Specific Collection Area (SCA) Particulate resistivity (if known) Spark rate Current and power levels
Venturi (or other high energy) scrubber	Pressure drop Liquid/gas (L/G) ratio Mist eliminator type
Packed-bed scrubber	Packing depth L/G ratio Caustic use (Y/N) pH Mist eliminator type
Carbon absorber	Bed depth Superficial gas velocity Bed temperature Desorption mechanism (media) Flue-gas moisture Cycle length Time-on-line after breakthrough

1988 July 11

RECEIVED
JUL 13 1988
AIR QUALITY TECH SERVICES

NC NRDC
Air Quality Section
P.O. Box 27687
Raleigh, NC 27611

Attn: Mr. Robert Wooten

RE: AMERICAN ROCKWOOL, SPRING HOPE, NC, EMISSION CALCULATIONS

Dear Mr. Wooten:

As per your request, this letter demonstrates how sulfur dioxide and fluoride emissions were calculated from the 1988 Feburary compliance testing at American Rockwools Spring Hope, NC, facility. Run 4, 1988 February 5, has been chosen for specific examples. All referenced data can be found in the compliance report, Report #93-88-003, 1988 February 26, or in the attachment.

Sulfur Dioxide - Sulfur dioxide emissions were determined using EPA Method 6.

The equation used for mass emission of SO_2 is as follows:

$$\text{lb/hr } SO_2 = \frac{Mso_2}{Vmstd} (Qstd) \left[\frac{1 \text{ lb}}{453600 \text{ mg}}\right] \left[\frac{60 \text{ min}}{1 \text{ hr}}\right] \qquad (A)$$

Where:

Mso_2	=	Total mass of SO_2 collected.	= 781 mg.
Vmstd	=	Dry gas volume metered, corrected to std conditions.	= 45.84 ft^3
Qstd	=	Standard volumetric flow rate of gas in stack.	= 46360 dscfm

$$\text{lb/hr } SO_2 = \frac{781 \text{ mg}}{45.84 \text{ft3}} \left[46360 \frac{\text{ds ft}^3}{\text{min}}\right] \left[\frac{1 \text{ lb}}{453600 \text{ mg}}\right] \left[\frac{60 \text{ min}}{1 \text{ hr}}\right] = 104.5 \text{ lb/hr} SO_2$$

The dry gas volume (Vmstd) and the standardized volumetric flowrate (Qstd) are from the test method data. The mass of SO_2 (M_{so2}) recovered from the sample train is obtained through laboratory analysis of the contents and rinse of the second, third and fourth impingers. After Run 4 was complete, the sampling crew quantitatively recovered the contents of the aforementioned impingers. These impingers and their connecting glassware were then rinsed quantitatively and this wash was combined with the original contents. This 0.625 l sample was then submitted to Alcoa's Analytical Chemistry Division for a Standard Method 6 Titration Analysis.

ALCOA
1988

From this 0.625 l sample, a 10 ml aliquot was removed. The 10 ml aliquot was then taken to a standard volume of 100 ml with distilled, deionized water. From this standard volume, a 5 ml sample was taken for titration. This 5 ml sample received 20 mls of 100% isopropanol and a few drops of thorin indicator. This mixture was then titrated to a pink endpoint with 2.00 mls of barium perchlorate. The sampling crew also obtained a "blank" sample of the impinger chemicals which were analyzed in the same manner as the "Run 4" chemicals. This was to assure that no contaminants were present in the absorbing solution. The "blank" chemicals were titrated to a pink endpoint with 0.05 mls. This value was subtracted from the sample value.

The equivalent SO_2 present in the initial sample was calculated per the following equations:

$$SO_2 \text{ mg/l} = \frac{\left(V_t - V_{tb}\right) N \left(\frac{V_{soln}}{Va}\right) K}{V} \qquad \text{(B)}$$

Where:

V_t	= Volume of barium perchlorate used for sample	=	2.00 ml
V_{tb}	= Volume of barium perchlorate used for blank	=	0.05 ml
N	= Normality of barium perchlorate titrant	=	0.01N
V_{soln}	= Total volume of solution which contains SO_2	=	100 ml
Va	= Volume of sample aliquot	=	10 ml
K	= Conversion constant	=	32.03 mg/meq
V	= Volume of SO_2 containing sample titrated	=	5 ml

$$SO_2 \text{ mg/l} = \frac{(2.00\text{ml}-0.05\text{ml})(0.01)\left[\frac{100 \text{ ml}}{10 \text{ ml}}\right]\left[\frac{32.03 \text{ mg}}{\text{meq}}\right]\left[\frac{1000 \text{ ml}}{1}\right]}{(5 \text{ ml})} = 1249.77 \text{ mg/l}$$

Remembering that this is the concentration of SO_2 per liter and the recovered sample and rinse volume was 0.625 l:

$$M_{so2} = \frac{1249.17 \text{ mg } SO_2}{1 \text{ l}} (0.625 \text{ l}) = 780.7 \text{ or } 781 \text{ total mg } SO_2$$

So, analysis yields 781 total mg of SO_2 for the Run 4 - Method 6 sample.

<u>Fluoride Emissions</u> - Fluoride emissions were determined using Alcoa Sampling Method 4075A coupled with Alcoa Analytical Methods 4076A and 4076B. The equation used for mass emission of F is as follows:

$$\text{lb/hr F} = \frac{M_F}{Vmstd} (Q_{std}) \left[\frac{1 \text{ lb}}{453600 \text{ mg}}\right] \left[\frac{60 \text{ min}}{1 \text{ hr}}\right] \qquad \text{(C)}$$

All of these terms should be familiar to the reader except M_F. The term M_F stands for the total mass of fluoride recovered from the Method 4075-A sampling train. This particular train has three areas that collect fluoride - the nozzle, the thimble and the impingers. Particulate fluoride is collected in the nozzle and thimble while gaseous fluoride is captured in the impingers. For analysis, the nozzle wash and a 50 ml sample from the impinger solution were directly distilled (sulfuric acid distillation) to 500 ml volume. They were then directly analyzed by Specific Ion Electrode (SIE) and the impinger value was corrected for a ten-fold dilution. The contents of the thimble had CaO added, were ashed and then fused with NaOH before being distilled (sulfuric acid distillation) for analysis by SIE. (Refer to Methods 4076A and 4076B.)

For an SIE analysis, a calibration is completed with known concentrations of fluoride. From the millivolt readings, a line can be determined and the millivolt reading is plotted vs. the log of the F concentration. The F concentration of an unknown is determined from this graph (or by the equation of the line) by reading the Y-axis value for the corresponding X-axis voltage. The concentration obtained is then factored for dilution (in this case, all of the concentrations are multiplied by the aliquot volume (10 ml) and converted to total fluoride by multiplying by the original sample volume. Sample calculations for the nozzle wash, thimble and impinger (F_n, F_t and F_i, respectively) F content follow. Please note that the total mass of fluoride (M_F) collected by this train is equal to the sum of F_n, F_t and F_i.

The nozzle:

	Y	X	LOG Y
Calibrations:	2 mg F/l	917 mV	0.301
	20 mg F/l	325 mV	1.301
	0.20 mg F/l	1490 mV	-0.699
	200 mg F/l	-258 mV	2.301

These values can either be plotted (X vs log Y) or an equation can be developed:

$$Y = 10^{mx+b} \quad \text{where } m = \text{slope}, \; b = \text{intercept}$$

The #4 sample nozzle wash sample produced an SIE millivolt reading of 1355 mV which corresponded to a concentration of 0.35 mg F/l. Since the distillation volume was 500 ml (0.5 l):

Fn = (0.35 mg F/l) (0.5 l) = 0.175 mg F

Calibration plots can be found in the attachments.

The Thimble:

	Y	X	LOG Y
Calibrations:	2 mg F/l	906 mV	0.301
	20 mg F/l	321 mV	1.301
	0.20 mg F/l	1486 mV	-0.699
	200 mg F/l	-263 mV	2.301

SIE for the #4 thimble sample gave a reading of 512 mV which corresponded to a concentration of 9.43 mg F/l. Therefore, total fluoride for the thimble is equal to:

F_T = (9.43 mg F/l) (0.5 l) = 4.72 mg F

The Impingers:

	Y	X	LOG Y
Calibrations:	2 mg F/l	904 mV	0.301
	20 mg F/l	314 mV	1.301
	0.20 mg F/l	1483 mV	-0.699
	200 mg F/l	-275 mV	2.301

SIE for the #4 impinger sample gave a reading of 1632 mV which corresponded to a concentration of 1.070 mg F/l. The impinger volume, as in Method 6, contains the glassware rinse as well as the original chemicals, was 0.525 l. Therefore, total fluoride for the impingers is equal to:

F_I = (1.070 mg F/l) (0.525 l) = 0.56 mg F

Total Fluoride:

M_F = Fn + Ft + F_I = 0.35mg + 4.72 mg + 0.56 mg = 5.63 mg F.

Therefore, equation (C) yields:

$$\text{lb/hr F} = \frac{5.63 \text{ mgF}}{47.21 \text{ dsft}^3}\left[\frac{45570 \text{ ds ft}^3}{\text{min}}\right]\left[\frac{1 \text{ lb}}{453600 \text{ mg}}\right]\left[\frac{60 \text{ min}}{\text{hr}}\right] = 0.7 \text{ lb F/hr}$$

Review of the laboratory data in the attachment shows QA/QC measures (spiked samples, duplicate samples and blanks) that have been taken.

I hope this letter addresses your needs regarding laboratory calculations. If I can be of any further assistance, please do not hesitate to call.

James V. Apicella

JAMES V. APICELLA

CC: L. C. Blayden, ATC-C
R. G. Small, Pittsburgh 23
D. Weeter Associates, Louisville, TN
B. W. Bromley, American Rockwool, Spring Hope, NC.

FAX TRANSMISSION

TO: John Kilmer

FROM: Richard Marinshaw
Midwest Research Institute
401 Harrison Oaks Boulevard, Suite 350
Cary, North Carolina 27513
(919) 677-0249, Ext. 5359
FAX: 919-677-0065

DATE: July 7, 1997

RECEIVING FAX NUMBER: 317-578-4250

SENDING FAX NUMBER: 919-677-0065

THIS FAX CONSISTS OF 28 PAGES (INCLUDING THIS PAGE)

ALUMINUM COMPANY OF AMERICA
ALCOA TECHNICAL CENTER
ALCOA CENTER, PA 15069

1988 July 13

RECEIVED
JUL 18 1988
AIR QUALITY TECH SERVICES

NC NRDC
Air Quality Section
P.O. Box 27687
Raleigh, NC 27611

Attn: Mr. Robert Wooten

Re: Revision - American Rockwool, Spring Hope, NC, Emission Calculations - of 1988 July 11

Dear Mr. Wooten:

Please discard the original letter and attachment cover page and replace with the included letter and attachment cover page. There are no corrections for the attachment itself. The new letter and attachment cover page include the following revisions:

a) The impinger analysis on Page 4 has been clarified.

b) Under the Total Fluoride section, Page 4, the value for Fn was erroneously reported as 0.35 mg F. It has been corrected to the proper value of 0.18 mg F.

c) On the attachment cover page, the LSN/ID# for the thimble and impinger were interchanged. They are now correct.

Sincerely,

James V. Apicella

James V. Apicella

JVA/mm

Attachments

cc: L. C. Blayden, ATC-C
R. G. Small, Pittsburgh 23
D. Weeter Associates, Louisville, TN
B. W. Bromley, American Rockwool, Spring Hope, NC

ALCOA
CENTENNIAL
1988

1988 July 13

NC NRDC
Air Quality Section
P.O. Box 27687
Raleigh, NC 27611

Attn: Mr. Robert Wooten

RE: REVISION - AMERICAN ROCKWOOL, SPRING HOPE, NC, EMISSION CALCULATIONS

Dear Mr. Wooten:

As per your request, this letter demonstrates how sulfur dioxide and fluoride emissions were calculated from the 1988 Feburary compliance testing at American Rockwools Spring Hope, NC, facility. Run 4, 1988 February 5, has been chosen for specific examples. All referenced data can be found in the compliance report, Report #93-88-003, 1988 February 26, or in the attachment.

Sulfur Dioxide - Sulfur dioxide emissions were determined using EPA Method 6.

The equation used for mass emission of SO_2 is as follows:

$$\text{lb/hr } SO_2 = \left[\frac{Mso_2}{Vmstd}\right](Qstd)\left[\frac{1\text{ lb}}{453600\text{ mg}}\right]\left[\frac{60\text{ min}}{1\text{ hr}}\right] \qquad (A)$$

Where:

Mso_2	=	Total mass of SO_2 collected.	= 781 mg.
Vmstd	=	Dry gas volume metered, corrected to std conditions.	= 45.84 ft^3
Qstd	=	Standard volumetric flow rate of gas in stack.	= 46360 dscfm

$$\text{lb/hr } SO_2 = \left[\frac{781\text{ mg}}{45.84\text{ft}3}\right]\left[\frac{46360\text{ ds ft}^3}{\text{min}}\right]\left[\frac{1\text{ lb}}{453600\text{ mg}}\right]\left[\frac{60\text{ min}}{1\text{ hr}}\right] = 104.5\text{ lb/hr}SO_2$$

The dry gas volume (Vmstd) and the standardized volumetric flowrate (Qstd) are from the test method data. The mass of SO_2 (M_{SO2}) recovered from the sample train is obtained through laboratory analysis of the contents and rinse of the second, third and fourth impingers. After Run 4 was complete, the sampling crew quantitatively recovered the contents of the aforementioned impingers. These impingers and their connecting glassware were then rinsed quantitatively and this wash was combined with the original contents. This 0.625 l sample was then submitted to Alcoa's Analytical Chemistry Division for a Standard Method 6 Titration Analysis.

ALCOA CENTENNIAL 1988

From this 0.625 l sample, a 10 ml aliquot was removed. The 10 ml aliquot was then taken to a standard volume of 100 ml with distilled, deionized water. From this standard volume, a 5 ml sample was taken for titration. This 5 ml sample received 20 mls of 100% isopropanol and a few drops of thorin indicator. This mixture was then titrated to a pink endpoint with 2.00 mls of barium perchlorate. The sampling crew also obtained a "blank" sample of the impinger chemicals which were analyzed in the same manner as the "Run 4" chemicals. This was to assure that no contaminants were present in the absorbing solution. The "blank" chemicals were titrated to a pink endpoint with 0.05 mls. This value was subtracted from the sample value.

The equivalent SO_2 present in the initial sample was calculated per the following equations:

$$SO_2 \text{ mg/l} = \frac{\left(V_t - V_{tb}\right) N \left[\frac{V_{soln}}{Va}\right] K}{V} \qquad \text{(B)}$$

Where:

V_t	= Volume of barium perchlorate used for sample	=	2.00 ml
V_{tb}	= Volume of barium perchlorate used for blank	=	0.05 ml
N	= Normality of barium perchlorate titrant	=	0.01N
V_{soln}	= Total volume of solution which contains SO_2	=	100 ml
Va	= Volume of sample aliquot	=	10 ml
K	= Conversion constant	=	32.03 mg/meg
V	= Volume of SO_2 containing sample titrated	=	5 ml

$$SO_2 \text{ mg/l} = \frac{(2.00\text{ml}-0.05\text{ml})(0.01)\left[\frac{100 \text{ ml}}{10 \text{ ml}}\right]\left[\frac{32.03 \text{ mg}}{\text{meg}}\right]\left[\frac{1000 \text{ ml}}{1}\right]}{(5 \text{ ml})} = 1249.77 \text{ mg/l}$$

Remembering that this is the concentration of SO_2 per liter and the recovered sample and rinse volume was 0.625 l:

$$M_{so2} = \left[\frac{1249.17 \text{ mg } SO_2}{1 \text{ l}}\right] (0.625 \text{ l}) = 780.7 \text{ or } 781 \text{ total mg } SO_2$$

So, analysis yields 781 total mg of SO_2 for the Run 4 - Method 6 sample.

<u>Fluoride Emissions</u> - Fluoride emissions were determined using Alcoa Sampling Method 4075A coupled with Alcoa Analytical Method 4076A. The equation used for mass emission of F is as follows:

$$\text{lb/hr F} = \left[\frac{M_F}{Vmstd}\right] (Q_{std}) \left[\frac{1 \text{ lb}}{453600 \text{ mg}}\right] \left[\frac{60 \text{ min}}{1 \text{ hr}}\right] \qquad \text{(C)}$$

All of these terms should be familiar to the reader except M_F. The term M_F stands for the total mass of fluoride recovered from the Method 4075-A sampling train. This particular train has three areas that collect fluoride - the nozzle, the thimble and the impingers. Particulate fluoride is collected in the nozzle and thimble while gaseous fluoride is captured in the impingers. For analysis, the nozzle wash and a 50 ml sample from the impinger solution were directly distilled (sulfuric acid distillation) to 500 ml volume. They were then directly analyzed by Specific Ion Electrode (SIE) and the impinger value was corrected for a ten-fold dilution. The contents of the thimble had CaO added, were ashed and then fused with NaOH before being distilled (sulfuric acid distillation) for analysis by SIE. (Refer to Method 4076A.)

For an SIE analysis, a calibration is completed with known concentrations of fluoride. From the millivolt readings, a line can be determined and the millivolt reading is plotted vs. the log of the F concentration. The F concentration of an unknown is determined from this graph (or by the equation of the line) by reading the Y-axis value for the corresponding X-axis voltage. The concentration obtained is then factored for dilution (in this case, all of the concentrations are multiplied by the aliquot volume (10 ml) and converted to total fluoride by multiplying by the original sample volume. Sample calculations for the nozzle wash, thimble and impinger (F_n, F_t and F_i, respectively) F content follow. Please note that the total mass of fluoride (M_F) collected by this train is equal to the sum of F_n, F_t and F_i.

The nozzle:

	Y	X	LOG Y
Calibrations:	2 mg F/l	917 mV	0.301
	20 mg F/l	325 mV	1.301
	0.20 mg F/l	1490 mV	-0.699
	200 mg F/l	-258 mV	2.301

These values can either be plotted (X vs log Y) or an equation can be developed:

$$Y = 10^{mx+b} \quad \text{where } m = \text{slope}, \; b = \text{intercept}$$

The #4 nozzle wash sample produced an SIE millivolt reading of 1355 mV which corresponded to a concentration of 0.35 mg F/l. Since the distillation volume was 500 ml (0.5 l):

Fn = (0.35 mg F/l) (0.5 l) = 0.175 mg F or 0.18 mg F

Calibration plots can be found in the attachments.

The Thimble:

	Y	X	LOG Y
Calibrations:	2 mg F/l	906 mV	0.301
	20 mg F/l	321 mV	1.301
	0.20 mg F/l	1486 mV	-0.699
	200 mg F/l	-263 mV	2.301

SIE for the #4 thimble sample gave a reading of 512 mV which corresponded to a concentration of 9.43 mg F/l. Therefore, total fluoride for the thimble is equal to:

Ft = (9.43 mg F/l) (0.5 l) = 4.72 mg F

The Impingers:

	Y	X	LOG Y
Calibrations:	2 mg F/l	904 mV	0.301
	20 mg F/l	314 mV	1.301
	0.20 mg F/l	1483 mV	-0.699
	200 mg F/l	-275 mV	2.301

The analysis of the impingers differs from that of the nozzle and thimble. The nozzle and thimble analyses make use of the entire submitted sample. Due to the large volume of the impinger field sample (V_f = 0.525 l) only a 50 ml aliquot (Va) is used for analysis. This fluoride containing aliquot is distilled by sulfuric acid distillation to a fluoride containing distillate volume (V_d) of 500 ml. This is equivalent to a tenfold dilution in the fluoride concentration because the same mass of fluoride that was originally in the 50 ml aliquot is now in the 500 ml distillate. From the distillate a 10 ml aliquot is taken for SIE analysis where it produced a reading of 1632 mV. This value corresponded to a distillate fluoride concentration (Cd) of 0.1070 mg F/l. The distillate concentration is not equal to field sample concentration (Ca).

Therefore:

Ca = (Vd/Va) Cd = (500 ml/50 ml) (0.1070 mg F/l) = 1.070 mg F/l

Since the field sample volume was 0.525 l and its concentration was 1.070 mg F/l, the same as the 50 ml aliquot, the total mass of fluoride contained in the impingers (Fi) equals:

$Fi = V_f\ Ca$ = (0.525 l) (1.070 mg F/l) = 0.56 mg F.

Total Fluoride:

M_F = Fn + Ft + Fi = 0.18 mg + 4.72 mg + 0.56 mg = 5.46 mg F.

Therefore, equation (C) yields:

$$\text{lb/hr F} = \frac{5.46\ \text{mgF}}{47.21\ \text{dsft}^3}\left[\frac{45570\ \text{ds ft}^3}{\text{min}}\right]\left[\frac{1\ \text{lb}}{453600\ \text{mg}}\right]\left[\frac{60\ \text{min}}{\text{hr}}\right] = 0.7\ \text{lb F/hr}$$

Review of the laboratory data in the attachment shows QA/QC measures (spiked samples, duplicate samples and blanks) that have been taken.

I hope this letter addresses your needs regarding laboratory calculations. If I can be of any further assistance, please do not hesitate to call.

Sincerely,

James V. Apicella

JAMES V. APICELLA

Attachments

CC: L. C. Blayden, ATC-C
R. G. Small, Pittsburgh 23
D. Weeter Associates, Louisville, TN
B. W. Bromley, American Rockwool, Spring Hope, NC.

RECEIVED

MAR 0 1 1988

RALEIGH REGIONAL OFFICE

COMPLIANCE REPORT ON PARTICULATE, SULFUR DIOXIDE, FLUORIDE AND VISUAL EMISSIONS FROM MINERAL WOOL PRODUCTION

AMERICAN ROCKWOOL, INC.
SPRING HOPE, NC 27882

NORTH CAROLINA AIR PERMIT NO. 3578R6

TEST PERIOD: 1988 FEBRUARY 3-5

BY

JAMES V. APICELLA
ENVIRONMENTAL SCIENTIST
ENVIRONMENTAL CONTROL LABORATORY
ALUMINUM COMPANY OF AMERICA
ALCOA TECHNICAL CENTER
ALCOA CENTER, PA 15069

Lee Blayden
(412) 337-2973

REPORT NO. 93-88-003
1988 FEBRUARY 26

Test Objective

The emission rates for particulate matter, sulfur dioxide and fluorides as well as opacity were determined for the common stack serving American Rockwool's two cupolas and their baghouses. The emissions were determined for two separate conditions:

1. Zero substitution for coke (Background) 1988 February 3-4
2. 710 lb SPL*/hr/cupola (710 SPL) 1988 February 5

*SPL is an aluminum smelting cell by-product which was substituted for coke on a lb carbon/lb carbon basis.

Summary of Test Results

Results from the test program are summarized and compared to Air Permit No. 3578R6 limits in Table 1.

TABLE 1

Average Emissions vs. Permit Limits
Cupola/Baghouse Common Stack

Condition	Particulate Matter lb/hr Front Half	Particulate Matter lb/hr Total*	Fluoride lb/hr	Sulfur Dioxide lb/hr	Sulfur Dioxide lb/mm Btu	Opacity %
Background	2.1	3.0	0.23	144.1	1.1	<5
710 SPL	3.8	4.0	0.86	111.0	0.9	<5
Air Permit No. 3578R6	10	--	6.0	100.0	2.3**	<20***

*Total includes particulate from impinger train. Back half reported but not counted against permit.
**North Carolina Air Pollution Control Regulations 466:0516
***Cannot exceed more than 20% opacity when averaged over a six minute period, except that six minute periods averaging not more than twenty percent opacity may occur not more than once in any hour nor more than four times in any 24-hour period.

Particulate matter, fluorides and opacity are well within permitted limits. While SO_2 exceeds the Maximum After Control Emissions limit of 100 lb/hr by 44.1 lb/hr (Background) and 11.0 lb/hr (710 SPL), the calculated SO_2 emissions from the fuel are well within the limit [1.1 lb SO_2/mm Btu (Background) and 0.9 lb SO_2/mm Btu (710 SPL) vs. 2.3 lb SO_2/mm Btu (limit)] defined by the North Carolina Air Pollution Control Regulations Title 15, Chapter 2, Subchapter 20, Section .0516 "Sulfur Dioxide Emissions from Fuel Burning Installations".

PROCESS DESCRIPTION

Figure 1 shows how mineral wool is produced at the Spring Hope plant of American Rockwool, Inc. A cupola is used to melt a combination of rock and slag. The molten product which exits the bottom of the cupola is directed onto a horizontal axis spinning disc. The resultant fibers are then collected in a blow chamber where oil is used to control dust. The fibers pass through a tumbler to remove unwanted particles, then to a bagger.

Large, spherical particles (shot), produced by the spinning head, are conveyed to a pit under the cupola using a small flow of water. Occasionally unwanted slag is tapped from the bottom of the cupola directly into the pit containing the "shot".

Emissions from the cupola are controlled by a spark box and baghouse. All air from the material collection and handling portions of the operation is scrubbed by a water spray system.

The plant utilizes two cupolas each equipped with its own fume control system. The emissions from both are combined into a common stack at the baghouse outlets.

The cupolas are charged at an average rate of 3.6 charges per hour of the following compositions:

Background		710 lb/hr SPL	
Charge	lb	Charge	lb
Coke	385-400	Coke	260
SPL	0	SPL	225
Duquesne Slag	1300	Duquesne Slag	1300
Trap Rock	1100	Trap Rock	1100
Lime	50	Lime	50
Steel	400	Steel	400
Tennessee Slag	400	Tennessee Slag	400

SAMPLING PROCEDURES

Testing was done according to the proposal submitted by J. E. Gibb dated 1988 January 05.

Sampling Locations - The 6 ft I.D. stack has two sampling ports 90° apart. Six points were sampled per port. Each point was sampled 5 minutes for a total sampling time of 60 minutes. The sampling location was 8 diameters downstream and 6 diameters upstream from any disturbance. The stack sampling locations are shown in Figure 2. No cyclonic flow was present.

Particulate Matter - Sulfur Dioxide - Opacity - The determination of these emissions followed procedures outlined by the U.S. Environmental Protection Agency (EPA) in Title 40 of the Code of Federal Regulations (CFR), Part 60, Appendix A.

- o Method 1 - "Sample and Velocity Traverses for Stationary Sources"
- o Method 2 - "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"
- o Method 3 - "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air and Dry Molecular Weight"
- o Method 4 - "Determination of Moisture Content in Stack Gases"
- o Method 5 - "Determination of Particulate Emissions from Stationary Sources", See Figure 3
- o Method 6 - "Determination of Sulfur Dioxide Emissions from Stationary Sources"
- o Method 9 - "Visual Determination of the Opacity of Emissions from Stationary Sources"

Fluoride Emissions - Fluoride Emissions were determined using Alcoa Method 4075A (approved by the State of North Carolina and Federal EPA) in conjunction with the necessary Federal Methods (1 through 4) to obtain isokinetic sampling for total particulate and gaseous fluoride. The method requires a cellulose thimble to remove particulate fluoride and ice cooled impingers of 1.0N sodium hydroxide for scrubbing gaseous fluoride (see Figure 4.

Raw Materials - Samples of the raw materials were taken from each charge. They were accumulated in separate 55 gallon drums over the three day test period. Different types of raw materials were not stored in the same drums, nor were they allowed to mix at any time during size reduction and/or analysis. This procedure netted composite samples between three and four hundred pounds for each of the raw materials. A mineral company, Kennedy Van Saun, Inc., handled the size reduction process which included the following steps for each material.

First the entire contents of the barrel were crushed to minus 3/8 inch and homogenized. From this mix forty pounds were split out and reduced to minus 40 mesh. After homogenization, thirty-five pounds were split out, reduced to minus 4 mesh and again homogenized. From this sample five pounds were split out, reduced to minus 10 mesh, once again homogenized and finally one quarter of a pound was reduced to minus 60 mesh. This thoroughly mixed, finely ground sample was then submitted for analysis by Alcoa's Analytical Chemistry Division.

ANALYTICAL PROCEDURES

Particulate Emissions

Particulate emissions were determined following procedures outlined in EPA Method 5. Particulate samples collected on Reeve Angel 934 AH glass fiber filters were analyzed gravimetrically. The probe and nozzles were washed with acetone. The wash was transferred to tared beakers and evaporated to dryness. This residual weight was included in the analysis. The back half was washed with 80% isopropanol and collected with the isopropanol used during the test in tared beakers. The residual weight was determined after the beakers were evaporated to dryness.

Fluoride and Sulfur Emissions

Alcoa's Analytical Chemistry Division (ACD) used Alcoa Method 4076A (a combination of ashing, fusion, sulfuric acid distillation and selective ion electrode) to measure particulate and gaseous fluoride. ACD used procedures outlined in EPA Method 6 to measure the total sulfur in the source samples. Gravimetric analysis (a combination of fusion, titration and precipitation) was used to measure sulfur in the raw materials.

Btu Content

The Btu content of coke and SPL was determined by standard Alcoa Method 1121 which uses a Parr Bomb calorimeter.

Opacity

A certified, qualified observer was used as per EPA Method 9 specifications. The certification is included in Appendix C.

QUALITY CONTROL PROCEDURES

Quality control procedures were followed for all aspects of field sampling including sample preservation and holding time; reagent quality; analytical method; analyst training; and instrument cleaning, calibration and safety. These procedures are consistent with EPA guidelines documented in "Quality Assurance Manuals for Air Pollution Measurement Systems," Vol. 3, "Stationary Source Specific Methods" (EPA-600/4-77-027b).

RESULTS

A composite of results from the test program is presented in Tables 2 and 3 of this report. Complete results, production data, raw data, calibration data and laboratory results are given in the Appendices.

DISCUSSION

A series of precompliance tests were run at the background condition, 350 lb SPL/hr per cupola and 700 lb SPL/hr per cupola at this facility 1988 January 13-17. Table 4 includes a summary of all test data. Comparison of precompliance results to the results of the compliance test shows excellent agreement. It should be noted that all of the Quality Assurance/Quality Control procedures and approved methods presented for the 1988 February 3-5 tests were also enforced for the 1988 January 13-17 testing program.

Testing

The test program went smoothly with only minor modifications. One problem encountered was the volatilization of the isopropanol in the Method 6 train. Even packed with ice, accurate determinations of stack gas moisture

were not always possible from this train. Since the 4075A train did not have this problem and the tests were simultaneous, Method 4075A moisture determinations were used for some Method 5 calculations. In reference to EPA Method 3, Fyrites were substituted for an Orsat analysis. While this is acceptable for carbon dioxide, it was justified for oxygen because the exhaust was mostly ambient air not combustion air, and the tests only required percent oxygen for molecular weight calculations. Reading Fyrites to an accuracy within one-half percent introduces negligible error into the molecular weight and ensuing calculations.

Process

The plant ran fairly consistent over the test times with only a minor upset in one of the cupolas during Run 6. Therefore, Run 7 was undertaken. Run 6 was included in the results because the upset was related to excessive tapping of the cupola bottoms. This did not affect gaseous emissions because combustion of charged materials was not interrupted. Particulate emissions temporarily increased (by approximately 1 lb/hr) but that was due to the faster rate of descent among the components in the cupola.

Although the average charge flows (lb/hr) were not always consistent with the permit specifications, the weight composition (lb material/charge) was consistent with the predetermined goal (see Appendix B).

TABLE 2

SPRING HOPE COMPLIANCE TESTING METHOD 5/6 RESULTS

DATE	88-02-03	88-02-03	88-02-04	88-02-05	88-02-05	88-02-05	88-02-05
RUN NUMBER	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7
START TIME	11:28 AM	3:59 PM	9:48 AM	7:48 AM	10:30 AM	1:30 PM	5:23 PM
FINISH TIME	1:48 PM	5:10 PM	11:00 AM	8:59 AM	11:40 AM	2:39 PM	6:31 PM
OPERATING CONDITIONS (APPROXIMATE)	BACK GROUND	BACK GROUND	BACK GROUND	710 SPL (C BASIS)	710 SPL (C BASIS)	710 SPL (C BASIS)	710 SPL (C BASIS)
GAS CONDITIONS (AVG)							
TEMPERATURE (°F)	89	84	89	77	80	87	79
MOISTURE (VOLUME %)	2	0.9	2	2	2	1.4	2
% O2 (DRY VOLUME %)	19	19	19	19	19.5	19	19
% CO2 (DRY VOLUME %)	2	2	2	2	2	2	2
VOLUMETRIC FLOW RATE							
ACFM	50500	50060	48450	47570	47270	47340	46480
DSCFM	48160	48730	45790	46360	45870	45630	45180
EMISSION RATE (LB/HR)							
PARTICULATE	2.9	2.1	1.6	3.6	3.5	4.5	3.2
SULFER DIOXIDE	169.9	131.4	130.9	104.5	118.6	100.3	120.6

144.1 lb/hr 111.0 lb/hr

TABLE 3

SPRING HOPE COMPLIANCE TESTING 4075-A RESULTS Fluorides

DATE	88-02-03	88-02-03	88-02-04	88-02-05	88-02-05	88-02-05	88-02-05
RUN NUMBER	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7
START TIME	11:28 AM	3:59 PM	9:48 AM	7:48 AM	10:30 AM	1:30 PM	5:23 PM
FINISH TIME	1:48 PM	5:10 PM	11:00 AM	8:59 AM	11:40 AM	2:39 PM	6:31 PM
OPERATING CONDITIONS (APPROXIMATE)	BACK GROUND	BACK GROUND	BACK GROUND	710 SPL (C BASIS)	710 SPL (C BASIS)	710 SPL (C BASIS)	710 SPL (C BASIS)
GAS CONDITIONS (AVG)							
TEMPERATURE (°F)	89	84	89	77	81	86	79
MOISTURE (VOLUME %)	1.9	0.9	2.1	1.9	2	2.1	1.6
% O2 (DRY VOLUME %)	19	19	19	19	19.5	19	19
% CO2 (DRY VOLUME %)	2	2	2	2	2	2	2
VOLUMETRIC FLOW RATE							
ACFM	50200	48050	47280	46700	46260	45250	47400
DSCFM	47900	46770	44560	45570	44830	43370	46260
EMISSION RATE (LB/HR)							
GASEOUS FLUORIDE	0.08	0.06	0.06	0.08	0.05	0.03	0.05
PARTICULATE FLUORIDE	0.21	0.14	0.13	0.63	0.77	0.91	0.93
TOTAL FLUORIDE	0.28	0.20	0.19	0.7	0.82	0.93	0.98

TABLE 4

SPRING HOPE N.C. PRECOMPLIANCE TESTS 88-1-13 THRU 88-01-17

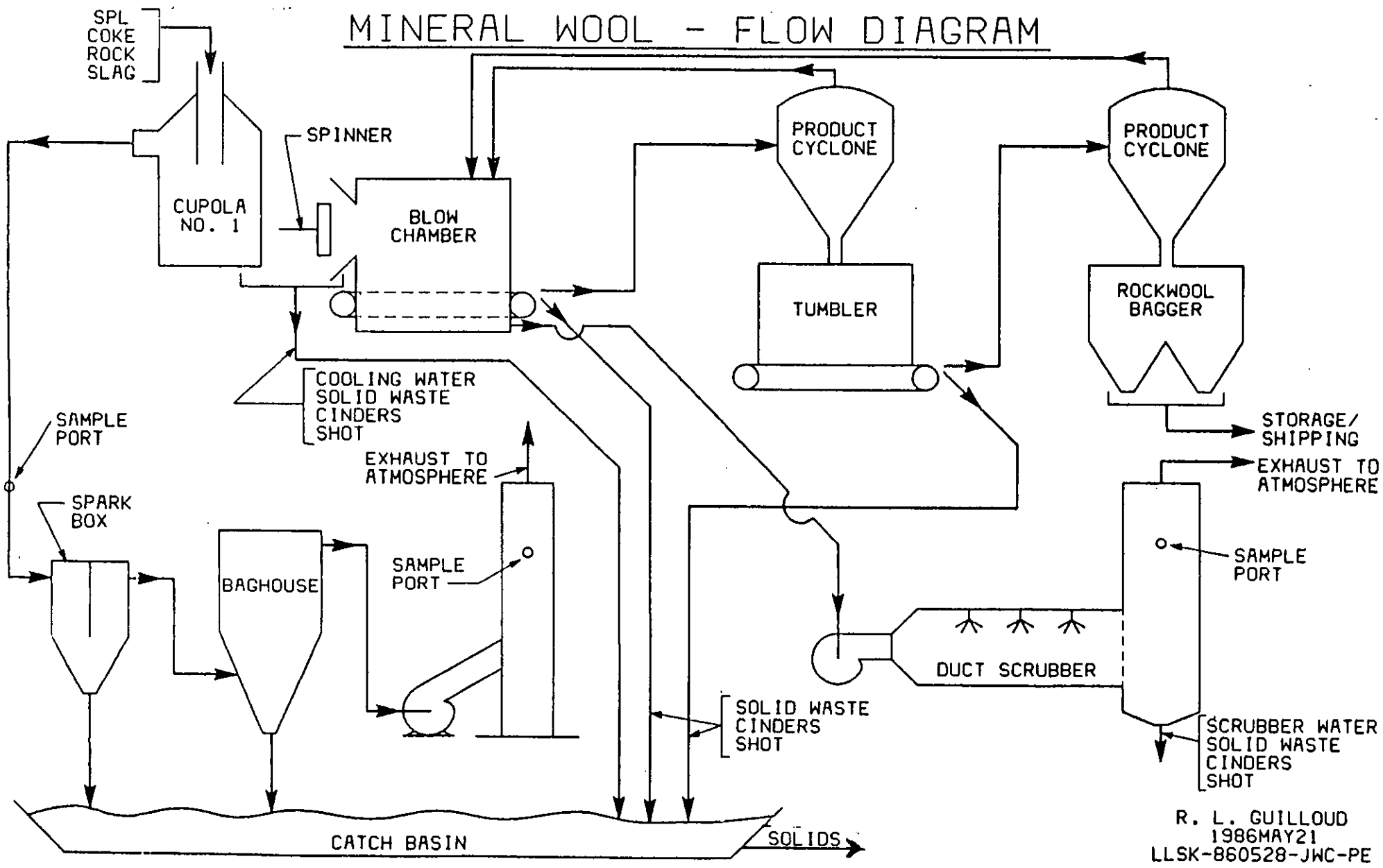
	BACKGROUND	RUNS 1-4			SPL 350#	RUNS 5-7		SPL 700#	RUNS 8-10	
RUN # (4075-A)	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7	RUN 8	RUN 9	RUN 10
DATE	88-1-13	88-1-13	88-1-14	88-1-14	88-1-15	88-1-15	88-1-15	88-1-16	88-1-16	88-1-16
VMSTD	42.19	53.15	52.32	52.46	63.8	63.03	64.01	54.85	53.21	54.17
DSCFM	49150	46630	47630	47980	49200	47970	47340	49920	47960	46340
% ISOKINETIC	83.4	106.7	99	99.8	104.7	103.8	106.1	102.8	99.7	103.1
MG OF GASEOUS F	0.5	0.7	0.4	1.4	0.3	0.3	0.3	0.4	0.4	0.6
MG OF PART F	1.1	1.6	1.4	1.5	5.3	5.1	4.5	9.1	5.8	5.8
LB/HR GASEOUS F	0.08	0.08	0.05	0.17	0.03	0.03	0.03	0.05	0.05	0.07
LB/HR PARTICULATE F	0.17	0.19	0.17	0.18	0.54	0.51	0.44	1.10	0.69	0.66
LB/HR FLUORIDE	0.25	0.27	0.22	0.35	0.57	0.54	0.47	1.14	0.74	0.72

PARTICULATE/SO2

RUN # (METHOD-5/6)	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7	RUN 8	RUN 9	RUN 10
VMSTD	48.19	46.36	47.99	49.64	48.45	47.49	45.66	49.86	47.46	46.05
DSCFM	49150	46630	47630	47980	49200	47970	47340	49920	47960	46340
% ISOKINETIC	100.9	102.3	103.7	106.5	101.4	101.9	99.3	102.8	103	102.3
PARTICULATE (gm)	0.0156	0.0138	0.0083	0.0083	0.0122	0.0124	0.0159	0.006	0.0153	0.0163
LB/HR PARTICULATE	2.1	1.8	1.1	1.1	1.6	1.7	2.2	0.8	2.0	2.2
SO2 (mg)	1273	943	1093	1100	995	846	836	841	918	711
LB/HR SO2	171.7	125.5	143.5	150.9	133.7	113.0	114.7	111.4	122.7	94.6

SUMMARY (AVG)	BKGRD	350# SPL	700# SPL
LB/HR GASEOUS F	0.09	0.03	0.05
LB/HR PART F	0.18	0.50	0.81
LB/HR FLUORIDE	0.27	0.53	0.87
LB/HR PARTICULATE	1.5	1.8	1.7
LB/HR SO2	148	120	110

FIGURE 1


MINERAL WOOL - FLOW DIAGRAM
SPL
COKE
ROCK
SLAG
CUPOLA NO. 1
SPINNER
BLOW CHAMBER
PRODUCT CYCLONE
PRODUCT CYCLONE
TUMBLER
ROCKWOOL BAGGER
COOLING WATER
SOLID WASTE
CINDERS
SHOT
SAMPLE PORT
SPARK BOX
EXHAUST TO ATMOSPHERE
BAGHOUSE
SAMPLE PORT
STORAGE/ SHIPPING
EXHAUST TO ATMOSPHERE
SAMPLE PORT
DUCT SCRUBBER
SOLID WASTE
CINDERS
SHOT
SCRUBBER WATER
SOLID WASTE
CINDERS
SHOT
CATCH BASIN
SOLIDS
R. L. GUILLOUD
1986MAY21
LLSK-860528-JWC-PE

MEMORANDUM

DATE: August 25, 1988

TO: Ken Schuster/Jerry Clayton

FROM: Robert Wooten

SUBJECT: Revision of Review of Emission Test Report for American Rockwool, Inc., Spring Hope, Nash Co., N.C., performed May 17-19, 1988.

The subject report was received July 1, 1988 with additional information received August 8, 1988. The test was performed by personnel of the Aluminum Company of America (ALCOA). The main purpose of the test was to determine fluoride emissions when producing rockwool with spent pot linings (SPL) salvaged from ALCOA's aluminum production operations. It was desired to show to what extent fluoride emissions increase when SPL is substituted for coke. It was also desired to show to what extent the addition of lime decreases fluoride emissions. The filter used for fluoride testing was weighed for particulate determination. Sulfur dioxide was also measured.

The method used for particulate determination involved weighing the sampling thimble used to collect particulate fluorides. Due to the filter being cellulose, it tended to gain atmospheric moisture readily which made the accuracy of the weighings slightly uncertain. Also, probe and filter holder washings were omitted. The particulate values should be somewhat less accurate than a properly performed Method 5 test.

The particulate emission test is insufficient to determine compliance. EPA Method 5 should be performed on the cupola stack and the duct scrubber stack. To meet the requirement of condition 5 of the permit, it will be necessary to determine the input to the blow chamber, the cleaning process transfer cyclone, and the bagging process transfer cyclone.

