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.

No file

State of Alabama
Department of Public Health
State Office Building
Montgomery, Alabama 36130

March 15, 1978

IRA L. MYERS, M. D.
STATE HEALTH OFFICER

13

GRAY
IRON FOUNDRIES 12.10
AP-42 Section 7.10
Reference Number
13

M E M O R A N D U M

TO: Ken Barrett KAB

FROM: Joe L. Marsh JLM

SUBJECT: Opelika Foundry Stack Samples

After making an additional run on the samples from the Opelika Foundry, we found the following weights may be added to Runs 1, 2, and 3:

Run # 1 - 0.0041 g
Run # 2 - 0.0012
Run #3 - 0.0000

If you have any questions concerning these date, please feel free to contact me.

JLM:fj

DLC
RECEIVED
MAR 16 1978
Alabama Air Pollution
Control Commission

7-13-06

Report of Particulate Emissions Testing

At

Opelika Foundry

Opelika, Alabama

206-0006

November 30, 1977

January 4, 1978

Test Report Prepared By:

Alabama Air Pollution Control Commission

Technical Services Section

Montgomery, Alabama

Table of Contents

Part I

Introduction 1

Summary of Results 2

Source Operation 5

Sampling and Analysis Procedures 7

Appendix A - Calculations 11

Appendix B - Field Data Sheets 16

Appendix C - Laboratory Data Sheets 23

Appendix D - Statement of Process Weight 28

Appendix D - Calibration 30

Appendix E - Visible Emissions Evaluation 36

Part II

Particle Sizing 48

Appendix G - Field Data 50

Appendix H - Visible Emissions Evaluation 54

Introduction

This is a report of particulate emission testing performed at Opelika Foundry, Opelika, Alabama November 30, 1977. Both particulate mass sampling and visible emissions evaluations were performed on the baghouse controlled emissions from the cupola.

Mr. Ray Hampton, Foundry Superintendent, was in charge of foundry production and operation of this baghouse during the test period.

Mr. Glen Golson, Engineering Services Section of the Alabama Air Pollution Control Commission served as liaison between the test team and the facility and performed visible emissions evaluations for the Commission. Tim Owen, Joe Sanders, and Steve Taylor performed the particulate mass testing for the Technical Services Section of the Commission.

Summary of Results

Emissions results for the test are displayed in Table 1. Particulate emission rates were 8.6, 10.0, and 7.7 pounds per hour for the three runs, respectively. Average emissions for the test were 8.8 pounds per hour.

Process weight during the test period was 10,800 pounds per hour, averaged over the entire day. Section 4.5.1, Table 4-3 of the Alabama Air Pollution Control Commission allows 17.5 pounds per hour for a small foundry cupola with the previously mentioned process weight.

Visible emissions evaluations were made during all runs. Run 1 corresponds to the preliminary particulate run on November 29, 1977, and visible emissions evaluations 2, 3, and 4 correspond to particulate runs 1, 2, 3, respectively. Emissions ranged from 40% to 55% opacity.

10,800

TEST EVALUATION

OPELIKA FOUNDRY 206-0006 11/30/7

CONDUCTED BY AAPCC TEST ON CUPOLA BAGHOUS

PARAMETER	RUN 1	RUN 2	RUN
DELTA H (IN. H2O)	2.51	2.71	2.8
AVE SQRT DELTA P (IN. H2O)	0.53	0.55	0.5
BAROMETRIC PRESS (IN. HG)	30.01	30.01	30.0
STACK PRESS (IN. HG)	30.00	30.00	30.0
METER TEMP (F)	83	88	8
STACK TEMP (F)	370	352	38
VOL METERED (CU. FT.)	49.453	52.254	40.65
VOL METERED STD (CU. FT.)	48.701	51.015	39.62
TOTAL VOL H2O (ML)	332.4	245.7	271.
VOL H2O VAPOR (CU. FT.)	15.76	11.65	12.8
% MOISTURE	24.4	18.6	24.
MOL WT DRY (LB/LB-MOLE)	29.76	29.91	30.1
MOL WT WET (LB/LB-MOLE)	26.89	27.70	27.2
AVG STACK VEL (FT/S)	37	37	3
FLOW RATE ACTUAL (CFM)	10000	10000	1100
FLOW RATE STD (CFM)	5000	6000	500
PART WT (MG)	632.0	697.1	456.
CONCENTRATION (GR/CU. FT.)	0.1998	0.2104	0.177
PART MASS RATE (LB/HR)	8.55	9.95	7.6
% ISOKINETIC	102.8	97.4	107.