Sulfur dioxide emissions were determined using a method said to be like EPA Method 15. None of the necessary supporting data was provided. It is not possible to accept the SO_2 results since there is nothing to show that correct procedures were followed. Also, the heat input is undetermined and SO_2 may come from other than fuel.

The method used for fluoride measurement was ALCOA Method 4075A. This method is similar to EPA Method 13B. After discussing certain details of the the test method with Gary McAllister of the EPA, I have concluded that Method 4075A should give accurate results for this source.

The attached table summarizes the fluoride emissions for the three operating conditions tested. The charge makeup and number of charges per hour given in Table 1 on page 2 of the report should be regarded as only nominal. I computed SPL, Lime, and coke charge rates from the production records covering the shift during which testing was performed. You may wish to have American Rockwool verify my numbers as their production records as reproduced in the report are a little confusing.

The first test run of condition B showed lower fluorides than the next three runs. It is not possible to say if the test run is flawed. If it is omitted, the average fluoride emission rate increases 23% (7.84 lbs/hr to 9.67 lbs/hr).

Only two fluoride runs were performed for condition D due to process problems. I accept the results of the two test runs performed.

For condition A, I calculated an emission factor of .000259 lb F/ lb coke. For condition B, I got .00557 lb F/ lb SPL (using 7.41 lb F/hr). This is 21.5 times greater than for coke pound for pound. Since more than a pound of SPL will replace a pound of coke, the actual fluoride increase should be greater.

For condition D, I found .00205 lb F/ lb SPL with .107 lb lime/ lb SPL. The emission factor for SPL with lime is 7.9 times that for coke. Note again that more SPL will be used than the weight of coke reduced.

The fluoride emission standard for this source is given in condition 11 of Permit # 3578R7. The use of 1420 lbs/hr of SPL in both cupolas combined is allowed. The fluoride emissions must not increase over 2.8 lbs/hr (total) when using SPL compared to what the fluoride emissions would be without SPL.

Test condition B shows a fluoride increase of 7.11 lb/hr over condition A with an SPL input of 1329.8 lb/hr (90 lb/hr less than the maximum allowed). If the first test run is omitted, the increase is 8.94 lb/hr. The B condition test shows that the cupolas violate the permitted fluoride increase limit set in the permit when SPL without lime is used.

Test condition D was allowed by permit for a limited time to establish emissions if lime is added along with the SPL. Condition D shows a fluoride increase of 4.37 lb/hr over condition A with a SPL input of 2382 lb/hr. If the emission factor found from this test is applied to the 1420 lb/hr SPL allowed by the permit, the fluoride emission due to SPL is 2.911 lb/hr. Of course, when SPL is used, it replaces coke at somewhat more than a pound of SPL per pound of coke. If it were a pound for a pound, the fluoride increase would be .001791 lbF/lb SPL or, for 1420 lb SPL/hr, 2.54 lbF/hr increase which is within the 2.8 lb/hr increase allowed.

As I understand it, the condition D test was not intended to determine compliance with Permit # 3578R7 operating conditions and emission limits. The results are useful for predicting fluoride emissions when lime is added to the cupolas in the proportions used for the Condition D test.

According to Ken Schuster, the real fluoride concern is that actual fluoride emissions not exceed six (6) pounds per hour and that the annual fluoride increase due to using SPL not exceed three tons. The six lb/hr figure comes from modeling. The 2.8 lb/hr increase figure in the permit comes from assumptions (apparently incorrect) about pre-SPL fluoride emissions and the six lb/hr modeling value.

Attachment

cc: Mike Aldridge
Central File via Lee Daniel

OPERATING CONDITIONS AND FLUORIDE EMISSIONS

	lbs/charge		charges/hr		lbs charged/hr			Average Fluoride lbs/hr
Cuploa	I	II	I	II	I	II	Total	combined
17MAY88 - Condition A								
SPL	0	0	0	0	0	0	0	
Lime	0	0	0	0	0	0	0	.73
Coke	388.8	388.6	3.63	3.63	1411	1411	2822	
18MAY88 - Condition B								
SPL	207.3	218.7	3.25	3.00	673.7	656.1	1329.8	
Lime	0	0	0	0	0	0	0	7.84
Coke	264.8	268.5	3.25	3.00	860.6	805.5	1666.1	* 9.67
19MAY88 - Condition D								
SPL	427.3	428.0	3.11	2.46	1329	1053	2382	
Lime	23.86	24.38	6.00	4.56	243.2	111.2	254.4	5.10
Coke	143.8	145.7	3.11	2.46	447.2	358.4	805.6	

* If the first of the four runs is omitted since it is much lower than the other three.

1988 August 4

NC NRDC
Air Quality Section
P.O. Box 27687
Raleigh, NC 27611
Attn: Mr. Robert Wooten

RE: 1988 MAY AMERICAN ROCKWOOL, SPRING HOPE, NC, EMISSION CALCULATIONS

Dear Mr. Wooten:

As per your request, this letter demonstrates how fluoride emissions were calculated from the 1988 May testing at American Rockwools Spring Hope, NC, Facility. Run 1, 1988 May 17, has been chosen for specific examples. All referenced data can be found in the formal report, #93-88-005, dated 1988 May 14, or in the attachment.

Fluoride Emissions - Fluoride emissions were determined using Alcoa Sampling Method 4075A coupled with Alcoa Analytical Method 4076A. The equation used for mass emission of F is as follows:

$$\text{lb/hr F} = \frac{M_F}{Vmstd} (Q_{std}) \left[\frac{1 \text{ lb}}{453600 \text{ mg}}\right] \left[\frac{60 \text{ min}}{1 \text{ hr}}\right] \qquad \text{(A)}$$

In equation (A) Vmstd is the dry standard volume of stack gas sampled during Run 1 and Q_{std} is the dry standard volumetric flow rate for the stack gas during Run 1. The term M_F stands for the total mass of fluoride recovered from the Method 4075-A sampling train. This particular train has three areas that collect fluoride - the nozzle, the thimble and the impingers. Particulate fluoride is collected in the nozzle and thimble while gaseous fluoride is captured in the impingers. For analysis, the nozzle wash and a 100 ml sample from the impinger solution were directly distilled (sulfuric acid distillation) to 500 ml volume. They were then directly analyzed by Specific Ion Electrode (SIE) and the impinger value was corrected for a dilution. The contents of the thimble had CaO added, were ashed and then fused with NaOH before being distilled (sulfuric acid distillation) for analysis by SIE. (Refer to Method 4076A.)

no visible particulate - in nozzle wash.
Gary McAllister says it should be OK

For an SIE analysis, a calibration is completed with known concentrations (analytical standards) of fluoride solutions. For each fluoride solution SIE yields a specific millivolt reading. From the millivolt readings and their respective fluoride concentrations a line can be determined. The millivolt reading is plotted vs the log of the F concentration. The F concentration of a sample solution (usually a 10 ml aliquot from the H_2SO_4 distillate) is determined from this graph (or by the equation of the line) by taking the antilog of the Y-axis value for the corresponding X-axis voltage. The fluoride concentration obtained is then factored for dilution (when applicable) and converted to total fluoride mass. Sample calculations for the nozzle wash, thimble and impinger (F_n, F_t and F_i, respectively) F content follow.

ALCOA
1988

Please note that the total mass of fluoride (M_F) collected by this train is equal to the sum of F_n, F_t and F_i.

The nozzle:

	Y	X	LOG Y
Calibrations:	2 mg F/l	828 mV	0.301
	20 mg F/l	244 mV	1.301
	0.20 mg F/l	1341 mV	-0.699
	200 mg F/l	-346 mV	2.301

These values can either be plotted (X vs log Y) or an equation can be developed:

$$Y = 10^{mx+b} \text{ where } m = \text{slope}, \; b = \text{intercept}$$

The Run 1 nozzle wash sample produced an SIE millivolt reading of 1205 mV which corresponded to a concentration of 0.395 mg F/l. Since the distillation volume was 500 ml (0.5 l):

Fn = (0.395 mg F/l) (0.5 l) = 0.198 mg F or 0.20 mg F

Calibration plots can be found in the attachments.

The Thimble:

	Y	X	LOG Y
Calibrations:	2 mg F/l	844 mV	0.301
	20 mg F/l	266 mV	1.301
	0.20 mg F/l	1357 mV	-0.699
	200 mg F/l	-327 mV	2.301

SIE for the Run 1 thimble sample gave a reading of 728 mV which corresponded to a concentration of 3.175 mg F/l. Therefore, total fluoride for the thimble is equal to:

Ft = (3.175 mg F/l) (0.5 l) = 1.588 mg F or 1.59 mg F

The Impingers:

	Y	X	LOG Y
Calibrations:	2 mg F/l	898 mV	0.301
	20 mg F/l	308 mV	1.301
	0.20 mg F/l	1420 mV	-0.699
	200 mg F/l	-279 mV	2.301

The analysis of the impingers differs from that of the nozzle and thimble. The nozzle and thimble analyses make use of the entire submitted sample. Due to the large volume of the impinger field sample (V_f = 0.510 l) only a 100 ml aliquot (Va) is used for analysis. This fluoride containing aliquot is distilled by sulfuric acid distillation to a fluoride containing distillate volume (V_d) of 500 ml. This is equivalent to a five-fold dilution in the fluoride concentration because the same mass of fluoride that was originally in the 100 ml aliquot is now in the 500 ml distillate.

From the distillate a 10 ml aliquot is taken for SIE analysis where it produced a reading of 1238 mV. This value corresponded to a distillate fluoride concentration (Cd) of 0.479 mg F/l. The distillate concentration is not equal to field sample concentration (Ca).

Therefore:

$Ca = (Vd/Va)\ Cd = (500\ ml/100\ ml)\ (0.479\ mg\ F/l) = 2.395\ mg\ F/l$

Since the field sample volume was 0.510 l and its concentration was 2.395 mg F/l, the same as the 100 ml aliquot, the total mass of fluoride contained in the impingers (Fi) equals:

$Fi = V_f\ Ca = (0.510\ l)\ (2.395\ mg\ F/l) = 1.22\ mg\ F.$

Total Fluoride:

$M_F = Fn + Ft + Fi = 0.20\ mg + 1.59\ mg + 1.22\ mg = 3.01\ mg\ F.$

Therefore, equation (A) yields:

$$lb/hr\ F = \frac{3.01\ mg\ F}{38.28\ dsft^3}\left[\frac{38019\ ds\ ft^3}{min}\right]\left[\frac{1\ lb}{453600\ mg}\right]\left[\frac{60\ min}{hr}\right] = 0.39\ lb\ F/hr$$

Review of the laboratory data in the attachment shows QA/QC measures (spiked samples, duplicate samples and blanks) that have been taken.

I hope this letter addresses your needs regarding laboratory calculations. If I can be of any further assistance, please do not hesitate to call.

Sincerely,

James V. Apicella

JAMES V. APICELLA ext. 2975

Attachments

CC: L. C. Blayden, ATC-C
R. G. Small, Pittsburgh 23
D. Weeter Associates, Louisville, TN
B. W. Bromley, American Rockwool, Spring Hope, NC.

RECEIVED
JUN 20 1988
RALEIGH REGIONAL OFFICE

PARTICULATE, SULFUR DIOXIDE, AND FLUORIDE EMISSIONS FROM MINERAL WOOL PRODUCTION WITH VARYING CHARGE COMPOSITIONS

RECEIVED
JUL 1 1988
AIR QUALITY PERMITS

AMERICAN ROCKWOOL, INC.
SPRING HOPE, NC 27882

TEST PERIOD: 1988 MAY 17-19
PERMIT NO. 3578R7, 1988 MAY 13

BY

JAMES V. APICELLA
ENVIRONMENTAL SCIENTIST
ENVIRONMENTAL CONTROL LABORATORY
ALUMINUM COMPANY OF AMERICA
ALCOA TECHNICAL CENTER
ALCOA CENTER, PA 15069

Promised 6-15-5

REPORT NO. 93-88-005
1988 JUNE 14

Test Objective

The emission rates for particulate matter, sulfur dioxide and fluorides were determined for the common stack serving American Rockwool's two cupolas and their baghouses. Emissions were determined for three different charges or conditions. The conditions correspond to Item 16 of Air Permit No. 3578R7. The approximate consist of each charge is listed in Table 1.

TABLE 1

Average Charge Makeup Per Cupola

Charge (lb)	1988 May 17 Condition A	1988 May 18 Condition B	1988 May 19 Condition D
SPL*	0	210	450
Lime	0	0	50
Coke	385	260	140
Duquesne Slag	1300	1300	1300
Trap Rock	1100	1100	1100
Steel Slag	400	400	400
Tennessee Slag	400	400	400
Avg. # charges/hr	3.5	3.4	3.0

*SPL is an aluminum smelting cell byproduct (SCB) which is substituted for coke on a lb carbon/lb carbon basis.

Summary of Test Results

Results from the test program are summarized in Table 2.

TABLE 2

Average Total Emissions for Two Cupola Operation
Cupola/Baghouse Common Stack

Condition	Particulate Matter lb/hr Front Half*	Fluoride lb/hr	Sulfur Dioxide lb/hr
A	1.2	0.73	104.7
B	1.8	7.84	95.2
D	1.8	5.10	57.1

*Method 4075A does not account for particulate matter captured in the back half of the impinger train.

PROCESS DESCRIPTION

Figure 1 shows how mineral wool is produced at the Spring Hope plant of American Rockwool, Inc. A cupola is used to melt a combination of rock and slag. The molten product which exits the bottom of the cupola is directed onto a horizontal axis spinning disc. The resultant fibers are then collected in a blow chamber where oil is used to control dust. The fibers pass through a tumbler to remove unwanted particles, then to a bagger.

Large, spherical particles (shot), produced by the spinning head, are conveyed to a pit under the cupola using a small flow of water. Occasionally unwanted slag is tapped from the bottom of the cupola directly into the pit containing the "shot".

Emissions from the cupola are controlled by a spark box and baghouse. All air from the material collection and handling portions of the operation is scrubbed by a water spray system.

The plant utilizes two cupolas each equipped with its own fume control system. After being collected by the fume control system, the gases are passed through their respective spark box and baghouse. After exiting the baghouse the gas streams are combined into a common stack before being emitted to the atmosphere.

SAMPLING PROCEDURES

The testing procedures followed were essentially those proposed by J. E. Gibb on 1988 January 05, reference Dr. Weeter's 1988 May 02 letter to Ken Schuster.

Sampling Location

The stack sampling location was designed 8 diameters downstream and 6 diameters upstream from the nearest disturbance. At this point in the 6 ft I.D. stack there are two 4 in. ports 90° apart. This is illustrated in Figure 2. For isokinetic sampling, six points were sampled per port at five minutes per point. For gas chromatography, a teflon probe was inserted at a point of average velocity. There was no cyclonic flow at this location.

Fluoride Emissions

Fluoride Emissions were determined using Alcoa Method 4075A (approved by the State of North Carolina and Federal EPA) in conjunction with the necessary Federal Methods (1 through 4) to obtain isokinetic sampling for total particulate and gaseous fluoride. The method requires a cellulose thimble to remove particulate fluoride and ice cooled impingers of 1.0N sodium hydroxide for scrubbing gaseous fluoride (see Figure 3).

Particulate Emissions

Particulate emissions were determined from the front half of the Method 4075A sampling train. Total particulate was collected by the cellulose thimble which had been tared before use.

Sulfur Dioxide Emissions

Sulfur dioxide emissions were determined by gas chromatography and flame photometric detection (GC-FPD). The sampling method paralleled EPA Method 15. The stack gas was drawn through a teflon probe into a glass sample bulb. They were heated or insulated as necessary to prevent condensation in the sample line and bulb. After drawing ten times the bulb's volume through the bulb (a purge to insure only the stack gas is present) it was immediately taken to the GC-FPD for analysis.

Raw Materials

Samples of Duquesne Slag, Tennessee Slag and Spent Potlining (SCB) were taken from each charge. They were accumulated in separate 55 gallon drums over the three day test period. Different types of raw materials were not stored in the same drums, nor were they allowed to mix at any time during size reduction and/or analysis. This sampling procedure yielded four drums of each type of slag and three drums of SCB. These drums were then shipped to Kennedy Van Saun for size reduction. Each drum of SCB was reduced individually according to the description below but the slags were first composited as follows: One quarter of the contents for each drum of Duquesne Slag was placed into a new drum after the contents of the original drums were thoroughly mixed. After the four drums were used to create this new composite drum, the composite drum was treated the same as the SCB. This procedure was also followed for the Tennessee Slag.

First the entire contents of the barrel are crushed to minus 3/8 inch and homogenized. From this mix forty pounds are split out and reduced to minus 40 mesh. After homogenization, thirty-five pounds are split out, reduced to minus 4 mesh and again homogenized. From this sample five pounds are split out, reduced to minus 10 mesh, once again homogenized and one quarter of a pound is reduced to minus 60 mesh. This thoroughly mixed, finely ground sample is submitted for analysis by Alcoa's Analytical Chemistry Division.

ANALYTICAL PROCEDURES

Fluoride Emissions

Alcoa's Analytical Chemistry Division (ACD) used Alcoa Method 4076A (a combination of ashing, fusion, sulfuric acid distillation and selective ion electrode) to measure particulate and gaseous fluoride.

Particulate Emissions

Particulate emissions were determined gravimetrically. Prior to testing, the Method 4075A thimbles were heated, desiccated and tared. The tare weights were recorded. After testing, the thimbles were once again heated, desiccated and weighed before being turned in for particulate fluoride analysis. Particulate emissions were determined from the net weight gain of the thimbles.

TABLE 3

AMERICAN ROCKWOOL
40/5-A & PARTICULATE

UNIT	BOTH	BOTH	BOTH	BOTH	BOTH	BOTH	BOTH	BOTH	BOTH
DATE	88-05-17	88-05-17	88-05-17	88-05-18	88-05-18	88-05-18	88-05-18	88-05-19	88-05-19
RUN NUMBER	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7	RUN 8	RUN 9
START TIME	9:25 AM	11:30 AM	2:32 PM	9:01 AM	11:01 AM	12:52 PM	3:30 PM	9:20 AM	11:09 AM
FINISH TIME	10:28 AM	12:33 PM	3:33 PM	10:03 AM	12:02 PM	1:53 PM	4:31 PM	10:12 AM	12:09 PM
OPERATING CONDITIONS	A	A	A	B	B	B	B	D	D
GAS CONDITIONS (AVG)									
TEMPERATURE °F	103	111	111	93	101	106	107	95	94
MOISTURE (VOLUME %)	2.8	2.9	3.3	2.6	2.8	3.0	2.5	2.5	2.8
% O2 (DRY VOLUME %)	18	18	18	18	18	18.5	19.5	19	18
% CO2 (DRY VOLUME %)	2	1.5	1.5	1	1	1	1.5	1.5	1
VOLUMETRIC FLOW RATE									
ACFM	41500	43516	44541	38859	41536	39927	43313	41117	39717
DSCFM	38019	38947	39723	35997	37813	35985	39161	38129	36781
EMISSION RATES									
PARTICULATE LB/HR	1.44	1.38	0.87	0.98	1.89	2.09	2.37	1.74	1.82
GASEOUS FLUORIDE LB/HR	0.16	0.63	0.64	1.70	6.20	11.44	8.80	3.47	4.96
PART. FLUORIDE LB/HR	0.24	0.26	0.26	0.66	0.85	0.80	0.91	0.84	0.93
TOTAL FLUORIDE LB/HR	0.39	0.90	0.90	2.36	7.05	12.25	9.71	4.31	5.88
SULFER DIOXIDE LB/HR	111.8	109.9	92.3	89.3	101.4	96.9	93.8	47.1	67.1

TABLE 4

TEST RESULTS

DATE OF TEST	88-05-17	88-05-17	88-05-17	88-05-18	88-05-18	88-05-18	88-05-18	88-05-19	88-05-19
RUN NUMBER	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7	RUN 8	RUN 9
TEST METHOD	4075-A	4075-A	4075-A	4075-A	4075-A	4075-A	4075-A	4075-A	4075-A
Vmstd	38.28	39.09	40.45	35.85	37.84	36.27	38.83	37.78	36.80
Vwstd	0.79	1.18	1.37	0.94	1.11	1.11	0.99	0.97	1.06
Bwo	0.020	0.029	0.033	0.026	0.028	0.030	0.025	0.025	0.028
Md	29.04	28.96	28.96	28.88	28.88	28.90	29.02	29.00	28.88
Ms	28.82	28.64	28.68	28.68	28.57	28.58	28.75	28.73	28.58
Vs	24.47	25.66	26.26	22.91	24.49	23.54	25.54	24.24	23.42
%ISOKINETIC	101.4	101.1	102.5	100.3	100.7	101.5	99.8	99.8	100.7
ACFM	41508	43516	44541	38859	41536	39927	43313	41117	39717
USCFM	38019	38947	39723	35997	37813	35985	39161	38129	36781
gr/dscf	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
PARTICULATE LB/HR	1.44	1.38	0.97	0.98	1.09	2.09	2.37	1.74	1.82
GASEOUS FLUORIDE LB/HR	0.16	0.63	0.64	1.70	6.20	11.44	8.80	3.47	4.96
PART FLUORIDE LB/HR	0.24	0.26	0.26	0.66	0.85	0.80	0.91	0.84	0.93
TOTAL FLUORIDE LB/HR	0.39	0.90	0.90	2.36	7.05	12.25	9.71	4.31	5.88

7/

RECEIVED

MAR 0 1 1988

RALEIGH REGIONAL OFFICE

COMPLIANCE REPORT ON PARTICULATE, SULFUR DIOXIDE, FLUORIDE AND VISUAL EMISSIONS FROM MINERAL WOOL PRODUCTION

AMERICAN ROCKWOOL, INC.
SPRING HOPE, NC 27882

NORTH CAROLINA AIR PERMIT NO. 3578R6

TEST PERIOD: 1988 FEBRUARY 3-5

BY

JAMES V. APICELLA
ENVIRONMENTAL SCIENTIST
ENVIRONMENTAL CONTROL LABORATORY
ALUMINUM COMPANY OF AMERICA
ALCOA TECHNICAL CENTER
ALCOA CENTER, PA 15069

Lee Bayless
(412) [illegible]

REPORT NO. 93-88-003
1988 FEBRUARY 26

TABLE OF CONTENTS

	Page No.
Summary	1
Compliance Report Summary	1
Test Objective	2
Summary of Test Results	2
Process Description	3
Sampling Procedures	3
Analytical Procedures	4
Quality Control Procedures	5
Results	5
Discussion	5
Tables	
Table 1 - Average Emissions vs. Permit Limits Cupola/Baghouse Common Stack	2
Table 2 - Spring Hope Compliance Testing Method 5/6 Results	7
Table 3 - Spring Hope Compliance Testing Method 4075A Results	7
Table 4 - Spring Hope, NC Precompliance Tests 88-01-13 through 88-01-17	8
Figures	
Figure 1 - Mineral Wool - Flow Diagram	9
Figure 2 - Sampling Location	10
Figure 3 - Combined Method 5/Method 6 Sampling Train	11
Appendices	
Appendix A - Nomenclature	
Sample Calculations	
Appendix B - Fuel Analysis	
Production Data	
Appendix C - Calibrations	
Appendix D - Parameter Sheets	
Raw Data	
Appendix E - Laboratory Results	

SUMMARY

Compliance Report Summary

Company: American Rockwool, Inc.
P.O. Box 880
Spring Hope, NC 27882

Source Tested and Date:
Common Baghouse Stack for Cupolas 1 and 2
1988 February 3-5

Test Crew: Aluminum Company of America's
Environmental Control Laboratory

Test Crew and Observers:

Testers	Observer
J. E. Gibb Sr. Environmental Scientist	Ernie Fuller State of North Carolina Dept. of Natural Resources
L. C. Blayden Manager	
J. V. Apicella Environmental Scientist	
S. J. Robuck Senior Engineer	
L. D. Penix Environmental Technician	
B. G. Breisinger Sr. Staff Technician	
Nancy Frerichs Mechanical Engineer Tennessee Operations	

Analytical Facilities:

Method 5 Analysis
Environmental Control Laboratory
Alcoa Technical Center
Alcoa Center, PA
L. D. Penix, Analyst

Method 6 Analysis
Analytical Chemistry Div.
Alcoa Technical Center
Alcoa Center, PA
J. W. Cashell, Analyst

Method 4076A Analysis
Analytical Chemistry Division
Alcoa Technical Center
Alcoa Center, PA
S. Deiseroth, Analyst

Elemental Sulfur Analysis
Analytical Chemistry Division
Alcoa Technical Center
Alcoa Center, PA
J. W. Cashell, Analyst

Btu Analysis
Analytical Chemistry Division
Alcoa Technical Center
Alcoa Center, PA
A. J. Kochanowski, Analyst

Test Objective

The emission rates for particulate matter, sulfur dioxide and fluorides as well as opacity were determined for the common stack serving American Rockwool's two cupolas and their baghouses. The emissions were determined for two separate conditions:

1. Zero substitution for coke (Background) 1988 February 3-4
2. 710 lb SPL*/hr/cupola (710 SPL) 1988 February 5

*SPL is an aluminum smelting cell by-product which was substituted for coke on a lb carbon/lb carbon basis.

Summary of Test Results

Results from the test program are summarized and compared to Air Permit No. 3578R6 limits in Table 1.

TABLE 1

Average Emissions vs. Permit Limits
Cupola/Baghouse Common Stack

Condition	Particulate Matter lb/hr Front Half	Particulate Matter lb/hr Total*	Fluoride lb/hr	Sulfur Dioxide lb/hr	Sulfur Dioxide lb/mm Btu	Opacity %
Background	2.1	3.0	0.23	144.1	1.1	<5
710 SPL	3.8	4.0	0.86	111.0	0.9	<5
Air Permit No. 3578R6	10	--	6.0	100.0	2.3**	<20***

*Total includes particulate from impinger train. Back half reported but not counted against permit.
**North Carolina Air Pollution Control Regulations 466:0516
***Cannot exceed more than 20% opacity when averaged over a six minute period, except that six minute periods averaging not more than twenty percent opacity may occur not more than once in any hour nor more than four times in any 24-hour period.

Particulate matter, fluorides and opacity are well within permitted limits. While SO_2 exceeds the Maximum After Control Emissions limit of 100 lb/hr by 44.1 lb/hr (Background) and 11.0 lb/hr (710 SPL), the calculated SO_2 emissions from the fuel are well within the limit [1.1 lb SO_2/mm Btu (Background) and 0.9 lb SO_2/mm Btu (710 SPL) vs. 2.3 lb SO_2/mm Btu (limit)] defined by the North Carolina Air Pollution Control Regulations Title 15, Chapter 2, Subchapter 20, Section .0516 "Sulfur Dioxide Emissions from Fuel Burning Installations".

PROCESS DESCRIPTION

Figure 1 shows how mineral wool is produced at the Spring Hope plant of American Rockwool, Inc. A cupola is used to melt a combination of rock and slag. The molten product which exits the bottom of the cupola is directed onto a horizontal axis spinning disc. The resultant fibers are then collected in a blow chamber where oil is used to control dust. The fibers pass through a tumbler to remove unwanted particles, then to a bagger.

Large, spherical particles (shot), produced by the spinning head, are conveyed to a pit under the cupola using a small flow of water. Occasionally unwanted slag is tapped from the bottom of the cupola directly into the pit containing the "shot".

Emissions from the cupola are controlled by a spark box and baghouse. All air from the material collection and handling portions of the operation is scrubbed by a water spray system.

The plant utilizes two cupolas each equipped with its own fume control system. The emissions from both are combined into a common stack at the baghouse outlets.

The cupolas are charged at an average rate of 3.6 charges per hour of the following compositions:

Background		710 lb/hr SPL	
Charge	lb	Charge	lb
Coke	385-400	Coke	260
SPL	0	SPL	225
Duquesne Slag	1300	Duquesne Slag	1300
Trap Rock	1100	Trap Rock	1100
Lime	50	Lime	50
Steel	400	Steel	400
Tennessee Slag	400	Tennessee Slag	400

SAMPLING PROCEDURES

Testing was done according to the proposal submitted by J. E. Gibb dated 1988 January 05.

Sampling Locations - The 6 ft I.D. stack has two sampling ports 90° apart. Six points were sampled per port. Each point was sampled 5 minutes for a total sampling time of 60 minutes. The sampling location was 8 diameters downstream and 6 diameters upstream from any disturbance. The stack sampling locations are shown in Figure 2. No cyclonic flow was present.

Particulate Matter - Sulfur Dioxide - Opacity - The determination of these emissions followed procedures outlined by the U.S. Environmental Protection Agency (EPA) in Title 40 of the Code of Federal Regulations (CFR), Part 60, Appendix A.

- o Method 1 - "Sample and Velocity Traverses for Stationary Sources"
- o Method 2 - "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"
- o Method 3 - "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air and Dry Molecular Weight"
- o Method 4 - "Determination of Moisture Content in Stack Gases"
- o Method 5 - "Determination of Particulate Emissions from Stationary Sources", See Figure 3
- o Method 6 - "Determination of Sulfur Dioxide Emissions from Stationary Sources"
- o Method 9 - "Visual Determination of the Opacity of Emissions from Stationary Sources"

Fluoride Emissions - Fluoride Emissions were determined using Alcoa Method 4075A (approved by the State of North Carolina and Federal EPA) in conjunction with the necessary Federal Methods (1 through 4) to obtain isokinetic sampling for total particulate and gaseous fluoride. The method requires a cellulose thimble to remove particulate fluoride and ice cooled impingers of 1.0N sodium hydroxide for scrubbing gaseous fluoride (see Figure 4.

Raw Materials - Samples of the raw materials were taken from each charge. They were accumulated in separate 55 gallon drums over the three day test period. Different types of raw materials were not stored in the same drums, nor were they allowed to mix at any time during size reduction and/or analysis. This procedure netted composite samples between three and four hundred pounds for each of the raw materials. A mineral company, Kennedy Van Saun, Inc., handled the size reduction process which included the following steps for each material.

First the entire contents of the barrel were crushed to minus 3/8 inch and homogenized. From this mix forty pounds were split out and reduced to minus 40 mesh. After homogenization, thirty-five pounds were split out, reduced to minus 4 mesh and again homogenized. From this sample five pounds were split out, reduced to minus 10 mesh, once again homogenized and finally one quarter of a pound was reduced to minus 60 mesh. This thoroughly mixed, finely ground sample was then submitted for analysis by Alcoa's Analytical Chemistry Division.

ANALYTICAL PROCEDURES

Particulate Emissions

Particulate emissions were determined following procedures outlined in EPA Method 5. Particulate samples collected on Reeve Angel 934 AH glass fiber filters were analyzed gravimetrically. The probe and nozzles were washed with acetone. The wash was transferred to tared beakers and evaporated to dryness. This residual weight was included in the analysis. The back half was washed with 80% isopropanol and collected with the isopropanol used during the test in tared beakers. The residual weight was determined after the beakers were evaporated to dryness.

Fluoride and Sulfur Emissions

Alcoa's Analytical Chemistry Division (ACD) used Alcoa Method 4076A (a combination of ashing, fusion, sulfuric acid distillation and selective ion electrode) to measure particulate and gaseous fluoride. ACD used procedures outlined in EPA Method 6 to measure the total sulfur in the source samples. Gravimetric analysis (a combination of fusion, titration and precipitation) was used to measure sulfur in the raw materials.

Btu Content

The Btu content of coke and SPL was determined by standard Alcoa Method 1121 which uses a Parr Bomb calorimeter.

Opacity

A certified, qualified observer was used as per EPA Method 9 specifications. The certification is included in Appendix C.

QUALITY CONTROL PROCEDURES

Quality control procedures were followed for all aspects of field sampling including sample preservation and holding time; reagent quality; analytical method; analyst training; and instrument cleaning, calibration and safety. These procedures are consistent with EPA guidelines documented in "Quality Assurance Manuals for Air Pollution Measurement Systems," Vol. 3, "Stationary Source Specific Methods" (EPA-600/4-77-027b).

RESULTS

A composite of results from the test program is presented in Tables 2 and 3 of this report. Complete results, production data, raw data, calibration data and laboratory results are given in the Appendices.

DISCUSSION

A series of precompliance tests were run at the background condition, 350 lb SPL/hr per cupola and 700 lb SPL/hr per cupola at this facility 1988 January 13-17. Table 4 includes a summary of all test data. Comparison of precompliance results to the results of the compliance test shows excellent agreement. It should be noted that all of the Quality Assurance/Quality Control procedures and approved methods presented for the 1988 February 3-5 tests were also enforced for the 1988 January 13-17 testing program.

Testing

The test program went smoothly with only minor modifications. One problem encountered was the volatilization of the isopropanol in the Method 6 train. Even packed with ice, accurate determinations of stack gas moisture

were not always possible from this train. Since the 4075A train did not have this problem and the tests were simultaneous, Method 4075A moisture determinations were used for some Method 5 calculations. In reference to EPA Method 3, Fyrites were substituted for an Orsat analysis. While this is acceptable for carbon dioxide, it was justified for oxygen because the exhaust was mostly ambient air not combustion air, and the tests only required percent oxygen for molecular weight calculations. Reading Fyrites to an accuracy within one-half percent introduces negligible error into the molecular weight and ensuing calculations.

Process

The plant ran fairly consistent over the test times with only a minor upset in one of the cupolas during Run 6. Therefore, Run 7 was undertaken. Run 6 was included in the results because the upset was related to excessive tapping of the cupola bottoms. This did not affect gaseous emissions because combustion of charged materials was not interrupted. Particulate emissions temporarily increased (by approximately 1 lb/hr) but that was due to the faster rate of descent among the components in the cupola.

Although the average charge flows (lb/hr) were not always consistent with the permit specifications, the weight composition (lb material/charge) was consistent with the predetermined goal (see Appendix B).

TABLE 2

SPRING HOPE COMPLIANCE TESTING METHOD 5/6 RESULTS

DATE	88-02-03	88-02-03	88-02-04	88-02-05	88-02-05	88-02-05	88-02-05
RUN NUMBER	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7
START TIME	11:28 AM	3:59 PM	9:48 AM	7:48 AM	10:30 AM	1:30 PM	5:23 PM
FINISH TIME	1:48 PM	5:10 PM	11:00 AM	8:59 AM	11:40 AM	2:39 PM	6:31 PM
OPERATING CONDITIONS (APPROXIMATE)	BACK GROUND	BACK GROUND	BACK GROUND	710 SPL (C BASIS)	710 SPL (C BASIS)	710 SPL (C BASIS)	710 SPL (C BASIS)
GAS CONDITIONS (AVG)							
TEMPERATURE (°F)	89	84	89	77	80	87	79
MOISTURE (VOLUME %)	2	0.9	2	2	2	1.4	2
% O2 (DRY VOLUME %)	19	19	19	19	19.5	19	19
% CO2 (DRY VOLUME %)	2	2	2	2	2	2	2
VOLUMETRIC FLOW RATE							
ACFM	50500	50060	48450	47570	47270	47340	46480
DSCFM	48160	48730	45790	46360	45870	45630	45180
EMISSION RATE (LB/HR)							
PARTICULATE	2.9	2.1	1.6	3.6	3.5	4.5	3.2
SULFER DIOXIDE	169.9	131.4	130.9	104.5	118.6	100.3	120.6

144.1 lb/hr 111.0 lb/hr

TABLE 3

SPRING HOPE COMPLIANCE TESTING 4075-A RESULTS Fluoride

DATE	88-02-03	88-02-03	88-02-04	88-02-05	88-02-05	88-02-05	88-02-05
RUN NUMBER	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7
START TIME	11:28 AM	3:59 PM	9:48 AM	7:48 AM	10:30 AM	1:30 PM	5:23 PM
FINISH TIME	1:48 PM	5:10 PM	11:00 AM	8:59 AM	11:40 AM	2:39 PM	6:31 PM
OPERATING CONDITIONS (APPROXIMATE)	BACK GROUND	BACK GROUND	BACK GROUND	710 SPL (C BASIS)	710 SPL (C BASIS)	710 SPL (C BASIS)	710 SPL (C BASIS)
GAS CONDITIONS (AVG)							
TEMPERATURE (°F)	89	84	89	77	81	86	79
MOISTURE (VOLUME %)	1.9	0.9	2.1	1.9	2	2.1	1.6
% O2 (DRY VOLUME %)	19	19	19	19	19.5	19	19
% CO2 (DRY VOLUME %)	2	2	2	2	2	2	2
VOLUMETRIC FLOW RATE							
ACFM	50200	48050	47280	46700	46260	45250	47400
DSCFM	47900	46770	44560	45570	44830	43370	46260
EMISSION RATE (LB/HR)							
GASEOUS FLUORIDE	0.08	0.06	0.06	0.08	0.05	0.03	0.05
PARTICULATE FLUORIDE	0.21	0.14	0.13	0.63	0.77	0.91	0.93
TOTAL FLUORIDE	0.28	0.20	0.19	0.7	0.82	0.93	0.98

$\bar{x}$ = .22 lb/hr $\bar{x}$ = .86 lb/hr

TABLE 4

SPRING HOPE N.C. PRECOMPLIANCE TESTS 88-1-13 THRU 88-01-17

	BACKGROUND	RUNS 1-4			SPL 350#	RUNS 5-7		SPL 700#	RUNS 8-10	
RUN # (4075-A)	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7	RUN 8	RUN 9	RUN 10
DATE	88-1-13	88-1-13	88-1-14	88-1-14	88-1-15	88-1-15	88-1-15	88-1-16	88-1-16	88-1-16
VMSTD	42.19	53.15	52.32	52.46	63.8	63.03	64.01	54.85	53.21	54.17
DSCFM	49150	46630	47630	47980	49200	47970	47340	49920	47960	46340
% ISOKINETIC	83.4	106.7	99	99.8	104.7	103.8	106.1	102.8	99.7	103.1
MG OF GASEOUS F	0.5	0.7	0.4	1.4	0.3	0.3	0.3	0.4	0.4	0.6
MG OF PART F	1.1	1.6	1.4	1.5	5.3	5.1	4.5	9.1	5.8	5.8
LB/HR GASEOUS F	0.08	0.08	0.05	0.17	0.03	0.03	0.03	0.05	0.05	0.07
LB/HR PARTICULATE F	0.17	0.19	0.17	0.18	0.54	0.51	0.44	1.10	0.69	0.66
LB/HR FLUORIDE	0.25	0.27	0.22	0.35	0.57	0.54	0.47	1.14	0.74	0.72

PARTICULATE/SO2

RUN # (METHOD-5/6)	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7	RUN 8	RUN 9	RUN 10
VMSTD	48.19	46.36	47.99	49.64	48.45	47.49	45.66	49.06	47.46	46.05
DSCFM	49150	46630	47630	47980	49200	47970	47340	49920	47960	46340
% ISOKINETIC	100.9	102.3	103.7	106.5	101.4	101.9	99.3	102.8	103	102.3
PARTICULATE (gm)	0.0156	0.0138	0.0083	0.0083	0.0122	0.0124	0.0159	0.006	0.0153	0.0163
LB/HR PARTICULATE	2.1	1.8	1.1	1.1	1.6	1.7	2.2	0.8	2.0	2.2
SO2 (mg)	1273	943	1093	1180	995	846	836	841	918	711
LB/HR SO2	171.7	125.5	143.5	150.9	133.7	113.0	114.7	111.4	122.7	94.6

SUMMARY (AVG)	BKGRD	350# SPL	700# SPL
LB/HR GASEOUS F	0.09	0.03	0.05
LB/HR PART F	0.18	0.50	0.81
LB/HR FLUORIDE	0.27	0.53	0.87
LB/HR PARTICULATE	1.5	1.8	1.7
LB/HR SO2	148	120	110

FIGURE 1

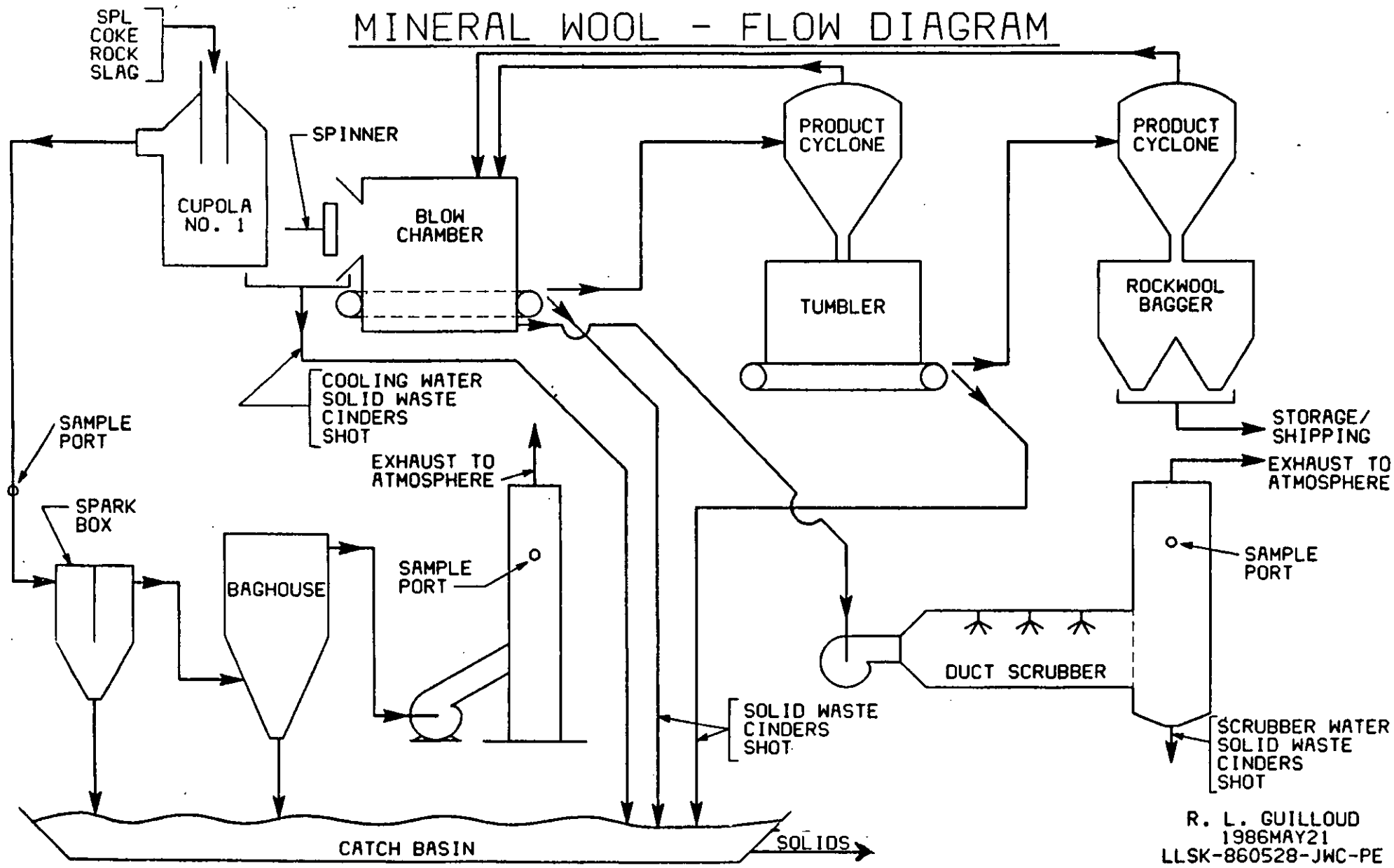
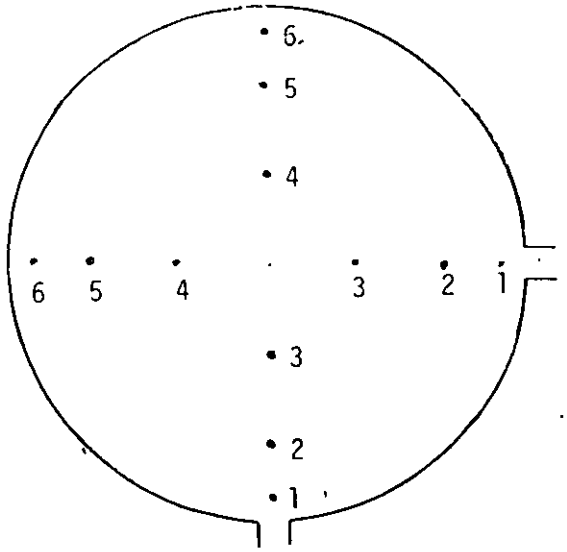

MINERAL WOOL - FLOW DIAGRAM
SPL
COKE
ROCK
SLAG
CUPOLA NO. 1
SPINNER
BLOW CHAMBER
PRODUCT CYCLONE
TUMBLER
PRODUCT CYCLONE
ROCKWOOL BAGGER
STORAGE/ SHIPPING
COOLING WATER
SOLID WASTE
CINDERS
SHOT
SAMPLE PORT
EXHAUST TO ATMOSPHERE
SPARK BOX
BAGHOUSE
SAMPLE PORT
EXHAUST TO ATMOSPHERE
SAMPLE PORT
DUCT SCRUBBER
SOLID WASTE
CINDERS
SHOT
SCRUBBER WATER
SOLID WASTE
CINDERS
SHOT
CATCH BASIN
SOLIDS
R. L. GUILLOUD
1986MAY21
LLSK-860528-JWC-PE

FIGURE 2

Sampling Location



72 inch Diameter

Traverse Point	Distance, in.
1	3.14
2	10.54
3	21.30
4	50.70
5	61.46
6	68.86

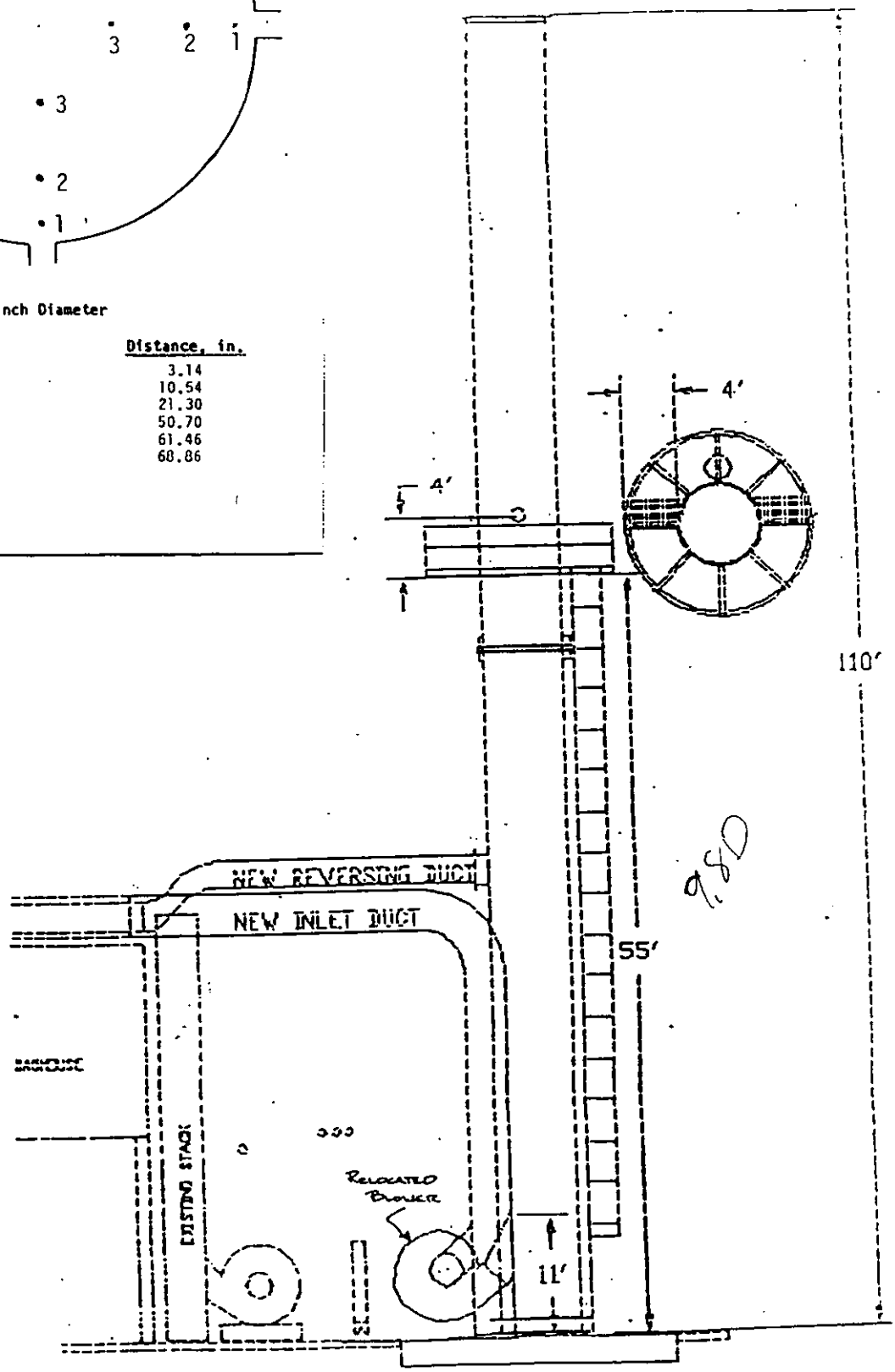


FIGURE 3

Combined Method 5/Method 6 Sampling Train

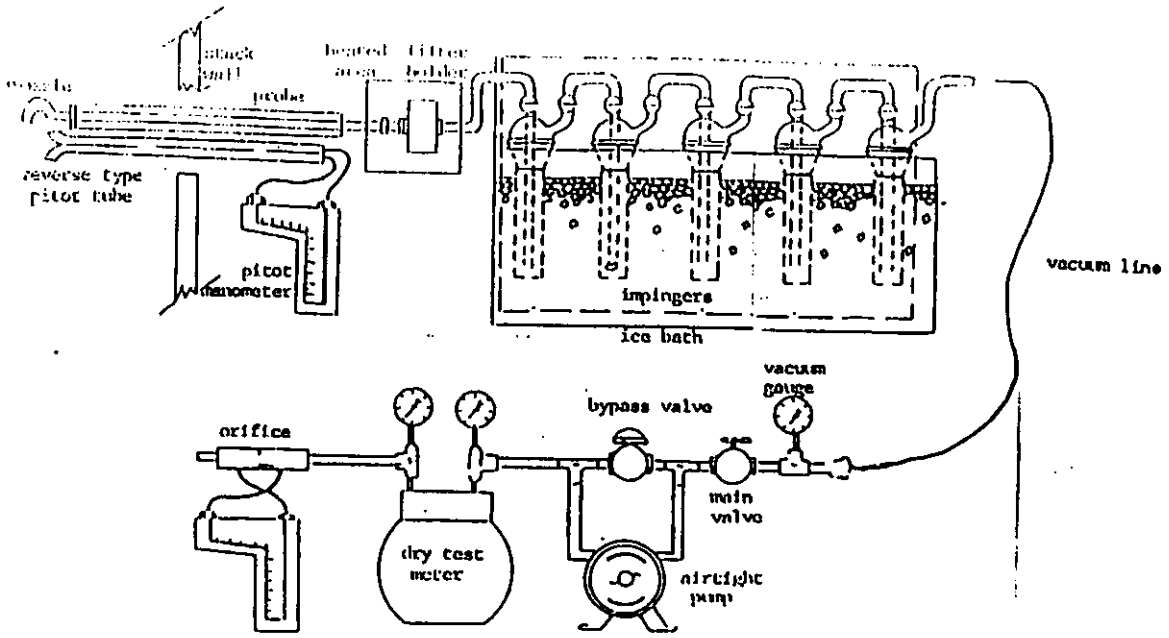
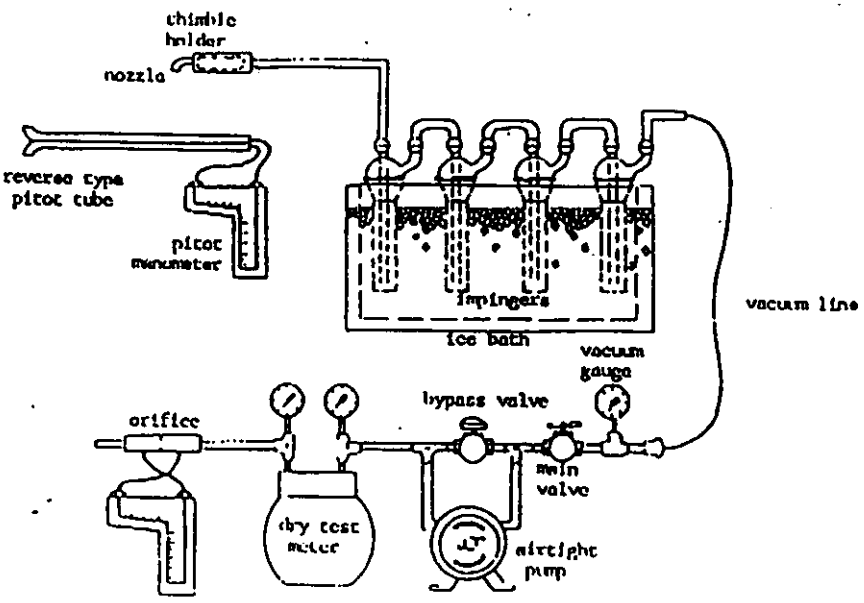


FIGURE 4

Method 4075A Sampling Train



APPENDIX A

Nomenclature
Sample Calculations

NOMENCLATURE

A_n	Area of nozzle, sq ft.
A_s	Area of stack, sq ft.
B_{wo}	Moisture content of stack gas
$\%CO_2$	Percentage of carbon dioxide in stack gas
C_p	Pitot tube coefficient
DH	Average pressure differential across orifice meter, inches H_2O
DH@	Orifice pressure differential that gives 0.75 cfm of air at standard temperature and pressure, inches H_2O
D_n	Nozzle diameter, inches
(DP)1/2	Square root of average pressure differential across pitot tube, inches H_2O
%I	Percent isokinicity
M_d	Dry stack gas molecular weight, lb/lb-mole
M_n	Particulate weight in grams
M_s	Wet stack gas molecular weight, lb/lb-mole
$\%O_2$	Percentage of oxygen in stack gas
P_b	Barometric pressure, inches Hg
P_s	Stack pressure, inches Hg
θ	length of test, minutes
T_m	meter temperature, degrees Fahrenheit
T_s	stack temperature, degrees Fahrenheit
V_{lc}	volume of liquid collected, milliliters
V_m	meter volume, cubic feet
V_{mstd}	dry meter volume at standard temperature and pressure, cubic feet (dscf)
V_s	velocity of stack gas, feet/second
V_{wstd}	volume of water vapor in stack gas at standard temperature and pressure, cubic feet (scf)
Y_d	Meter factor, cf/cf

CALCULATIONS

VOLUME METERED STD - (29.92) (68 F)

$$Vmstd = (17.64)\ (Vm)\ \left(\frac{(Pb + \Delta H/13.6)}{Tm}\right)(Yd)$$

VOLUME OF WATER VAPOR -

$$Vwstd = (0.0471)\ (Vlc)$$

MOISTURE -

$$Bwo = \frac{Vwstd}{Vmstd + Vwstd}$$

$$\%\ MOISTURE = Bwo \times 100$$

DRY MOLECULAR WEIGHT -

$$Md = 0.44(\%\ CO2) + 0.32(\%\ O2) + 0.28(\%\ N + \%\ CO)$$

WET MOLECULAR WEIGHT -

$$Ms = Md(1-Bwo) + 18(Bwo)$$

VELOCITY -

$$Vm = 85.49 \times (Cp)\ (\sqrt{\Delta P})\ \left(\sqrt{\frac{(460 + Ts)}{(Ps)(Ms)}}\right)$$

% ISOKINICITY -

$$\%I = \frac{(0.0945)(460 + Ts)(Vmstd)}{(Ps)(Vs)(An)(\theta)(1-Bwo)}$$

VOLUME OUT OF STACK -

$$ACFM = 60 \times Vs \times As$$

$$DSFM = ACFM\ \left(\frac{Ps}{29.92}\right)\ \left(\frac{528}{460 + Ts}\right)(1-Bwo)$$

GR/DSCF -

$$Cs = (15.43)\ \frac{m}{Vmstd}$$

LB/HR -

$$\frac{Cs \times DSCFM \times 60}{7000}$$

APPENDIX B

Fuel Analysis
Production Records

SPRING HOPE FUEL 88-02-03	ANALYSIS COKE	SPL
LB/HR CHARGE	2820	0
BTU/LB	13140	7870
mmBTU/HR	37.055	0.000
PERCENT SULFER	0.74	0.16
LB/HR SULFER	20.868	0.000
EQUIVALENT LBS SO2	41.7	0.0
LB SO2/mmBTU	1.1	
N.C. 466:0516	2.3 LBS SO2/mmBTU	

$$\frac{((37.055 \times 2) + 37.252)}{3} = 37.12 \times 10^6 \frac{BTU}{hr}$$

SPRING HOPE FUEL 88-02-04	ANALYSIS COKE	SPL
LB/HR CHARGE	2835	0
BTU/LB	13140	7870
mmBTU/HR	37.252	0.000
PERCENT SULFER	0.74	0.16
LB/HR SULFER	20.979	0.000
EQUIVALENT LBS SO2	41.9	0.0
LB SO2/mmBTU	1.1	
N.C. 466:0516	2.3 LBS SO2/mmBTU	

$$\frac{144.1 \text{ lb } SO_2/hr}{37.12 \times 10^6 \text{ BTU/h}} = 3.88 \frac{\text{lb } SO_2}{10^6 \text{ BTU}}$$

SPRING HOPE FUEL 88-02-05	ANALYSIS COKE	SPL
LB/HR CHARGE	1922	1596
BTU/LB	13140	7870
mmBTU/HR	25.255	12.561
PERCENT SULFER	0.74	0.16
LB/HR SULFER	14.223	2.554
EQUIVALENT LBS SO2	28.4	5.1
LB SO2/mmBTU	0.9	
N.C. 466:0516	2.3 LBS SO2/mmBTU	

$$\frac{111 \text{ lb } SO_2/hr}{37.81 \times 10^6 \text{ BTU/hr}} = 2.911 \frac{\text{lb } SO_2}{10^6 \text{ BTU}}$$

B-2

SPRING HOPE PRODUCTION DATA 88-02-03
TIME 10:30AM - 5:30PM BACKGROUND TESTS

		UNIT 1	UNIT 2	TOTAL	ACTUAL AVG CHARGE (POUNDS)	THEORETICAL AVG CHARGE (POUNDS)
PRODUCT	BAGS	1764	1764			
	POUNDS	51156	51156			
	TIME (hr)	7	7			
	LB/HR	7308	7308	14616		
COKE	POUNDS	9464	10301		392	385-400
	TIME (hr)	7.02	7.00			
	LB/HR	1348	1472	2820		
SPL	POUNDS	0	0		0	0
	TIME (hr)	7.02	7.00			
	LB/HR	0	0	0		
DUQUESNE	POUNDS	31201	34575		1303	1300
	TIME (hr)	7.02	7.00			
	LB/HR	4445	4939	9384		
TRAP	POUNDS	26338	29188		1100	1100
	TIME (hr)	7.02	7.00			
	LB/HR	3752	4170	7922		
LIME	POUNDS	1162	1317		49	50
	TIME (hr)	7.02	7.00			
	LB/HR	166	188	354		
STEEL	POUNDS	9958	10970		404	400
	TIME (hr)	7.17	7.22			
	LB/HR	1389	1519	2908		
TENNESSE	POUNDS	9669	10515		400	400
	TIME (hr)	7.02	7.00			
	LB/HR	1377	1502	2879		
PERCENT RECOVERY		65.7	59.3	62.3		
RAW MATERIAL LB/HR		11128	12319	23447	+ 2820 =	
TOTAL CHARGE LB/HR		12476	13790	26267		

$$E = 4.10\left(\frac{26267}{2000}\right)^{.67} = 23.0 \text{ lb/in}$$

B-4

SPRING HOPE PRODUCTION DATA 88-02-05
TIME 8:00AM - 4:00PM 700# SPL

		UNIT 1	UNIT 2	TOTAL	ACTUAL AVG CHARGE (POUNDS)	THEORETICAL AVG CHARGE (POUNDS)
PRODUCT	BAGS	1862	1813			
	POUNDS	53998	52577			
	TIME (hr)	8	8			
	LB/HR	6750	6572	13322		
COKE	POUNDS	7155	8222		267	260
	TIME (hr)	8	8			
	LB/HR	894	1028	1922		
SPL	POUNDS	6056	6715		222	225
	TIME (hr)	8	8			
	LB/HR	757	839	1596		
DUQUESNE	POUNDS	36435	39675		1321	1300
	TIME (hr)	8	8			
	LB/HR	4554	4959	9514		
TRAP	POUNDS	30468	33600		1112	1100
	TIME (hr)	8	8			
	LB/HR	3809	4200	8009		
LIME	POUNDS	1436	1606		53	50
	TIME (hr)	8	8			
	LB/HR	180	201	380		
STEEL	POUNDS	11343	12384		412	400
	TIME (hr)	8	8			
	LB/HR	1418	1548	2966		
TENNESSE	POUNDS	11142	12224		406	400
	TIME (hr)	8	8			
	LB/HR	1393	1528	2921		
PERCENT RECOVERY		59.5	52.8	56.0		
RAW MATERIAL LB/HR		11353	12436	23789	+ 1922 + 1596	
TOTAL CHARGE LB/HR		13004	14303	27308		

$$E = 4.10 \left(\frac{27308}{2000}\right)^{.67} = 23.6 \text{ lb}$$

DRY

AUG. 11,783

Date 2/3/88

American Rockwool, Inc.
Daily Production Report

total 12,250 Bag's

	Bags per Line		81 Line 1		82 Line 2	
	#1 today	#2 today	today	MTD average	today	MTD average
Day of Operation			1	2.79	1	2.79
Charge (uncorrected)			264,354#	719,414#	266,901#	733,193#
Coke (uncorrected)			32 788#	89,341#	33,155#	91,213#
Charge/Coke Ratio			806	8.05	8.05	8.03
#1 Wool Good Production	6,370	—	184,730#	480,298#	—	—
#2 Wool Good Production	—	5880#	—	—	170,520#	471,772#
Wool Cryo or Pouring	—	—	—	—	—	1,350#
Recovery %			69.87%	66,76%	63,88	64,52%
Percent Efficiency	90,27%	83,33%				
	today oxygen	MTD Total	today	MTD Total	today	MTD Total
Hour of Operation Start	255"		24	67	24	67
Downtime Schedule used	35"					
Downtime Unschedule Bal	220"		-0-	220 min's	-0-	65 min's
% Downtime tap out			52 min's	104 min's	67 min's	98 min's
% Downtime						

81 Charges Used #1		82 #2		today	MTD today
Tenn. 400#	32584#	400#	32,618	65,202#	178,633#
Steel 400#	33,370#	400#	33,644#	67,014#	180,582#
D.U.Q. 1300#	105,677#	1300#	107,044#	212,721#	581,282#
Trap 1100#	88,919#	1100#	89,779#	178,698#	490,447#
N-R St. Louis	—		—	—	—
Lime 50#	3804#	50#	3,816#	7,620#	21,663#
Coke 400#	32,783#	400#	33,155#	65,938#	180,554#

Comments: (State reason for downtime. List major inoperative equipment. Explain unusual performance. List major charge changes. State critical materials not on hand). E.P.A. testing

#1 Line 52 min's tapout.

#2 Line 67 min's tapout.

O.A 255 7:00
KY 220 7:30

PRODUCTION REPORT

LINE: I
DATE: 7-3-88

FOREMAN Don

Charge	lbs.
Coke	400 385
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky	

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
8-9	1056 2112	294	294		
9-10		294	294		
10-11		294	245		
11-12		294	294		
12-1		294	245		
1-2		294	245		
2-3		294	245		
3-4		294	245		
Total----------		2352	2107		

Comments:
5 min Tap Out
10 min Tap Out
8 min Tap Out

FOREMAN JACK

Charge	lbs.
Coke	385-400
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky	

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
4-5		294	245		
5-6		294	245		
6-7		294	245		
7-8	1008 2016	294	245		
8-9		294	245		
9-10		294	294		
10-11		294	245		
11-12		294	245		
Total----------		2352	2059		

Comments:
Tap Out 5 Mins
Tap Out 5 Mins

FOREMAN Rabbit

Charge	lbs
Coke	400
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky	

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
12-1		294	245		
1-2		294	294		
2-3	1115	294	245		
3-4	K 2	294	294		
4-5	2230	294	294		
5-6		294	294		
6-7		294	294		
7-8		294	294		
Total----------		2352	2254		

Comments:
Tap out 10 min
Tap out 6 min

COPY-IT COPY CENTER 500

375

(11)

CHARGING SHEET

DATE 2-3-88 SHIFT 1ST LINE I CHARGER R.C.

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1.	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]			
2.	657	546	22			200			
3.	1409	752	1631		206	1609		8:08	
4.	1411	752	1627		204	1605		8:10	
5. 444	659 651	548 541	22 25			199 221		8:12	
6.	1402	757	1648		210	1623		8:23	
7.	1403	756	1624		200	1603		8:25	
8. 416	647 644	556 555	21 26			200 195		8:27	
9.	1405	761	1626		206	1600		8:41	
10.	1403	758	1625		206	1606		8:44	
1. 405	645 655	552 544	19 27			203 199		8:50	
12.	1407	752	1628		208	1601		8:59	
3.	1399	757	1629		223	1602		9:01	
14. 403	642 649	644 517	27 23			203 201		9:03	
5.	1400	751	1624		234	1601		9:17	
16.	1402	749	1624		210	1607		9:20	
7. 411	653 645	539 545	17 24			205 198		9:27	
18.	1401	756	1623		211	1599		9:35	
9.	1395	744	1626		207	1620		9:37	
20. 413	651 649	537 546	6 20			225 203		9:41	
21.	1400	751	1623		205	1603		9:50	
22.	1399	751	1627		201	1600		9:54	
23. 396	648 645	550 505	27 33			201 191		9:58	
24.	1404	759	1628		254	1595		10:08	
25.	1400	757	1626		208	1603		10:12	
26. 387	643 641	549 549	23 18			203 237		10:14	
27.	1398	757	1653		208	1635		10:23	
28.	1400	748	1636		204	1610		10:28	
29. 394	652 651	544 555	26 14			210 211		10:32	
30.	1401	750	1626		195	1612		10:43	
31.	1400	751	1622		223	1585		10:45	
32. 386	649 650	528 539	37 15			185 209		10:48	
33.	1399	749	1623		210	1608		11:01	
34. 405	1402	748	1630		210	1598	1185	11:04	
	10 380 654	535	12 217	32 504	41-27	196			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

(71)

DATE 2-3-88 SHIFT 1ST LINE I CHARGER R.C. C.M.

	COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1.	400	658	545	22			197		11:06	
2.		1407	749	1626		204	1604		11:14	
3.		1406	760	1631		204	1603		11:17	
4.	382	646 656	555 544	28 40			197 192		11:20	
5.		1403	747	1635		203	1595		11:31	
6.		1405	752	1630		204	1600		11:33	
7.	391	653 635	548 561	30 14			195 214		11:35	
8.		1398	762	1626		202	162		11:45	
9.		1398	748	1627		203	1611		11:47	
10.	384	650 654	545 551	16 12			213 213		11:50	
11.		1410	756	1625		205	1613		11:59	
12.		1385	751	1624		204	1612		12:03	
13.	390	1634 652	547 548	12 23			227 199		12:06	
14.		1401	749	1623		201	1600		12:19	
15.		1402	751	1620		202	1601		12:20	
16.	401	651 649	549 552	19 19			199 201		12:23	
17.		1401	752	1621		200	1602		12:36	R.C.
18.		1398	750	1628		203	1617		12:40	C.M.
19.	386	648 660	547 548	11 19			219 193		12:44	C.M.
20.		1414	754	1626		206	1607		12:50	C.M.
21.		1391	754	1627		200	1600		12:51	C.M.
22.	394	637 654	554 547	37 32			209 190		12:53	C.M.
23.		1407	753	1629		206	1597		1:10	C.M.
24.		1398	752	1635		200	1598		1:11	C.M.
25.	387	646 650	552 550	37 26			200 200		1:13	R.C.
26.		1400	750	1626		200	1600		1:25	R.C.
27.		1401	753	1628		201	1600		1:27	R.C.
28.	397	648 652	552 545	28 23			199 202		1:28	R.C.
29.		1400	748	1625		203	1602		1:43	R.C.
30.		1404	752	1623		200	1599		1:44	R.C.
31.	393	652 651	552 548	24 22			195 200		1:45	R.C.
32.		1403	752	1625		204	1603		1:57	R.C.
33.		1403	750	1626		205	1598		1:59	R.C.
34.	396	653	545	28		4460	195		2:00	R.C.
	4701	14399	13505	512			4449			

COPY-IT PRINTING CO. 100

(6½)

CHARGING SHEET

DATE 2-3-88 SHIFT 1st LINE I CHARGER C.M. R.C.

COKE	653 DUQ.	551 TRAP	29 LIME		STEEL	165 TENN	OTHER	TIME	COMMENTS
1.	1404	751	1628		200	1599		2:17	C.M.
2.	1401	782	1630		201	1601		2:19	C.M.
3. 424	649 636	551 561	29 30			200 199		2:21	C.M.
4.	1402	766	1631		205	1601		2:32	C.M.
5.	1404	755	1627		200	1596		2:36	R.C.
6. 400	649 651	555 550	31 24			192 199		2:38	R.C.
7.	1401	750	1624		200	1600		2:50	R.C.
8.	1400	752	1627		204	1600		2:52	R.C.
9. 399	648 654	548 545	27 24			200 198		2:54	R.C.
10.	1404	750	1626		205	1602		3:09	R.C.
1.	1405	755	1627		200	1597		3:11	R.C.
12. 400	650 651	555 552	30 25			192 199		3:13	C.M.
3.	1404	753	1628		201	1603		3:29	C.M.
4.	1403	753	1625		201	1607		3:31	C.M.
5. 385	650 659	552 549	18 19			204 200		3:34	C.M.
16.	1409	750	1628		201	1609		3:44	C.M.
7.	1401	754	1624		200	1599		3:45	C.M.
18. 407	647 650	554 556	25 27			198 190		3:48	C.M.
9.	1409	759	1626		203	1599			C.M.
20.									
21.									
22.									
23.									
24.									
25.									
26.									
27.									
28.									
29.									
30.									
31.									
32. 2415	8,447	7179	338		2621	2566			
33.									
34.									

COPY-IT PRINTING CO. 1000

(11 1/2)

Marshal Edwards

CHARGING SHEET

DATE 2-3-88 SHIFT 2nd LINE 1 CHARGER

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1.	1412	752	1627		203	1614		4:12	EW
2. 385	661 648	549 546	13 27			201 199		4:14	EW
3.	1399	751	1625		205	1598		4:22	EW
4.	1399	747	1623		206	1607		4:30	EW
5. 390	652 651	541 547	16 17			208 211		4:32	EW
6.	1398	747	1626		200	1609		4:40	EW
7.	1400	750	1626		201	1611		4:47	EW
8. 388	650 649	549 545	15 24			211 199		4:49	EW
9.	1401	752	1624		207	1600		5:03	EW
10.	1396	749	1627		200	1610		5:08	EW
1. 405	647 651	549 544	17 26			214 200		5:11	EW
12.	1399	748	1625		204	1599		5:26	EW
3.	1398	749	1625		209	1611		5:29	EW
14. 406	649 658	540 544	14 24			203 200		5:33	EW
5.	1402	749	1626		205	1602		5:38	EW
16.	1397	753	1624		207	1600		5:40	EW
7. 418	644 656	546 526	24 22			203 199		5:46	KM
18.	1406	750	1627		224	1605		6:01	KM
19.	1404	752	1629		225	1604		6:07	EW
20. 400	652 651	527 547	25 25			200 203		6:09	EW
21.	1402	751	1630		204	1605		6:17	EW
22.	1399	754	1629		201	1608		6:20	EW
23. 502	645 648	550 549	21 27			209 202		6:24	EW
24.	1400	752	1629		203	1602		6:29	EW
25.	1397	749	1623		208	1602		6:42	EW
26. 401	648 652	541 543	21 23			205 199		6:46	EW
27.	1400	748	1622		205	1599		6:56	EW
28.	1400	749	1625		211	1607		7:02	EW
29. 405	651 650	538 545	18 24			207 206		7:05	KM
30.	1401	751	1631		206	1607		7:16	KM
31.	1398	756	1627		205	1602		7:20	KM
32. 414	642 649	551 553	25 12			204 219		7:23	KM
33.	1402	753	1633		200	1621		7:35	KM
34. 4514#	1403	753	1625		200	1604		7:40	KM
	14051 1450	553 1254	21 481		47112	201 4703			

COPY-IT PRINTING CO. 1800

CHARGING SHEET (11)

DATE 2-3-88 SHIFT 2nd LINE 1 CHARGER Manhall Edward

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1. 412	653	543	14			211		7:43	KM
2.	1401	748	1626		205	1612		7:50	KM
3.	1408	752	1625		200	1605		7:54	KM
4. 408	656 648	552 553	20 25			197 198		7:57	KM
5.	1401	753	1624		200	1599		8:09	EW
6.	1400	756	1626		211	1601		8:14	EW
7. 402	644 655	545 545	25 24			201 201		8:19	EW
8.	1404	749	1629		204	1605		8:28	EW
9.	1400	752	1627		205	1603		8:30	EW
10. 406	648 644	547 546	24 25			203 203		8:35	EW
1.	1398	754	1626		208	1601		8:48	EW
12.	1396	753	1631		207	1600		8:53	EW
3. 402	643 653	546 537	31 20			204 205		8:56	EW
14.	1404	751	1629		214	1609		9:07	KM
5.	1402	750	1630		203	1599		9:12	KM
16. 406	652 651	547 550	31 31			197 213		9:14	KM
7.	1403	752	1647		202	1616		9:25	KM
18.	1407	754	1629		204	1599		9:29	KM
19. 402	653 654	550 549	30 26			192 199		9:31	KM
20.	1404	750	1629		201	1603		9:43	KM
21.	1400	753	1624		202	1600		9:46	KM
22. 410	647 646	551 544	24 15			200 212		9:50	KM
23.	1400	754	1627		210	1612		10:00	KM
24.	1398	749	1624		203	1599		10:05	EW
25. 408	649 653	546 540	25 13			201 211		10:09	EW
26.	1400	747	1624		207	1611		10:23	EW
27.	1407	750	1624		208	1600		10:26	EW
28. 396	657 658	542 546	24 25			193 192		10:29	EW
29.	1408	750	1625		204	1606		10:47	EW
30.	1399	752	1626		215	1599		10:48	EW
31. 404	647 641	537 550	27 19			200 206		10:55	EW
32.	1399	758	1624		208	1605		11:01	EW
33.	1402	754	1625		210	1600		11:04	EW
34. 432	648	544	25			198		11:08	[redacted]
1500	1400	1710	592		1631	1627			

COPY-IT PRINTING CO. 1-800

CHARGING SHEET (2)

Marshall
Edwards

DATE 2-3-88 SHIFT 2nd LINE 1 CHARGER

COKE	DOLO. 652	TRAP 545	LIME 25		STEEL	TENN 196	OTHER	TIME	COMMENTS
1.	1404	752	1625		207	1600		11:20	KM
2.	1409	777	1624		203	1599		11:22	KM
3. 406	632 646	574 551	25 30			190 197		11:25	KM
4.	1402	756	1629		205	1599		11:40	KM
5.	1404	751	1625		206	1607		11:42	KM
6. 412	653	545	18			203		11:46	KM
7.									
8.									
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									
21.									
22.									
23.									
24.									
25.									
26.									
27.									
28.									
29.									
30.									
31.									
32.									
33.									
34. 818	2583	2,215	98		821	786			

COPY-IT PRINTING

(11)

CHARGING SHEET

DATE 2-3-88 SHIFT 3rd LINE 1 CHARGER Don B.

COKE	646 DUQ.	543 TRAP	25 LIME		STEEL	203 TENN	OTHER	TIME	COMMENTS
1.	1400	754	1628		211	1603		12:02	
2.	1400	751	1627		220	1602		12:06	
3. 406	649 628	531 574	25 25			202 197		12:12	
4.	1405	777	1627		203	1602		12:25	
5.	1402	754	1623		207	1600		12:28	
6. 417	648 635	547 562	23 24			198 204		12:31	
7.	1400	765	1628		203	1604		12:43	
8.	1406	752	1623		206	1607		12:47	
9. 400	654 655	546 547	16 19			201 209		12:52	
10.	1407	752	1635		205	1616		1:00	
11.	1425	754	1624		211	1609		1:02	
12. 408	671 652	543 541	15 26			184 199		1:04	
13.	1401	749	1626		208	1600		1:17	
14.	1401	751	1629		206	1601		1:19	
15. 402	650 651	545 545	28 24			200 204		1:21	
16.	1401	750	1629		205	1605		1:34	
17.	1410	751	1627		200	1601		1:36	
18. 409	659 649	551 550	26 47			191 201		1:38	
19.	1402	753	1650		203	1603		1:50	
20.	1415	754	1625		201	1616		1:57	
21. 430	661 652	553 547	9 19			201 202		2:01	
22.	1407	755	1628		208	1604		2:05	
23.	1401	753	1625		220	1600		2:10	
24. 412	648 640	533 538	25 12			199 214		2:14	
25.	1408	748	1634		210	1622		2:26	
26.	1412	755	1625		205	1592		2:29	
27. 407	657 644	550 555	33 33			180 199		2:33	
28.	1399	755	1631		200	1598		2:41	
29.	1414	755	1628		202	1600		2:43	
30. 407	659 550	553 542	28 23			186 199		2:45	
31.	1402	752	1624		210	1601		3:00	
32.	1403	756	1640		205	1599		3:02	
33. 418	647	557	41			196		3:05	
34. 4,516	14,225	12,147	546		4,549	4,369			

COPY-IT PRINTING CO 1000

CHARGING SHEET (11)

DATE 2-3-88 SHIFT 3rd LINE I CHARGER Don B.

COKE	DUQ. 649	542 TRAP	LIME 23		STEEL	204 TENN	OTHER	TIME	COMMENTS
1.	1401	752	1628		210	1605		3:15	
2.	1400	754	1626		200	1600		3:17	
3. 410	646 648	554 550	26 34			200 201		3:19	
4.	1399	751	1634		201	1600		3:33	
5.	1404	750	1628		200	1600		3:35	
6. 408	654 653	550 547	28 21			196 201		3:37	
7.	1403	750	1625		203	1604		3:50	
8.	1401	753	1627		202	1601		3:52	
9. 400	648 650	551 544	26 25			208 198		3:55	
10.	1402	752	1625		208	1600		4:07	
11.	1400	750	1626		205	1601		4:09	
12. 408	650 651	545 542	25 22			201 204		4:13	
13.	1401	750	1627		208	1605		4:24	
14.	1400	758	1626		200	1600		4:26	
15. 400	542 661	558 544	26 35			200 189		4:28	
16.	1411	750	1635		206	1600		4:40	
17.	1402	750	1628		215	1595		4:42	
18. 401	653 632	535 566	33 26			193 200		4:45	
19.	1400	768	1626		202	1600		4:55	
20.	1421	758	1629		211	1623		4:57	
21. 405	663 653	547 539	6 19			202 216		5:02	
22.	1401	748	1636		209	1617		5:15	
23.	1398	753	1620		212	1594		5:17	
24. 403	645 653	541 546	35 29			196 194		5:21	
25.	1405	752	1628		206	1599		5:30	
26.	1401	773	1623		201	1606		5:32	
27. 400	628 653	572 548	17 26			205 198		5:34	
28.	1403	750	1627		202	1601		5:48	
29.	1405	751	1625		204	1600		5:50	
30. 400	654 645	547 552	25 22			195 209		5:52	
31.	1400	755	1631		203	1609		6:03	
32.	1412	750	1623		212	1601		6:05	
33. 420	662	538	22			189		6:08	
34. 4455	14,192	12,058	551		4,520	4,391			

COPY-IT PRINTING CO. 1

(6)

CHARGING SHEET

DATE 2-3-88 SHIFT 3rd LINE I CHARGER Don B.

COKE	650 DUQ.	545 TRAP	19 LIME		STEEL	205 TENN	OTHER	TIME	COMMENTS
1.	1406	750	1624		205	1605		6:20	
2.	1406	755	1624		204	1604		6:22	
3. 402	649 651	551 547	20 19			198 203		6:25	
4.	1402	751	1624		204	1605		6:31	
5.	1411	756	1624		225	1600		6:37	
6. 400	655 649	531 549	24 21			189 206		6:41	
7.	1400	751	1627		202	1606		6:54	
8.	1410	762	1622		208	1598		6:57	
9. 409	648 651	554 540	24 12			188 207		7:00	
10.	1406	755	1625		215	1613		7:09	
1.	1401	772	1627		210	1602		7:11	
12. 405	629 665	562 546	25 21			201 187		7:13	
3.	1416	751	1624		205	1603		7:24	
14.	1404	758	1623		212	1610		7:27	
15. 404	646 650	546 551	13 33			206 200		7:29	
16. 1	1401	751	1634		200	1601		7:40	
17.	1400	756	1626		203	1608		7:42	
18. 401	644	553	20			208		7:44	
19.									
20.									
21.									
22.									
23.									
24.									
25.									
26.									
27.									
28.									
29.									
30.									
31.									
32.									
33.									
34 2421	7,787	6,575	251		2493	2398			

COPY-IT PRINTING CO 1000

PRODUCTION REPORT

LINE: II

DATE: 2-3-84

FOREMAN Don

Charge	lbs.
Coke	400-385
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky	

Shift	Product	Bags per Hour Plan	29 lb	other	Var.
8-9	1001	294	245		
9-10	2002	294	245		
10-11		294	245		
11-12		294	245		
12-1		294	245		
1-2		294	294		
2-3		294	245		
3-4		294	246		
Total----------		2352	2009	✓	

Comments:

Tap out 6 mins

Tap out 7 mins

8 mins Tap Out

Tap Out 10 mins

FOREMAN Jack

Charge	lbs.
Coke	385-400
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky	

Shift	Product	Bags per Hour Plan	29 lb	other	Var.
4-5		294	245		
5-6		294	245		
6-7	984	294	245		
7-8	2	294	245		
8-9	1968	294	245		
9-10		294	245		
10-11		294	245		
11-12		294	245	✓	
Total----------		2352	1960		

Comments:

TAP OUT 5 MINS

TAP OUT 7 MINS

FOREMAN Rabbit

Charge	lbs
Coke	400
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky	

Shift	Product	Bags per Hour Plan	29 lb	other	Var.
12-1		294	245		
1-2		294	245		
2-3	965	294	245		
3-4	x 2	294	245		
4-5	1930	294	245		
5-6		294	245		
6-7		294	245		
7-8		294	196		
Total----------		2352	1911	✓	

Comments:

Tap out 6 mins

Tap out 20 mins

Tap out 8 mins

COPY-IT COPY CENTER 500

5000

CHARGING SHEET

DATE 2-3-88 SHIFT I ST LINE II CHARGER R. C.

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1. 400	1300	1100	50		400	400			
2.	659	539	24			190			
3.	1410	751	1624		212	1600		8:00	
4.	1406	752	1632		207	1605		8:03	
5. 405	654 651	545 551	27 22			199 204		8:05	
6.	1401	750	1627		199	1605		8:16	
7.	1402	750	1629		208	1601		8:18	
8. 399	652 659	542 549	18			199 195		8:20	
9.	1411	752	1624		203	1606		8:33	
10.	1411	751	1634		205	1617		8:35	
1. 404	666 656	546 548	17 28			200 206		8:37	
12.	1410	754	1632		206	1604		8:45	
13.	1399	750	1611		204	1596		8:48	
14. 401	649 647	546 554	15 29			197 202		8:52	
15.	1401	764	1632		210	1603		9:03	
16.	1426	753	1622		209	1598		9:06	
17. 403	673 639	544 556	24 16			172 212		9:10	
18.	1398	759	1625		203	1609		9:18	
19.	1401	757	1627		207	1602		9:22	
20. 403	650 644	544 554	25 23			201 201		9:25	
21.	1402	758	1626		204	1603		9:35	
22.	1425	750	1621		220	1594		9:39	
23. 388	675 655	530 547	27 19			169 199		9:43	
24.	1404	749	1622		202	1603		9:49	
25.	1399	752	1625		190	1606		9:51	
26. 403	647 656	553 555	19 8			207 198		9:56	
27.	1404	748	1610		213	1602		10:05	
28.	1422	753	1622		200	1596		10:07	
29. 397	669 647	553 557	26 28			174 200		10:09	
30.	1401	754	1629		197	1601		10:20	
31.	1414	759	1644		202	1625		10:23	
32. 412	655 648	557 550	19 26			211 206		10:25	
33.	1399	751	1631		201	1605		10:34	
34. 4416	1440	751	1640		204	1625		10:38	

COPY-IT PRINTING CO 100

CHARGING SHEET

DATE 2-3-88 SHIFT 1ST LINE IV CHARGER R.C.