EVALUATED BY TSO 12/21/7

COMPANY NAME Opelika Foundry FACILITY NO. 206-0006

TEST BY: AAPCC DATE: 11-30-77

TEST ON: Cupola Baghouse

Parameter	Run I	Run II	Run III
Production Rate	5.4 T/HR	5.4 T/HR	5.4 T/HR
$\overline{\Delta H}$	2.51	2.71	2.83
$\overline{\sqrt{\Delta P}}$	.531	.547	.545
$\overline{t_m}$	83	88	89
$\overline{t_s}$	370	352	386
P_b	30.01	30.01	30.01
P_s	30.00	30.00	30.00
V_m .976	50.669 ~~[illegible]~~ 49.453	53.539 52.254	41.654 40.654
$\%CO_2$	8.2	9.0	11.0
$\%O_2$	11.3	11.8	10.8
$\%N_2$	80.5	79.2	78.2
%CO	0	0	0
V_{1c}	332.4	245.7	271.1
M_n	~~456.1~~ 632.0	697.1	456.1
C_p	.80	.80	.80
~~A_s~~ d_s	2'5¼"	2'5¼"	2'5¼"
~~A_n~~ d_n	.368	.368	.368
θ	60	60	46.25

Source Operation

Opelika Foundry has a Whiting (Morris Steel Products) Model 3 cupola furnace with a manufacturer's design capacity of 4.5 tons/hour. The cupola furnace is charged with metal, limestone, and coke. The metal charge consists of 75% per cent scrap metal and 25% pig iron. Coke is added at a rate of 10 pounds per 100 pounds of metal and limestone at a rate of one pound per 150 pounds of metal. The cupola is operated continuously from 7:00 a.m. to 3:30 p.m. daily with materials added in batch modes. Molten metal is periodically tapped from the cupola and cast into various molds.

Effluent gases from the cupola are exited through an afterburner section to oxidize carbon monoxide emissions. The gas stream is then passed through a quench tower where gases are cooled to reduce the air volume and to protect the baghouse from excessive temperatures. The gas stream is cleaned by an American Air Filter baghouse. The baghouse is a negative pressure design and employs pulsed air cleaning of the bags. The cleaned air is then drawn through a fan and exhausted through the stack.