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1. 391	653	527	19			196		10:40	
2.	1401	748	1616		221	1597		10:57	
3.	1397	763	1631		205	1603		10:54	
4. 400	634 655	558 544	28 27			206 197		10:56	
5.	1405	750	1629		206	1602		11:07	
6.	1401	757	1630		204	1601		11:10	
7. 389	650 646	547 542	29 15			200 202		11:13	
8.	1409	763	1626		221	1611		11:21	
9.	1432	750	1628		204	1601		11:23	
10. 387	682 656	546 537	27 31			169 191		11:27	
11.	1412	756	1634		199	1603		11:38	
12.	1408	757	1631		197	1592		11:40	
13. 392	651 652	560 548	34 26			184 200		11:42	
14.	1401	749	1627		207	1601		11:51	
15.	1405	764	1626		208	1603		11:54	
16. 396	641 655	556 543	23 22			198 200		11:57	
17.	1405	750	1627		207	1605		12:03	
18.	1401	749	1628		201	1604		12:04	
19. 397	652 649	548 548	24 23			203 204		12:07	
20.	1401	752	1628		204	1605		12:15	
21.	1400	760	1631		205	1604		12:19	
22. 2:00	640 649	655 547	27 27			204 203		12:21	
23.	1400	751	1630		204	1603		12:33	R.C.
24.	1400	750	1632		204	1600		12:34	R.C.
25. 404	650 647	546 561	52 32			200 192		12:36	R.C.
26.	1407	760	1631		199	1599		12:48	C.M.
27.	1422	753	1625		213	1601		12:50	C.M.
28. 391	669 647	540 553	24 28			179 200		12:51	C.M.
29.	1400	753	1628		200	1600		1:00	C.M
30.	1397	748	1628		200	1605		1:02	C.M.
31. 390	649 639	548 563	23 18			208 207		1:04	C.M.
32.	1400	761	1625		198	1607		1:18	C.M.
33.	1408	750	1624		200	1600		1:20	R.C.
34. 402	658	550	24			192		1:21	R.C.
[illegible]	[illegible]	[illegible]	560		4507	4335			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-3-88 SHIFT 1st LINE II CHARGER R.C. C.M

COKE	650 DUQ.	553 TRAP	23 LIME		STEEL	197 TENN	OTHER	TIME	COMMENTS
1.	1403	753	1623		200	1600		1:32	R.C.
2.	1400	751	1624		200	1598		1:34	R.C.
3. 400	649 646	551 554	26 25			198 200		1:36	R.C.
4.	1400	754	1625		200	1600		1:50	R.C.
5.	1397	750	1626		204	1603		1:51	R.C.
6. 388	647 643	546 551	23 23			206 207		1:53	R.C.
7.	1397	754	1627		203	1604		2:08	R.C.
8.	1400	750	1627		200	1601		2:10	C.M.
9. 390	650 654	550 557	26 28			201 192		2:11	C.M.
10.	1409	755	1629		198	1601		2:28	C.M.
11.	1408	751	1625		200	1600		2:29	C.M.
12. 402	657 663	551 542	25 29			192 191		2:31	R.C.
13.	1407	744	1627		202	1598		2:40	R.C.
14.	1399	753	1627		200	1598		2:43	R.C.
15. 395	646 652	553 549	29 24			199 199		2:45	R.C.
16.	1401	749	1624		200	1600		2:59	R.C.
17.	1400	750	1627		200	1600		3:00	R.C.
18. 405	650 652	550 547	27 28			200 198		3:01	R.C.
19.	1402	750	1628		203	1600		3:19	R.C.
20.	1407	752	1627		199	1607		3:20	C.M.
21. 388	653 646	553 552	20 22			200 200		3:22	C.M.
22.	1404	758	1626		206	1604		3:28	C.M.
23.	1402	750	1624		204	1600		3:29	C.M.
24. 389	652 642	546 553	24 25			198 200		3:32	C.M.
25.	1400	758	1625		205	1600		3:45	C.M.
26.	1401	754	1624		200	1599		3:47	C.M.
27. 403	647 649	554 547	25 21			198 201		3:49	C.M.
28.	1403	754	1625		207	1604			C.M.
29.	1408	744	1628		197	1608			C.M.
30.	664	547	20			200			
31.									
32. 3560	13,014	11,006	493		4,028	3977			
33.									
34.									

13,050 ✓ 10,120 ✓

COPY-IT PRINTING CO. 100

(114)

CHARGING SHEET

Marshall Edward

DATE 2-3-88. SHIFT 2nd LINE 2 CHARGER

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1.	1468	744	1628		197	1608		4:08	E W
2. 394	664 650	547 547	20 21			200 203		4:14	E W
3.	1400	750	1624		203	1603		4:22	E W
4.	1399	755	1629		198	1608		4:27	E W
5. 409	647 664	557 540	21 25			209 187		4:31	E W
6.	1412	748	1624		208	1599		4:35	E W
7.	1398	749	1627		204	1600		4:43	E W
8. 386	649 651	545 543	27 32			202 199		4:48	E W
9.	1399	748	1630		205	1598		5:03	E W
0.	1399	749	1626		206	1601		5:05	E W
1. 401	650 653	543 545	25 25			202 199		5:09	EW
2.	1400	747	1624		202	1599		5:21	EW
3.	1399	749	1625		205	1597		5:23	EW
4. 401	650 647	545 545	28 25			198 202		5:25	EW
5.	1400	753	1627		208	1602		5:40	EW
6.	1398	748	1625		204	1600		5:42	EW
7. 398	650 654	544 543	25 20			202 199		5:45	EW
8.	1405	751	1624		208	1604		6:02	KM
9.	1401	751	1629		203	1614		6:03	KM
0. 400	650 647	548 551	15 26			213 209		6:05	EW
1.	1399	752	1626		201	1600		6:14	EW
2.	1397	748	1625		203	1603		6:17	EW
3. 405	649 650	545 541	22 22			206 204		6:22	EW
4.	1398	748	1624		207	1602		6:35	EW
5.	1403	749	1626		206	1613		6:37	EW
6. 501	654 651	543 540	13 19			210 206		6:39	EW
7.	1400	749	1625		209	1606		6:55	EW
8.	1399	751	1625		203	1599		6:58	EW
9. 407	648 657	548 547	26 19			200 197		7:03	KM
30.	1409	752	1625		205	1606		7:15	KM
31.	1401	752	1660		196	1602		7:17	KM
32. 402	649 660	556 542	58 19			201 199		7:21	KM
33.	1409	749	1627		207	1608		7:34	KM
34. 4504#	1416	751	1622		202	1602		7:36	KM
	1400 665	549	1620 20	533	1600	166	1625		

COPY-IT PRINTING CO. 10

(11)

CHARGING SHEET

Manlock
Eavanda

DATE 2-3-88 SHIFT 2nd LINE 2 CHARGER

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1. 403	662	546	21			193		7:41	KM
2.	1412	750	1626		204	1605		7:50	KM
3.	1414	753	1630		224	1603		7:52	KM
4. 420	661 660	529 545	27 29			189 192		7:55	KM
5.	1410	750	1631		205	1602		8:09	KM
6.	1399	750	1625		202	1606		8:10	EW
7. 405	649 653	548 547	19 27			207 196		8:16	EW
8.	1404	751	1627		204	1600		8:26	EW
9.	1402	747	1628		199	1600		8:32	EW
10. 420	665 653	548 543	28 25			198 195		8:34	EW
11.	1406	753	1626		210	1601		8:47	EW
12.	1402	756	1629		207	1601		8:49	EW
13. 398	646 645	549 551	28 27			199 196		8:55	EW
14.	1402	757	1625		206	1598		9:07	EW
15.	1406	753	1628		212	1606		9:09	KM
16. 403	653 644	541 542	22 30			200 199		9:13	KM
17.	1398	754	1629		212	1599		9:24	KM
18.	1408	750	1627		206	1603		9:26	KM
19. 401	658 642	544 559	24 20			195 205		9:30	KM
20.	1401	759	1626		200	1606		9:41	KM
21.	1401	750	1625		202	1600		9:43	KM
22. 401	657 647	548 549	23 31			199 184		9:47	KM
23.	1397	750	1632		201	1601		10:00	KM
24.	1403	760	1627		216	1601		10:02	KM
25. 420	643 648	544 543	26 24			198 205		10:07	EW
26.	1398	750	1627		207	1603		10:12	EW
27.	1400	752	1629		210	1602		10:14	EW
28. 397	648 660	542 540	27 21			202 194		10:18	EW
29.	1409	749	1624		209	1603		10:31	EW
30.	1402	748	1629		206	1598		10:34	EW
31. 397	654 648	542 544	31 26			198 199		10:36	EW
32.	1400	752	1625		208	1599		10:47	EW
33.	1400	750	1627		207	1599		10:51	EW
34. 395	650	543	28			199		10:53	EW
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]			

COPY-IT PRINTING CO 1000

(3)

Marshall
Edwards

CHARGING SHEET

DATE 2-3-88 SHIFT 2nd LINE 2 CHARGER

COKE	DUQ. 647	TRAP 544	LIME 28		STEEL	TENN 198	OTHER	TIME	COMMENTS
1.	1399	752	1625		208	1597		11:02	EW
2.	1405	758	1636		203	1612		11:10	KM
3. 415	647 651	555 543	24 25			207 209		11:12	KM
4.	1400	749	1634		206	1609		11:22	KM
5.	1400	752	1627		202	1606		11:25	KM
6. 401	648 649	550 540	21 26			206 203		11:27	KM
7.	1401	752	1630		212	1604		11:42	KM
8.	1401	750	1633		200	1608		11:45	KM
9. 433	651	550	25			207		11:47	KM
10.									
1.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									
21.									
22.									
23.									
24.									
25.									
26.									
27.									
28.									
29.									
30.									
31.									
32.									
33.									
34. 1,249	3,893	3,282	149		1,231	1,230			

COPY-IT PRINTING CO 100

(11)

CHARGING SHEET

DATE 2-3-88 SHIFT 3rd LINE 2 CHARGER Don B.

COKE	648 DUQ.	551 TRAP	16 LIME		STEEL	201 TENN	OTHER	TIME	COMMENTS
1.	1399	751	1626		200	1610		12:03	
2.	1400	750	1624		204	1614		12:10	
3. 407	650 645	546 550	16 21			214 223		12:14	
4.	1399	754	1623		204	1602		12:21	
5.	1400	749	1624		204	1601		12:23	
6. 405	651 642	545 507	23 23			201 189		12:25	
7.	1412	750	1624		243	1601		12:43	
8.	1400	750	1641		209	1613		12:45	
9. 407	650 650	541 543	28 20			213 204		12:50	
10.	1401	751	1625		208	1605		1:04	
11.	1402	752	1625		209	1601		1:07	
12. 470	650 646	543 554	24 25			199 200		1:11	
13.	1400	754	1625		200	1600		1:25	
14.	1400	749	1624		230	1601		1:27	
15. 403	651 639	519 555	23 22			201 205		1:29	
16.	1399	760	1626		205	1604		1:44	
17.	1410	759	1634		200	1625		1:54	
18. 403	651 646	559 537	4 24			215 191		1:59	
19.	1413	747	1628		210	1604		2:03	
20.	1409	751	1626		218	1600		2:07	
21. 414	658 620	533 547	26 30			191 180		2:12	
22.	1420	750	1630		203	1600		2:25	
23.	1407	756	1629		205	1604		2:27	
24. 405	651 633	551 561	25 19			197 197		2:31	
25.	1404	771	1620		210	1601		2:44	
26.	1408	752	1628		208	1597		2:47	
27. 400	656 657	544 546	31 31			184 200		2:50	
28.	1403	746	1634		200	1603		3:06	
29.	1399	756	1624		208	1602		3:08	
30. 413	643 653	548 540	22 23			203 202		3:11	
31.	1405	752	1670		212	1607		3:25	
32.	1404	750	1623		208	1601		3:28	
33. 417	659	542	22			192		3:30	
34. 4544	14,339	11,962	497		4,598	4,387			

COPY-IT PRINTING

(11)

CHARGING SHEET

DATE 2-3-88 SHIFT 3rd LINE II CHARGER Don B.

COKE	650 DUQ.	547 TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1.	1400	750	1627	25	203	1602	202	3:45	
2.	1410	751	1625		203	1601		3:47	
3. 415	659 651	548 547	24 18			191 202		3:49	
4.	1404	753	1624		206	1606		4:05	
5.	1400	752	1626		209	1605		4:10	
6. 411	648 669	541 548	21 28			205 193		4:12	
7.	1419	750	1630		202	1602		4:29	
8.	1407	752	1628		210	1604		4:33	
9. 406	649 650	542 548	24 10			203 220		4:35	
10.	1400	750	1630		202	1620		4:53	
11.	1400	760	1623		200	1610		4:55	
12. 403	640 649	560 544	13 25			210 201		4:59	
13.	1400	751	1626		207	1601		5:15	
14.	1404	751	1626		202	1612		5:19	
15. 400	653 655	549 550	14 32			208 196		5:23	
16.	1404	749	1632		199	1600		5:35	
17.	1400	750	1628		209	1602		5:38	
18. 463	650 650	541 553	26 27			202 200		5:42	
19.	1403	753	1630		200	1603		5:50	
20.	1400	750	1627		205	1602		5:53	
21. 426	650 652	545 546	25 19			202 204		5:58	
22.	1402	750	1625		204	1606		6:10	
23.	1454	750	1624		200	1603		6:13	
24. 404	704 697	550 550	21 11			149 170		6:25	
25.	1450	753	1631		203	1620		6:31	
26.	1400	751	1628		201	1600		6:33	
27. 402	650 650	550 549	28 24			200 200		6:35	
28.	1400	750	1624		201	1600		6:49	
29.	1410	750	1626		207	1603		6:51	
30. 405	660 655	543 548	23 26			193 193		6:53	
31.	1407	752	1628		204	1602		7:11	
32.	1401	750	1630		212	1620		7:15	
33. 403	649	538	10			219		7:18	
34. 4472	14440	12137	474		4489	4353			

COPY-IT PRINTING CO 100C

2'1'

CHARGING SHEET

DATE 2-3-88 SHIFT 3rd LINE II CHARGER Don B.

COKE	DUQ. 650	TRAP 554	LIME 10		STEEL	TENN 208	OTHER	TIME	COMMENT
1.	1407	757	1625		203	1615		7:29	
2.	1399	757	1625		213	1604		7:31	
3. 405	648 649	538 544	21 15			203 217		7:34	
4.	1401	752	1653		208	1618		7:45	
5.	1405	750	1627		200	1607		7:47	
6. 405	655 646	550 547	20 15			202 214		7:50	
7.	1398	752	1627		205	1612			
8.									
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									
21.									
22.									
23.									
24.									
25.									
26.									
27.									
28.									
29.									
30.									
31.									
32.									
33.									
34. 812	3248	2733	81		1029	1044			

COPY-IT PRINTING CO

AUG. 11, 90.6

Date 2/4/88

American Rockwool, Inc.
Daily Production Report

total 12,250 Bag's

	Bags per Line		78 Line 1		79.5 Line 2	
	#1 today	#2 today	today	MTD average	today	MTD average
Day of Operation			1	3.79	1	3.79
Charge (uncorrected)			254,093#	973,507#	256,389#	989,582#
Coke (uncorrected) Coke S.P.L.			25,263# 11,185#	114,604# 11,185#	25,142# 11,672#	116,355# 11,672#
Charge/Coke Ratio			6.97	7.73	6.96	7.72
#1 Wool Good Production	6,125#	—	177,625#	657,923#	—	—
#2 Wool Good Production	—	61,25	—	—	177,625#	649,397#
Wool Cryo or Pouring	—	—	—	—	—	1,350
Recovery %			69,90%	67,58%	69,27%	65,75%
Percent Efficiency	86,80%	86,80				
	today OXYGEN	MTD Total	today	MTD Total	today	MTD Total
Hour of Operation start	220"		24	91	24	91
Downtime Schedule used	45"					
Downtime Unschedule Bal	175"		0	220 min's	0	65 min's
% Downtime tap out			73 min's	172 min's	53 min's	151 min's
% Downtime						

78 Charges Used #1			79.5 #2		today	MTD today
Tenn.	400	31,433#	400	32,091#	63,524#	242,157#
Steel	400	31,935#	400	32,424#	64,359#	244,941#
D.U.Q.	1300	101,407#	1300	100,859#	202,266#	783,548#
Trap	1100	85,524#	1120	87,079#	172,603#	663,050#
St. Louis		—		—	—	—
Lime	50	3,794#	50	3936	7,730#	29,393
Coke 400# 460#		25,263#	400# 425#	25,142	50,405#	230,959#
S.P.L.#		11,185#	225#	11,672	22,857#	22,857#

Comments: (State reason for downtime. List major inoperative equipment. Explain unusual performance. List major charge changes. State critical materials not on hand). E.P.A. Testing

#1 Line 73 min's tapout.

#2 Line 53 min's tapout.

10-X-175

PRODUCTION REPORT

LINE: I

DATE: 2-4-88

FOREMAN Don

Charge	lbs.
Coke	400
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky	

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
8-9	1009	294	245		
9-10	2018	294	245		
10-11		294	294		
11-12		294	245		
12-1		294	245		
1-2		294	245		
2-3		294	245		
3-4		294	245		
Total----------		2352	2009		

Comments:

8 min Tap Out

6 min Tap Out

10 min Tap Out

FOREMAN Sam

Charge	lbs.
Coke	260
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky SPL	225

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
4-5		294	245		
5-6		294	294		
6-7	1032	294	245		
7-8	x 2 2064	294	245		
8-9		294	294		
9-10		294	245		
10-11		294	245		
11-12		294	245		
Total----------		2352	2058		

Comments:

TAP OUT 10 mins

TAPOUT 8 mins

TAP OUT 5 mins

FOREMAN Robert

Charge	lbs
Coke	260
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky S.P.L	225

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
12-1		294	196		
1-2		294	245		
2-3	1028	294	245		
3-4	x 2	294	294		
4-5	2056	294	245		
5-6		294	245		
6-7		294	294		
7-8		294	294		
Total----------		2352	2058		

Comments:

Tap out 12 min

Tap out 8 min

Tap out 6 min

COPY-IT COPY CENTER 500

C.M.

CHARGING SHEET

DATE 2-4-88 SHIFT 1 LINE I CHARGER R.C.

COKE	653 DUQ.	536 TRAP	24 LIME		STEEL	198 TENN	OTHER	TIME	COMMENTS
1.	1407	754	1630		218	1606		8:00	W.Mc
2.	1485	716	1631		208	1603		8:01	W.Mc
3. 400	639 649	558 552	28 23			198 198		8:05	RC.
4.	1402	753	1623		201	1600		8:12	R.C
5.	1404	748	1630		207	1607		8:14	R.C.
6. 415	636 645	541 547	23 27			203 204		8:16	R.C.
7.	1396	751	1627		204	1600		8:27	R.C.
8.	1400	754	1622		199	1597		8:29	R.C.
9. 414	646 662	555 547	25 21			197 192		8:31	R.C.
10.	1413	751	1626		204	1605		8:47	R.C.
11.	1399	755	1625		204	1610		8:49	R.C.
12. 404	644 630	551 556	14 19			201 218		8:50	R.C.
13.	1389	759	162[illegible]		203	1607		9:03	R.C.
14.	1405	753	1623		213	1600		9:05	R.C.
15. 404	658 648	540 547	23 18			195 209		9:07	C.M.
16.	1399	751	1626		204	1608		9:23	C.M.
17.	1400	752	1624		200	1602		9:24	C.M.
18. 402	648 656	552 550	22 30			202 192		9:25	C.M.
19.	1407	751	1629		201	1599		9:37	C.M.
20.	1397	760	1672		203	1661		9:39	C.M.
21. 422	637 647	557 554	11 15			254 227		9:42	C.M.
22.	1400	753	1642		199	1627		9:55	C.M.
23.	1407	779	1624		202	1606		9:56	C.M.
24. 403	628 554	537 547	18 32			199 200		9:58	C.M.
25.	1401	747	1633		200	1601		10:00	CM
26.	1401	749	1633		201	1600		10:11	R.C.
27. 406	652 650	548 550	33 24			199 203		10:20	R.C.
28.	1400	750	1627		200	1603		10:30	R.C.
29.	1400	751	1620		204	1598		10:32	R.C.
30. 400	649 644	547 545	22 25			198 199		10:33	R.C.
31.	1401	747	1625		202	1600		10:47	R.C.
32.	1398	749	1627		200	1613		10:48	C.M.
33. 421	649 644	549 572	14 27			205 186		10:50	C.M.
34.	1416	772	1639	115	200	1602		[illegible]	C.M.

COPY-IT PRINTING CO. 19

CHARGING SHEET

DATE 2-4-88 SHIFT 1ST LINE I CHARGER C.M. R.C.

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1.	1404	757	1670		205	1656		11:14	C.M.
2. 431	647 664	552 553	19 21			242 197		11:16	C.M.
3.	1413	749	1631		196	1610		11:21	C.M.
4.	1414	750	1628		215	1609		11:23	R.C.
5. 415	664 648	535 550	19 23			195 202		11:26	R.C.
6.	1402	754	1627		204	1604		11:40	R.C.
7.	1396	748	1624		204	1608		11:41	R.C.
8. 409	651 634	549 559	16 29			209 199		11:45	R.C.
9.	1395	759	1623		200	1594		11:55	R.C.
10.	1398	757	1627		201	1600		11:56	R.C.
11. 411	641 653	556 540	27 31			202 195		12:02	C.M.
12.	1405	752	1631		212	1600		12:14	cm
13.	1396	763	1626		199	1602		12:16	cm
14. 416	633 644	564 553	24 24			206 206		12:21	cm
15.	1397	753	1627		201	1603		12:32	cm
16.	1403	761	1655		202	1632		12:36	cm
17. 402	642 645	559 552	23 18			229 206		12:38	R.C.
18.	1405	760	1629		208	1611		12:53	R.C.
19.	1403	749	1630		200	1612		12:56	R.C.
20. 404	654 641	549 559	18 44			209 199		12:58	R.C.
21.	1405	760	1648		205	1604		1:12	R.C.
22.	1400	750	1625		200	1600		1:14	C.M.
23. 400	650 647	550 552	25 24			200 203		1:18	C.M.
24.	1400	753	1627		201	1603		1:30	C.M.
25.	1400	744	1625		204	1597		1:32	C.M.
26. 399	656 654	540 542	28 16			197 210		1:35	C.M.
27.	1402	748	1628		206	1612		1:48	C.M.
28.	1401	742	1648		199	1627		1:50	C.M.
29. 470	629 639	553 540	19 24			226 231		1:53	C.M.
30.	1397	758	1652		198	1628		2:06	C.M.
31.	1399	750	1651		200	1628		2:08	R.C.
32. 401	649 654	550 551	23 24			229 202		2:10	R.C.
33.	1405	751	1631		200	1607		2:21	R.C.
34. 4558	1407	759	1626	11.5	197	1598		2:23	R.C.
	14,881	648 12,665	562 542	28	4657	191 4805			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-4-88 SHIFT 1ST LINE I CHARGER R.C. C.M.

	COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1.	402	670	542	29			179		2:26	R.C.
2.		1417	747	1625		205	1596		2:38	R.C.
3.		1401	750	1643		212	1609		2:42	C.M.
4.	412	651 1647	538 552	34 25			208 200		2:44	C.M.
5.		1399	752	1624		200	1599		2:55	C.M.
6.		1400	750	1633		200	1618		2:58	C.M.
7.	405	650 1620	550 550	15 20			218 190		3:01	C.M.
8.		1427	757	1637		207	1617		3:13	C.M.
9.		1400	750	1624		200	1600		3:15	C.M.
10.	412	650 1642	550 557	24 24			200 198		3:16	C.M.
11.		1403	761	1625		204	1601		3:35	R.C.
12.		1401	750	1623		200	1600		3:37	R.C.
13.	415	651 1650	550 555	23 47			199 185		3:39	R.C.
14.		1415	765	1647		210	1600		3:48	R.C.
15.		1400	752	1627		201	1602		3:49	R.C.
16.	418	648	551	25			202		3:51	R.C.
17.		1397	759	1626		211	1600			R.C.
18.		1636	548	26			203			
19.					5.5					
20.										
21.										
22.										
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										
31.										
32.										
33.										
34.	2464	7165	6043	292		2250	2182			

COPY-IT PRINTING CO.

CHARGING SHEET

DATE 2-4-88 SHIFT 2nd LINE 1 CHARGER Leonard

COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1. 499	656	550	18			201		4:08	EW
2.	1406	750	1625		200	1607		4:19	EW
3.	1402	757	1631	222	202	1603		4:24	EW
4. 262	645 694	555 542	28 21	484		201 205		4:29	EW
5.	1401	747	1627		205	1606		4:36	EW
6.	1397	750	1624	225	202	1609		4:39	EW
7. 263	647 654	548 543	15 19	488		212 194		4:47	EW
8.	1402	748	1625		205	1596		4:54	EW
9.	1398	755	1623	220	203	1602		4:56	EW
0. 263	643 649	552 528	21 20	483		204 211		5:04	KM
11.	1400	751	1631		223	1611		5:13	KM
2.	1402	750	1630	219	201	1600		5:15	KM
13. 266	652 648	549 550	30 31	485		198 200		5:19	KM
4.	1400	752	1631		202	1600		5:30	KM
15.	1403	751	1626	225	205	1600		5:33	KM
16. 261	652 644	546 551	26 24	486		197 202		5:37	KM
17.	1399	755	1625		204	1601		5:46	KM
8.	1400	750	1627	219	202	1599		5:48	KM
19. 268	650 648	548 551	28 19	487		199 202		5:55	KM
0.	1403	755	1624		204	1605		6:01	KM
21.	1399	751	1624	224	204	1604		6:07	EW
22. 258	648 649	547 540	20 32	482		205 199		6:12	EW
23.	1398	749	1629		209	1597		6:21	EW
24.	1399	753	1626	222	206	1603		6:25	EW
25. 263	646 654	547 541	23 23	485		204 201		6:29	EW
26.	1403	749	1627		208	1604		6:36	EW
27.	1400	753	1623	228	204	1604		6:43	EW
28. 260	647 633	549 571	19 26	488		204 194		6:47	EW
29.	1406	773	1626		202	1600		6:56	EW
30.	1401	748	1626	217	206	1601		7:01	EW
31. 269	653 667	542 549	25 21	486		200 192		7:06	KM
32.	1413	751	1631		202	1610		7:18	KM
33.	1400	750	1627	11 223	204	1599		7:21	KM
34. 262	650	546	28	485		199		7:25	KM
3394	14,289	12,045	517	2,444	4503	4,424			

COPY-IT PRINTING CO.

CHARGING SHEET

DATE 2-4-88 SHIFT 2nd LINE 1 CHARGER Edwards

COKE	647 DUQ.	547 TRAP	27 LIME	SPL	STEEL	206 TENN	OTHER	TIME	COMMENTS
1.	1399	752	1626		205	1605		7:32	KM
2.	1407	749	1629	218	201	1602		7:35	KM
3. 266	658 646	548 405	27 26	484		195 202		7:41	KM
4.	1401	755	1629		350	1603		7:51	KM
5.	1404	750	1627	217	200	1601		7:57	KM
6. 270	654 649	550 534	26 28	487		197 200		8:02	KM
7.	1399	750	1627		216	1599		8:15	EW
8.	1401	753	1628	226	201	1603		8:18	EW
9. 260	648 653	552 551	25 25	486		202 201		8:23	EW
0.	1404	751	1630		200	1605		8:35	EW
11.	1405	754	1624	225	205	1599		8:37	EW
2. 259	651 651	549 544	27 25	484		194 200		8:38	EW
13.	1399	748	1624		204	1599		8:55	EW
4.	1405	752	1630	222	204	1602		8:57	EW
15. 262	653 644	548 553	28 28	484		197 198		8:59	EW
6.	1401	757	1627		204	1599		9:10	KM
17.	1401	750	1626	233	206	1601		9:13	KM
18. 260	651 646	544 548	25 23	493		200 200		9:17	KM
19.	1400	754	1633		206	1600		9:30	KM
20.	1406	750	1627	224	199	1607		9:33	KM
21. 262	656 652	551 547	20 22	486		201 202		9:35	KM
22.	1402	750	1626		203	1604		9:49	KM
23.	1401	751	1631	221	199	1599		9:50	KM
24. 263	650 652	552 546	32 33	484		198 203		9:52	KM
25.	1402	750	1632		204	1605		10:11	KM
26.	1399	754	1639	227	204	1613		10:12	EW
27. 261	645 651	550 547	26 26	488		214 198		10:15	EW
28.	1401	750	1625		203	1599		10:22	EW
29.	1401	750	1626	224	200	1605		10:25	EW
30. 264	651 662	550 543	21 28	488		204 189		10:30	EW
31.	1411	749	1628		206	1600		10:42	EW
32.	1403	748	1623	219	200	1601		10:44	EW
33. 267	655 643	548 550	22 20	486		198 209		10:48	EW
34.	1397	754	1626	115	204	1606		11:10	EW
2894	14,968	12457	594	2,456	4,824	4608			

COPYCIT PRINTING CO. INC.

Marshall Edwards

CHARGING SHEET

DATE 2-4-88 SHIFT 2nd LINE 1 CHARGER

COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1.	1404	750	1631	214	207	1599		11:12	KM
2. 279	654 655	543 548	32 26	493		195 196		11:14	KM
3.	1408	753	1630		205	1604		11:29	KM
4.	1410	757	1628	226	203	1609		11:31	KM
5. 261	653 648	554 550	19 22	487		199 211		11:33	KM
6.	1401	753	1634		203	1612		11:50	KM
7.	1400	752	1625	231	205	1605		11:52	KM
8. 262	648	547	20	493		205		11:53	KM
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									
21.									
22.									
23.									
24.									
25.									
26.									
27.									
28.									
29.									
30.									
31.									
32.				2.5					
33.									
34. 802	3258	2742	119	671	1023	1006			

COPY-IT PRINTING CO. 1-00

CHARGING SHEET

DATE 2-4-88 SHIFT 3rd LINE 1 CHARGER W. M

COKE	DUQ. 661	TRAP 555	LIME 22	SPL	STEEL	TENN 182	OTHER	TIME	COMMENTS
1.	1419	758	1623		203	1601		12:15	
2.	1400	752	1627	210	201	1602		12:17	
3. 314	648 658	551 548	25 35	524		202 199		12:20	
4.	1407	749	1641		201	1606		12:39	
5.	1401	750	1624	234	202	1600		12:41	
6. 300	651 642	548 555	24 27	534		199 200		12:44	
7.	1400	758	1627		203	1600		1:07	
8.	1401	753	1626	220	207	1600		1:09	
9. 269	648 653	546 547	26 29	489		199 191		1:12	
10.	1405	752	1625		205	1596		1:33	
11. 259	1402	760	1626		205	1614		1:36	
12. 487	642 ~~654~~	555 ~~551~~	12	228		212		1:42	
13.	1403	749	1627	217	205	1600		1:55	
14. 268	654 649	544 548	27 26	485		197 201		1:57	
15.	1399	750	1626		202	1600		2:10	
16.	1408	751	1631	228	203	1608		2:12	
17. 263	657 646	548 544	23 26	491		200 199		2:15	
18.	1400	754	1625		210	1599		2:28	
19.	1400	751	1625	222	209	1600		2:30	
20. 263	649 657	542 536	28 14	485		200 206		2:32	
21.	1406	749	1626		213	1612		2:43	
22.	1401	753	1627	222	203	1602		2:45	
23. 265	648 649	550 556	25 30	487		201 195		2:47	
24.	1405	756	1630		200	1600		3:09	
25.	1410	751	1624	225	202	1600		3:11	
26. 264	659 657	549 544	24 23	489		190 193		3:13	
27.	1411	754	1627		210	1604		3:25	
28.	1414	750	1631	214	201	1605		3:27	
29. 280	664 647	549 545	24 28	494		191 212		3:30	
30.	1396	749	1636		204	1608		3:43	
31.	1404	752	1628	225	205	1600		3:45	
32. 265	652	547	28	496		196		3:47	
33.	13691								
34. 3010	~~14,345~~	11507	528	10,5 2,445	4294	4165			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-4-88 SHIFT 3rd LINE P CHARGER W. M.

	COKE	DUQ. (661)	TRAP (551)	LIME (21)	SPL	STEEL	TENN (195)	OTHER	TIME	COMMENTS
1.		1412	751	1628		200	1607		4:01	
2.		1406	759	1635	227	212	1606		4:04	
3.	260	647 662	547 546	29 21	487		200 192		4:06	
4.		1412	750	1625		204	1604		4:20	
5.		1411	751	1628	221	201	1600		4:22	
6.	265	660 640	550 561	28 16	486		189 213		4:24	
7.		1400	760	1629		199	1613		4:40	
8.	264	1400	756	1644		201	1601		4:50	
9.	487	644 661	555 547	48 25	223		201 188		4:48	
10.		1412	751	1625		204	1600		4:58	
11.	260	1400	763	1624		203	1606		5:02	
12.	485	637 645	560 555	18 35	225		206 200		5:07	
13.		1400	755	1625		200	1600		5:16	
14.	260	1402	750	1625		203	1602		5:21	
15.	485	652 649	547 550	23 14	225		200 212		5:25	
16.		1400	751	1626		201	1612		5:34	
17.	262	1402	752	1624		264	1601		5:38	
18.	489	650 650	548 554	23 25	227		199 207		5:40	
19.		1404	754	1626		200	1611		5:52	
20.	260	1400	751	1624		203	1601		5:57	
21.	488	649 647	548 553	23 26	228		201 200		5:59	
22.		1400	756	1626		203	1600		6:13	
23.	256	1408	760	1625		201	1605		6:15	
24.	488	648 648	559 551	20 28	232		197 203		6:21	
25.		1404	756	1635		205	1607		6:31	
26.	261	1418	756	1636		204	1609		6:33	
27.	497	662 649	552 527	25 28	236		189 201		6:38	
28.		1399	750	1628		223	1600		6:44	
29.	255	1413	751	1628		205	1595		6:46	
30.	485	663 662	546 546	33 22	230		182 194		6:51	
31.		142	750	1630		204	1608		7:00	
32.		1400	753	1629	225	209	1614		7:02	
33.	262	647	544	13	487		216		7:04	
34.	2865	14330	12,097	529	11 2,499	4489	4385			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-4-88 SHIFT 3rd LINE I CHARGER W. M.

	COKE	DUQ.	TRAP	LIME	SP2	STEEL	TENN	OTHER	TIME	COMMENTS
		657	548	17			210			
1.		1408	751	1632		203	1618		7:17	
2.		1406	755	1625	225	200	1604		7:19	
3.	260	651 657	555 549	21 26	485		198 192		7:21	
4.		1408	751	1626		202	1600		7:36	
5.		1409	751	1629	222	209	1600		7:38	
6.	265	658 654	542 550	29 29	487		191 197		7:40	
7.		1404	750	1630		200	1601		7:50	
8.		1400	750	1626	223	204	1600		7:52	
9.	260	650	546	26	483		200		7:54	
0.										
11.										
2.					3					
13.										
4.										
15.										
6.										
17.										
8.										
19.										
0.										
21.										
2.										
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										
31.										
32.										
33.										
34.	785	3927	3290	145	670	1218	1188			

COPY-IT PRINTING CO. 1000

PRODUCTION REPORT

LINE: II

DATE: 2-4-88

FOREMAN Don

Charge	lbs.
Coke	400
Duq	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky	

Shift	Product	Bags per Hour Plan	29 lb	other	Var.
8-9		294	294		
9-10	1015 ~~507~~	294	245		
10-11		294	245		
11-12		294	245		
12-1		294	245		
1-2		294	~~245~~		
2-3		294	245		
3-4		294	245		
Total----------		2352	2009		

Comments:

8 min Tap Out

5 min Tap Out

~~10 Min~~ Tap out

FOREMAN

Charge	lbs.
Coke	260
Duq	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
SPL	225

Shift	Product	Bags per Hour Plan	29 lb	other	Var.
4-5		294	245		
5-6		294	245		
6-7		294	294		
7-8	1024 x 2	294	245		
8-9	048	294	294		
9-10		294	245		
10-11		294	245		
11-12		294	245		
Total----------		2352	2058		

Comments:

Tap out 6 mins

Tap out 8 mins

FOREMAN Rabbit

Charge	lbs
Coke	260
Duq	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
SPL	225

Shift	Product	Bags per Hour Plan	29 lb	other	Var.
12-1		294	245		
1-2		294	245		
2-3	1025	294	245		
3-4	x 2	294	245		
4-5	2050	294	294		
5-6		294	294		
6-7		294	245		
7-8		294	245		
Total----------		2352	2058		

Comments:

Tap out 5 min

Tap out 6 min

Tap out 5 min

COPY-IT COPY CENTER 500

CHARGING SHEET

DATE 2-4-88 SHIFT 1ST LINE II CHARGER R.C. C.M.

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
	646	547	15			204			
1.	1398	752	1627		205	1612		8:01	R.C.
2.	1398	750	1624		200	1613		8:03	R.C.
3. 409	648 654	550 549	19 29			205 195		8:07	R.C.
4.	1403	749	1627		200	1598		8:18	R.C.
5.	1402	751	1627		200	1602		8:19	R.C.
6. 403	651 644	551 560	25 26			200 195		8:21	R.C.
7.	1403	759	1624		199	1598		8:36	R.C.
8.	1396	758	1626		204	1596		8:37	R.C.
9. 403	638 640	554 554	30 18			200 201		8:39	R.C.
10.	1399	759	1628		205	1610		8:52	R.C.
11.	1397	759	1626		203	1607		8:54	R.C.
12. 406	638 625	556 553	19 23			210 209		8:57	R.C.
13.	1395	760	1627		207	1604		9:11	R.C.
14.	1398	763	1628		206	1619		9:13	C.M.
15. 404	638 653	557 549	9 23			221 199		9:14	C.M.
16.	1404	751	1626		202	1603		9:29	C.M.
17.	1406	750	1635		197	1613		9:30	C.M.
18. 403	656 640	553 559	23 17			207 230		9:32	C.M.
19.	1399	759	1646		200	1629		9:44	C.M.
20.	1402	750	1625		197	1599		9:45	C.M.
21. 400	652 648	553 552	26 18			197 206		9:48	C.M.
22.	1400	752	1624		200	1606		10:01	C.M.
23.	1401	750	1625		200	1601		10:04	R.C.
24. 401	651 650	550 550	24 23			200 201		10:07	R.C.
25.	1401	751	1625		201	1602		10:12	R.C.
26.	1402	750	1631		200	1601		10:19	R.C.
27. 400	652 651	550 548	30 26			199 199		10:22	R.C.
28.	1402	751	1627		203	1601		10:34	R.C.
29.	1404	751	1620		204	1598		10:37	R.C.
30. 406	647 630	547 569	22 11			194 210		10:40	R.C.
31.	1403	773	1624		204	1613		10:55	C.M.
32.	1389	750	1631		204	1601		10:56	C.M.
33. 405	639 648	546 550	30 36			212 201		10:58	C.M.
34. 440	1400	752	1637	11.5	202	1601		11:10	C.M.
	14,836	12,707	514		4,643	4,705			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-4-88 SHIFT 1st LINE II CHARGER R.C. C.M

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1.	1400	770	1653		221	1638		11:12	C.M.
2. 402	630 652	549 503	15 13			238 214		11:14	C.M.
3.	1397	745	1624		242	1611		11:21	C.M.
4.	1414	750	1628		211	1598		11:25	R.C.
5. 426	664 664	539 540	30 25			184 188		11:27	R.C.
6.	1411	747	1624		207	1599		11:40	R.C.
7.	1406	746	1628		203	1597		11:44	R.C.
8. 412	660 640	543 550	31 18			191 206		11:46	R.C.
9.	1398	758	1622		208	1604		11:56	R.C.
0.	1394	750	1654		204	1633		12:00	C.M.
11. 411	644 648	546 545	11 28			239 206		12:02	CM
2.	1400	752	1634		207	1606		12:14	CM
13.	1394	763	1629		216	1596		12:18	CM
4. 417	631 657	547 539	33 30			202 195		12:22	CM
15.	1405	748	1630		207	1600		12:30	C.M.
6.	1403	761	1655		202	1632		12:31	CM
17. 426	642 656	559 541	23 30			229 194		12:37	R.C
8.	1406	750	1630		208	1600		12:48	R.C.
19.	1397	757	1631		210	1605		12:50	R.C
20. 407	640 648	547 550	26 26			208 217		12:51	R.C.
21.	1407	759	1650		209	1624		1:08	RC
22.	1383	724	1639		217	1608		1:10	C.M.
23. 400	659 648	507 550	31 24			225 202		1:11	CM.
24.	1398	750	1624		200	1600		1:26	C.M.
25.	1400	750	1625		200	1600		1:28	C.M.
26. 402	650 655	550 535	25 34			200 192		1:29	C.M.
27.	1401	746	1627		269	1593		1:45	C.M.
28.	1403	760	1645		205	1624		1:46	C.M.
29. 414	643 650	555 534	21 24			221 210		1:48	C.M.
30.	1398	748	1632		214	1608		1:58	C.M.
31.	1404	752	1666		200	1651		2:00	C.M.
32. 413	652 653	552 545	15 25			247 213		2:03	R.C
33.	1402	749	1640		201	1615		2:18	RC
34 4530	1400	751	1626	11.56	201	1602		2:20	R.C
14,935	649	550	12,479	29 562	4803	202	4833		

COPY-IT PRINTING CO 1000

CHARGING SHEET

DATE 2-4-88 SHIFT 1st LINE II CHARGER R.C. C.M.

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
1. 412	651	550	25			199		2:24	R.C.
2.	1401	750	1625		200	1600		2:36	R.C.
3.	1402	751	1631		200	1600		2:38	R.C.
4. 403	651 650	551 544	31 16			198 204		2:43	C.M.
5.	1401	751	1621		207	1605		2:53	C.M.
6.	1399	748	1639		218	1595		2:55	C.M.
7. 401	651 660	530 543	44 16			196 229		3:00	C.M.
8.	1406	746	1651		203	1635		3:10	C.M.
9.	1402	757	1637		206	1598		3:11	C.M.
10. 403	645 659	551 548	39 22			196 201		3:17	C.M.
11.	1407	748	1630		200	1608		3:30	R.C.
12.	1460	754	1622		204	1600		3:31	R.C.
13. 410	646 677	550 525	22 30			200 205		3:38	R.C.
14.	1419	742	1654		217	1624		3:45	R.C.
15.	1418	758	1625		212	1600		3:47	R.C.
16. 401	660	546	25			182		3:48	R.C.
17.	1403	759	1624		196	1602			R.C.
18.	644	563	22			199			
19.									
20.				5.5					
21.									
22.									
23.									
24.									
25.									
26.									
27.									
28.									
29.									
30.									
31.									
32.									
33.									
34 2430	7194	6001	292		2263	2209			

COPY-IT PRINTING CO. 1000

CHARGING SHEET (11) Edwards

DATE 2-4-88 SHIFT 2nd LINE 2 CHARGER

COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1. 501	648	543	26			197		4:06	EW
2.	1401	753	1624		210	1598		4:20	EW
3.	1400	751	1631	227	210	1599		4:21	EW
4. 259	649 650	541 545	32 16	486		199 205		4:27	EW
5.	1405	755	1626		210	1610		4:38	EW
6.	1397	754	1626	222	203	1597		4:43	EW
7. 262	645 623	557 571	29 27	484		200 199		4:45	EW
8.	1401	778	1627		207	1600		4:56	EW
9.	1400	758	1635	222	204	1597		4:59	EW
10. 262	642 633	554 566	38 26	484		197 201		5:01	EW
11.	1401	768	1628		202	1602		5:15	KM
12.	1402	751	1628	222	201	1611		5:18	KM
13. 266	651 647	550 545	17 31	488		209 199		5:22	KM
14.	1400	753	1630		208	1599		5:31	KM
15.	1403	750	1626	226	211	1602		5:35	KM
16. 262	653 648	539 547	24 25	488		199 200		5:39	KM
17.	1399	751	1626		204	1601		5:46	KM
18.	1402	751	1628	225	204	1605		5:50	KM
19. 264	651 657	547 541	23 31	489		203 193		5:57	KM
20.	1408	751	1632		210	1601		6:01	KM
21.	1401	750	1625	223	208	1600		6:04	EW
22. 263	651 604	542 591	25 29	486		199 202		6:10	EW
23.	1398	794	1629		203	1600		6:21	EW
24.	1404	752	1629	221	204	1604		6:23	EW
25. 264	652 648	548 551	25 27	485		200 200		6:27	EW
26.	1400	752	1627		201	1600		6:37	EW
27.	1401	754	1626	231	199	1601		6:40	EW
28. 258	647 649	555 546	25 20	479		200 206		6:45	EW
29.	1400	751	1626		205	1606		6:56	EW
30.	1399	744	1626	228	204	1611		6:58	EW
31. 262	655 651	540 550	15 36	490		212 194		7:04	KM
32.	1404	753	1634		203	1598		7:17	KM
33.	1408	752	1628	1226	205	1605		7:18	KM
34. 261	656	547	23	487		197		7:23	KM
3,384	14,208	12,110	570	2,922	4,516	4,413			

COPY-IT PRINTING CO. 100

CHARGING SHEET

DATE 2-4-88 SHIFT 2nd LINE 2 CHARGER Edwards

COKE	DUQ. 645	TRAP 550	LIME 31	SPL	STEEL	TENN 201	OTHER	TIME	COMMENTS
1.	1399	754	1631		204	1600		7:32	KM
2.	1400	751	1630	223	202	1600		7:38	KM
3. 268	649 655	549 531	30 23	491		200 196		7:40	KM
4.	1407	752	1626		221	1603		7:50	KM
5.	1404	750	1628	228	208	1601		7:55	KM
6. 263	654 654	542 546	27 29	491		197 194		7:59	KM
7.	1403	749	1626		203	1597		8:12	EW
8.	1402	750	1631	218	206	1603		8:13	EW
9. 266	652 652	544 553	28 26	484		201 195		8:15	EW
10.	1406	754	1627		201	1601		8:26	EW
11.	1401	747	1625	233	203	1599		8:30	EW
12. 254	654 646	544 547	26 26	487		198 204		8:33	EW
13.	1397	751	1627		204	1601		8:45	EW
14.	1401	749	1631	224	202	1609		8:47	EW
15. 266	652 653	547 547	22 28	490		208 197		8:49	EW
16.	1404	751	1629		204	1601		9:02	EW
17.	1403	752	1626	209	201	1603		9:05	KM
18. 282	651 653	551 550	23 25	491		200 200		9:08	KM
19.	1404	751	1629		201	1604		9:20	KM
20.	1403	750	1628	216	211	1600		9:22	KM
21. 269	653 656	539 546	28 27	485		197 195		9:24	KM
22.	1406	750	1622		204	1601		9:38	KM
23.	1409	749	1622	222	204	1600		9:41	KM
24. 263	660 660	544 550	22 28	485		191 191		9:43	KM
25.	1409	749	1628		199	1600		9:58	KM
26.	1400	751	1630	223	203	1617		10:01	KM
27. 261	649 657	548 544	13 20	484		217 199		10:05	EW
28.	1405	748	1624		204	1604		10:18	EW
29.	1403	747	1623	225	204	1601		10:22	EW
30. 260	664 652	549 549	22 23	485		198 199		10:27	EW
31.	1403	751	1625		202	1602		10:40	EW
32.	1400	753	1623	225	201	1599		10:41	EW
33. 259	647 655	552 548	24 22	484		199 201		10:47	EW
34.	1404	749	1627	11.5	201	1605		[illegible]	[illegible]
2911	15,023	12,564	573	2,446	4,693	4,578			

COPY-IT PRINTING

Marshall Edwards

CHARGING SHEET

DATE 2-4-88 SHIFT 2nd LINE 2 CHARGER

COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1.	1398	751	1627	221	211	1598		11:04	EW
2. 261	647 649	540 501	29 26	482		200 201		11:07	KM
3.	1399	750	1626		249	1600		11:21	KM
4.	1400	755	1624	219	205	1600		11:22	KM
5. 267	645 649	550 541	24 24	486		200 202		11:25	KM
6.	1399	750	1625		209	1601		11:42	KM
7.	1402	751	1626	234	202	1603		11:43	KM
8. 261	651	549	23	495		201		11:45	KM
9.									
0.									
11.									
2.				25					
13.									
4.									
15.									
6.									
17.									
18.									
19.									
20.									
21.									
22.									
23.									
24.									
25.									
26.									
27.									
28.									
29.									
30.									
31.									
32.									
33.									
34. 789	3241	2681	126	674	1076	1,004			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-4-88 SHIFT 3rd LINE 2 CHARGER W. M.

COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
	652	541	35			193			
1.	1408	756	1636		215	1601		12:06	
2.	1401	753	1625	244	206	1598		12:09	
3. 260	648 644	547 556	27 25	504		197 201		12:11	
4.	1400	756	1626		200	1601		12:27	
5.	1403	749	1628	223	206	1600		12:29	
6. 307	654 649	543 551	28 27	530		197 202		12:31	
7.	1400	751	1629		200	1602		12:49	
8.	1403	751	1623	224	204	1600		12:51	
9. 301	652 648	547 546	23 35	525		197 201		12:53	
0.	1400	752	1636		206	1601		1:11	
1.	1403	752	1632	216	205	1605		1:14	
2. 266	651 660	547 550	27 25	482		202 186		1:18	
3.	1414	754	1625		204	1600		1:36	
4.	1401	752	1627	231	200	1605		1:38	
5. 264	649 643	552 554	22 27	495		204 199		1:41	
6.	1400	757	1626		203	1599		1:56	
7.	1408	750	1630	217	210	1605		2:00	
8. 207	668 647	540 551	25 21	484		187 208		2:03	
9.	1402	755	1632		204	1610		2:17	
0.	1402	753	1628	225	206	1608		2:19	
21. 260	649 630	547 556	20 7	485		206 219		2:21	
2.	1400	770	1626		214	1619		2:37	
23.	1406	774	1628	224	202	1620		2:39	
4. 266	632 654	572 545	8 23	490		214 196		2:41	
25.	1405	751	1624		206	1601		2:56	
26.	1401	755	1625	225	203	1600		2:58	
27. 262	646 658	552 549	25 21	487		199 199		3:00	
28.	1408	750	1628		201	1607		3:19	
29.	1401	753	1625	232	200	1605		3:20	
30. 260	648 648	553 545	20 23	492		204 208		3:22	
31.	1400	752	1625		207	1602		3:34	
32.	1400	751	1629	216	205	1607		3:36	
33. 268	649	546	22	484		207		3:39	
34. 2,981	14,279	12,090	516	11	4,303	4,420			
				2,477					

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-4-88 SHIFT 3rd LINE II CHARGER W. M.

COKE	DUQ. 671	TRAP 542	LIME 26	SPL	STEEL	TENN 183	OTHER	TIME	COMMENTS
1.	1420	749	1629		207	1600		3:52	
2.	1402	752	1628	223	210	1598		3:54	
3. 262	650 650	542 548	30 33	485		196 200		3:57	
4.	1402	752	1635		204	1602		4:06	
5.	1405	750	1636	227	204	1601		4:08	
6. 260	655 658	546 553	35 21	487		196 187		4:11	
7.	1413	755	1627		202	1606		4:23	
8.	1400	760	1629	220	211	1608		4:26	
9. 266	640 649	549 551	21 26	486		208 203		4:31	
10.	1401	750	1630		199	1604		4:41	
11.	1406	751	1631	217	200	1600		4:44	
12. 268	655 651	551 549	31 27	485		194 197		4:46	
13.	1403	752	1627		203	1600		4:57	
14.	1406	750	1627	222	201	1604		4:59	
15. 268	656 641	549 560	23 32	490		198 198		5:04	
16.	1405	764	1635		204	1603		5:16	
17.	1401	754	1627	223	204	1602		5:18	
18. 262	647 649	550 551	25 30	485		201 199		5:23	
19.	1401	752	1630		201	1600		5:34	
20.	1403	751	1625	225	201	1600		5:36	
21. 263	652 658	550 550	25 27	488		197 194		5:59	
22.	1409	751	1630		201	1603		5:52	
23.	1400	755	1628	221	210	1601		5:54	
24. 265	645 656	545 550	27 18	486		201 200		5:56	
25.	1406	750	1624		200	1606		6:14	
26.	1400	750	1624	230	202	1609		6:17	
27. 260	650 652	548 547	15 27	490		209 195		6:19	
28.	1405	753	1627		206	1600		6:31	
29.	1406	752	1633	222	204	1608		6:36	
30. 261	654 650	548 545	25 25	483		208 200		6:41	
31.	1400	750	1625		205	1600		6:46	
32.	1410	751	1630	227	225	1602		6:49	
33. 260	659	526	28	487		192		6:53	
34. 2895	14,348	12,050	577	11	4504	4350			
				2,457					

COPY-U PRINTING CO. 10

CHARGING SHEET

DATE 2-4-88 SHIFT 3rd LINE II CHARGER W. M.

	COKE	DUQ. 651	TRAP 545	LIME 28	SPL	STEEL	TENN 211	OTHER	TIME	COMMENTS
1.		1401	750	1640		205	1612		7:06	
2.		1415	753	1629	245	204	1599		7:09	
3.	263	662 667	549 551	30 21	508		184 189		7:11	
4.		1418	751	1628		200	1607		7:21	
5.		1400	753	1626	225	202	1603		7:23	
6.	260	647 647	551 561	23 35	485		203 194		7:28	
7.		1407	760	1636		199	1601		7:40	
8.		1415	750	1628	226	206	1611		7:42	
9.	259	665 649	544 549	27 27	485		196 197		7:45	
10.		1401	752	1625		203	1598		7:54	
11.		1410	751	1630		204	1615		7:58	
12.		659	547	15			205			
13.										
14.										
15.										
16.										
17.										
18.										
19.										
20.										
21.										
22.										
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										
31.										
32.					4					
33.										
34.	782	5,247	4,397	206	696	1,623	1,579			

COPY-IT PRINTING CO. 1000

17½ DAY

AVG. 11,824

Date 2/5/88

American Rockwool, Inc.
Daily Production Report

total 11,515 Bags

	Bags per Line		77 Line 1		77.5 Line 2	
	#1 today	#2 today	today	MTD average	today	MTD average
Day of Operation			1	4.79	1	4.79
Charge (uncorrected)			250,235#	1,223,742#	252,587#	1,242,169#
Coke (uncorrected) coke / SPL			20,123# / 16,982#	134,727# / 28,654#	21,309# / 17,277#	137,664# / 28,949#
Charge/Coke Ratio			6.74	7.49	6.54	7.45
#1 Wool Good Production	6027#	—	174,783#	832,705#	—	—
#2 Wool Good Production	—	5488#	—	—	159,152#	808,549#
Wool Cryo or Pouring	—	—	—	—	—	1,350#
Recovery %			69.80%	68.04%	63.06%	65.20%
Percent Efficiency	85.41%	77.77%				
	today oxygen	MTD Total	today	MTD Total	today	MTD Total
Hour of Operation start	175"		24	115	24	115
Downtime Schedule used	35"					
Downtime Unschedule Bal	140"		30 min's	250 min's	95 min's	160 min's
% Downtime tap out			69 min's	246 min's	57 min's	208 min's
% Downtime						

Charges Used #1		#2		today	MTD today
Tenn. 400#	30,601	400#	30,922#	61,523#	303,680#
Steel 400#	31,517#	400#	31,772#	63,289#	308,230#
D.U.Q. 1300#	100,088#	1300#	100,814#	200,902#	984,450#
Trap 1100#	84,235#	1100#	85,173#	169,408#	832,458#
St. Louis NR	—	—		—	—
Lime 50#	3794#	50#	3906	7700#	37,093#
Coke 260#	20,123#	260#	21,309#	41,432#	272,392#
S.P.L. 225#	16982#	225#	17,277#	34,259	57,116#

Comments: (State reason for downtime. List major inoperative equipment. Explain unusual performance. List major charge changes. State critical materials not on hand). E.P.A. testing

#1 Line 69 min's tapout, 30 min's Shut Line Down for Cleanup and Repairs
#2 Line 57 min's tapout, 15 min's Down with Cupola to fix chain on Blow Chamber Conveyor tapout Cupola 30 min's Down trouble with Bagger. 25 min's Down trouble with Iron Clean Head and Notch - 25 min's Drop Bottom.

O.X 140 AT 6=55

PRODUCTION REPORT

LINE: I

DATE: 2-5-88

FOREMAN Non

Charge	lbs.
Coke	260
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky SPL	225

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
8-9		294	196		
9-10		294	245		
10-11		294	196		
11-12		294	245		
12-1	950 / 18	294	245		
1-2		294	245		
2-3		294	245		
3-4		294	245		
Total----------		2352	1862	✓	

Comments:

10 TAP OUT

15 min Lost Burners & Install

10 TAP OUT

FOREMAN Jack

Charge	lbs.
Coke	2600
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky SPL	225

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
4-5		294	245		
5-6		294	245		
6-7	1032 x 2	294	245		
7-8	2064	294	294		
8-9		294	245		
9-10		294	294		
10-11		294	245		
11-12		294	245		
Total----------		2352	2058	✓	

Comments:

TAP OUT 5 MINS

TAP OUT 10 MINS

TAP OUT 5 MINS

FOREMAN Rabbit

Charge	lbs
Coke	360
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
S.P.L	225

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
12-1		294	245		
1-2		294	294		
2-3	1045	294	294		
3-4	x 2	294	294		
4-5	2090	294	245		
5-6		294	294		
6-7		294	294		
7-8		294	147		
Total----------		2352	2107	✓	

Comments:

Tapout 6 min

Tap out 8 min

OFF line 7:30

COPY-IT COPY CENTER 500

CHARGING SHEET

DATE [redacted] SHIFT 1ST LINE I CHARGER K.C.

	COKE	DUST	TRAP	LIME	STONE	STEEL	TENN	OTHER	TIME	COMMENTS
	[redacted]	[redacted]	[redacted]	1626	[redacted]	[redacted]	[redacted]	[redacted]	8:09	C.M.
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	8:11	C.M.
	[redacted]	[redacted]	[redacted]	1634	[redacted]	[redacted]	1616	[redacted]	8:13	C.M.
	[redacted]	[redacted]	[redacted]	1634	[redacted]	[redacted]	1597	[redacted]	8:24	C.M.
	[redacted]	[redacted]	[redacted]	1627	[redacted]	[redacted]	1616	[redacted]	8:26	C.M.
	640 654	569 587	11 24	[redacted]	[redacted]	[redacted]	196 195	[redacted]	8:29	C.M.
	1405	790	1629	[redacted]	[redacted]	[redacted]	1604	[redacted]	8:44	C.M.
	1414	754	1628	223	207	1604	[redacted]	[redacted]	8:50	C.M.
260	660 644	547 555	24 33	[redacted]	[redacted]	[redacted]	186 200	[redacted]	8:50	C.M.
	1397	753	1630	[redacted]	[redacted]	[redacted]	1597	[redacted]	9:00	C.M.
	[redacted]	755	1645	223	[redacted]	1622	[redacted]	[redacted]	9:05	C.M.
260	644 657	543 542	23 30	48[illegible]	[redacted]	[redacted]	223 203	[redacted]	9:08	R.C.
	1402	745	1635	[redacted]	203	1605	[redacted]	[redacted]	9:17	R.C.
	1409	757	1623	229	208	1601	[redacted]	[redacted]	9:21	R.C.
260	652 667	549 542	22 24	48[illegible]	[redacted]	[redacted]	192 188	[redacted]	9:25	R.C.
	[redacted]	747	1626	[redacted]	205	1602	[redacted]	[redacted]	9:34	R.C.
	1408	744	1628	200	207	1597	[redacted]	[redacted]	9:38	R.C.
269	664 661	537 541	31 25	489	[redacted]	189 198	[redacted]	[redacted]	9:40	R.C.
	1410	749	1633	[redacted]	208	1608	[redacted]	[redacted]	9:55	R.C.
	1406	752	1622	200	207	1602	[redacted]	[redacted]	9:56	R.C.
261	654 651	545 554	20 25	488	[redacted]	196 195	[redacted]	[redacted]	9:58	R.C.
	1409	758	1629	[redacted]	202	1604	[redacted]	[redacted]	10:16	R.C.
	1408	759	1631	243	199	1605	[redacted]	[redacted]	10:18	C.M.
272	649 649	560 548	26 29	515	[redacted]	197 203	[redacted]	[redacted]	10:23	C.M.
	1402	753	1634	[redacted]	205	1605	[redacted]	[redacted]	10:33	C.M.
	1399	751	1624	223	200	1600	[redacted]	[redacted]	10:35	C.M.
262	648 642	551 544	24 24	485	[redacted]	201 209	[redacted]	[redacted]	10:37	R.C.
	1396	754	1629	[redacted]	210	1605	[redacted]	[redacted]	10:48	R.C.
	1401	755	1624	223	189	1602	[redacted]	[redacted]	10:52	[redacted]
265	646 651	556 551	22 24	488	[redacted]	201 199	[redacted]	[redacted]	10:55	[redacted]
	1402	751	1625	[redacted]	[redacted]	1601	[redacted]	[redacted]	[redacted]	C.M.
	1398	758	1628	229	[redacted]	1598	[redacted]	[redacted]	[redacted]	[redacted]
260	640 661	554 546	30 29	489	[redacted]	206 196	[redacted]	[redacted]	[redacted]	[redacted]
	1412	75[illegible]	1637	[redacted]	205	1608	[redacted]	[redacted]	[redacted]	[redacted]
2888	15010	12,204	760	4045	1675	10	[redacted]	[redacted]	[redacted]	[redacted]

CHARGING SHEET

DATE 2-5-88 SHIFT 1st LINE I CHARGER R.C. C.M.

	COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1.		1399	758	1637	225	202	1617		11:25	C.M.
2.	264	641 644	556 561	20 24	489		218 196		11:29	C.M.
3.		1405	761	1625		200	1601		11:41	C.M.
4.		1412	768	1630	225	201	1606		11:43	C.M.
5.	261	644 660	567 552	24 25	496		186 205		11:45	C.M.
6.		1405	745	1635		193	1610		11:54	C.M.
7.		1407	755	1629	226	198	1600		11:59	C.M.
8.	260	652 657	557 550	29 17	486		193 204		12:03	R.C.
9.		1407	750	1628		200	1611		12:17	R.C.
0.		1400	752	1625	229	199	1602		12:19	R.C.
1.	260	648 649	553 552	23 22	489		202 202		12:22	R.C.
2.		1401	752	1625		200	1603		12:27	R.C.
3.		1401	751	1625	226	200	1601		12:30	R.C.
4.	269	658 648	551 552	24 28	489		206 198		12:35	R.C.
5.		1400	752	1626		200	1598		12:45	R.C.
6.		1397	750	1623	214	198	1601		12:49	C.M.
7.	280	647 640	552 563	22 15	494		204 205		12:52	C.M.
8.		1404	764	1624		201	1609		1:04	C.M.
9.		1406	753	1654	239	202	1602		1:06	C.M.
0.	260	653 643	551 552	52 24	499		196 208		1:10	C.M.
1.		1400	757	1632		205	1608		1:21	C.M.
22.		1398	778	1638	247	193	1622		1:25	C.M.
3.	270	620 658	585 562	16 17	517		224 197		1:28	C.M.
24.		1420	762	1634		200	1617		1:38	C.M.
5.		1398	749	1629	226	201	1606		1:40	R.C.
26.	261	649 635	548 564	27 25	487		208 196		1:45	R.C.
27.		1401	766	1622		202	1597		1:55	R.C.
28.		1416	756	1627	216	210	1609		1:58	R.C.
29.	270	660 651	546 542	28 23	486		193 205		2:00	R.C.
30.		1402	751	1630		209	1607		2:[illegible]	R.C.
31.		1402	751	1630	228	201	1607		2:11	CM
32.	261	651 649	550 552	23 27	489		205 200		2:18	CM
33.		1401	752	1628		200	1601		2:25	CM
34.	2,916	1400	760	1629	[illegible]	205	1600		[illegible]	[illegible]
		14,894	6,665	55,127	2,954	2,495	16,426		197,4[illegible]	

PRINTING CO.

CHARGING SHEET

DATE 2-5-88 SHIFT I st LINE I CHARGER R.C. C.M.

	COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1	264	646	551	20	490		207		2:35	C.M.
2.		1400	754	1627	226	203	1607		2:50	R.C.
3.		1410	762	1623	229	200	1606		2:53	R.C.
4.	260	648 647	562 546	17 20	499		196 191		2:58	R.C.
5.		1397	750	1628		204	1608		3:09	R.C.
6.		1400	759	1627	210	202	1601		3:13	C.M.
7.	289	641 676	557 536	26 25	499		201 177		3:15	C.M.
8.		1422	746	1624		210	1599		3:23	C.M.
9.		1414	764	1635	224	199	1603		3:26	C.M.
10.	268	650 660	565 540	32 52	492		189 202		3:30	C.M.
11.		1401	741	1661		201	1609		3:45	C.M.
12.		1400	751	1638	217	220	1600		3:47	C.M.
13.	270	649 648	551 537	38 35	487		220 201		3:49	C.M.
14.		1410	762	1642		225	1617			C.M.
15.		1415	750	1647		204	1602			C.M.
16.		665	546	45			187			
17.										
18.										
19.										
20.										
21.					5					
22.										
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										
31.										
32.										
33.										
34.	1351	6530	5491	310	1106	2048	1963			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-5-88 SHIFT 2nd LINE 1 CHARGER

COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1.	1415	750	1647	230	204	1602		4:10	
2.	665 651	546 546	43 17	488		187 202		4:17	EW
3.	1401	750	1620		204	1603		4:25	EW
4.	1397	750	1631	221	209	1602		4:29	EW
5.	647 658	541 546	29 26	488		205 194		4:33	EW
6.	1406	748	1626		202	1600		4:42	EW
7.	1401	750	1625	230	213	1602		4:46	EW
8.	651 656	537 553	23 27	487		201 194		4:51	EW
9.	1410	754	1631		201	1604		4:57	EW
0.	1405	746	1625	224	208	1608		5:03	KM
11. 269	659 644	538 554	17 26	493		203 202		5:08	KM
2.	1403	759	1625		205	1605		5:15	KM
13.	1405	750	1636	213	207	1610		5:19	KM
4. 267	653 660	543 552	26 29	480		205 189		5:27	KM
15.	1417	756	1627		204	1606		5:33	KM
6.	1402	760	1626	227	203	1599		5:40	KM
17. 267	642 654	557 548	27 35	494		197 196		5:44	KM
18.	1405	751	1636		203	1601		5:55	KM
19.	1408	767	1630	198	209	1602		5:58	KM
20. 284	641 671	558 535	28 26	482		194 186		6:02	KM
21.	1419	748	1625		213	1599		6:10	EW
22.	1400	752	1625	229	204	1607		6:14	EW
23. 261	648 648	548 543	18 22	490		207 204		6:17	EW
24.	1400	752	1626		209	1604		6:28	EW
25.	1400	751	1629	223	201	1601		6:35	EW
26. 265	649 653	550 543	28 28	488		201 191		6:40	EW
27.	1407	754	1626		211	1598		6:47	EW
28.	1409	751	1624	221	203	1605		6:49	EW
29. 264	658 650	548 555	19 24	485		196 198		6:56	EW
30.	1404	754	1626		199	1602		7:00	EW
31.	1403	750	1633	209	204	1602		7:04	KM
32. 275	653 649	546 552	25 25	484		199 198		7:08	KM
33.	1402	753	1629		201	1600		7:11	KM
34.	1401	750	1632	115	202	1604		7:16	KM
2,934	65	15,014 548	12,587 28	884 2,425	4,713	203	4,546		

COPY-IT PRINTING CO. 1000

Marsman
Edward

CHARGING SHEET

DATE 2-5-88 SHIFT 2nd LINE 1 CHARGER

	COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1.	258	655	541	22	487		194		7:22	KM
2.		1408	753	1624	229	212	1602		7:34	KM
3.		1404	754	1634	221	208	1604		7:36	KM
4.	260	650 661	546 545	30 32	481		200 190		7:40	KM
5.		1409	748	1631		203	1599		7:55	KM
6.		1416	757	1610	222	200	1601		7:57	KM
7.	265	659 664	557 538	39 25	487		185 187		8:05	EW
8.		1412	748	1626		210	1599		8:12	EW
9.		1398	748	1630	221	206	1604		8:19	EW
10.	267	650 654	542 539	26 27	488		206 195		8:22	EW
11.		1403	749	1625		210	1598		8:34	EW
12.		1401	750	1625	231	207	1603		8:37	EW
13.	258	651 646	543 551	22 19	489		202 205		8:42	EW
14.		1400	754	1624		203	1605		8:54	EW
15.		1402	752	1624	215	210	1607		8:57	EW
16.	268	650 657	542 542	17 24	483		205 194		9:01	EW
17.		1406	749	1624		207	1600		9:22	KM
18.		1394	815	1630	211	208	1604		9:25	KM
19.	281	579 658	607 543	26 23	492		210 196		9:30	KM
20.		1409	751	1628		211	1605		9:35	KM
21.		1413	753	1629	226	209	1613		9:40	KM
22.	260	660 653	544 555	16 28	486		200 181		9:43	KM
23.		1416	763	1625		208	1597		9:47	KM
24.		1405	783	1625	239	213	1601		9:52	KM
25.	269	622 637	570 551	24 21	508		196 201		9:56	KM
26.		1403	766	1625		215	1604		10:09	KM
27.		1405	750	1622	218	202	1602		10:11	EW
28.	266	655 645	548 541	20 17	484		197 213		10:15	EW
29.		1401	756	1631		215	1614		10:28	EW
30.		1409	758	1623	222	208	1605		10:31	EW
31.	265	651 651	550 528	18 21	487		196 204		10:40	EW
32.		1399	748	1624		220	1603		10:48	EW
33.		1400	746	1622	223	205	1599		10:50	EW
34.	263	654	541	23	486		199			EW
	3,180	14,262	12,024	520	12,678	4,590	4,356			

COPY-IT PRINTING CO. 100

Edward

CHARGING SHEET

DATE 2-5-88 SHIFT 2nd LINE 1 CHARGER

COKE	658 DUQ.	548 TRAP	20 LIME	SPL	STEEL	198 TENN	OTHER	TIME	COMMENTS
1.	1406	748	1624		203	1604		11:07	EW
2.	1404	763	1627	219	205	1607		11:09	KM
3. 261	641 649	558 548	20 26	480		203 198		11:11	KM
4.	1404	755	1628		207	1602		11:26	KM
5.	1399	756	1625	193	207	1601		11:28	KM
6. 289	648 648	549 549	24 23	482		202 201		11:30	KM
7.	1400	752	1624		203	1601		11:44	KM
8.	1403	751	1626	209	219	1603		11:46	KM
9. 274	652	532	23	483		200		11:48	KM
0.									
11.									
2.									
13.									
4.									
15.									
6.				3					
17.									
8.									
19.									
20.									
21.									
22.									
23.									
24.									
25.									
26.									
27.									
28.									
29.									
30.									
31.									
32.									
33.									
34. 824	3891	3284	136	621	1244	1202			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-5-88 SHIFT 3rd LINE 1 CHARGER W. M

COKE	DUQ. 647	TRAP 558	LIME 16	SPL	STEEL	TENN 207	OTHER	TIME	COMMENTS
1.	1406	759	1629		201	1613		12:05	
2.	1400	750	1627	232	204	1605		12:10	
3. 260	650 649	546 546	22 21	492		205 204		12:12	
4.	1400	751	1625		205	1604		12:24	
5. 262	1404	750	1628		202	1604		12:33	
6. 487	654 651	548 550	24 28	225		200 199		12:37	
7.	1401	750	1628		200	1600		12:41	
8. 264	1401	749	1629		204	1603		12:46	
9. 489	652 636	545 562	26 35	225		203 196		12:50	
0.	1402	766	1631		204	1598		12:55	
11. 262	1412	755	1628		201	1606		1:00	
2. 485	657 649	553 552	22 18	223		194 200		1:05	
13.	850	1602	1620		201	1050		1:15	
14. 278	850	1603	1631		213	1051		1:17	
15. 498	637 634	548 555	28 20	220		201 195		1:21	
16.	855	1605	1625		201	1050		1:28	
17.	850	1607	1628	225	204	1052		1:31	
18. 260	646 639	555 545	21 21	485		202 202		1:33	
19.	852	1599	1620		213	1054		1:44	
20.	853	1602	1627	214	207	1051		1:46	
21. 272	646 655	551 542	25 20	486		198 199		1:49	
22.	859	1600	1620		204	1058		2:01	
23. 257	857	1601	1630		217	1055		2:04	
24. 487	640 644	546 549	29 18	230		198 201		2:06	
25.	849	1607	1625		205	1050		2:16	
26.	854	1601	1626	224	199	1051		2:19	
27. 264	655 653	550 556	25 18	488		197 194		2:21	
28.	857	1607	1625		204	1051		2:34	
29.	850	1600	1624	228	204	1054		2:36	
30. 260	646 644	546 549	24 31	488		204 203		2:39	
31.	852	1600	1621		206	1055		2:50	
32.	853	1600	1629	225	206	1053		2:54	
33. 260	647	547	24	485		200		2:54	
34. 2899	14,253	12,093	521	11 2,471	4,505	4402			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-5-88 SHIFT 3rd LINE T CHARGER W. M

COKE	DUQ. 641	TRAP 551	LIME 30	SPL.	STEEL	TENN 200	OTHER	TIME	COMMENTS
1.	850	1601	1631		209	1050		3:07	
2.	852	1600	1627	260	201	1053		3:12	
3. 230	651 650	547 559	27 19	490		201 200		3:16	
4.	852	1611	1630		202	1052		3:26	
5. 263	854	1603	1624		205	1050		3:28	
6. 489	649 654	553 547	21 24	226		196 195		3:34	
7.	858	1600	1624		204	1053		3:45	
8.	853	1601	1622	218	203	1053		3:47	
9. 268	650 661	548 549	21 20	486		200 193		3:51	
0.	861	1603	1623		200	1054		4:03	
11.	850	1602	1624	227	207	1049		4:05	
2. 261	643 647	553 551	22 24	~~486~~		199 195		4:08	
13.	855	1601	1625		204	1050		4:25	
4. 267	850	1606	1626	~~267~~	205	1050		4:28	
15. 493	645 650	556 548	20 27	226		200 201		4:33	
6.	852	1601	1628		202	1053		4:40	
17.	858	1600	1630	228	204	1052		4:42	
8. 261	649 649	548 550	30 25	489		194 199		4:44	
19.	851	1600	1625		202	1050		4:50	
20. 263	870	1610	1631		216	1060		4:52	
21. 488	654 649	550 543	11 15	225		190 209		4:55	
22.	853	1605	1620		204	1062		5:08	
23.	869	1600	1623	230	206	1057		5:10	
24. 260	663 648	549 541	23 24	490		182 210		5:13	
25.	850	1601	1625		202	1060		5:26	
26.	852	1600	1628	220	203	1050		5:28	
27. 269	649 646	550 550	28 24	489		198 200		5:31	
28.	850	1600	1624		204	1050		5:45	
29. 260	854	1602	1627		200	1050		5:47	
30. 485	654 648	552 554	25 25	225		196 206		5:50	
31.	851	1605	1630		203	1051		6:06	
32.	852	1601	1623	226	208	1050		6:08	
33. 260	645	542	22	486		196		6:10	
34. 2862	14,295	12091	507	112 2511	4503	4354			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-5-88 SHIFT 3rd LINE I CHARGER [illegible]

COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
	650	550	26			198			
1.	855	1603	1624		205	1053		6:23	
2.	852	1601	1626	220	210	1050		6:25	
3. 269	642	551	25	499		198		6:27	
4.	850	1600	1625		204	1053		6:40	
5.	646	547	25			203			
6.				1.5					
7.									
8.									
9.									
0.									
11.									
2.									
13.									
4.									
15.									
6.									
17.									
8.									
19.									
20.									
21.									
22.									
23.									
24.									
25.									
26.									
27.									
28.									
29.									
30.									
31.									
32.									
33.									
34. 269	1938	1648	71	220	619	599			

COPY-IT PRINTING CO. 1000

PRODUCTION REPORT

LINE: 11

DATE: 1-5-88

FOREMAN DON

Charge	lbs.
Coke	260
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky SPC	225

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
8-9		294	196		
9-10	908	294	245		
10-11	2	294	245		
11-12	1816	294	245		
12-1		294	245		
1-2		294	196		
2-3		294	196		
3-4		294	245		
Total----------		2352	1813	✓	

Comments:

Tap Out 15 min

Chain on conveyor change off plus tap out 13 min

Tap out 5 min

T

FOREMAN JACK

Charge	lbs.
Coke	260
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
Ky SPC	225

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
4-5		294	245		
5-6		294	245		
6-7	971	294	196		
7-8	2	294	245		
8-9	1942	294	245		
9-10		294	245		
10-11		294	245		
11-12		294	245		
Total----------		2352	1911	✓	

Comments:

Tap out 5 mins

Tap out 10 mins

Tap out 7 mins

Tap out 5 mins

FOREMAN Rabbit

Charge	lbs
Coke	260
Dug	1300
Trap	1100
Lime	50
Steel	400
Tenn	400
St. Louis	
S.P.L.	225

Bags per Hour

Shift	Product	Plan	29 lb	other	Var.
12-1		294	196		
1-2		294	294		
2-3	883	294	245		
3-4	x 2	294	245		
4-5	1766	294	196		
5-6		294	294		
6-7		294	147		
7-8		294	147		
Total----------		2352	1764	✓	

Comments:

Tapout 10 min

Bagger stop up 12 min

Bagger stop up 18 min

Clean out Notch & head 25 min

OFF Line 7:35

COPY-IT COPY CENTER 500

CHARGING SHEET

DATE | SHIFT 1ST | LINE II | CHARGER R.C.

COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1 261	670	554	25	225		184		8:02	C.M.
2.	1424	754	1633		200	1608		8:13	C.M.
3.	1408	744	1863	203	217	1621		8:15	C.M
4. 285	664 652	527 545	42 21	488		213 200		8:17	C.M.
5.	1403	751	1624		206	1603		8:28	C.M.
6.	1411	753	1625	228	202	1604		8:31	C.M.
7. 263	658 650	551 554	21 29	491		193 194		8:33	C.M
8.	1404	754	1627		200	1598		8:44	C.M.
9.	1419	776	1625	225	207	1600		8:46	C.M.
0. 260	643 631	549 553	25 38	485		181 187		8:48	C.M.
1.	1424	753	1649		198	1611		9:00	C.M.
2.	1399	755	1645	225	212	1622		9:02	CM
3. 260	644 647	543 548	23 36	485		223 191		9:06	R.C.
4.	1406	759	1633		211	1597		9:17	R.C.
5.	1401	761	1623	225	202	1596		9:19	R.C.
6. 262	640 641	559 552	27 31	487		195 195		9:23	R.C.
7.	1402	761	1628		209	1597		9:33	R.C.
8.	1405	757	1625	228	200	1596		9:35	R.C.
9. 260	648 639	557 556	29 35	488		191 204		9:38	R.C.
20.	1396	757	1625		201	1600		9:46	R.C.
21.	1409	754	1632	227	199	1605		9:47	R.C.
22. 264	655 654	555 542	27 29	491		196 198		9:50	R.C.
23.	1406	752	1627		210	1598		10:00	R.C.
24.	1408	757	1627	212	201	1608		10:03	C.M.
25. 281	651 640	556 556	19 31	493		200 203		10:05	CM
26.	1396	756	1630		200	1599		10:17	CM
27.	1402	749	1621	231	206	1610		10:21	CM
28. 262	653 651	543 547	21 38	493		198 212		10:25	CM
29.	1403	752	1653		205	1615		10:33	C.M.
30.	1420	758	1628	226	195	1606		10:35	C.M.
31. 263	642 642	563 547	22 15	489		186 204		10:38	R.C.
32.	1394	752	1625		205	1616		10:48	R.C.
33.	1407	758	1628	227	201	1603		10:50	R.C.
34 264	649	557	25	491		194		10:55	R.C.
3,185	14,284	12,136	599	2,457	4,987	4,370			

CHARGING SHEET

DATE 2-5-88 SHIFT 1st LINE II CHARGER C.M. R.C.