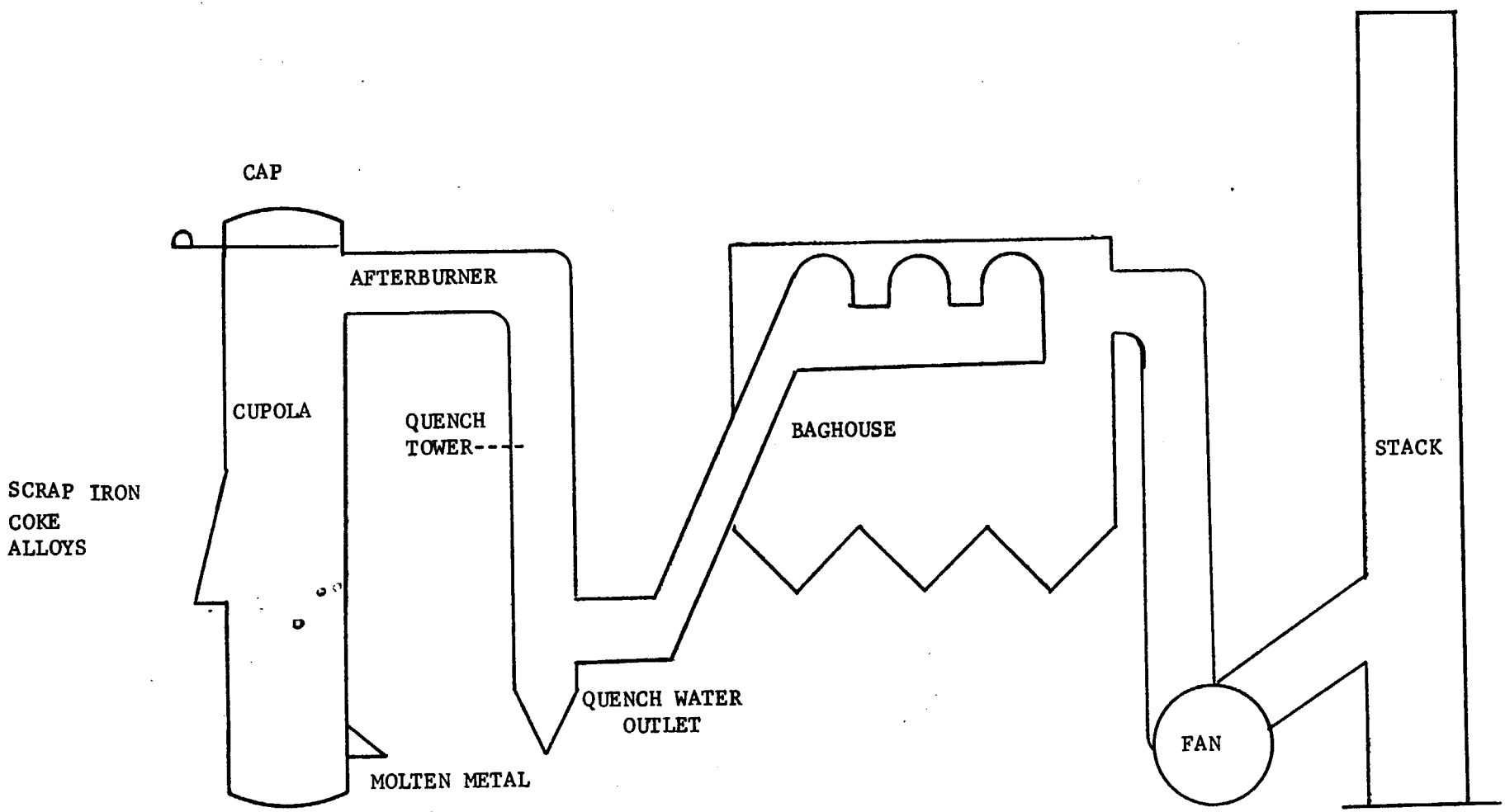


Fig. 1 Schematic of Cupola and Baghouse

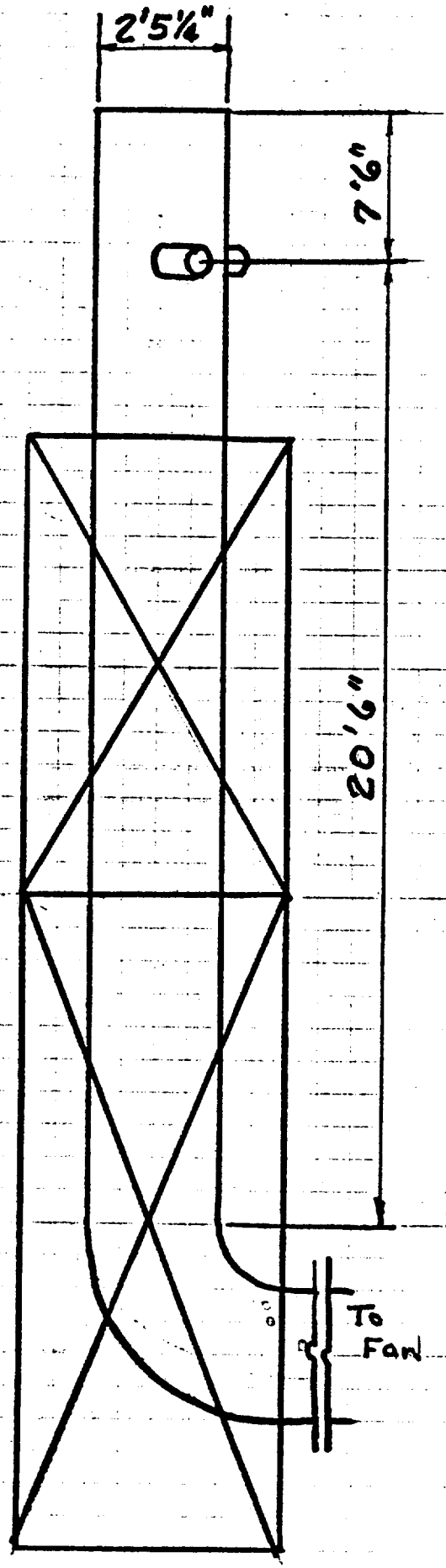
Sampling and Analysis Procedures

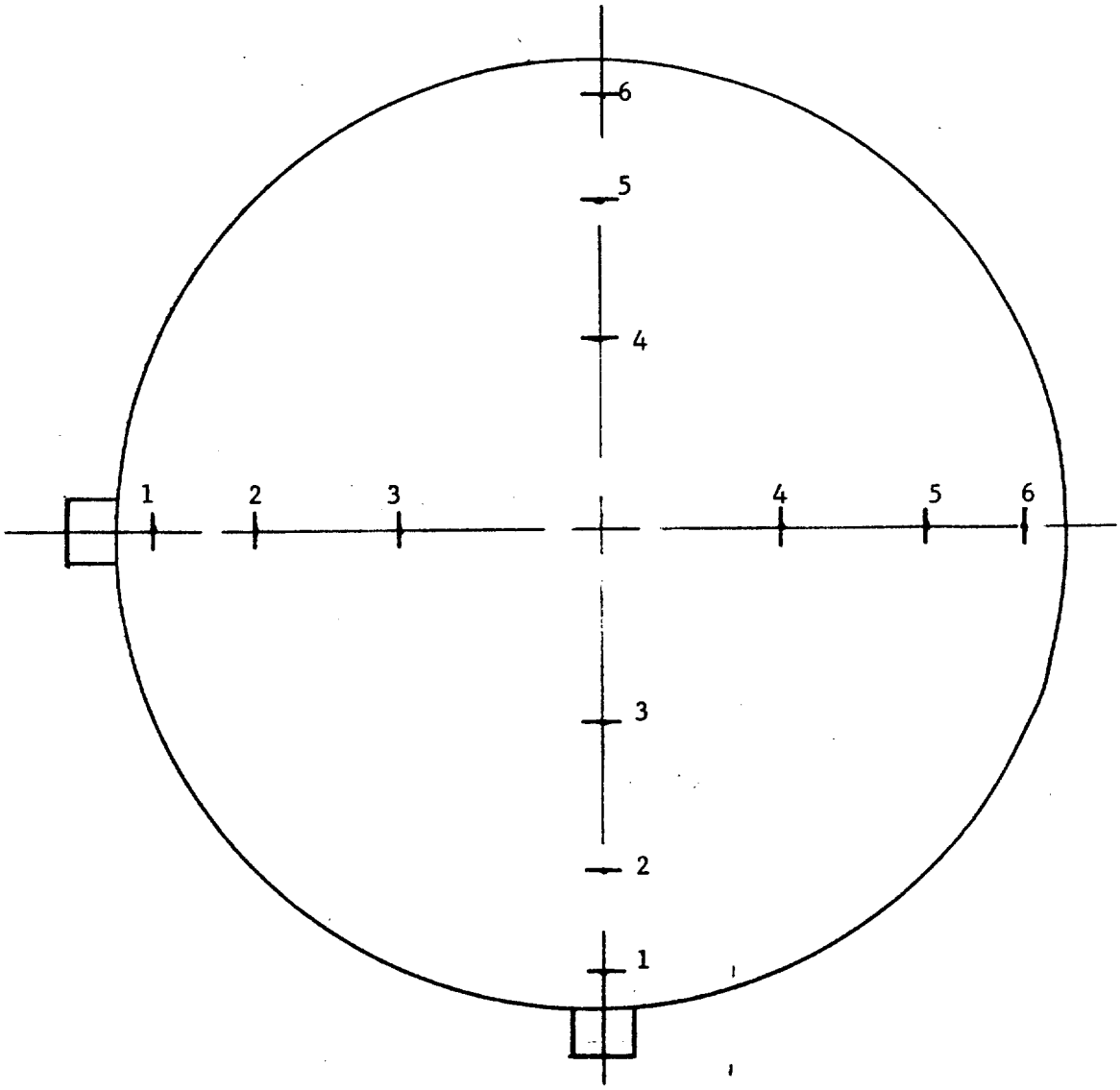
The source test was conducted in accordance with the "Particulate Sampling Guidelines and Reporting Format" as revised October, 1977.

The sampling train used was manufactured by Research Appliance Corporation, and a three-foot glass lined heated probe was used. The material collected was a fine gray material that was dispersed uniformly on the filter and evenly coated the glassware prior to the filter. The particulate consisted of a ferrous fraction as determined using a magnet.

Samping duration for Run 3 was less than the required one hour sampling time due to premature shutdown of the facility.

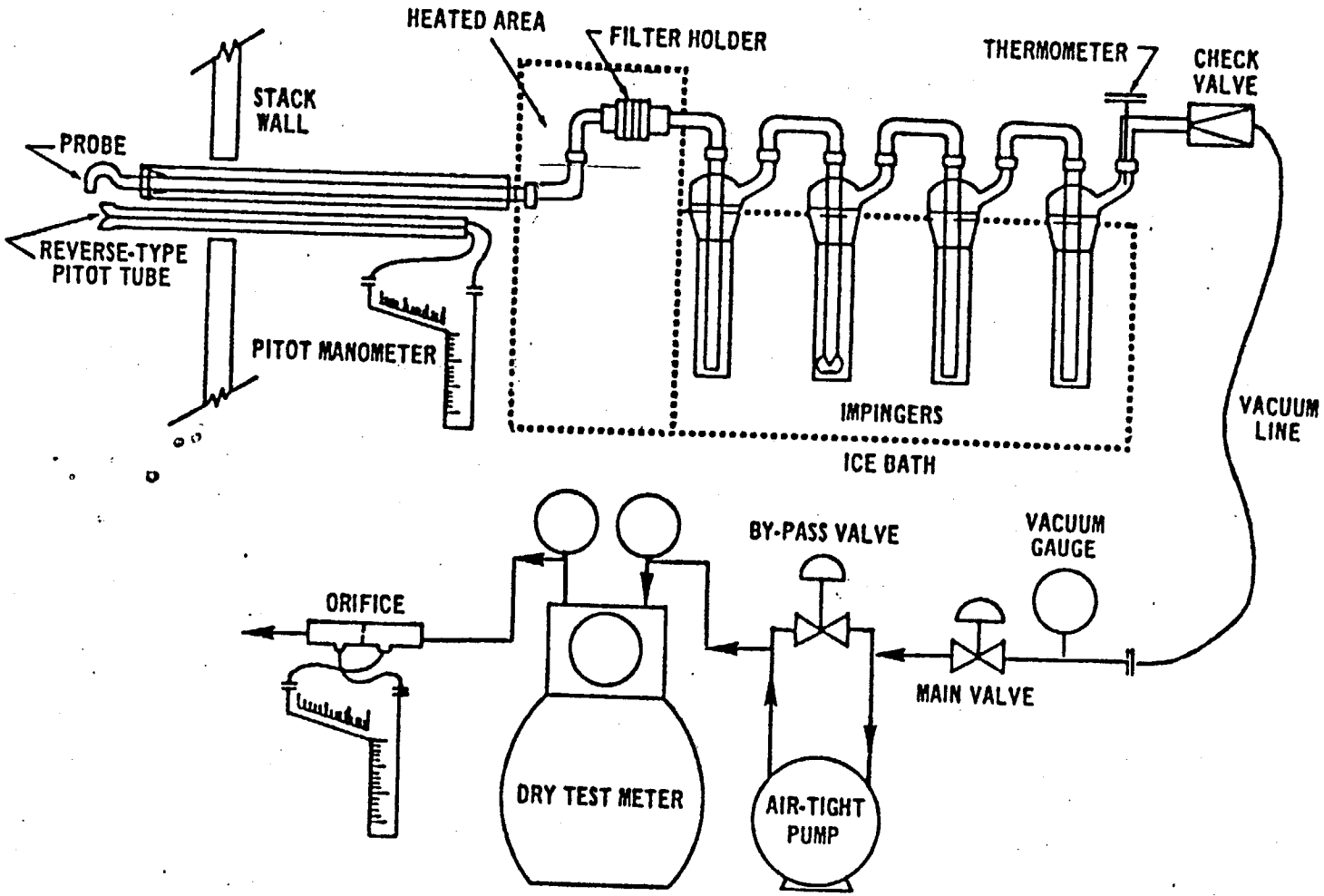
On November 29, 1977, a preliminary run was made, but the results were not analysed due to extreme anisokinetic conditions.


2'5¼"
7'6"
20'6"
To
Fan



Stack diameter 2'5¼"
Port extension 6¼"

Point No.	% of Dia	Distance from Port Opening
1	4.4	7 1/2
2	14.6	10 1/2
3	29.6	15
4	70.4	26 7/8
5	85.4	31 1/4
6	95.6	34 1/4



Particulate sampling train.

APPENDIX A

Calculations are performed on a Wang 2200 calculator. Equations used are those listed on the following pages, and the Program is on file at this office.