COKE	649 DUQ.	552 TRAP	26 LIME	SPL	STEEL	200 TENN	OTHER	TIME	COMMENTS
1.	1401	752	1627		200	1601		11:05	R.C.
2.	1400	751	1628	224	200	1600		11:07	C.M.
3. 265	649 645	551 558	28 19	489		200 203		11:10	C.M.
4.	1406	761	1628		203	1609		11:22	C.M.
5.	1400	759	1636	229	205	1603		11:23	C.M.
6. 260	641 647	554 547	33 25	489		203 206		11:28	C.M.
7.	1397	750	1628		203	1603		11:37	C.M.
8.	1398	754	1625	225	260	1602		11:39	C.M.
9. 262	644 657	554 550	23 25	447		204 193		11:42	C.M.
0.	1407	750	1625		200	1600		11:55	C.M.
11.	1403	758	1633	220	197	1609		11:57	C.M.
2. 262	645 645	561 557	24 26	482		206 206		12:02	RC
13.	1403	758	1625		201	1609		12:14	RC
4.	1402	750	1624	218	200	1600		12:16	RC
15. 278	652 652	550 550	27 23	499		198 198		12:18	RC
6.	1402	750	1624		200	1601		12:30	R.C.
17.	1401	750	1625	224	200	1605		12:31	R.C.
8. 269	651 637	550 558	20 25	493		204 204		12:34	R.C.
19.	1395	758	1624		200	1599		12:45	R.C.
0.	1397	747	1625	217	200	1600		12:46	RC.
21. 266	650 657	547 546	25 15	483		203 201		12:51	C.M.
2.	1407	750	1623		204	1608		1:03	C.M.
23.	1400	758	1655	234	200	1636		1:04	C.M.
4. 262	642 653	556 549	19 37	496		236 199		1:09	C.M.
25.	1406	753	1642		204	1605		1:20	C.M.
6.	1406	749	1635	211	209	1618		1:22	C.M.
27. 280	657 654	540 547	17 31	491		212 204		1:26	C.M.
28.	1403	749	1638		202	1607		1:33	C.M.
29.	1421	757	1634	231	211	1610		1:36	R.C.
30. 263	664 660	546 553	24 16	494		189 183		1:38	R.C.
31.	1423	763	1622		210	1606		1:49	R.C.
32.	1403	758	1621	222	206	1602		1:50	R.C.
33. 263	645 661	552 537	19 23	485		199 207		1:57	R.C.
34.	1405	744	1635	165	210	1612		2:03	R.C.
2923	14,957	12,664	537	2455	4,665	4659			

COPYCIT PRINTING CO. 1000

CHARGING SHEET

DATE 2-5-88 SHIFT 1st LINE H CHARGER R.C / C.M

COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1.	1405	752	1628	226	200	1601		2:04	C.M.
2. 261	653 653	552 552	27 27	487		196 196		2:06	C.M.
3.	1405	752	1628		200	1601		2:19	C.M.
4.	1401	751	1629	223	200	1602		2:21	C.M.
5. 263	650 654	551 551	27 27	486		201 194		2:22	C.M.
6.	1407	753	1628		202	1601		2:30	C.M.
7.	1414	751	1634	230	202	1602		2:32	C.M.
8. 260	663 649	549 551	32 20	490		188 207		2:37	C.M.
9.	1400	751	1627		200	1607		2:45	R.C.
0.	1378	743	1624	224	204	1605		2:48	R.C.
11. 260	635 638	539 556	19 26	484		227 203		2:50	R.C.
2.	1397	759	1626		209	1600		3:05	R.C.
13.	1408	751	1638	222	200	1609		3:07	R.C.
4. 264	657 648	554 564	29 31	486		201 189		3:08	R.C.
15.	1412	764	1632		200	1601		3:23	C.M.
6.	1400	749	1624	217	208	1600		3:25	T.T.
17. 275	661 661	549 545	24 46	492		206 197		3:28	C.M.
8.	1407	746	1650		201	1604		3:38	C.M.
19.	1398	763	1675	227	205	1636		3:39	C.M.
20. 268	635 649	558 550	39 24	495		238 202		3:40	C.M.
21.	1399	750	1625		200	1601		3:54	C.M.
22.	1402	752	1648	234	203	1609		3:55	C.M.
23. 263	650 678	549 539	39 33	497		207 179		3:57	C.M.
24.	1423	745	1635		206	1602			C.M.
25.									
26.				8					
27.									
28.									
29.									
30.									
31.									
32.									
33.									
34.									
2,114	10,434	8,800	470	1,803	3,232	3,225			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

Edward

DATE 2-5-88 SHIFT 2nd LINE 2 CHARGER

COKE	DUQ.	TRAP	LIME	SPh	STEEL	TENN	OTHER	TIME	COMMENTS
1.	1399	748	1627	220	203	1603		4:13	EW
2.	651 655	545 550	24 49	484		204 202		4:15	EW
3.	1406	751	1657		201	1608		4:25	EW
4.	1408	750	1623	233	210	1603		4:26	EW
5. 258	658 650	540 544	20 27	491		195 205		4:31	EW
6.	1398	748	1630		204	1603		4:42	EW
7.	1400	749	1626	229	204	1605		4:43	EW
8. 261	651 652	545 550	21 24	490		205 198		4:49	EW
9.	1403	751	1625		201	1601		4:55	EW
10.	1411	751	1626	221	208	1609		5:00	EW
11. 271	661 666	543 547	27 27	492		198 187		5:06	KM
12.	1420	754	1634		207	1607		5:15	KM
13.	1404	751	1631	232	199	1611		5:23	KM
14. 263	653 651	552 550	20 25	495		207 208		5:25	KM
15.	1400	749	1633		199	1608		5:33	KM
16.	1406	750	1633	216	200	1603		5:36	KM
17. 268	656 683	550 554	30 35	484		197 163		5:42	KM
18.	1437	754	1635		200	1600		5:48	KM
19.	1406	754	1628	187	206	1600		5:51	KM
20. 297	652 645	548 544	28 27	484		194 200		5:59	KM
21.	1398	753	1625		209	1598		6:05	EW
22.	1401	750	1624	212	207	1606		6:07	EW
23. 271	651 657	543 543	18 24	483		205 196		6:15	EW
24.	1404	747	1624		204	1600		6:20	EW
25.	1406	750	1629	221	203	1599		6:25	EW
26. 264	656 662	547 538	30 29	485		193 187		6:27	EW
27.	1414	752	1630		214	1601		6:30	EW
28.	1403	752	1625	221	209	1605		6:33	EW
29. 263	651 650	543 538	20 23	484		202 195		6:39	EW
30.	1404	754	1622		216	1599		6:45	EW
31.	1399	754	1687	222	207	1602		6:52	EW
32. 263	645 643	542 543	85 28	485		203 204		6:54	EW
33.	1400	757	1632		208	1604		7:07	EW
34. 2,943	1399	764	1632	115	229	1601	4550	7:09	
	15,034 635	635	12,545 31	662	2,414	4,748	202		

COPY-IT PRINTING CO. 3005

CHARGING SHEET

Tim Edwards

DATE 2-5-88 SHIFT 2nd LINE 2 CHARGER

COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1. 267	1659	547	47	487		193		7:13	KM
2. [redacted]	1407	748	1647	220	201	1600		7:19	KM
3. [redacted]	1403	752	1630	229	207	1607		7:21	KM
4. 259	651 648	545 550	23 25	488		204 204		7:23	KM
5. [redacted]	1398	750	1627		200	1602		7:29	KM
6. [redacted]	1403	755	1630	175	202	1608		7:31	KM
7. 314	648 655	553 537	22 28	489		205 183		7:33	KM
8.	1414	759	1625		222	1597		7:55	KM
9.	1398	758	1624	218	210	1599		8:00	KM
10. 268	640 646	548 544	25 27	486		201 198		8:03	EW
11.	1398	752	1623		208	1596		8:11	EW
12.	1401	758	1628	228	210	1602		8:15	EW
13. 260	643 630	548 533	26 20	488		204 205		8:20	EW
14.	1403	753	1628		220	1608		8:33	EW
15.	1407	748	1624	226	208	1616		8:34	EW
16. 360	659 646	540 557	8 28	586		209 199		8:40	EW
17.	1400	760	1627		203	1599		8:53	EW
18.	1404	796	1628	222	201	1602		8:55	EW
19. 366	608 659	595 548	26 29	588		198 194		9:00	EW
20.	1407	750	1630		202	1601		9:18	KM
21.	1410	752	1624	152	213	1598		9:27	KM
22. 358	658 637	539 540	26 26	510		188 210		9:29	KM
23.	1409	752	1645		212	1619		9:33	KM
24.	1404	756	1635	225	209	1611		9:37	KM
25. 264	648 642	547 547	24 23	489		207 208		9:41	KM
26.	1400	758	1631		211	1608		9:46	KM
27.	1404	752	1625	226	201	1607		9:50	KM
28. 263	652 659	551 536	28 25	489		203 192		9:55	KM
29.	1412	753	1629	221	217	1604		10:09	KM
30. 262	652	540	30	483		199		10:13	EW
31.	1401	749	1630		209	1608		10:21	EW
32.	1414	763	1624	222	211	1609		10:24	EW
33. 264	651 626	552 574	15 27	486		195 191		10:26	EW
34.	1410	734	1628	11	210	1601		10:32	EW
3505	14,252	12,071	548	2,564	4587	4387			

COPY-IT PRINTING CO. 100

Wilson
Edward

CHARGING SHEET

DATE 2-5-88 SHIFT 2nd LINE 2 CHARGER

COKE	DUQ.	TRAP	LIME	SPL	STEEL	TENN	OTHER	TIME	COMMENTS
1.	1405	745	1625	222	207	1598		10:36	EW
2. 263	669 634	538 543	27 25	485		193 199		10:39	EW
3.	1403	749	1627		206	1602		10:53	EW
4.	1398	748	1627	217	205	1608		10:55	EW
5. 270	650 665	543 542	19 24	487		210 191		10:57	EW
6.	1411	746	1626		204	1602		11:14	EW
7.	1411	771	1625	225	203	1608		11:15	KM
8. 272	640 647	568 540	17 28	497		197 201		11:17	KM
9.	1401	754	1630		214	1602		11:37	KM
0.	1411	752	1638	205	206	1604		11:38	KM
11. 278	659	546	34	483		193		11:40	KM
2.									
13.									
4.									
15.				3.5					
6.									
17.									
8.									
19.									
20.									
21.									
22.									
23.									
24.									
25.									
26.									
27.									
28.									
29.									
30.									
31.									
32.									
33.									
34. 1083	4,575	3820	174	869	1,445	1,384			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-5-88 SHIFT 3rd LINE 2 CHARGER W. M

	COKE	650 DUQ.	546 TRAP	24 LIME	SPL	STEEL	198 TENN	OTHER	TIME	COMMENTS
1.		1402	752	1624		206	1600		12:00	
2.		1400	755	1638	229	210	1617		12:02	
3.	300	695 666	545 539	21 0	529		217 209		12:04	
4.		1416	750	1625		211	1625		12:20	
5.		1402	751	1628	225	204	1601		12:29	
6.	260	651 651	547 545	27 30	485		199 201		12:35	
7.		1399	748	1630		203	1600		12:39	
8.		1412	750	1625	225	204	1600		12:43	
9.	260	662 641	546 554	25 18	485		188 208		12:48	
10.		1400	759	1626		205	1608		12:52	
11.		1407	758	1630	230	203	1601		12:57	
12.	260	649 649	555 550	29 20	490		194 201		1:02	
13.		849	1600	1620		200	1050		1:15	
14.		853	1602	1624	234	203	1053		1:19	
15.	261	650 630	549 550	22 21	495		200 203		1:24	
16.		850	1603	1624		220	1053		1:31	
17.		851	1610	1630		201	1067		1:35	
18.	260	651 646	549 554	20 21	497		216 195		1:38	
19.		857	1606	1627	237	211	1052		1:49	
20.		849	1610	1628		206	1058		1:51	
21.	264	643 653	552 558	18 16	486		209 196		1:56	
22.		856	1610	1626	222	203	1052		2:10	
23.		850	1604	1624		204	1052		2:12	
24.	260	646 650	552 558	20 15	485		202 200		2:14	
25.		850	1608	1623	225	200	1050		2:26	
26.		851	1600	1625		210	1050		2:29	
27.	264	641 654	550 553	25 21	483		199 200		2:31	
28.		853	1606	1627	219	199	1053		2:45	
29.		851	1600	1627		204	1053		2:47	
30.	262	649 647	543 544	29 25	486		202 206		2:48	
31.		851	1601	1626	224	204	1057		3:05	
32.		857	1602	1624	220	200	1051		3:07	
33.	268	657	551	22	488		194		3:09	
34.	2919	14,279	12,084	469	11,[illegible]	4511				
					2490		4437			

COPY-IT PRINTING CO. 1000

CHARGING SHEET

DATE 2-5-88 SHIFT 3rd LINE II CHARGER W. M

COKE	DUQ.	TRAP	LIME		STEEL	TENN	OTHER	TIME	COMMENTS
	648	553	16			209			
1.	851	1613	1629		203	1060		3:26	
2.	850	1605	1623	225	204	1053		3:30	
3. 265	646 649	552 554	18 21	490		209 193		3:32	
4.	858	1605	1626		209	1051		3:45	
5.	858	1606	1628		212	1049		3:49	
6. 266	646 643	557 549	22 21	483		191 205		3:54	
7.	850	1604	1625	217	207	1055		4:08	
8.	870	1600	1628		215	1054		4:10	
9. 260	655 657	546 560	28 15	485		184 193		4:15	
10.	857	1610	1625	225	200	1050		4:25	
11.	858	1608	1629		205	1050		4:31	
12. 260	653 648	558 551	21 28	487		192 196		4:38	
13.	853	1600	1628	227	205	1049		4:45	
14.	856	1612	1631		204	1050		4:48	
15. 265	652 653	562 557	19 20	490		194 197		4:50	
16.	854	1605	1625	225	201	1051		5:00	
17.	850	1600	1624		208	1052		5:02	
18. 264	642 647	548 551	24 28	484		202 198		5:05	
19.	851	1600	1628	220	204	1049		5:16	
20.	857	1600	1630		204	1050		5:18	
21. 271	653 646	550 560	30 18	483		193 199		5:20	
22.	851	1610	1628	218	205	1050		5:32	
23.	857	1601	1626		200	1058		5:34	
24. 261	657 648	543 558	25 15	486		201 198		5:37	
25.	853	1609	1624	225	205	1051		6:50	
26.	858	1600	1627		201	1053		6:52	
27. 265	657 654	547 549	27 24	491		195 197		6:55	
28.	854	1600	1624	224	200	1051		6:27	
29.	850	1601	1628		205	1050		6:29	
30. 260	645	551	27	485		200			
31.				225					
32.					10				
33.									
34. 2637	12,999	11,053	447	2225	4,097	3940			

COPY-IT PRINTING CO. 1000

APPENDIX C

Calibrations

a. Visual Emissions Certificate
b. Sampling Consoles
c. Pitots
d. Thermocouples
e. Nozzles

C-1

TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
CUSTOMS HOUSE
701 BROADWAY
NASHVILLE, TENNESSEE 37219-5403

NOV 10 1987

Nancy Frerichs
Aluminum Co. of America
Hall Road P.O. Box 9128
Alcoa, TN 37701

RE: Certificate Number 1130

Dear Ms. Frerichs:

Enclosed you will find your certification card and certificate for successfully completing the October 20-22, 1987 Visible Emissions Evaluation School held in Knoxville, Tennessee. In order to be certified as a qualified Visible Emissions Evaluator for all the methods approved by the Tennessee Air Pollution Control Board, one must meet an intensive array of criteria.

The individual reading criteria is as follows:

1. EPA Method 9 (6 Minute Average) requires a deviation of less than 7.5 on white and black smoke, and that the reader miss no reading by more than 15% opacity.

2. Tennessee Visible Emissions Evaluation Method 1 (Roads and Parking Areas) requires a worst-two-minute deviation of 8.8 or less.

3. TVEE Method 2 (Aggregate or Time Count) has the same criteria requirements as EPA Method 9.

4. TVEE Method 3 (Zero Percent Opacity) requires that the value assigned to a zero reading during a certification run shall not exceed 10% opacity, nor shall the combination of other zero readings exceed 10% opacity (i.e. two readings of five percent opacity).

5. TVEE Method 4 (Fugitive Dust Emissions from Non-Stack Emission Points) has the same criteria requirements as EPA Method 9.

Based on these criteria you are certified by the State of Tennessee to read EPA Method 9, and TVEE Methods 1, 2, 3, and 4.

This certification is valid until April 21, 1988.

You must complete the requirements for recertification prior to this expiration date to retain your status as a qualified Visible Emissions Evaluator.

It was a pleasure having your participation in our Visible Emissions School. The Tennessee Division of Air Pollution Control would welcome any comments, or suggestions you may have concerning the operation of the school. Please forward any comments to the Division at (615)741-3931 or at the above address.

Sincerely yours,

Carl Koontz

Carl Koontz, Instructor
Visible Emissions Evaluation School
Division of Air Pollution Control

Enclosure

Serial # ~~2346~~ ~~2168~~

DRY GAS METER CALIBRATION DATA

Meter box number _____ Used on 4075

Calibrated by JEG/JVM

Date 88-02-01

Run Number

		1	2	3	4	5	
Critical Orifice ID		15/4-2	14/2-2	13/3-2	13/1-2	12/4-2	
Critical Orifice K' factor		0.2860	0.4609	0.5484	0.6256	0.7994	
Dry Gas Meter							
Final reading	ft^3	281.11	284.96	290.50	297.19	303.70	
Initial reading	ft^3	279.20	281.90	286.80	293.00	298.30	
Difference, V_m	ft^3	1.91	3.06	3.7	4.19	5.4	
Inlet/Outlet temperatures							
Initial	°F	83/79	86/80	90/80	96/82	96/82	
Final	°F	84/80	90/80	95/82	98/82	103/83	
Avg. temperature, t_d	°F	82	84	87	90	91	
Time, θ	min/sec	00/00	/	/	/	/	
	min	5:00	→	→	→	→	
Orifice man. rdg. ΔH	in. H_2O	0.45	1.2	1.9	2.3	3.9	
Bar. pressure, P_b	in. Hg	30.32	→	→	→	→	
Ambient temperature, t_i	°F	72	→	→	→	→	
Pump vacuum	in. Hg	22	17	21	21	19.5	
$V_{m(std)}$	ft^3	1.89	3.02	3.63	4.10	5.29	Avg
$V_{cr(std)}$	ft^3	1.88	3.03	3.60	4.11	5.25	
DGM cal. factor, Y		0.99	1.00	0.99	1.00	0.99	1.00 ✓
Orifice factor, ΔHθ		1.76	1.84	~~2.36~~ 2.01	1.91	1.96	1.90 ✓

Fast Cal
ΔHθ = 1.98
t_d = 1.01

$$V_{m(std)} = 17.64\, V_m \frac{(P_b + \Delta H/13.6)}{(t_d + 460)}$$

$$V_{cr(std)} = K' \frac{P_b\ \theta}{\sqrt{t_i + 460}}$$

$$Y = \frac{V_{cr(std)}}{V_{m(std)}}$$

$$\Delta H\theta = \frac{0.0317\ \Delta H}{P_b\ (t_{d_o} + 460)} \cdot \left[\frac{(t_d + 460)\ \theta}{V_m}\right]^2$$

C-2

DRY GAS METER CALIBRATION DATA

Sen H

Meter box number 2168 Calibrated by JEG/JVA Date 98-02-01

Run Number		1	2	3	4	5	
Critical Orifice ID		15/4-2	14/2-2	13/3-2	13/1-2	12/4-2	
Critical Orifice K' factor		0.2860	0.4609	0.5484	0.6256	0.7994	
Dry Gas Meter							
Final reading	ft^3	407.55	413.51	419.55	426.49	433.13	
Initial reading	ft^3	405.52	410.26	415.65	422.07	427.40	
Difference, V_m	ft^3	2.03	3.25	3.90	4.42	5.73	
Inlet/Outlet temperatures							
Initial	°F	90.76	96.77	102.79	107.80	110.81	
Final	°F	91.76	100.78	106.80	110.81	114.83	
Avg. temperature, t_d	°F	83	88	92	95	97	
Time, θ	min/sec	1	1	1	1	1	
	min	5	5				
Orifice man. rdg. ΔH	in. H_2O	0.49	1.35	1.95	2.5	4.25	
Bar. pressure, P_b	in. Hg	30.32					
Ambient temperature, t_i	°F	72					
Pump vacuum	in. Hg	25	~~17~~ 23	20	20	21	
$V_m(std)$	ft^3	2.00	3.18	3.80	4.29	5.56	Avg
$V_{cr}(std)$	ft^3	1.88	3.03	3.60	4.11	5.25	
DGM cal. factor, Y		0.94	~~1.04~~ 0.95	0.95	0.96	0.94	0.95
Orifice factor, ΔHθ		1.71	1.87	1.89	1.91	1.94	1.86

Last Cal
ΔHθ = 1.83
Y_d = 0.96

P-3

$$V_{m(std)} = 17.64\, V_m \frac{(P_b + \Delta H/13.6)}{(t_d + 460)} \qquad V_{cr(std)} = K' \frac{P_b\ \theta}{\sqrt{t_i + 460}}$$

$$Y = \frac{V_{cr(std)}}{V_{m(std)}} \qquad \Delta H\theta = \frac{0.0317\ \Delta H}{P_b\ (t_{d_o} + 460)} \cdot \left[\frac{(t_d + 460)\ \theta}{V_m}\right]^2$$

DRY GAS METER CALIBRATION DATA

Meter box number 882-131 Calibrated by JVA Date 88-02-02

		Run Number 1	2	3	4	5	
		11	21	28	34	43	
Critical Orifice ID		15/4-2	14/2-2	13/3-2	13/1-2	12/4-2	
Critical Orifice K' factor		0.2860	0.4609	0.5484	0.6256	0.7994	
Dry Gas Meter							
Final reading	ft^3	867.52	873.31	877.89	884.26	891.34	
Initial reading	ft^3	865.59	870.15	874.11	880.00	885.80	
Difference, V_m	ft^3	1.93	3.16	3.78	4.26	5.54	
Inlet/Outlet temperatures							
Initial	°F	84/70	95/73	100/76	110/79	120/83	
Final	°F	85/72	99/75	108/78	115/81	127/85	
Avg. temperature, t_d	°F	78	86	91	96	104	
Time, θ	min/sec	00/100	1	1	1	1	
	min	5					
Orifice man. rdg. ΔH	in. H_2O	0.48	1.30	1.9	2.4	4.3	
Bar. pressure, P_b	in. Hg	30.25					
Ambient temperature, t_i	°F	64					
Pump vacuum	in. Hg	25	24	23	22	21	
$V_{m(std)}$	ft^3	1.92	3.10	3.68	4.11	5.30	Avg
$V_{cr(std)}$	ft^3	1.89	3.05	3.62	4.13	5.28	
DGM cal. factor, Y		0.98	0.98	0.98	1.00	0.996	0.99
Orifice factor, ΔH@		1.84	1.90	1.97	1.98	2.15	1.97

Old
Y_d = 1.00
ΔH@ = 1.97

$$V_{m(std)} = 17.64\, V_m \frac{(P_b + \Delta H/13.6)}{(t_d + 460)}$$

$$V_{cr(std)} = K' \frac{P_b\ \theta}{\sqrt{t_i + 460}}$$

$$Y = \frac{V_{cr(std)}}{V_{m(std)}}$$

$$\Delta H@ = \frac{0.0317\ \Delta H}{P_b\ (t_{d_o} + 460)} \cdot \left[\frac{(t_d + 460)\ \theta}{V_m}\right]^2$$

PITOT CALIBRATION
1988 JANUARY 05

PITOT P1

	P_{std}	P_s	C_p
SIDE A	.18	.25	.84
	.18	.25	.84
	.17	.24	.83
		AVG.	.84
SIDE B	.17	.24	.83
	.17	.24	.83
	.18	.25	.84
		AVG.	.835
SIDE A	.43	.60	.84
	.42	.58	.84
	.42	.58	.84
		AVG.	.84
SIDE B	.43	.60	.84
	.43	.60	.84
	.42	.59	.835
		AVG.	.84

PITOT P6

SIDE A	.19	.26	.85
	.18	.25	.84
	.18	.25	.84
		AVG.	.84
SIDE B	.20	.28	.85
	.20	.28	.85
	.20	.29	.83
		AVG.	.84
SIDE A	.41	.58	.84
	.40	.58	.83
	.41	.58	.84
		AVG.	.84
SIDE B	.42	.60	.84
	.41	.60	.83
	.42	.60	.84
		AVG.	.84

P_{std} = Standard Pitot Tube
P_s = S-Type Pitot Tube

C_p = Pitot Tube Coefficient

$$C_p = .99\sqrt{\frac{P_{std}}{P}}$$

TEMPERATURE CALIBRATION

Name Ann D Perrin Date 88-01-28

Barometric Pressure 29.04 Land Elevation

ICE BATH

Extech Pyrometer # 1

Hg in Glass Thermometer Temperature				Corrected Hg in Glass Temperature				Temperature Device Thermocouple Identification No. 1 Temperature			
°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
1		33						1		34	

BOILING WATER BATH

Hg in Glass Temperature				Corrected Temperature				Device Thermocouple No. 1			
°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
100		212						100		212	

MINERAL OIL BATH

Point	Hg in Glass Temperature				Corrected Temperature				Device No.			
	°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
1												
2												
3												
4												

C-7

TEMPERATURE CALIBRATION

Name Jon D. Perry Date 88-01-08

Barometric Pressure 29.04 Land Elevation

ICE BATH

Eutectic pyrometer #1

Hg in Glass Thermometer Temperature				Corrected Hg in Glass Temperature				Temperature Device thermocouple Identification No. 2 Temperature			
°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
1		33						1		34	

BOILING WATER BATH

Hg in Glass Temperature				Corrected Temperature				Device thermocouple No. 2			
°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
100		212						100		212	

MINERAL OIL BATH

Point	Hg in Glass Temperature				Corrected Temperature				Device No.			
	°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
1												
2												
3												
4												

C-8

TEMPERATURE CALIBRATION

Name Gian D Pinnip Date 88-01-28

Barometric Pressure 29.04 Land Elevation

ICE BATH

Extech pyrometer #1

Hg in Glass Thermometer Temperature				Corrected Hg in Glass Temperature				Temperature Device thermocouple Identification No. 3 Temperature			
°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
2		34						1		33	

BOILING WATER BATH

Hg in Glass Temperature				Corrected Temperature				Device thermocouple No. 3			
°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
100		212						100		212	

MINERAL OIL BATH

Point	Hg in Glass Temperature				Corrected Temperature				Device No.			
	°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
1												
2												
3												
4												

TEMPERATURE CALIBRATION

Name Lisa D. Pierce Date 88-01-28

Barometric Pressure 29.04 Land Elevation

ICE BATH

Extech Dynometer #1

Hg in Glass Thermometer Temperature				Corrected Hg in Glass Temperature				Temperature Device Thermocouple Identification No. 4 Temperature			
°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
2		34						2		34	

BOILING WATER BATH

Hg in Glass Temperature				Corrected Temperature				Device Thermocouple No. 4			
°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
100		212						100		212	

MINERAL OIL BATH

Point	Hg in Glass Temperature				Corrected Temperature				Device No.			
	°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
1												
2												
3												
4												

C-10

TEMPERATURE CALIBRATION

Name Lisa D Perry Date 88-01-28

Barometric Pressure 29.04 Land Elevation

ICE BATH

Extech Pyrometer #1

Hg in Glass Thermometer Temperature				Corrected Hg in Glass Temperature				Temperature Device Thermocouple Identification No. 5 Temperature			
°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
2		34						2		35	

BOILING WATER BATH

Hg in Glass Temperature				Corrected Temperature				Device Thermocouple No. 5			
°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
100		212						100		212	

MINERAL OIL BATH

Point	Hg in Glass Temperature				Corrected Temperature				Device No.			
	°C	°K	°F	°R	°C	°K	°F	°R	°C	°K	°F	°R
1												
2												
3												
4												

C-11

ALCOA

ENVIRONMENTAL CONTROL LABORATORY
NOZZLE CALIBRATION DATA

Nozzle # ECL-8A
Plant American Rockwool NC
Sampling Location STACK
Calibrated by JVA

Pre-test		Post-test	
Date	88-02-02	Date	88-02-05
Measurement #1	0.293	Measurement #1	0.294
Measurement #2	0.295	Measurement #2	0.294
Measurement #3	0.294	Measurement #3	0.293
AVERAGE	0.294	AVERAGE	0.294

Nozzle # ECL-8B
Plant Am Rockwool NC
Sampling Location Stack
Calibrated by JVA

Pre-test		Post-test	
Date	88-02-02	Date	88-02-05
Measurement #1	0.293	Measurement #1	0.294
Measurement #2	0.293	Measurement #2	0.294
Measurement #3	0.295	Measurement #3	0.293
AVERAGE	0.294	AVERAGE	0.294

APPENDIX D

Parameter Sheets
Raw Data
- Methods 5/6
- Method 4075A
- Method 9

D-1

PARAMETER SHEET

ALCOA

PLANT Arn Rockwood
CITY Sp Hpe STATE NC
DATE 88-02-03

RUN 1 METHOD 5
UNIT Both
○ INLET
☒ OUTLET STACK
START TIME 11:28 AM/PM
FINISH TIME 1:48 AM/PM
METER OPERATOR JVA

COMMENTS:
Monorail Weld broke
⟹ delay
Leak check passed!

METER BOX NO. 2168
DH @ 1.86

FILTER NO. 2
THIMBLE NO.

	DATA			RESULTS			Assume 2% Bw
1	Pb	30.29	"Hg	Vmstd	47.46	dscf	
2	Static	-0.25	"wc	Vwstd	0.396	scf	
3	Vlc	8.4	ml	Bwo	0.008		
4	Mn		g	Md	29.08	lb/lb-mole	29.08
5	θ	60	min	Ms	28.99	lb/lb-mole	28.86
6	% O_2	19		Vs	29.71	ft/s	29.77
7	% CO_2	2		% I	97.7		98.6
8	DH	2.21	"wc	acfm	50390		50500
9	Cp	0.84		dscfm	48620		48160
10	Tm	71	F	Particulate		gr/dscf	
11	$\sqrt{Dp}$	0.523	$\sqrt{"wc}$			lb/hr	
12	Ts	89	F	SO_2	169.9	lb/hr	
13	Vm	49.38	ft^3	Gaseous F	—	lb/hr	
14	Dn	0.294	in	Particulate F	—	lb/hr	
15	As	28.27	ft^2	Total F	—	lb/hr	
16	Yd	0.95	cf/cf				

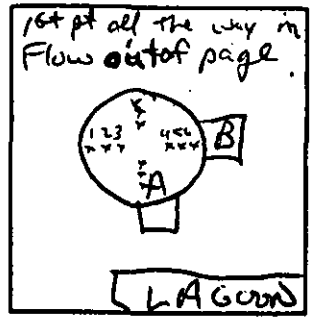
PARTICULATE TESTING
RAW DATA SET

ALCOA

1:15 day weld broke

Plant: Am Rockwool
Unit#: ____ Inlet/Outlet: STACK
Operator: JVA
Date: 88-02-03
Run No.: 1
Sample Box No.: ____
Meter Box No.: 2168
Meter DH@: 1.86
K Factor: 8.07 80/90
Pitot C_p: 0.84 Pitot Leak Ck: ✓
Leak Rate Before: 0.017 CFM @ 15 Hg
Leak Rate After: 0.013 CFM @ 9 Hg
Static Press., In. H_2O (+/⊖): 0.25

Start Time: 11:28 AM PM
Finish Time: 1:48 AM PM
Meter Y_d: 0.95



SCHEMATIC OF TESTING LOCATION

Filter #'s: 2
Thimble #: ____
Beaker #: ____

Ambient Temperature, °F: 40
Barometric Pressure, In. Hg: 30.29
Assumed Moisture, %: 2.5
Heater Box Setting: 250±
Probe Length, Ft.: ____ No.: ____
Nozzle Diameter, In.: 0.294
Probe Heater Setting: 250±
% O_2: ____
% CO_2: ____
H_2O, ml: -5
Silica Gel, gm: 13.4
Total V_{lc}: 8.4
Stack Area, Ft^2: ____
Pyrometer No.: ____

MIN/PT 5

TRAVERSE POINT NUMBER	SAMPLING TIME θ, min.	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	Initial Volume: 435.69 GAS SAMPLE VOLUME V_m, Ft^3	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m In, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p °F
A-1	5	4	87	0.24	1.9	439.64	70	58	42	238
2	10	5	87	0.25	2.0	443.55	83	60	43	255
3	15	6	89	0.33	2.66	448.10	88	63	44	261
4	20	5	89	0.3	2.4	452.28	89	64	46	258
5	25	6	90	0.33	2.66	456.76	89	65	46	259
6	30	5	91	0.28	2.26	460.94	91	65	45	260
B-1	35	5	89	0.26	2.1	466.03	70	60	40	266
2	40	6	88	0.33	2.66	470.46	85	63	42	264
3	45	5	88	0.26	2.1	474.48	90	64	44	268
4	50	5	89	0.28	2.26	478.63	90	66	44	265
5	55	5	88	0.26	2.1	482.68	90	66	45	268
6	60	4	88	0.18	1.45	486.18	88	67	47	264
TOTAL			1063	6.27	26.55	49.38	AVG. 78	AVG. 63		
AVERAGE			88	.523	2.21	~~50.49~~	AVG. 77			

2nd port 462.05 = In Vol

We can't wait for tomorrow

D-2

PARAMETER SHEET

ALCOA

PLANT Am Rockwool
CITY Sp Hope STATE N.C.
DATE 88-02-03

RUN 2 METHOD 5
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 3:59 AM/PM
FINISH TIME 5:10 AM/PM
METER OPERATOR JVA

COMMENTS:
IPA evaporation ⇒ Vlc loss
Assume 1% Bwo

METER BOX NO. 2168
DH @ 1.86

FILTER NO. 3
THIMBLE NO.

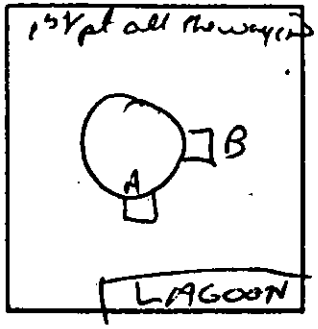
	DATA			RESULTS			~~Assume Bwo~~
1	Pb	30.3	"Hg	Vmstd	46.4	dscf	
2	Static	-0.25	"wc	Vwstd	0.424	scf	
3	Vlc	~~9.5~~ 9	ml	Bwo	0.009		
4	Mn		g	Md	29.08	lb/lb-mole	
5	θ	60	min	Ms	28.98	lb/lb-mole	
6	% O_2	19		Vs	29.51	ft/s	
7	% CO_2	2		% I	95.3	✓	
8	DH	2.16 ~~0.522~~	"wc	acfm	50060		
9	Cp	0.84		dscfm	48730		
10	Tm	75	F	Particulate		gr/dscf	
11	$\sqrt{Dp}$	0.522	$\sqrt{"wc}$			lb/hr	
12	Ts	84	F	SO_2	131.4	lb/hr	
13	Vm	48.63	ft^3	Gaseous F	—	lb/hr	
14	Dn	0.294	in	Particulate F	—	lb/hr	
15	As	28.27	ft^2	Total F	—	lb/hr	
16	Yd	0.95	cf/cf				

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: Am Rockwool NC
Unit#: Both Inlet/Outlet: STACK
Operator: LVI
Date: 88-02-03
Run No.: 2
Sample Box No.:
Meter Box No.: 2168
Meter DH@: 1.86
K Factor: 7.87
Pitot C_p: 0.84 Pitot Leak Ck: ✓
Leak Rate Before: 0.011 CFM @ 15 Hg
Leak Rate After: 0.010 CFM @ 10 Hg
Static Press., In. H_2O (+/⊖): 0.25

Start Time: 3:59 AM/PM
Finish Time: 5:10 AM/PM
Meter Y_d: 0.95



SCHEMATIC OF TESTING LOCATION

Filter #'s: 3
Thimble #:
Beaker #:

Ambient Temperature, °F:
Barometric Pressure, In. Hg: 30.3
Assumed Moisture, %: 2
Heater Box Setting: 250 ± 25
Probe Length, Ft.: No.:
Nozzle Diameter, In.: 0.294
Probe Heater Setting: -
% O_2:
% CO_2:
H_2O, ml: -25
Silica Gel, gm: 18.4
Total V_{lc}: -6.6
Stack Area, Ft^2:
Pyrometer No.:

MIN/PT: 5

TRAVERSE POINT NUMBER	SAMPLING TIME θ, min.	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	Initial Volume: 488.46 GAS SAMPLE VOLUME V_m, Ft^3	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m In, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p °F
A-1	5	4	84	0.22	1.73	492.10	70	60	40	235
2	10	5	88	0.30	2.36	496.25	86	62	41	254
3	15	5	87	0.28	2.20	500.40	92	66	42	260
4	20	5	86	0.31	2.44	504.76	92	66	42	262
5	25	5	87	0.34	2.68	509.30	94	66	44	260
6	30	5	85	0.28	2.20	513.46	96	67	45	251
B-1	35	4	82	0.25	1.97	517.30	70	65	42	268
2	40	6	83	0.37	2.9	521.90	80	65	43	265
3	45	5	82	0.31	2.36	526.18	86	66	45	263
4	50	4	82	0.20	1.57	529.71	86	66	46	258
5	55	4	82	0.24	1.9	533.52	86	66	49	254
6	60	4	82	0.20	1.57	537.04	86	66	51	256
TOTAL			1010	6.264	25.88		AVG. 1024	AVG. 781		
AVERAGE			84.1667	0.522	2.16	48.63	AVG. 75			

We can't wait for tomorrow ALCOA

D-3

PARAMETER SHEET

ALCOA

PLANT Am Rockwool
CITY Sp Hpe STATE NC
DATE 88-02-04

RUN 9 METHOD 5
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 9:48 AM/PM
FINISH TIME 11:02 AM/PM
METER OPERATOR SVA

COMMENTS:

METER BOX NO. 2168
DH @ 1.86

FILTER NO. 4
THIMBLE NO.

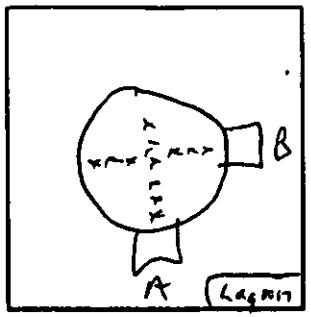
		DATA		RESULTS			Assume Bwo=
1	Pb	29.97	"Hg	Vmstd	45.94	dscf	
2	Static	-0.24	"wc	Vwstd	0.325	scf	
3	Vlc	6.9	ml	Bwo	0.007		
4	Mn		g	Md	29.08	lb/lb-mole	29.08
5	θ	60	min	Ms	29.00	lb/lb-mole	28.86
6	% O_2	19		Vs	28.55	ft/s	28.62
7	% CO_2	2		% I	99.3		100.4
8	DH	2.06	"wc	acfm	48420		48540
9	Cp	0.84		dscfm	46290		45790
10	Tm	62	F	Particulate		gr/dscf	
11	$\sqrt{Dp}$	0.500	$\sqrt{\text{"wc}}$			lb/hr	
12	Ts	89	F	SO_2	130.9	lb/hr	
13	Vm	47.51	ft^3	Gaseous F	—	lb/hr	
14	Dn	0.294	in	Particulate F	—	lb/hr	
15	As	28.27	ft^2	Total F	—	lb/hr	
16	Yd	0.95	cf/cf				

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: Am Rockwool
Unit#: Both Inlet/Outlet: STACK
Operator: JVA
Date: 08-02-04
Run No.: 3
Sample Box No.:
Meter Box No.: 2168
Meter DH@: 1.86
K Factor: 0.13
Pitot C_p: 0.84 Pitot Leak Ck: ✓
Leak Rate Before: 0.015 CFM @ 15 Hg
Leak Rate After: -.011 CFM @ 14 Hg
Static Press., In. H_2O (+/-): 0.24

Start Time: 9:48 AM PM
Finish Time: 11:00 AM PM
Meter Y_d: 0.95



SCHEMATIC OF TESTING LOCATION

Filter #'s:
Thimble #:
Beaker #:

Ambient Temperature, °F:
Barometric Pressure, In. Hg: 29.97
Assumed Moisture, %: 2
Heater Box Setting: 250
Probe Length, Ft.: No.:
Nozzle Diameter, In.: 0.294
Probe Heater Setting:
% O_2:
% CO_2:
H_2O, ml: -10
Silica Gel, gm: 16.7
Total V_{lc}: 6.9
Stack Area, Ft^2: 28.27
Pyrometer No.:

TRAVERSE POINT NUMBER	MIN/PT ____ SAMPLING TIME θ, min.	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	Initial Volume: 537.94 GAS SAMPLE VOLUME V_m, Ft^3	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m in, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p, °F
A-1	5	4	87	0.2	1.6	541.44	59	50	41	242
2	10	5	87	0.29	2.35	545.62	73	52	41	246
3	15	5	90	0.3	2.44	549.96	77	56	43	243
4	20	5	91	0.29	2.35	554.24	80	56	43	247
5	25	5	92	0.27	2.2	558.32	81	58	44	259
6	30	4	92	0.23	1.9	562.15	80	159	46	255
B-1	35	4	89	0.27	2.2	566.20	54	52	42	262
2	40	4	88	0.27	2.2	570.28	63	52	44	260
3	45	5	90	0.3	2.44	574.55	67	52	45	262
4	50	4	89	0.23	1.9	578.40	70	53	46	259
5	55	4	88	0.23	1.9	582.26	~~71~~ 69	53	43	257
6	60	3	86	0.15	1.2	585.45	68	53	42	262
TOTAL			1069	6.005	24.68		AVG. 841	AVG. 646		
AVERAGE			89	0.500	2.06	47.51	AVG. 62			

0.04/min

We can't wait for tomorrow ALCOA

Page 1 of 1

D-4

PARAMETER SHEET

ALCOA

PLANT Am Rockwool
CITY Spiffax STATE NC
DATE 88-02-05

RUN 4 METHOD 5
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 7:48 AM/PM
FINISH TIME 8:59 AM/PM
METER OPERATOR JVA

COMMENTS:
~ 99%

METER BOX NO. 2168
DH @ 1.86

FILTER NO. 5
THIMBLE NO.

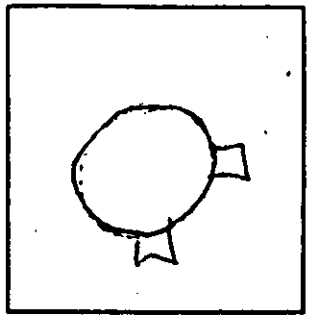
	DATA			RESULTS			Assume Bwo = 29
1	Pb	30.28	"Hg	Vmstd	45.84	dscf	
2	Static	-0.22	"wc	Vwstd	0.367	scf	
3	Vlc	7.8	ml	Bwo	0.008		
4	Mn		g	Md	29.08	lb/lb-mole	29.08
5	θ	60	min	Ms	28.99	lb/lb-mole	28.86
6	% O_2	19		Vs	27.98	ft/s	28.04
7	% CO_2	2		% I	98.0		99.0
8	DH	2.02	"wc	acfm	47460		47570
9	Cp	0.84		dscfm	46820		46360
10	Tm	54	F	Particulate		gr/dscf	
11	$\sqrt{Dp}$	0.498	$\sqrt{"wc}$			lb/hr	
12	Ts	77	F	SO_2	104.5	lb/hr	
13	Vm	46.21	ft^3	Gaseous F	—	lb/hr	
14	Dn	0.294	in	Particulate F	—	lb/hr	
15	As	28.27	ft^2	Total F	—	lb/hr	
16	Yd	0.95	cf/cf				

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: Am Rockwool
Unit#: BOM Inlet/Outlet: STACK
Operator: JVG
Date: 98-02-05
Run No.: 4
Sample Box No.:
Meter Box No.: 2168
Meter DH@: 1.86
K Factor: 0.13
Pitot C_p: 0.84 Pitot Leak Ck: ✓
Leak Rate Before: 0.013 CFM @ 15 Hg
Leak Rate After: 0.008 CFM @ 10 Hg
Static Press., In. H_2O (+/-): 0.22

Start Time: 7:48 AM PM
Finish Time: 8:59 AM PM
Meter Y_d: 0.95



SCHEMATIC OF TESTING LOCATION

Filter #'s:
Thimble #:
Beaker #:

Ambient Temperature, °F:
Barometric Pressure, In. Hg: 30.28
Assumed Moisture, %:
Heater Box Setting:
Probe Length, Ft.: No.:
Nozzle Diameter, In.:
Probe Heater Setting:
% O_2:
% CO_2:
H_2O, ml: -5
Silica Gel, gm: 12.8
Total V_{lc}: 7.8
Stack Area, Ft^2:
Pyrometer No.:

TRAVERSE POINT NUMBER	MIN/PT 5 SAMPLING TIME θ, min.	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	Initial Volume: 529.68 GAS SAMPLE VOLUME V_m, Ft^3	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m In, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p °F
A-1	5	5	78	0.20	1.6	593.09	51	36	30	252
2	10	5	78	0.25	2.0	596.86	61	38	33	246
3	15	5	78	0.28	2.28	600.90	66	40	34	250
4	20	5	79	0.22	1.8	604.60	68	42	34	253
5	25	6	79	0.31	2.5	608.84	68	42	34	255
6	30	5	77	0.21	1.7	612.47	72	46	JVG ~~35~~ 37	258
B-1	35	5	75	0.28	2.28	616.56	51	43	36	270
2	40	5	76	0.28	2.28	620.56	64	45	39	267
3	45	6	75	0.31	2.5	624.85	71	46	40	260
4	50	5	77	0.26	2.1	628.83	75	47	42	259
5	55	5	76	0.25	2.0	632.69	78	48	43	250
6	60	5	75	0.15	1.2	635.89	77	50	45	252
TOTAL			923	5.97	24.24		AVG. 802	AVG. 523		
AVERAGE			77	0.498	2.02	46.21	AVG. 54			

We can't wait for tomorrow ALCOA

D-5

PARAMETER SHEET

ALCOA

PLANT Ames Rockwool
CITY Sp Hpe STATE N.C.
DATE 88-02-05

RUN 5 METHOD 5
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 10:30 AM/PM
FINISH TIME 11:40 AM/PM
METER OPERATOR SVA

COMMENTS:
~99%

METER BOX NO. 2168
DH @ 1.86

FILTER NO. 6
THIMBLE NO.