CALCULATIONS FOR RUN 1

1. Volume of water collect

$$V_{wstd} = Vl_c\ (.0474)$$

2. Volume of air metered

$$V_{mstd} = (17.71)\ (V_m)\left(\frac{P_b + \frac{\Delta h}{13.6}}{T_m}\right) \quad (mcf)$$

3. Moisture Content

$$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$$

4. Molecular Weight of dry gas stream

$$M_d = (\%\ CO_2)\ (.44) + (\%\ O_2)\ (.32) + (\%\ CO)\ (.28) + (\%\ N_2)\ (.28)$$

5. Molecular weight of stack gas

$$M_w = M_d\ (1-B_{wo}) + 18\ (B_{wo})$$

Velocity of exit gases

$$\overline{V}_s = K_p\, C_p \sqrt{\frac{\overline{T}_s}{P_s\, M_s}}\ \sqrt{\overline{\Delta P}}$$

7. Total flow of stack gases

$$Q_a = A_s\, \overline{V}_s \times 60$$

$$Q_s = Q_a \left(\frac{530}{t_s + 460}\right) \left(\frac{P_s}{29.92}\right)$$

$$Q_{std} = Q_a \left(\frac{P_s}{P_{std}}\right) \left(\frac{T_{std}}{T_s}\right) (1 - B_{wo})$$

8. Concentration

$$C_s = \frac{(.0154)\ M_n}{Vm_{std}}$$

$$C_{12} = C_s \frac{12}{\%\ CO_2}$$

$$C_{50} = \frac{C_s}{1 - \left[1.5\ (\%\ O_2) - .133\ (\%\ H_2) - .75\ (\%\ CO)\right]}$$

9. Emissions from stack

$$PMR = \frac{C_s \, Q_{std} \times 60}{7000}$$

10.

$$\% I = \frac{(\overline{T_s})(1.667)\left[(.00267)\, VI_c + \frac{V_m}{\overline{T_m}} \left(P_b + \frac{\Delta h}{13.6}\right)\right]}{\theta \, \overline{v_s} \, P_s \, A_n}$$

APPENDIX B

PLANT Topeka Foundry
SAMPLING SITE Baghouse Stack
OPERATOR AAPCC
RUN NO. 1 DATE 11-30-77
TIME BEGIN 810 TIME END 918
SAMPLE BOX NO. 1
METER BOX NO. 1511
C_p .82
GAS ANALYSIS: CO_2 8.5 8.3 8.0
O_2 11.5 11.0 11.5
N_2 80.0 80.7 80.5

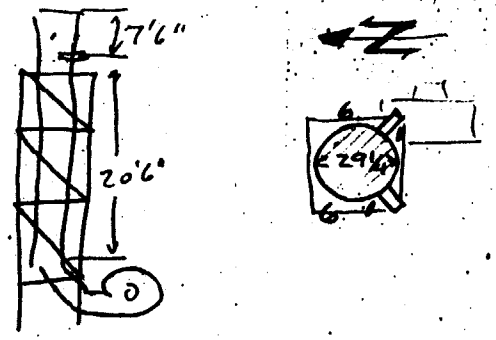
METER READING

FINAL	771.818
INITIAL	721.149
NET	50.669

RAY HAMPTON PLANT SUPER
RAY KIRE PLANT ENGR

R Pump OK

206-0006



SCHEMATIC OF STACK X-SECTION
DISTANCE UPSTREAM 20.5 ft
DISTANCE DOWNSTREAM 7.5 ft
STACK DIAMETER 29¼ in

pitot ¾

AMBIENT TEMP. 60
BAROMETRIC PRESS. 30.2
STATIC PRESS. (.134.0) in.
NOZZLE CALIBRATION- PRETEST POST
.368 in. .368 in.
.368 in. .369 in.
.369 in. .368 in.
AVERAGE DIAMETER .368 in. .368 in.
PROBE HEATER SETTING 85
PROBE LINER MATERIAL Glass
LENGTH 3 ft.
LEAK RATE .014 cfm @ 12 in. Hg
FILTER NO. 238
NOMOGRAPH VALUES: $\Delta H@$ 1.95, T_m 85
$\%H_2O$ 25, P_s/P_m 1
Δp_{ref} 2.0 c .73