Assume 2% B

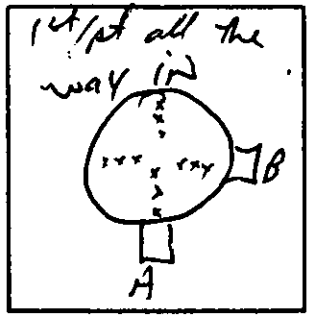
	DATA			RESULTS			
1	Pb	30.32	"Hg	Vmstd	45.31	dscf	
2	Static	-0.23	"wc	Vwstd	0.127	scf	
3	Vlc	2.7	ml	Bwo	0.003		
4	Mn		g	Md	29.1	lb/lb-mole	29.1
5	θ	60	min	Ms	29.07	lb/lb-mole	28.88
6	% O_2	19.5		Vs	27.78	ft/s	27.87
7	% CO_2	2		% I	97.5 ✓		98.9
8	DH	1.99	"wc	acfm	47110		47270
9	Cp	0.84		dscfm	46520		45870
10	Tm	56	F	Particulate		gr/dscf	
11	$\sqrt{Dp}$	0.494	$\sqrt{"wc}$			lb/hr	
12	Ts	80	F	SO_2	118.6	lb/hr	
13	Vm	45.79	ft^3	Gaseous F	—	lb/hr	
14	Dn	0.294	in	Particulate F	—	lb/hr	
15	As	28.27	ft^2	Total F	—	lb/hr	
16	Yd	0.95	cf/cf				

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: Am Rock
Unit#: Bath Inlet/Outlet: STACK
Operator: SVA
Date: 93-02-05
Run No.: 5
Sample Box No.:
Meter Box No.: 2168
Meter DH@: 1.86
K Factor: 8.13
Pitot C_p: 0.84 Pitot Leak Ck: ✓
Leak Rate Before: 0.006 CFM @ 15 Hg
Leak Rate After: 0.006 CFM @ 15 Hg
Static Press., In. H_2O (+/-): 0.23

Start Time: 10 : 30 AM PM
Finish Time: 11 : 40 AM PM
Meter Y_d: 0.95



SCHEMATIC OF TESTING LOCATION

Filter #'s:
Thimble #:
Beaker #:

Ambient Temperature, °F:
Barometric Pressure, In. Hg: 30.32
Assumed Moisture, %:
Heater Box Setting:
Probe Length, Ft.: No.:
Nozzle Diameter, In.:
Probe Heater Setting:
% O_2:
% CO_2:
H_2O, ml: -10
Silica Gel, gm: 12.7
Total V_{lc}: 2.7
Stack Area, Ft²:
Pyrometer No.:

TRAVERSE POINT NUMBER	MIN/PT ____ SAMPLING TIME θ, min.	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	Initial Volume: 637.00 GAS SAMPLE VOLUME V_m, Ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m in, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p °F
A-1	5	3	76	0.18	1.46	640.30	53	48	33	228
2	10	5	81	0.24	1.95	644.04	68	48	33	238
3	15	5	80	0.3	2.4	648.24	74	50	35	251
4	20	4	81	0.25	2.0	652.13	77	50	37	260
5	25	4	81	0.26	2.1	656.09	70	50	38	259
6	30	4	80	0.21	1.70	659.70	67	50	40	252
B-1	35	4	80	0.24	1.95	663.44	54	48	33	256
2	40	5	80	0.29	2.36	667.58	56	48	34	250
3	45	5	79	0.31	2.5	671.84	60	48	36	248
4	50	~~5~~ 4	80	0.26	2.1	675.77	62	46	38	244
5	55	4	80	0.24	1.95	679.54	62	46	38	247
6	60	3	~~80~~ 81	0.17	1.4	682.79	64	46	39	251
TOTAL			959	5.927	23.87		AVG. 767	AVG. 578		
AVERAGE			80	0.494	1.99	45.79	AVG. 56			

Page 1 of 1

We can't wait for tomorrow ALCOA

D-6

PARAMETER SHEET

ALCOA

PLANT Am Rockwool
CITY Sp Hpe STATE NC
DATE 88-02-06

RUN 6 METHOD 5
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 1:30 AM/PM
FINISH TIME 2:39 AM/PM
METER OPERATOR JVA

COMMENTS:
Process Upset!

METER BOX NO. 2168
DH @ 1.86

FILTER NO.
THIMBLE NO.

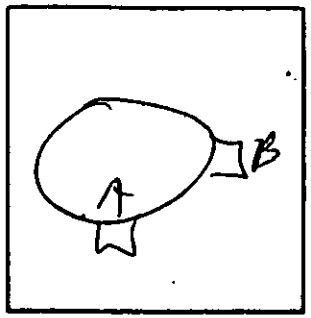
	DATA			RESULTS		
1	Pb	30.32	"Hg	Vmstd	45.56	dscf
2	Static	-0.23	"wc	Vwstd	0.645	scf
3	Vlc	13.7	ml	Bwo	0.014	
4	Mn		g	Md	29.08	lb/lb-mole
5	θ	60	min	Ms	28.93	lb/lb-mole
6	% O_2	19		Vs	27.91	ft/s
7	% CO_2	2		% I	99.9	
8	DH	1.98	"wc	acfm	47340	
9	Cp	0.84		dscfm	45630	
10	Tm	56	F	Particulate		gr/dscf
11	$\sqrt{Dp}$	0.492	$\sqrt{\text{"wc}}$			lb/hr
12	Ts	87	F	SO_2	100.3	lb/hr
13	Vm	46.05	ft^3	Gaseous F	—	lb/hr
14	Dn	0.294	in	Particulate F	—	lb/hr
15	As	28.27	ft^2	Total F	—	lb/hr
16	Yd	0.95	cf/cf			

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: Am. Rockwool
Unit#: Bath Inlet/Outlet: STACK
Operator: JJA
Date: 88-02-05
Run No.: 6
Sample Box No.:
Meter Box No.: 2168
Meter DH@: 1.86
K Factor: 3.13
Pitot C_p: 0.84 Pitot Leak Ck: ✓
Leak Rate Before: 0.011 CFM @ 15 Hg
Leak Rate After: CFM @ Hg
Static Press., In. H_2O (+/−): 0.23

Start Time: 1:30 AM/PM
Finish Time: 2:34 AM/PM
Meter Y_d: 0.95



SCHEMATIC OF TESTING LOCATION

Filter #'s:
Thimble #:
Beaker #:

Ambient Temperature, °F:
Barometric Pressure, In. Hg: 30.32
Assumed Moisture, %:
Heater Box Setting:
Probe Length, Ft.: No.:
Nozzle Diameter, In.: 0.294
Probe Heater Setting:
% O_2: 20
% CO_2: 1
H_2O, ml: 0
Silica Gel, gm: 13.7
Total V_{lc}: 13.7
Stack Area, Ft²:
Pyrometer No.:

TRAVERSE POINT NUMBER	MIN/PT ____ SAMPLING TIME θ, min.	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	Initial Volume: 684.45 GAS SAMPLE VOLUME V_m, Ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m in, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p, °F
A-1	5	3	87	0.18	1.46	687.80	53	50	34	261
2	10	5	87	0.26	2.1	691.75	62	50	34	261
3	15	6	88	0.29	2.35	695.93	65	50	34	263
4	20	6	87	0.29	2.35	700.13	67	50	34	252
5	25	6	88	0.29	2.35	704.33	66	50	36	244
6	30	3	87	0.18	1.46	707.66	66	50	36	249
B-1	35	5	88	0.23	1.87	711.40	49	48	35	246
2	40	6	85	0.31	2.5	715.69	59	49	37	251
3	45	6	86	0.29	2.35	719.88	65	49	39	254
4	50	5	85	0.22	1.8	723.57	69	49	40	253
5	55	5	85	0.25	2.0	727.38	69	50	40	261
6	60	4	85	0.15	1.2	730.50	66	50	40	261
TOTAL			1038	5.905	23.79		AVG. 756	AVG. 595		
AVERAGE			87	0.492	1.98	46.05	AVG. 56			

We can't wait for tomorrow ALCOA

D-7

PARAMETER SHEET

ALCOA

PLANT Am Rockwool
CITY Sc Hpe STATE N.C.
DATE 88-02-05

RUN 7 METHOD 5
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 5:23 AM/PM
FINISH TIME 6:31 AM/PM
METER OPERATOR JVA

COMMENTS:

METER BOX NO. 2168
DH @ 1.86

FILTER NO.
THIMBLE NO.

	DATA			RESULTS			Assume 2% Bu
1	Pb	30.32	"Hg	Vmstd	44.78	dscf	
2	Static	-0.24	"wc	Vwstd	0.231	scf	
3	Vlc	4.9	ml	Bwo	0.005		
4	Mn		g	Md	29.08	lb/lb-mole	29.08
5	θ	60	min	Ms	29.02	lb/lb-mole	28.86
6	% O_2	19		Vs	27.32	ft/s	27.4
7	% CO_2	2		% I	98.0		99.2
8	DH	1.93	"wc	acfm	46350		46480
9	Cp	0.84		dscfm	45740		45180
10	Tm	65	F	Particulate		gr/dscf	
11	$\sqrt{Dp}$	0.486	$\sqrt{"wc}$			lb/hr	
12	Ts	79	F	SO_2	120.6	lb/hr	
13	Vm	46.05	ft^3	Gaseous F	—	lb/hr	
14	Dn	0.294	in	Particulate F	—	lb/hr	
15	As	28.27	ft^2	Total F	—	lb/hr	
16	Yd	0.95	cf/cf				

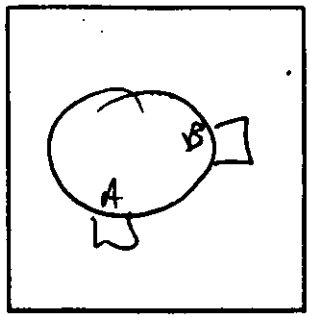
PARTICULATE TESTING
RAW DATA SET

ALCOA

7:04
- 33
6:31

Plant: Am Rockwool
Unit#: B-M Inlet/Outlet: STACK
Operator: JVA
Date: 04-02-05
Run No.: 7
Sample Box No.: ~~2106~~ 2168
Meter Box No.: 1.86
Meter DH@: 1.86
K Factor: 8.13
Pitot C_p: 0.84 Pitot Leak Ck: ✓
Leak Rate Before: 0.007 CFM @ 15 Hg
Leak Rate After: ____ CFM @ ____ Hg
Static Press., In. H_2O (+/-): 0.24

Start Time: 5:23 AM PM
Finish Time: 6:31 AM PM
Meter Y_d: 0.95



SCHEMATIC OF TESTING LOCATION

Filter #'s: ____
Thimble #: ____
Beaker #: ____

Ambient Temperature, °F: ____
Barometric Pressure, In. Hg: 30.32
Assumed Moisture, %: ____
Heater Box Setting: ____
Probe Length, Ft.: ____ No.: ____
Nozzle Diameter, In.: 0.294
Probe Heater Setting: ____
% O_2: ____
% CO_2: ____
H_2O, ml: -10
Silica Gel, gm: 14.9
Total V_{lc}: 4.9
Stack Area, Ft²: 28.27
Pyrometer No.: ____

TRAVERSE POINT NUMBER	MIN/PT ____ SAMPLING TIME θ, min.	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	Initial Volume: 731.70 GAS SAMPLE VOLUME V_m, Ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m In, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p °F
A-1	5	4	77	0.16	1.3	734.89	60	50	35	229
2	10	4	79	0.23	1.87	738.62	70	52	35	236
3	15	4	80	0.25	2.0	742.52	74	53	37	256
4	20	5	80	0.29	2.36	746.76	76	54	38	252
5	25	5	80	0.30	2.44	751.10	79	56	38	255
6	30	4	79	0.21	1.7	754.78	79	58	39	258
B-1	35	4	78	0.21	1.7	758.39	64	56	38	261
2	40	5	80	0.27	2.2	762.41	70	56	40	257
3	45	5	80	0.27	2.2	766.53	77	58	41	256
4	50	5	80	0.26	2.1	770.55	78	58	40	256
5	55	4	80	0.25	2.0	774.45	80	59	41	260
6	60	3	80	0.16	1.3	777.75	81	60	43	254
TOTAL			953	5.83	23.17		AVG. 888	AVG. 670		
AVERAGE			79	0.486	1.93	46.05	AVG. 65			

Page 1 of 1

We can't wait for tomorrow ALCOA

D-8

PARAMETER SHEET

ALCOA

PLANT Am Rockwool
CITY Sp Hpe STATE NC
DATE 88-02-03

RUN 1 METHOD 4075-14
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 11:30 AM/PM
FINISH TIME 1:50 AM/PM
METER OPERATOR SJR

COMMENTS:

METER BOX NO. 1874
DH @ 1.90

FILTER NO.
THIMBLE NO. 1

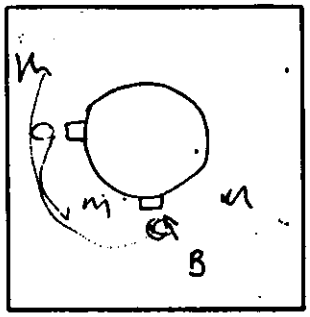
	DATA			RESULTS		
1	Pb	30.29	"Hg	Vmstd	49.43	dscf
2	Static	-0.25	"wc	Vwstd	0.975	scf
3	Vlc	20.7	ml	Bwo	0.019	
4	Mn		g	Md	29.08	lb/lb-mole
5	θ	60	min	Ms	28.87	lb/lb-mole
6	% O_2	19		Vs	29.6	ft/s
7	% CO_2	2		% I	103.3	
8	DH	2.225	"wc	acfm	50200	
9	Cp	0.84		dscfm	47900	
10	Tm	66	F	Particulate	—	gr/dscf
11	$\sqrt{Dp}$	0.52	$\sqrt{"wc}$		—	lb/hr
12	Ts	89	F	SO_2	—	lb/hr
13	Vm	48.404	ft^3	Gaseous F	0.08	lb/hr
14	Dn	0.294	in	Particulate F	0.21	lb/hr
15	As	28.27	ft^2	Total F	0.28	lb/hr
16	Yd	1.00	cf/cf			

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: SPRING HOPE (AM ROCKWOOL)
Unit#: Inlet/Outlet: OUTLET
Operator: SJ ROBUCK
Date: 7/3/88
Run No.: 1
Sample Box No.:
Meter Box No.: 1874
Meter DH@: 1.90
K Factor: 8.34
Pitot C_p: 0.84 Pitot Leak Ck: ✓
Leak Rate Before: 0.013 CFM @ 15 Hg
Leak Rate After: .009 CFM @ 9 Hg
Static Press., In. H_2O (+/−): 0.25

Start Time: 11:30 AM PM
Finish Time: 1:50 AM PM
Meter Yd: 1.00



SCHEMATIC OF TESTING LOCATION

Filter #'s:
Thimble #:
Beaker #:

Ambient Temperature, °F: 45
Barometric Pressure, In. Hg: 30.29
Assumed Moisture, %:
Heater Box Setting:
Probe Length, Ft.: No.:
Nozzle Diameter, In.: .294
Probe Heater Setting:
% O_2:
% CO_2:
H_2O, ml: 10
Silica Gel, gm: 10.7
Total Vlc: 20.7
Stack Area, Ft²:
Pyrometer No.:

TRAVERSE POINT NUMBER	MIN/PT. SAMPLING TIME θ, min.	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	Initial Volume: 348.192 GAS SAMPLE VOLUME V_m, Ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m in, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_b °F
B 6	5	4	87	.20	1.6	351.75	66	~~87~~ 58	46	
5	10	4	88	.20	1.6	355.25	69	58	47	
4	15	5	90	.25	2.0	358.89	72	59	50	
3	20	6	91	.29	2.4	363.10	73	59	52	
2	25	6	90	.35	2.8	367.81	78	60	53	
1	30	6	89	.34	2.8	372.980	79	61	56	
				New ~~[illegible]~~ Leak						
A 1	5	4	88	.20	1.6	376.03	68	58	43	
2	10	5	88	.30	2.4	380.26	74	59	48	
3	15	5	89	.26	2.1	384.20	74	59	52	
4	20	5	89	.31	2.5	388.5	74	59	54	
5	25	5	88	.36	2.9	393.09	74	59	55	
TOTAL 6	30	5	88	.24	2.0	397.074	AVG. 73	AVG. 59	55	
AVERAGE			1065 / 89	6.259	26.7	~~[illegible]~~	AVG. 66	874 708		
				0.52	2.225	48.404				

New Initial 372.458

We can't wait for tomorrow ALCOA

Page ____ of ____

D-9

PARAMETER SHEET

ALCOA

PLANT Alm Rockwood
CITY Sp Hpe STATE N. C.
DATE 88-02-03

RUN 2 METHOD 4075-A
UNIT Both
○ INLET
⊗ OUTLET Stack
START TIME 3:59 AM/PM
FINISH TIME 5:10 AM/PM
METER OPERATOR SJR

COMMENTS:

METER BOX NO. 1874
DH @ 1.90

FILTER NO.
THIMBLE NO. 2

		DATA			RESULTS	
1	Pb	30.30	"Hg	Vmstd	48.96	dscf
2	Static	-0.25	"wc	Vwstd	0.447	scf
3	Vlc	9.5	ml	Bwo	0.009	
4	Mn		g	Md	29.08	lb/lb-mole
5	θ	60	min	Ms	28.98	lb/lb-mole
6	% O_2	19		Vs	28.33	ft/s
7	% CO_2	2		% I	104.8	
8	DH	2.03	"wc	acfm	48050	
9	Cp	0.84		dscfm	46770	
10	Tm	67	F	Particulate	—	gr/dscf
11	$\sqrt{Dp}$	0.501	$\sqrt{"wc}$		—	lb/hr
12	Ts	84	F	SO_2	—	lb/hr
13	Vm	48.042	ft^3	Gaseous F	0.06	lb/hr
14	Dn	0.244	in	Particulate F	0.14	lb/hr
15	As	28.27	ft^2	Total F	0.20	lb/hr
16	Yd	1.00	cf/cf			

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: SPRING HOPE
Unit#: ____ Inlet/Outlet: OUTLET
Operator: SJ ROBUCK
Date: 2/3/88
Run No.: 2
Sample Box No.: ____
Meter Box No.: 1874
Meter DH@: 1.90
K Factor: 7.98 @ 66/84 2%
Pitot C_p: ____ Pitot Leak Ck: ____
Leak Rate Before: .007 CFM @ 15 Hg
Leak Rate After: .007 CFM @ 10 Hg
Static Press., In. H_2O (+/−): -.25

Start Time: 3:59 AM PM
Finish Time: 5:10 AM PM
Meter Y_d: 1.00

SCHEMATIC OF TESTING LOCATION

Filter #'s: ____
Thimble #: 2
Beaker #: ____

Ambient Temperature, °F: 45
Barometric Pressure, In. Hg: ____
Assumed Moisture, %: ____
Heater Box Setting: ____
Probe Length, Ft.: ____ No.: ____
Nozzle Diameter, In.: ____
Probe Heater Setting: ____
% O_2: ____
% CO_2: ____
H_2O, ml: 0
Silica Gel, gm: 9.5
Total V_{lc}: 9.5
Stack Area, Ft^2: ____
Pyrometer No.: ____

TRAVERSE POINT NUMBER	SAMPLING TIME θ, min. (MIN/PT ____)	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	GAS SAMPLE VOLUME V_m, Ft^3 (Initial Volume: 390.958)	GAS SAMPLE TEMPERATURE AT DRY GAS METER: INLET T_m in, °F	GAS SAMPLE TEMPERATURE AT DRY GAS METER: OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p °F
B 6	5	3	87	.16	1.3	401.30	65	54	53	
5	10	3	88	.17	1.3	404.37	69	55	53	
4	15	3	86	.22	1.7	408.00	71	56	53	
3	20	4	85	.25	2.0	—	74	58	53	
2	25	4	84	.35	2.8	416.30	78	59	53	
1	30	4	84	.31	2.5	420.758	79	60	53	
A 1	5	.4	84	.26	2.0	424.2 *	73	62	53	
2	10	4	83	.35	2.8	429.15	77	63	54	
3	15	4	82	.30	2.4	433.61	76	63	54	
4	20	3	82	.21	1.7	437.16	75	62	54	
5	25	3	81	.27	2.1	441.03	74	62	54	
6	30	3	80	.21	1.7	445.055	73	61	54	
TOTAL			1006	6.015	24.3		AVG. 884	AVG. 715		
AVERAGE			84	0.501	2.03	48.042	AVG. 67			

* 420.813 New Port

We can't wait for tomorrow ALCOA

Page ____ of ____

D-10

PARAMETER SHEET

ALCOA

PLANT Am Rockwool
CITY Spring Hope STATE N.C.
DATE 88-02-04

RUN 3 METHOD 4075-A
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 9:45 AM/PM
FINISH TIME 11:00 AM/PM
METER OPERATOR SJR

COMMENTS:

METER BOX NO. 1874
DH @ 1.90

FILTER NO.
THIMBLE NO. 3

	DATA			RESULTS		
1	Pb	29.97	"Hg	Vmstd	46.19	dscf
2	Static	-0.24	"wc	Vwstd	0.999	scf
3	Vlc	21.2	ml	Bwo	0.021	
4	Mn		g	Md	29.03	lb/lb-mole
5	θ	60	min	Ms	28.85	lb/lb-mole
6	% O_2	19		Vs	27.88	ft/s
7	% CO_2	2		% I	103.8	
8	DH	1.91	"wc	acfm	47280	
9	Cp	0.84		dscfm	44560	
10	Tm	66	F	Particulate	—	gr/dscf
11	$\sqrt{Dp}$	0.487	$\sqrt{"wc}$		—	lb/hr
12	Ts	89	F	SO_2	—	lb/hr
13	Vm	45.738	ft^3	Gaseous F	0.06	lb/hr
14	Dn	0.294	in	Particulate F	0.13	lb/hr
15	As	28.27	ft^2	Total F	0.19	lb/hr
16	Yd	1.00	cf/cf			

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: SPRING HOPE
Unit#: ____ Inlet/Outlet: OUTLET
Operator: SJ ROBUCK
Date: 7/4/88
Run No.: 3
Sample Box No.: ____
Meter Box No.: 1874
Meter DH@: 1.90
K Factor: 8.1
Pitot C_p: ____ Pitot Leak Ck: ____
Leak Rate Before: .012 CFM @ 15 Hg
Leak Rate After: .007 CFM @ 10 Hg
Static Press., in. H_2O (+/-): 0.24

Start Time: 9:45 AM PM
Finish Time: 11:00 AM PM
Meter Y_d: 1.00

SCHEMATIC OF TESTING LOCATION

Filter #'s: ____
Thimble #: ____
Beaker #: ____

Ambient Temperature, °F: 50
Barometric Pressure, in. Hg: ____
Assumed Moisture, %: ____
Heater Box Setting: ____
Probe Length, Ft.: ____ No.: ____
Nozzle Diameter, in.: .294
Probe Heater Setting: ____
% O_2: ____
% CO_2: ____
H_2O, ml: 10
Silica Gel, gm: 11.2
Total V_{lc}: 21.2
Stack Area, Ft^2: ____
Pyrometer No.: ____

K = 8.1 4075

TRAVERSE POINT NUMBER	MIN/PT ____ SAMPLING TIME θ, min.	VACUUM in. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, in. H_2O	Initial Volume: 446.007 GAS SAMPLE VOLUME V_m, Ft^3	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m in, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p °F
B 6	5	3	90	.15	1.2	449.18	64	54	53	
5	10	3	91	.24	1.9	452.85	68	55	53	
4	15	3	92	.25	2.0	456.80	71	57	53	
3	20	3	92	.27	2.2	460.69	71	58	53	
2	25	3	92	.29	2.3	465.32	73	59	53	
1	30	3	92	.24	1.9	468.891	73	59	53	
A 1	5	3	88	.24	1.9	472.87 *	67	59	53	
2	10	3	88	.26	2.1	477.00	78	61	53	
3	15	3	88	.27	2.2	481.04	79	62	53	
4	20	3	87	.24	1.9	484.71	78	62	52	
5	25	3	86	.24	1.9	488.45	77	62	53	
6	30	3	85	.18	1.4	491.819	77	62	53	
TOTAL			1071	5.8487	22.9	491.819	AVG. 876	AVG. 710		
AVERAGE			89	0.487	1.91	45.738	AVG. 66			

* 468.965 New Port Init

We can't wait for tomorrow ALCOA

Page 1 of 1

D-11

PARAMETER SHEET

ALCOA

PLANT Am Rockwool
CITY Sp Hpe STATE NC
DATE 88-02-05

RUN 4 METHOD 4075-A
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 7:45 AM/PM
FINISH TIME 8:59 AM/PM
METER OPERATOR SJR

COMMENTS:
~10%

METER BOX NO. 1874
DH @ 1.90

FILTER NO.
THIMBLE NO. 4

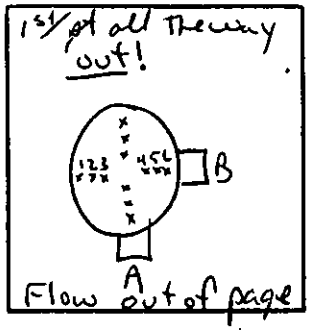
	DATA			RESULTS		
1	Pb	30.28	"Hg	Vmstd	47.21	dscf
2	Static	-0.22	"wc	Vwstd	0.9	scf
3	Vlc	19.1	ml	Bwo	0.019	
4	Mn		g	Md	29.08	lb/lb-mole
5	θ	60	min	Ms	28.87	lb/lb-mole
6	% O_2	19		Vs	27.53	ft/s
7	% CO_2	2		% I	103.7	
8	DH	1.98	"wc	acfm	46700	
9	Cp	0.84		dscfm	45570	
10	Tm	60	F	Particulate	—	gr/dscf
11	$\sqrt{Dp}$	0.489	$\sqrt{"wc}$		—	lb/hr
12	Ts	77	F	SO_2	—	lb/hr
13	Vm	45.738	ft^3	Gaseous F	0.08	lb/hr
14	Dn	0.294	in	Particulate F	0.63	lb/hr
15	As	28.27	ft^2	Total F	0.70	lb/hr
16	Yd	1.00	cf/cf			

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: SPRING HOPE
Unit#: ____ Inlet/Outlet: OUTLET
Operator: S J ROBUCK
Date: 2/5/88
Run No.: 4
Sample Box No.: ____
Meter Box No.: 1874
Meter DH@: 1.90
K Factor: 8.1
Pitot C_p: ____ Pitot Leak Ck: ____
Leak Rate Before: .006 CFM @ 15 Hg
Leak Rate After: .005 CFM @ 12 Hg
Static Press., In. H_2O (+/−): ____

Start Time: 7:45 AM / PM
Finish Time: 8:59 AM / PM
Meter Y_d: 1.00



SCHEMATIC OF TESTING LOCATION

Filter #'s: ____
Thimble #: ____
Beaker #: ____

Ambient Temperature, °F: 35
Barometric Pressure, In. Hg: ____
Assumed Moisture, %: ____
Heater Box Setting: ____
Probe Length, Ft.: ____ No.: ____
Nozzle Diameter, In.: ____
Probe Heater Setting: ____
% O_2: ____
% CO_2: ____
H_2O, ml: 10
Silica Gel, gm: 9.1
Total Vlc: 19.1
Stack Area, Ft^2: ____
Pyrometer No.: ____

TRAVERSE POINT NUMBER	MIN/PT ____ SAMPLING TIME θ, min.	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	Initial Volume: 493.987 GAS SAMPLE VOLUME V_m, Ft^3	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m in, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p °F
B 6	5	3	78	.17	1.4	497.30	52	41	33	
5	10	3	78	.19	1.5	500.64	59	44	36	
4	15	3	78	.25	2.0	504.30	64	47	40	
3	20	4	76	.21	1.7	507.73	67	49	40	
2	25	5	75	.29	2.3	511.75	72	51	41	
1	30	5	75	.22	1.8	515.473	72	52	41	
A 1	5	6	76	.21	1.7	519.05	65	52	44	
2	10	6	77	.28	2.3	523.22	71	53	47	
3	15	7	75	.28	2.3	527.21	73	53	49	
4	20	7	77	.30	2.6	531.77	78	54	53	
5	25	6	76	.32	2.7	536.17	78	55	53	
6	30	5	77	.18	1.5	539.725	77	55	53	
TOTAL			918	5.868			AVG. 828	AVG. 606		
AVERAGE			77	0.489	1.98	45.738	AVG. 60			

We can't wait for tomorrow ALCOA

D-12

PARAMETER SHEET

ALCOA

PLANT Am Rockwood
CITY Spt Hpe STATE NC
DATE 88-02-05

RUN 5 METHOD 4075-A
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 10:30 AM/PM
FINISH TIME 11:40 AM/PM
METER OPERATOR SJR

COMMENTS:
210352

METER BOX NO. 1874
DH @ 1.90

FILTER NO.
THIMBLE NO. 5

	DATA			RESULTS		
1	Pb	30.32	"Hg	Vmstd	46.26	dscf
2	Static	-0.23	"wc	Vwstd	0.923	scf
3	Vlc	19.6	ml	Bwo	0.02	
4	Mn		g	Md	29.1	lb/lb-mole
5	θ	60	min	Ms	28.88	lb/lb-mole
6	% O_2	19.5		Vs	27.27	ft/s
7	% CO_2	2		% I	103.3	
8	DH	1.91	"wc	acfm	46260	
9	Cp	0.84		dscfm	44830	
10	Tm	68	F	Particulate	—	gr/dscf
11	$\sqrt{Dp}$	0.483	$\sqrt{"wc}$		—	lb/hr
12	Ts	81	F	SO_2	—	lb/hr
13	Vm	45.462	ft^3	Gaseous F	0.05	lb/hr
14	Dn	0.294	in	Particulate F	0.77	lb/hr
15	As	28.27	ft^2	Total F	0.82	lb/hr
16	Yd	1.00	cf/cf			

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: SPRING HOPE
Unit#: ____ Inlet/Outlet: OUTLET
Operator: SJ ROBUCK
Date: 2/5/88
Run No.: 5
Sample Box No.: ____
Meter Box No.: 1874
Meter DH@: 1.90
K Factor: 8.1
Pitot C_p: ____ Pitot Leak Ck: ____
Leak Rate Before: .013 CFM @ 15 Hg
Leak Rate After: .015 CFM @ 10 Hg
Static Press., In. H_2O (+/−): ____

Start Time: 10:30 AM
Finish Time: : AM PM
Meter Y_d: 1.00

SCHEMATIC OF TESTING LOCATION

Filter #'s: ____
Thimble #: ____
Beaker #: ____

Ambient Temperature, °F: 38
Barometric Pressure, In. Hg: 30.32
Assumed Moisture, %: ____
Heater Box Setting: ____
Probe Length, Ft.: ____ No.: ____
Nozzle Diameter, In.: ____
Probe Heater Setting: ____
% O_2: ____
% CO_2: ____
H_2O, ml: 10
Silica Gel, gm: 9.6
Total V_{lc}: 19.6
Stack Area, Ft^2: ____
Pyrometer No.: ____

TRAVERSE POINT NUMBER	MIN/PT. ____ SAMPLING TIME θ, min.	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	Initial Volume: 540.560 GAS SAMPLE VOLUME V_m, Ft^3	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m in, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p, °F
B 6	5	3	80	.15	1.2	543.75	64	59	59	
5	10	3	81	.20	1.6	546.63	71	59	59	
4	15	4	82	.25	2.0	550.92	76	61	59	
3	20	4	82	.29	2.3	554.91	79	61	58	
2	25	4	81	.28	2.3	559.18	79	62	58	
1	30	3	80	.20	1.6	562.738	79	62	58	
A 1	5	3	80	.18	1.5	566.13	68	59	58	
2	10	4	80	.27	2.2	570.24	74	59	58	
3	15	4	80	.27	2.2	574.42	77	60	58	
4	20	4	80	.28	2.3	578.55	79	61	59	
5	25	4	80	.26	2.1	582.57	79	62	59	
6	30	4	81	.20	1.6	586.022	79	62	59	
TOTAL			967	5.799	22.9		AVG. 904	AVG. 727		
AVERAGE			81	0.483	1.91	45.463	AVG. 68			

We can't wait for tomorrow ALCOA

Page ____ of ____

D-13

PARAMETER SHEET

ALCOA

PLANT American Rockwool
CITY Spg Hope STATE N.C.
DATE 88-02-05

RUN 6 METHOD 4075-A
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 1:31 AM/PM
FINISH TIME 2:39 AM/PM
METER OPERATOR SJR

COMMENTS:
Process Upset!

METER BOX NO. 1874
DH @ 1.90

FILTER NO.
THIMBLE NO.

	DATA			RESULTS		
1	Pb	30.32	"Hg	Vmstd	44.18	dscf
2	Static	-0.23	"wc	Vwstd	0.956	scf
3	Vlc	20.3	ml	Bwo	0.021	
4	Mn		g	Md	29.08	lb/lb-mole
5	θ	60	min	Ms	28.85	lb/lb-mole
6	% O_2	19		Vs	26.67	ft/s
7	% CO_2	2		% I	102 ✓	
8	DH	1.84	"wc	acfm	45250	
9	Cp	0.84		dscfm	43370	
10	Tm	71	F	Particulate	—	gr/dscf
11	$\sqrt{Dp}$	0.47	$\sqrt{"wc}$		—	lb/hr
12	Ts	86	F	SO_2	—	lb/hr
13	Vm	43.669	ft^3	Gaseous F	0.03	lb/hr
14	Dn	0.294	in	Particulate F	0.91	lb/hr
15	As	28.27	ft^2	Total F	0.93	lb/hr
16	Yd	1.00	cf/cf			

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: SPRING HOPE
Unit#: Inlet/Outlet: OUTLET
Operator: S J ROBUCK
Date: 2/5/88
Run No.: 6
Sample Box No.:
Meter Box No.: 1874
Meter DH@: 1.90
K Factor: 8.1
Pitot C_p: Pitot Leak Ck:
Leak Rate Before: .008 CFM @ 15 Hg
Leak Rate After: .015 CFM @ 7 Hg
Static Press., in. H_2O (+/-): 0.23

Start Time: 1:31 AM / PM
Finish Time: 2:39 AM / PM
Meter Y_d: 1.00

SCHEMATIC OF TESTING LOCATION
407SA

Filter #'s:
Thimble #:
Beaker #:

Ambient Temperature, °F:
Barometric Pressure, in. Hg: 30.32
Assumed Moisture, %:
Heater Box Setting:
Probe Length, Ft.: No.:
Nozzle Diameter, in.:
Probe Heater Setting:
% O_2: 20
% CO_2: 1
H_2O, ml: 10
Silica Gel, gm: 10.3
Total Vlc: 20.3
Stack Area, Ft²:
Pyrometer No.:

TRAVERSE POINT NUMBER	MIN/PT ____ SAMPLING TIME θ, min.	VACUUM in. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, in. H_2O	Initial Volume: 587.201 GAS SAMPLE VOLUME V_m, Ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m in, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p °F
A 6	5	3	88	.10	.81	589.81	69	63	44	
5	10	4	88	.23	1.9	593.40	75	63	45	
4	15	5	87	.25	2.0	596.87	78	63	48	
3	20	6	87	.27	2.2	600.63	79	64	49	
2	25	6	87	.31	2.5	605.21	83	64	50	
1	30	5	86	.23	1.9	608.818	82	64	51	
A 1	5	4	84	.17	1.4	612.18 *	72	62	49	
2	10	4	85	.25	2.0	616.27	77	62	53	
3	15	5	85	.28	2.3	620.19	81	63	57	add ice
4	20	5	85	.22	1.8	623.82	81	63	56	
5	25	4	85	.25	2.0	627.6	81	64	53	
6	30	4	85	.16	1.3	630.870	80	64	53	
TOTAL			1032	~~22.11~~ 5.66	22.11		AVG. 938	AVG. 759		
AVERAGE			86	0.47	1.84	43.669	AVG. 71			

* New Port 608.854 Init

We can't wait for tomorrow ALCOA

Page ____ of ____

D-14

PARAMETER SHEET

ALCOA

PLANT Am Rockwool
CITY Sp Hpe STATE N.C.
DATE 88-02-05

RUN 7 METHOD 4075-A
UNIT Both
○ INLET
⊗ OUTLET STACK
START TIME 5:25 AM/PM
FINISH TIME 6:31 AM/PM
METER OPERATOR SJR

COMMENTS:

METER BOX NO. 1874
DH @ 1.90

FILTER NO.
THIMBLE NO.

	DATA			RESULTS		
1	Pb	30.32	"Hg	Vmstd	46.96	dscf
2	Static	-0.24	"wc	Vwstd	0.777	scf
3	Vlc	16.5	ml	Bwo	0.016	
4	Mn		g	Md	29.08	lb/lb-mole
5	θ	60	min	Ms	28.9	lb/lb-mole
6	% O_2	19		Vs	27.94	ft/s
7	% CO_2	2		% I	101.6	
8	DH	2.0	"wc	acfm	47400	
9	Cp	0.84		dscfm	46260	
10	Tm	68	F	Particulate	—	gr/dscf
11	$\sqrt{Dp}$	0.496	$\sqrt{"wc}$		—	lb/hr
12	Ts	79	F	SO_2	—	lb/hr
13	Vm	46.14	ft^3	Gaseous F	0.05	lb/hr
14	Dn	0.294	in	Particulate F	0.93	lb/hr
15	As	28.27	ft^2	Total F	0.98	lb/hr
16	Yd	1.00	cf/cf			

PARTICULATE TESTING
RAW DATA SET

ALCOA

Plant: SPRING HOPE
Unit#: ____ Inlet/Outlet: OUTLET
Operator: ST ROBUCK
Date: 7/5/88
Run No.: 7
Sample Box No.: ____
Meter Box No.: 1874
Meter DH@: 1.90
K Factor: 8.1
Pitot C_p: ____ Pitot Leak Ck: ____
Leak Rate Before: .009 CFM @ 15 Hg
Leak Rate After: .004 CFM @ 10 Hg
Static Press., In. H_2O (+/-): 0.24

Start Time: 5:25 AM (PM)
Finish Time: 6:31 AM (PM)
Meter Y_d: 1.00

SCHEMATIC OF TESTING LOCATION
4075 A

Filter #'s: ____
Thimble #: ____
Beaker #: ____

Ambient Temperature, °F: ____
Barometric Pressure, In. Hg: 30.32
Assumed Moisture, %: ____
Heater Box Setting: ____
Probe Length, Ft.: ____ No.: ____
Nozzle Diameter, In.: 0.294
Probe Heater Setting: ____
% O_2: ____
% CO_2: ____
H_2O, ml: 5.0
Silica Gel, gm: 11.5
Total V_{lc}: 16.5
Stack Area, Ft²: ____
Pyrometer No.: ____

TRAVERSE POINT NUMBER	MIN/PT ____ SAMPLING TIME θ, min.	VACUUM In. Hg	STACK TEMPERATURE T_s, °F	VELOCITY HEAD DP_s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER DH, In. H_2O	Initial Volume: 631.633 GAS SAMPLE VOLUME V_m, Ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET T_m in, °F	OUTLET T_m out, °F	TEMP. OF GAS LEAVING CONDENSER OR LAST IMPINGER T_c, °F	SAMPLE BOX TEMPERATURE T_p, °F
B 6	5	4	80	.17	1.4	634.98	69	57	42	
5	10	5	80	.24	1.9	634.31	76	59	42	
4	15	6	80	.22	1.8	642.16	79	60	~~42~~ 44	
3	20	6	79	.29	2.3	646.13	81	61	46	
2	25	6	78	.32	2.6	650.69	82	63	48	
1	30	6	78	.26	2.1	654.794	82	63	49	
A 1	5	~~6~~ 5	78	.20	1.6	658.16	69	62	43	
2	10	6	80	.28	2.3	662.13	71	61	43	
3	15	6	80	.27	2.2	666.32	71	61	44	
4	20	5	80	.29	2.3	670.44	73	61	45	
5	25	5	80	.25	2.0	674.32	74	62	46	
6	30	4	79	.19	1.5	677.773	74	61	46	
TOTAL			952	5.956	24		AVG. 901	AVG. 731		
AVERAGE			79	0.446	2.0	46.14	AVG. 68			

We can't wait for tomorrow ALCOA

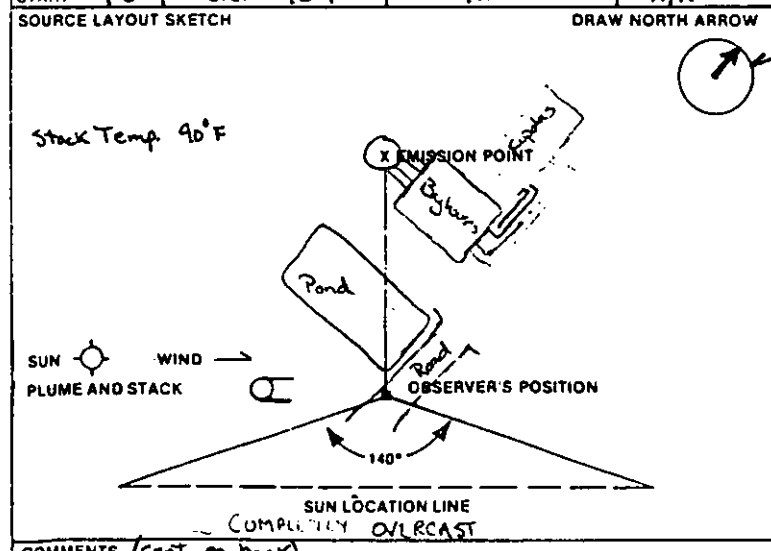
Page ____ of ____

VISIBLE EMISSION OBSERVATION FORM

D-15

SOURCE NAME	American Rockwool, Inc., Spring Hope Division
ADDRESS	Alt. 64 East
	P.O. Box 880
CITY	Spring Hope
STATE	NC
ZIP	27882
PHONE	(800) 334-0394 (919) 478-5111
SOURCE ID NUMBER	No. 1 & No 2
PROCESS EQUIPMENT	Two Cupolas
OPERATING MODE	150 lb/hr/cupola
CONTROL EQUIPMENT	Two Baghouses
OPERATING MODE	1-3 lb/hr (total)
DESCRIBE EMISSION POINT	White Circular Stack w/ Blue and Red Band at Top
START	Same
STOP	
HEIGHT ABOVE GROUND LEVEL	START 109 FT STOP 109 FT
HEIGHT RELATIVE TO OBSERVER	START 109 FT STOP 109 FT
DISTANCE FROM OBSERVER	START 325 FT STOP 325 FT
DIRECTION FROM OBSERVER	START NW STOP NW
DESCRIBE EMISSIONS	START No visible emissions observed STOP Same
EMISSION COLOR	START Clear STOP Same
PLUME TYPE: CONTINUOUS ✓	FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT:	NO ✓ YES ☐
IF WATER DROPLET PLUME:	N/A ATTACHED ☐ DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	START Stack exit STOP Stack Exit
DESCRIBE BACKGROUND	START Overcast Sky STOP Same
BACKGROUND COLOR	START Gray STOP Gray
SKY CONDITIONS	START Overcast STOP Overcast
WIND SPEED	START 4 to 7 MPH STOP Same
WIND DIRECTION	START NE STOP NE
AMBIENT TEMP.	START 45°F STOP 46°F
WET BULB TEMP.	N/A
RH, percent	N/A

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE: 88-02-03 START TIME: 11:30 am STOP TIME: 1:45 p.m.

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	<5	<5	<5	<5	31 (1:15)	<5	<5	<5	<5
2	<5	<5	<5	<5	32	<5	<5	<5	<5
3	<5	<5	<5	<5	33	<5	<5	<5	[illegible]
4	<5	<5	<5	<5	34	<5	<5	[illegible]	[illegible]
5	<5	<5	<5	<5	35	[illegible]	[illegible]	[illegible]	[illegible]
6	<5	<5	<5	[illegible]	36	[illegible]	[illegible]	[illegible]	<5
7	<5	<5	<5	<5	37	<5	<5	<5	<5
8	<5	<5	<5	<5	38	<5	<5	<5	<5
9	<5	<5	<5	<5	39	<5	<5	<5	<5
10	<5	<5	10	<5	40	<5	<5	<5	<5
11	<5	<5	<5	<5	41	<5	<5	<5	<5
12	<5	<5	<5	<5	42 (5.2%)	<5	<5	<5	<5
13	<5	<5	<5	<5	43	<5	<5	<5	<5
14	<5	<5	<5	<5	44	<5	<5	<5	<5
15	<5	<5	<5	<5	45	<5	<5	<5	<5
16	<5	<5	<5	<5	46	<5	<5	<5	<5
17	<5	<5	<5	<5	47	<5	<5	<5	<5
18	<5	<5	<5	<5	48	<5	<5	<5	<5
19	<5	<5	<5	<5	49	<5	<5	<5	<5
20	<5	<5	<5	<5	50	<5	<5	<5	<5
21	<5	<5	<5	<5	51	<5	<5	<5	<5
22	<5	<5	<5	<5	52	<5	<5	<5	<5
23	<5	<5	<5	<5	53	<5	<5	<5	<5
24	<5	<5	<5	<5	54	<5	<5	<5	<5
25	<5	<5	<5	<5	55	<5	<5	<5	<5
26	<5	<5	<5	<5	56	<5	<5	<5	<5
27	<5	<5	<5	<5	57	<5	<5	<5	<5
28	<5	<5	<5	<5	58	<5	<5	<5	<5
29	<5	<5	<5	<5	59	<5	<5	<5	<5
12:00 30	<5	<5	<5	<5	60	<5	<5	<5	<5

AVERAGE OPACITY FOR HIGHEST PERIOD (6-MIN) <5.2%

NUMBER OF READINGS ABOVE % WERE N/A

RANGE OF OPACITY READINGS — MINIMUM <5% MAXIMUM 10%

OBSERVER'S NAME (PRINT): Nancy Louise Frerichs

COMMENTS (cont. on back): The only possible background was the sky

*Small amount of <10% drifting

Insulation Manufacturing Plant, up in front of stack

OBSERVER'S SIGNATURE: Nancy L. Frerichs DATE: 88-02-03

ORGANIZATION: Aluminum Co. of America

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE: Bill Dunlap

TITLE: Pres. DATE: 2-5-88

~~CERTIFIED BY~~ STANDARD: 20% EPA Method 9 DATE: 87-10-22

VERIFIED BY DATE

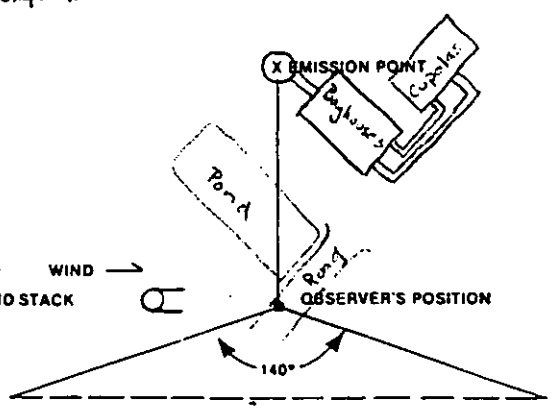
D-16

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	American Rockwool, Inc. Spring Hope Division
ADDRESS	Alt. 64 East
	P.O. Box 880
CITY	Spring Hope
STATE	NC
ZIP	27882
PHONE	(800) 334-0344
	(919) 478-5111
SOURCE ID NUMBER	No. 1 & No. 2
PROCESS EQUIPMENT	Two Cupolas
OPERATING MODE	150 lb/hr/Cupola
CONTROL EQUIPMENT	Two Baghouses
OPERATING MODE	1-3 lb/hr (Total)
DESCRIBE EMISSION POINT	White Circular Stack w/ Blue and Red Band at Top
START	Same
STOP	
HEIGHT ABOVE GROUND LEVEL	START 109 FT STOP 109 FT
HEIGHT RELATIVE TO OBSERVER	START 109 FT STOP 109 FT
DISTANCE FROM OBSERVER	START 325 FT. STOP 325 FT
DIRECTION FROM OBSERVER	START NW STOP NW
DESCRIBE EMISSIONS	START No visible emissions observed STOP Same
EMISSION COLOR	START Clear STOP Clear
PLUME TYPE: CONTINUOUS ☑	FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT:	NO ☑ YES ☐
IF WATER DROPLET PLUME: N/A	ATTACHED ☐ DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	START Stack Exit STOP Stack Exit
DESCRIBE BACKGROUND	START Overcast Sky STOP Overcast Sky
BACKGROUND COLOR	START Gray STOP Gray
SKY CONDITIONS	START Overcast STOP Same
WIND SPEED	START 4 To 7 mph STOP 4 To 7 mph
WIND DIRECTION	START NE STOP NE
AMBIENT TEMP.	START 46° F STOP 44° F
WET BULB TEMP.	N/A
RH, percent	N/A

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW

Stack Temp. 90°F



Completly Overcast

OBSERVATION DATE	START TIME	STOP TIME
88-02-03	3:59 p.m.	5:09 p.m.

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	<5	<5	<5	<5	31 (4:39)	<5	<5	<5	<5
2	<5	<5	<5	<5	32	<5	<5	<5	<5
3	<5	<5	<5	<5	33	<5	<5	<5	<5
4	<5	<5	<5	<5	34	<5	<5	<5	<5
5	<5	<5	<5	<5	35 (5%)	<5	<5	<5	<5
6	<5	<5	<5	<5	36	<5	<5	<5	<5
7	<5	<5	<5	<5	37	<5	<5	<5	<5
8	<5	<5	<5	<5	38	<5	<5	<5	<5
9	<5	<5	<5	<5	39	<5	<5	<5	<5
10	<5	<5	<5	<5	40	<5	<5	<5	<5
11	<5	<5	<5	<5	41	<5	<5	<5	<5
12	<5	<5	<5	<5	42	<5	<5	<5	<5
13	<5	<5	<5	<5	43	<5	<5	<5	<5
14	<5	<5	<5	<5	44	<5	<5	<5	<5
15	<5	<5	<5	<5	45	<5	<5	<5	<5
16	<5	<5	<5	<5	46	<5	<5	<5	<5
17	<5	<5	<5	<5	47	<5	<5	<5	<5
18	<5	<5	<5	<5	48	<5	<5	<5	<5
19	<5	<5	<5	<5	49	<5	<5	<5	<5
20	<5	<5	<5	<5	50	<5	<5	<5	<5
21	<5	<5	<5	<5	51	<5	<5	<5	<5
22	<5	<5	<5	<5	52	<5	<5	<5	<5
23	<5	<5	<5	<5	53	<5	<5	<5	<5
24	<5	<5	<5	<5	54	<5	<5	<5	<5
25	<5	<5	<5	<5	55	<5	<5	<5	<5
26	<5	<5	<5	<5	56	<5	<5	<5	<5
27	<5	<5	<5	<5	57	<5	<5	<5	<5
28	<5	<5	<5	<5	58	<5	<5	<5	<5
29	<5	<5	<5	<5	59	<5	<5	<5	<5
30 (4:29)	<5	<5	<5	<5	60	<5	<5	<5	<5

AVERAGE OPACITY FOR HIGHEST PERIOD (6-MIN) <5%

NUMBER OF READINGS ABOVE % WERE N/A

RANGE OF OPACITY READINGS — MINIMUM <5% MAXIMUM <5%

OBSERVER'S NAME (PRINT): Nancy Louise Frerichs

COMMENTS: The only possible background was the sky. Insulation Mfg. Plant. After 30 minutes, broke for ~10 minutes and began 4:39

OBSERVER'S SIGNATURE: Nancy L Frerichs

DATE: 88-02-03

ORGANIZATION: Aluminum Co. of America

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE: [illegible]

TITLE: Plan

DATE: 2-1-88

~~CERTIFIED BY~~ Standard: 20% EPA Method 9

DATE: 87-10-22

VERIFIED BY

DATE

SOURCE NAME	OBSERVATION DATE	START TIME	STOP TIME
American Rockwool, Inc., Spring Hope Division (D-17)	88-02-04	9:45 am	11:00 am

ADDRESS
Alt. 64 East
P.O. Box 880

CITY	STATE	ZIP
Spring Hope	NC	27882

PHONE 1-(800)-334-0354
1-(919)-478-5111

SOURCE ID NUMBER No. 1 & No 2

PROCESS EQUIPMENT Two Cupolas
OPERATING MODE 150 T/hr / Cupolas

CONTROL EQUIPMENT Two baghouses
OPERATING MODE 1-3 T/hr (Total)

DESCRIBE EMISSION POINT white circular stack w/ blue & red band at Top
START red band at Top STOP Same

HEIGHT ABOVE GROUND LEVEL START 109 FT STOP 109 FT
HEIGHT RELATIVE TO OBSERVER START 109 FT STOP 109 FT

DISTANCE FROM OBSERVER START 325 FT - STOP 325 FT
DIRECTION FROM OBSERVER START NW STOP NW

DESCRIBE EMISSIONS START No visible emissions observed STOP Same

EMISSION COLOR START Clear STOP Clear
PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☑ YES ☐
IF WATER DROPLET PLUME: N/A ATTACHED ☐ DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED START Stack Exit STOP Stack Exit

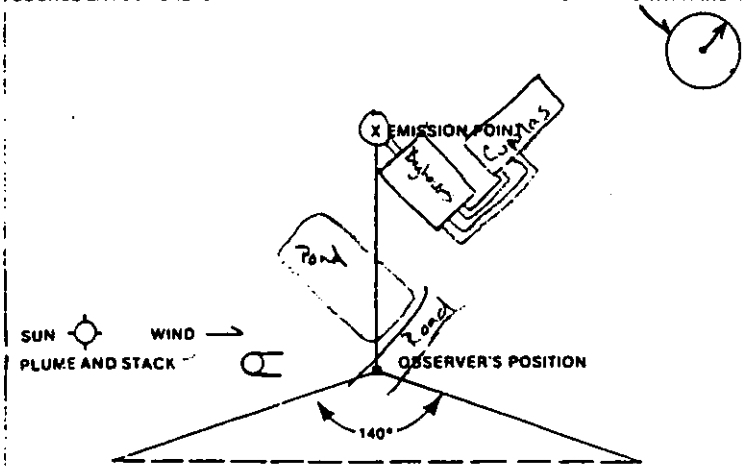
DESCRIBE BACKGROUND START Overcast Sky STOP Overcast Sky

BACKGROUND COLOR START Gray STOP Gray
SKY CONDITIONS START Overcast STOP Rainy Overcast

WIND SPEED START 4 to 7 mph STOP Same
WIND DIRECTION START W STOP W

AMBIENT TEMP. START 45°F STOP 45°F
WET BULB TEMP. N/A
RH, percent N/A

SOURCE LAYOUT SKETCH



COMPLETELY OVERCAST

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
1	<5	<5	<5	<5	10:31	<5	<5	<5	<5
2	<5	<5	<5	<5	32	<5	<5	<5	<5
3	<5	<5	<5	<5	33	-			
4	<5	<5	<5	<5	34				
5	<5	<5	<5	<5	35	<5	<5	<5	<5
6	<5	<5	<5	<5	36	<5	<5	<5	<5
7	<5	<5	<5	<5	37	<5	<5	<5	<5
8	<5	<5	<5	<5	38	<5	<5	<5	<5
9	<5	<5	<5	<5	39	-	-	-	-
10	<5	<5	<5	<5	40	<5	<5	<5	<5
11	<5	<5	<5	<5	41	-	-	<5	<5
12	<5	<5	<5	<5	42	-	-	-	-
13	<5	<5	<5	<5	43	-	-	-	-
14	<5	<5	<5	<5	44	-	-	<5	-
15	<5	<5	<5	<5	45	-	-	-	-
16	<5	<5	<5	<5	46	<5	<5	<5	<5
17	<5	<5	<5	<5	47	<5	-	-	<5
18	<5	<5	<5	<5	48	<5	<5	-	-
19	<5	<5	<5	<5	49	-	<5	<5	<5
20	<5	<5	<5	<5	50	<5	<5	-	-
21	<5	<5	<5	<5	51	<5	-	-	-
22	<5	<5	<5	<5	52	-	-	-	-
23	<5	<5	<5	<5	53	<5	<5	-	-
24	<5	<5	<5	<5	54	-	-	-	<5
25	<5	<5	<5	<5	55	-	-	-	-
26	<5	<5	<5	<5	56	-	-	-	-
27	<5	<5	<5	<5	57	-		-	<5
28	<5	<5	<5	<5	58	-	-	-	-
29	<5	<5	<5	<5	59	-	-	-	-
10:15 30	<5	<5	<5	<5	60	-	-	<5	<5

AVERAGE OPACITY FOR HIGHEST PERIOD (6-MIN) <5%
NUMBER OF READINGS ABOVE % WERE N/A
RANGE OF OPACITY READINGS MINIMUM <5% MAXIMUM <5%

OBSERVER'S NAME (PRINT) Nancy Louise Frerichs

COMMENTS (cont)
The only possible background was the sky, Insulation Manufacturing Plant, Occasional steam rising from

OBSERVER'S SIGNATURE Nancy L Frerichs
DATE 88-02-04
ORGANIZATION Aluminum Co. of America

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE [illegible]
TITLE [illegible]
DATE 2-5-88

~~CERTIFIED BY~~ Standard: 20% EPA Method 9
DATE 87-10-22
VERIFIED BY
DATE

PATR 0131

D-18

SOURCE NAME	OBSERVATION DATE	START TIME	STOP TIME
American Rockwool, Inc., Spring Hope Division	88-02-05	7:45 am	8:55 am

ADDRESS: Alt. 64 East

P.O. Box 880

CITY	STATE	ZIP
Spring Hope	NC	27882

PHONE: 1-(800)-334-0394; 1-(919)-478-5111

SOURCE ID NUMBER: No. 1 & No. 2

PROCESS EQUIPMENT: Two Cupolas

OPERATING MODE: 150 T/hr/Cupola

CONTROL EQUIPMENT: Two Baghouses

OPERATING MODE: 1-3 T/hr (Total)

DESCRIBE EMISSION POINT: white circular stack w/blue & red band at top

START: same STOP: same

HEIGHT ABOVE GROUND LEVEL: START 109 FT STOP 109 FT

HEIGHT RELATIVE TO OBSERVER: START 109 FT STOP 109 FT

DISTANCE FROM OBSERVER: START 325 FT STOP 325 FT

DIRECTION FROM OBSERVER: START NW STOP NW

DESCRIBE EMISSIONS: START No visible emissions observed STOP Same

EMISSION COLOR: START Clear STOP Clear

PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☑ YES ☐

IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐ N/A

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START Stack Exit STOP Stack Exit

DESCRIBE BACKGROUND: START Broken Clouds STOP Clouds

BACKGROUND COLOR: START Blue & Gray STOP Gray

SKY CONDITIONS: START Partly (Broken) Cloudy STOP Overcast

WIND SPEED: START 1 to 3 mph STOP 1 to 3 mph

WIND DIRECTION: START SW STOP SW

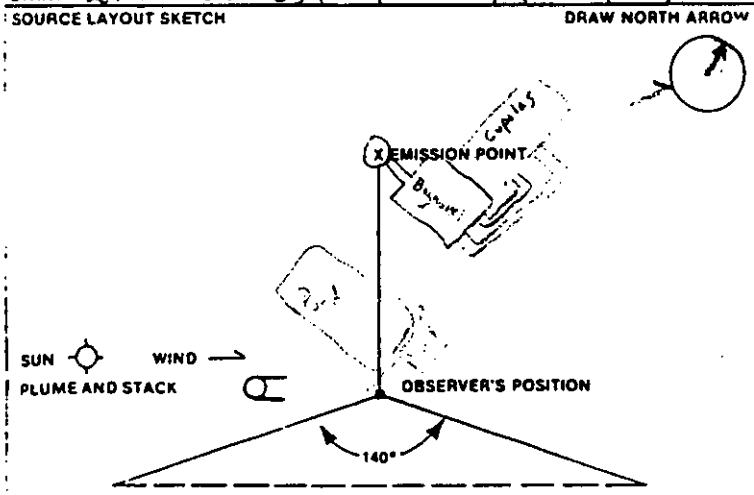
AMBIENT TEMP.: START 29°F STOP 35°F

WET BULB TEMP.: N/A

RH, percent: N/A

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



No shadow because of overcast

MIN	SEC 0	15	30	45	MIN	SEC 0	15	30	45
1	<5	<5	<5	<5	31 (8:25)	<5	<5	<5	—
2	<5	<5	<5	<5	32	<5	<5	<5	<5
3	<5	<5	<5	<5	33	<5	<5	—	<5
4	<5	<5	<5	<5	34	—	<5	—	<5
5	<5	<5	<5	<5	35	<5	—	—	—
6	<5	<5	<5	<5	36	<5	<5	<5	<5
7	<5	<5	<5	<5	37	<5	<5	—	<5
8	<5	<5	<5	<5	38	—	<5	<5	—
9	<5	<5	<5	<5	39	—	<5	<5	—
10	<5	<5	<5	<5	40	—	<5	—	—
11	<5	<5	<5	<5	41	—	—	—	—
12	<5	<5	<5	<5	42	—	—	—	—
13	<5	<5	<5	<5	43	<5	<5	<5	<5
14	<5	<5	<5	<5	44	<5	<5	—	—
15	<5	<5	<5	<5	45	—	—	—	—
16	<5	<5	<5	<5	46	—	—	—	<5
17	<5	<5	<5	<5	47	<5	<5	—	<5
18	<5	<5	<5	<5	48	<5	—	—	—
19	<5	<5	<5	<5	49	<5	<5	—	—
20	<5	<5	<5	<5	50	<5	<5	<5	<5
21	<5	<5	<5	<5	51	—	—	—	—
22	<5	<5	<5	<5	52	—	—	—	—
23	<5	<5	<5	<5	53	—	—	—	—
24	<5	<5	<5	<5	54	—	—	—	—
25	<5	<5	<5	<5	55	—	—	—	—
26	<5	<5	<5	<5	56	—	—	—	—
27	<5	—	<5	<5	57	<5	—	<5	<5
28	<5	<5	<5	<5	58	<5	<5	<5	<5
29	<5	<5	<5	<5	59	<5	<5	<5	<5
8:15 30	<5	<5	<5	<5	60	<5	<5	<5	<5

AVERAGE OPACITY FOR HIGHEST PERIOD (6-min): <5%

NUMBER OF READINGS ABOVE % WERE: N/A

RANGE OF OPACITY READINGS: MINIMUM <5% MAXIMUM <5%

OBSERVER'S NAME (PRINT): Nancy Louise Frerichs

COMMENTS (cont.): Occasional steam rising from other equipment. After 30 minutes, the test was interrupted for ~10 minutes to change parts

OBSERVER'S SIGNATURE: Nancy L. Frerichs

DATE: 88-02-05

ORGANIZATION: Aluminum Co. of America

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE: Bill Bromley

TITLE: Pres.

DATE: 2-5-88

~~CERTIFIED BY~~ Standard: 20% EPA Method 9

DATE: 87-10-22

VERIFIED BY

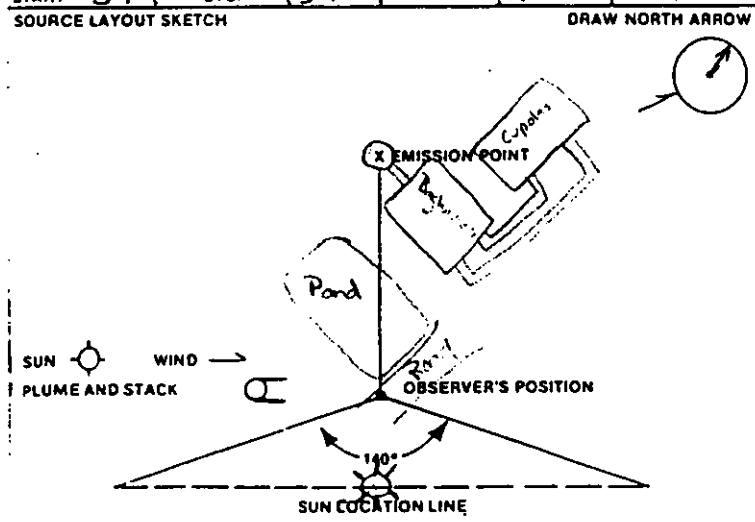
DATE

D-19

SOURCE NAME	American Rockwool, Inc., Spring Hope Division
ADDRESS	Alt. 64 East
	P.O. Box 880
CITY	Spring Hope
STATE	NC
ZIP	27882
PHONE	1-(800)-334-0344 1-(919)-478-5111
SOURCE ID NUMBER	No. 1 & No. 2
PROCESS EQUIPMENT	Two Cupolas
OPERATING MODE	150 lb/hr / Cupola
CONTROL EQUIPMENT	Two Baghouses
OPERATING MODE	1-3 lb/hr (Total)
DESCRIBE EMISSION POINT	White Circular stack w/ blue & red band at top
START	same
STOP	
HEIGHT ABOVE GROUND LEVEL	START 109 FT STOP 109 FT
HEIGHT RELATIVE TO OBSERVER	START 109 FT STOP 109 FT
DISTANCE FROM OBSERVER	START 325 FT STOP 325 FT
DIRECTION FROM OBSERVER	START NW STOP NW
DESCRIBE EMISSIONS	START No visible emissions observed STOP Same
EMISSION COLOR	START Clear STOP Clear
PLUME TYPE: CONTINUOUS ☑	FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT:	NO ☑ YES ☐
IF WATER DROPLET PLUME:	ATTACHED ☐ DETACHED ☐ N/A
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	START Stack Exit STOP Stack Exit
DESCRIBE BACKGROUND	START Broken Clouds STOP Overcast Clouds
BACKGROUND COLOR	START Blue & Gray STOP Gray
SKY CONDITIONS	START Broken Clouds STOP Overcast
WIND SPEED	START 1 to 3 mph STOP 1 to 3 mph
WIND DIRECTION	START SW STOP SW
AMBIENT TEMP.	START 39°F STOP 43°F
WET BULB TEMP.	N/A
RH, percent	N/A

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



OBSERVATION DATE	START TIME	STOP TIME
88-02-05	10:30 a.m.	11:40 a.m.

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	<5	<5	<5	—	11:31	<5	<5	<5	<5
2	<5	<5	<5	<5	32	<5	<5	<5	<5
3	<5	<5	<5	<5	33	<5	<5	<5	<5
4	<5	<5	<5	[illegible]	34	[illegible]	<5	<5	<5
5	<5	<5	<5	<5	35	<5	<5	<5	<5
6	<5	<5	<5	<5	36	<5	<5	<5	<5
7	<5	<5	<5	<5	37	<5	<5	<5	<5
8	<5	<5	<5	<5	38	<5	<5	<5	<5
9	<5	<5	<5	<5	39	<5	<5	<5	<5
10	<5	<5	<5	<5	40	<5	<5	<5	<5
11	<5	<5	<5	<5	41	<5	<5	<5	<5
12	<5	<5	<5	<5	42	<5	<5	<5	<5
13	<5	<5	<5	<5	43	<5	<5	<5	<5
14	<5	<5	<5	<5	44	<5	<5	<5	<5
15	<5	<5	<5	<5	45	<5	<5	<5	<5
16	<5	<5	<5	—	46	—	<5	<5	<5
17	—	—	<5	<5	47	<5	<5	<5	<5
18	<5	<5	<5	<5	48	<5	<5	<5	<5
19	<5	<5	<5	<5	49	<5	<5	<5	<5
20	<5	<5	<5	<5	50	<5	<5	<5	<5
21	<5	<5	<5	<5	51	<5	<5	<5	<5
22	<5	<5	<5	<5	52	<5	<5	<5	<5
23	<5	<5	<5	<5	53	<5	<5	<5	<5
24	<5	<5	<5	<5	54	<5	<5	<5	<5
25	—	<5	<5	<5	55	<5	<5	<5	<5
26	<5	<5	<5	<5	56	<5	<5	<5	<5
27	<5	<5	<5	<5	57	<5	<5	<5	<5
28	<5	<5	<5	<5	58	<5	<5	<5	<5
29	<5	<5	<5	<5	59	<5	<5	<5	<5
11:33 30	<5	<5	<5	<5	60	<5	<5	<5	<5

AVERAGE OPACITY FOR HIGHEST PERIOD (6-MIN) <5%

NUMBER OF READINGS ABOVE % WERE N/A

RANGE OF OPACITY READINGS MINIMUM <5% MAXIMUM <5%

OBSERVER'S NAME (PRINT): Nancy Louise Frerichs

OBSERVER'S SIGNATURE: Nancy L. Frerichs

DATE: 88-02-05

ORGANIZATION: Aluminum Co. of America

COMMENTS (continued on back)

The only possible background was the sky. Insulation Mfg. Plant. The test was interrupted for ~10 minutes to change parts

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE: [illegible]

TITLE: Plant

DATE: 2-5-88

~~CERTIFIED BY~~ Standard: 20% EPA Method 9

DATE: 87-10-22

VERIFIED BY

DATE

D-20

SOURCE NAME	OBSERVATION DATE	START TIME	STOP TIME
American Rockwool, Inc., Spring Hope Division	88-02-05	1:30 p.m.	2:40 p.m.

ADDRESS: Alt. 64 East

P.O. Box 880

CITY	STATE	ZIP
Spring Hope	NC	27882

PHONE: 1-(800)-334-0349; 1-(919)-478-5111

SOURCE ID NUMBER: No. 1 & No. 2

PROCESS EQUIPMENT: Two Cupolas

OPERATING MODE: 150 lb/hr / Cupola

CONTROL EQUIPMENT: Two Baghouses

OPERATING MODE: 1-3 lb/hr (Total)

DESCRIBE EMISSION POINT: White Circular stack w/blue & red band at top

START: Same STOP: Same

HEIGHT ABOVE GROUND LEVEL: START 109 FT STOP 109 FT

HEIGHT RELATIVE TO OBSERVER: START 109 FT STOP 109 FT

DISTANCE FROM OBSERVER: START 325 FT STOP 325 FT

DIRECTION FROM OBSERVER: START NW STOP NW

DESCRIBE EMISSIONS: START No visible emissions observed STOP Same

EMISSION COLOR: START Clear STOP Clear

PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☑ YES ☐

IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐ N/A

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START Stack Exit STOP Stack Exit

DESCRIBE BACKGROUND: START Broken Clouds STOP Overcast Clouds

BACKGROUND COLOR: START Blue & White STOP Gray

SKY CONDITIONS: START Broken Clouds STOP Overcast

WIND SPEED: START 4 to 7 mph STOP 4 to 7 mph

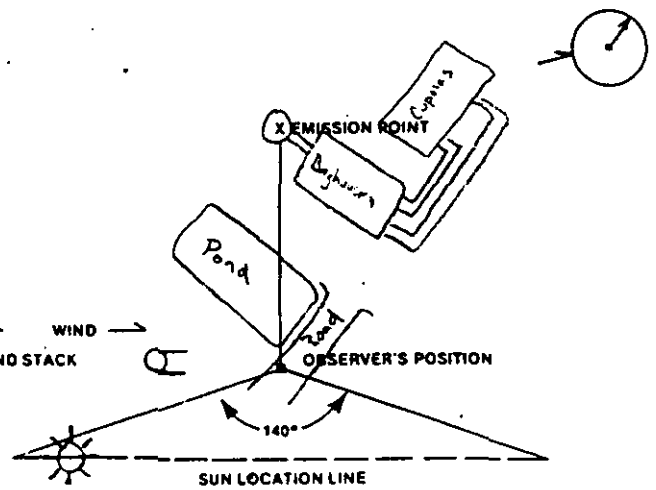
WIND DIRECTION: START SW STOP SW

AMBIENT TEMP.: START 47°F STOP 45°F

WET BULB TEMP.: N/A

RH, percent: N/A

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
1	<5	<5	<5	<5	2:10 31	<5	<5	<5	<5
2	<5	<5	<5	<5	32	<5	<5	<5	<5
3	<5	<5	<5	<5	33	<5	<5	<5	<5
4	<5	<5	<5	<5	34	<5	<5	<5	<5
5	<5	<5	<5	<5	35	<5	<5	<5	<5
6	<5	<5	<5	<5	36	<5	<5	<5	<5
7	<5	<5	<5	<5	37	<5	<5	<5	<5
8	<5	<5	<5	<5	38	<5	<5	<5	<5
9	<5	<5	<5	<5	39	<5	<5	<5	<5
10	<5	<5	<5	<5	40	<5	<5	<5	<5
11	<5	<5	<5	<5	41	<5	<5	<5	<5
12	<5	<5	<5	<5	42	<5	<5	<5	<5
13	<5	<5	<5	<5	43	<5	<5	<5	<5
14	<5	<5	<5	<5	44	<5	<5	<5	<5
15	<5	<5	<5	<5	45	<5	<5	<5	<5
16	<5	<5	<5	<5	46	<5	<5	<5	<5
17	<5	<5	<5	<5	47	<5	<5	<5	<5
18	<5	<5	<5	<5	48	<5	<5	<5	<5
19	<5	<5	<5	<5	49	<5	<5	<5	<5
20	<5	<5	<5	<5	50	<5	<5	<5	<5
21	<5	<5	<5	<5	51	<5	<5	<5	<5
22	<5	<5	<5	<5	52	<5	<5	<5	<5
23	<5	<5	<5	<5	53	<5	<5	<5	<5
24	<5	<5	<5	<5	54	<5	<5	<5	<5
25	<5	<5	<5	<5	55	<5	<5	<5	<5
26	<5	<5	<5	<5	56	<5	<5	<5	<5
27	<5	<5	<5	<5	57	<5	<5	<5	<5
28	<5	<5	<5	<5	58	<5	<5	<5	<5
29	<5	<5	<5	<5	59	<5	<5	<5	<5
2:00 30	<5	<5	<5	<5	60	<5	<5	<5	<5

AVERAGE OPACITY FOR HIGHEST PERIOD (6-MIN): <5%

NUMBER OF READINGS ABOVE % WERE: N/A

RANGE OF OPACITY READINGS: MINIMUM <5% MAXIMUM <5%

OBSERVER'S NAME (PRINT): Nancy Louise Frerichs

COMMENTS (continued on back)

The only possible background was the sky. Insulation mfg. Plant. The test was interrupted for ~10 minutes to change

OBSERVER'S SIGNATURE: Nancy L. Frerichs

DATE: 88-02-05

ORGANIZATION: Aluminum Co. of America

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE: R W Dramby

TITLE: Pres

DATE: 2-5-88

CERTIFIED BY standard: 20% EPA Method 9

DATE: 87-10-22

VERIFIED BY

DATE

EATR010

D-21

SOURCE NAME	OBSERVATION DATE	START TIME	STOP TIME
American Rockwool, Inc. Spring House Division	88-02-05	5:23 pm	6:10 pm

ADDRESS: Alt. 64 East

P.O. Box 880

CITY	STATE	ZIP
Spring Hope	NC	27882

PHONE: 1-(800)-334-0394, 1-(919)-478-5111

SOURCE ID NUMBER: No. 1 & No. 2

PROCESS EQUIPMENT: Two Cupolas

OPERATING MODE: 150 T/hr / Cupola

CONTROL EQUIPMENT: Two Baghouses

OPERATING MODE: 1-3 T/hr (Total)

DESCRIBE EMISSION POINT: white circular stack w/blue

START: red band at Top STOP: Same

HEIGHT ABOVE GROUND LEVEL: START 109 FT STOP 109 FT

HEIGHT RELATIVE TO OBSERVER: START 109 FT STOP 109 FT

DISTANCE FROM OBSERVER: START 325 FT STOP 325 FT

DIRECTION FROM OBSERVER: START NW STOP NW

DESCRIBE EMISSIONS: START No visible emissions observed STOP Same

EMISSION COLOR: START Clear STOP Clear

PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☑ YES ☐

IF WATER DROPLET PLUME: N/A ATTACHED ☐ DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START Stack Exit STOP Stack Exit

DESCRIBE BACKGROUND: START Overcast Clouds STOP Overcast Clouds

BACKGROUND COLOR: START Gray STOP Gray

SKY CONDITIONS: START Overcast STOP Overcast

WIND SPEED: START 1-3 mph STOP 1-3 mph

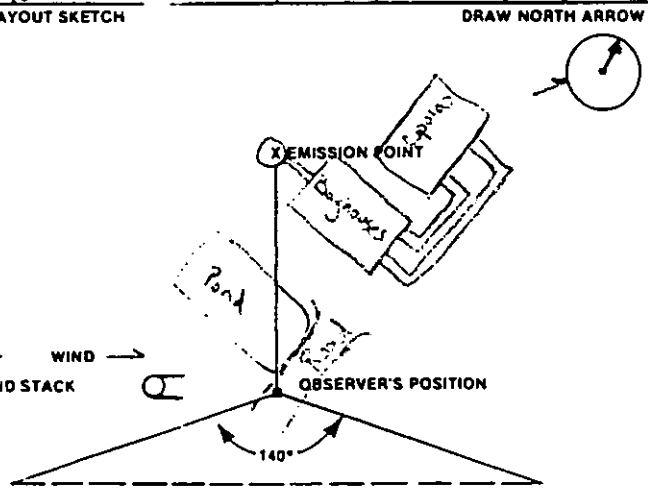
WIND DIRECTION: START SW STOP SW

AMBIENT TEMP.: START 40°F STOP 37°F

WET BULB TEMP.: N/A

RH, percent: N/A

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



SUN LOCATION LINE: No shadow - Overcast

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
1	<5	<5	<5	<5	6:00 31	<5	<5	<5	<5
2	<5	<5	<5	<5	32	<5	<5	<5	<5
3	<5	<5	<5	<5	33	<5	<5	<5	<5
4	<5	<5	<5	<5	34	<5	<5	<5	<5
5	<5	<5	<5	<5	35	<5	<5	<5	<5
6	<5	<5	<5	<5	36	<5	<5	<5	<5
7	<5	<5	<5	<5	37	<5	<5	<5	<5
8	<5	<5	<5	<5	38	<5	<5	<5	<5
9	<5	<5	<5	<5	39	<5	<5	<5	<5
10	<5	<5	<5	<5	40	<5	<5	<5	<5
11	<5	<5	<5	<5	41	–	–	–	–
12	<5	<5	<5	<5	42	–	–	–	–
13	<5	<5	<5	<5	43	–	–	–	–
14	<5	<5	<5	<5	44	–	–	–	–
15	<5	<5	<5	<5	45	–	–	–	–
16	<5	<5	<5	<5	46	–	–	–	–
17	<5	<5	<5	<5	47	–	–	–	–
18	<5	<5	<5	<5	48	–	–	–	–
19	<5	<5	<5	<5	49	–	–	–	–
20	<5	<5	<5	<5	50	–	–	–	–
21	<5	<5	<5	<5	51	–	–	–	–
22	<5	<5	<5	<5	52	–	–	–	–
23	<5	<5	<5	<5	53	–	–	–	–
24	<5	<5	<5	<5	54	–	–	–	–
25	<5	<5	<5	<5	55	–	–	–	–
26	<5	<5	<5	<5	56	–	–	–	–
27	<5	<5	<5	<5	57	–	–	–	–
28	<5	<5	<5	<5	58	–	–	–	–
29	<5	<5	<5	<5	59	–	–	–	–
5:53 30	<5	<5	<5	<5	60	–	–	–	–

AVERAGE OPACITY FOR HIGHEST PERIOD (6-min) <5%

NUMBER OF READINGS ABOVE % WERE N/A

RANGE OF OPACITY READINGS: MINIMUM <5% MAXIMUM <5%

OBSERVER'S NAME (PRINT): Nancy Louise Frerichs

COMMENTS (Continued on back): The only possible background was the sky. Insulation Mfg. Plant. The test was interrupted for ~7

OBSERVER'S SIGNATURE: Nancy L. Frerichs

DATE: 88-02-05

ORGANIZATION: Aluminum Co. of America

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE: [illegible]

TITLE: Pres.

DATE: 2-1-88

~~CERTIFIED BY~~ Standard: 20% EPA Method 9

DATE: 87-10-22

VERIFIED BY

DATE

P-TR 0101

APPENDIX E

Laboratory Data
- Method 5
- Method 6
- Method 4075A
  - Nozzle
  - Thimble
  - Impinger
- Raw Materials

ALCOA

BALANCE Sartorius 2462
OPERATOR Jim D. Pennix
DATE 88-01-29
SHEET 1 OF 3

PLANT American Rockwool, Inc
LOCATION Spring Hope, NC
UNIT 1 + 2
RUN 1-7 - Method 5

RUN #	IDENTIFICATION NUMBER	F B	WASH ML.	WASH CORR.	GROSS WT.	TARE WT.	NET WT.	FILTER DESCRIPTION
1	2	F			0.6896	0.6830	0.0049g	
					0.6879	0.6830		
					0.6881	0.6832		
2	3	F			0.6866	0.6827	0.0036g	
					0.6862	0.6825		
						0.6826		
3	4	F			0.6697	0.6660	0.0033g	
					0.6694	0.6661		
						0.6661		
4	5	F			0.6947	0.6818	0.0128g	
					0.6948	0.6822		
						0.6820		
5	6	F			0.6682	0.6493	0.0195g	
					0.6685	0.6491		
						0.6490		
6	7	F			0.7096	0.6864	0.0235g	
					0.7100	0.6862		
						0.6865		
7	8	F			0.6771	0.6592	0.0172g	
					0.6767	0.6595		
						0.6595		

E-2

ALCOA

BALANCE Sartorius 2462
OPERATOR Lisa D. Perry
DATE 88-02-01
SHEET 2 OF 3

PLANT American Rockwool, Inc.
LOCATION Spring Hope, NC
UNIT 1&2
RUN 1-7 Method 5

RUN #	IDENTIFICATION NUMBER	F B	WASH ML	WASH CORR.	GROSS WT.	TARE WT.	NET WT.	FILTER DESCRIPTION
1	BKGND 1 front half	B	100	0.0005	64.2552	64.2380	0.0167	
					64.2552	64.2381		
2	BKGND 2 front half	B	125	0.0006	52.5774	52.5656	0.0112	
					52.5775	52.5657		
3	BKGND 3 front half	B	130	0.0006	98.3809	98.3713	0.0090	
					98.3810	98.3714		
4	SPL7001 front half	B	100	0.0005	97.1448	97.1301	0.0142	
					97.1449	97.1302		
5	SPL7002 front half	B	95	0.0004	104.6440	104.6366	0.0070	
					104.6441	104.6365		
6	SPL7003 front half	B	98	0.0005	95.5223	95.5113	0.0105	
					95.5224	95.5115		
7	SPL7004 front half	B	100	0.0005	106.1002	106.0932	0.0065	
					106.1001	106.0933		
	blank) - acetone	B	150		79.6028	79.6021	0.0007g	
					79.6029	79.6020		

ALCOA

BALANCE Sartorius 2462
OPERATOR Lisa D. Penick
DATE 88-02-01
SHEET 3 OF 3

PLANT American Rockwool Inc
LOCATION Spring Hope, NC
UNIT 102
RUN 1-7 Method 5

RUN #	IDENTIFICATION NUMBER	F B	WASH ML	WASH CORR.	GROSS WT.	TARE WT.	NET WT.	FILTER DESCRIPTION
1	BKGND1 back half	B	145	0.0003	176.1655 176.1654	176.1571 176.1573	0.0081	
2	BKGND2 back half	B	135	0.0003	192.0244 192.0245	192.0177 192.0179	0.0064	
3	BKGND3 back half	B	150	0.0003	170.2106 170.2106	170.2062 170.2064	0.0041	
4	SPL7001 back half	B	160	0.0003	175.3843 175.3840	175.3829 175.3830	0.0011	
5	SPL7002 back half	B	160	0.0003	185.8239 185.8241	185.8213 185.8215	0.0023	
6	SPL7003 back half	B	160	0.0003	178.1593 178.1593	178.1575 178.1576	0.0015	
7	SPL7004 back half	B	150	0.0003	178.5654 178.5653	178.5619 178.5620	0.0032	
	blank-isopropanol	B	550		175.5030 175.5031	175.5019 175.5021	0.0011g	

E-4

ALCOA TECHNICAL CENTER
ANALYTICAL CHEMISTRY DIVISION

88-02-24 15:47 PAGE 2
J.O. NO. 88-021018

AREA: 205 - SPECIAL ANALYSIS

APPROVED:88-02-18

ANALYSIS: SO2

UNITS:TOTAL MG - Method 6

LSN/ID	SO2
804218 539026 BKG ND1	1266.
804219 539027 BKG ND2	946.
804220 539028 BKG ND3	993.
804221 539029 BLA NK	N.D.
804222 539030 SPL 7001	781.
804223 539031 SPL 7002	886.
804224 539032 SPL 7003	757.
804225 539033 SPL 7004	904.

E-5

ALCOA TECHNICAL CENTER
ANALYTICAL CHEMISTRY DIVISION

88-02-24 15:42 PAGE 2
J.O. NO. 88-021020

AREA: 201 - FLUORIDE LAB

ANALYSIS: FLUORIDE

UNITS:TOTAL MG - 4075A Nozzle Washes

LSN/ID	FLUORIDE	VOLUME (ml)
804240 539018 BLA NK	0.5	1040
804241 539019 BKG ND1 OUT	0.2	53
804242 539020 BKG ND2 OUT	0.1	48
804243 539021 BKG ND3 OUT	0.1	43
804244 539022 SPL 7001 OUT	0.2	79
804245 539023 SPL 7002 OUT	#	50
804246 539024 SPL 7003 OUT	0.2	43
804247 539025 SPL 7004 OUT	0.1	90

AREA: 201 - FLUORIDE LAB

ANALYSIS: TOTAL PARTICULATE FLUORIDE - 4075A Thimbles

UNITS: TOTAL MG

LSN/ID	TOTAL PARTICULATE FLUORIDE
804001 538997 BKG ND 1	1.4
804002 538998 BKG ND 2	1.0
804003 538999 BKG ND 3	0.9
804004 539000 700 SPL1	4.7
804005 539001 700 SPL2	5.8
804006 539002 700 SPL3	6.8
804007 539003 700 SPL4	7.0

****

E-7

ALCOA TECHNICAL CENTER
ANALYTICAL CHEMISTRY DIVISION

88-02-24 15:42 PAGE 2
J.O. NO. 88-021019

AREA: 201 - FLUORIDE LAB

ANALYSIS: FLUORIDE - 4075A Impingers

UNITS:TOTAL MG

LSN/ID	FLUORIDE	VOLUME(ml)
804229 539007 BLA NK	0.2	575
804230 539008 BKG ND1 OUT	0.6	505
804231 539009 BKG ND2 OUT	0.5	595
804232 539010 BKG ND3 OUT	0.5	500
804233 539011 SPL 7001 OUT	0.6	525
804234 539012 SPL 7002 OUT	0.4	515
804235 539013 SPL 7003 OUT	0.2	465
804236 539014 SPL 7004 OUT	0.4	480

AREA: 202 - CARBON MATERIALS

ANALYSIS: HEAT OF COMBUSTION

UNITS:BTU

LSN/ID	HEAT OF COMBUSTION
804969	13140.
539060 COK E	
804970	7870.
539061 SPL	

****

LAB REFERENCES: 2833/22-23

ANALYST(S): A.T. KOCHANOWSKI

****

APPROVED BY: DENNIS R. DECAPITE

AREA: 205 - SPECIAL ANALYSIS

ANALYSIS: SULFUR

UNITS:%

LSN/ID	SULFUR
804969	0.74
539060 COK E	
804970	0.16
539061 SPL	

LAB REFERENCES: 2808: 35;36 JWC

ANALYST(S): JOSEPH W. CASHELL

****

APPROVED BY: DENNIS R. DECAPITE

*** END OF REPORT ***