ILR = .010 17"Hg K = 8.63

Port# / Point#	Time	Gas Meter Volume (Ft.^{3})	Stack Velocity Head-Δp (in.-H_2O)	Orifice Velocity Head-ΔH (in.-H_2O)	Gas Meter Temp. T_m (°F) Inlet	Gas Meter Temp. T_m (°F) Outlet	Stack Temp. Ts (°F)	Oven Temp (°F)	Impinger Temp. (°F)	Vacuum (in.-Hg)
W 1	810	721.149	.16	1.38	65	64	260	245	55	2
W 2	815	724.4	.19	1.65	72	63	300	250	50	4
W3	820	727.8	.22	1.90	80	66	330	260	51	4
W4	825	731.4	.26	2.25	85	70	340	270	52	4
W5	830	735.4	.29	2.5	91	72	340	265	53	6
W6	835	739.8	.31	2.7	96	76	350	270	54	7
	840	744.04								

SAMPLING SITE BH Stack
OPERATOR AAPCC
RUN NO. 7 DATE 11-30-77
TIME BEGIN 1035 TIME END 1146
SAMPLE BOX NO. Box 2
METER BOX NO. 1511
C_p .82
GAS ANALYSIS: CO_2 9.0 9.0 9.0
O_2 12.0 11.5 12.0
CO

METER READING

FINAL	826.531
INITIAL	772.992
NET	53.539

See Run 1

SCHEMATIC OF STACK X-SECTION
DISTANCE UPSTREAM ____ ft
DISTANCE DOWNSTREAM ____ ft
STACK DIAMETER 29½ in

AMBIENT TEMP. 65 °F
BAROMETRIC PRESS. 30.0 in. Hg
STATIC PRESS. 30.0 in. Hg
NOZZLE CALIBRATION- PRETEST POST TEST
.368 in. .368 in.
.369 in. .368 in.
.368 in. .368 in.
AVERAGE DIAMETER .368 in. .368 in.
PROBE HEATER SETTING 85
PROBE LINER MATERIAL Glass
LENGTH 3 ft.
LEAK RATE .014 cfm @ 14 in. Hg
FILTER NO. 237
NOMOGRAPH VALUES: ΔH@ 1.95, T_m 85
$\%H_2O$ 25, P_s/P_m 1
K 8.641

BH 2 OK 4 OK

ILR .007CF@ 12" Hg

Port# / Point#	Time	Gas Meter Volume (Ft.³)	Stack Velocity Head-Δp (in.-H_2O)	Orifice Velocity Head-ΔH (in.-H_2O)	Gas Meter Temp. Tm (°F) Inlet	Gas Meter Temp. Tm (°F) Outlet	Stack Temp. Ts (°F)	Oven Temp (°F)	Impinger Temp. (°F)	Vacuum (in.-Hg)
E 6	1035	772.992	.26	2.38	75	75	290	225	60	6
E 5	1040	777.1	.23	2.1	83	75	300	235	55	6
E 4	1045	781.1	.26	2.3	89	76	320	255	60	7
E 3	1050	785.3	.28	2.45	94	78	340	260	60	7
E 2	1055	789.5	.30	2.61	98	80	350	245	60	8
E 1	1100	793.9	.23	1.98	100	82	360	230	60	7
	1105	797.96								

Run 2 Opelika laundry 11-30-77

APC 129-2

Port# / Point#	Time	Gas Meter Volume (Ft.^{3})	Stack Velocity Head-Δp (in.-H_2O)	over $\sqrt{\Delta p}$	Orifice Velocity Head-ΔH (in.-H_2O)	Gas Meter Temp. Tm (^oF) Inlet	Gas Meter Temp. Tm (^oF) Outlet	Stack Temp. Ts (^oF)	Impinger Temp. (^oF)	Vacuum (in.-Hg)
W-6	1116	797.7	.4	240	3.5	90	82	340	50	10
W-5	1121	802.9	.47	250	3.45	96	82	300	55	12
W-4	1126	808.2	.280	260	2.62	104	84	300	58	9
W-3	1131	812.6	.37	265	3.33	104	84	330	60	12
W-2	1136	817.3	.34	265	3.31	108	86	340	60	12
W-1	1141	822.1	.28	260	2.51	108	88	340	68	11.5
	1146	826.531								

PLANT Opelika Foundry
SAMPLING SITE BH Stack
OPERATOR AAPCC
RUN NO. 3 DATE 11-30-77
TIME BEGIN 1355 TIME END
SAMPLE BOX NO. 1
METER BOX NO. 1511
C_p .82

GAS ANALYSIS: CO_2 10.5 12.0 10.5
O_2 10.5 11.0 10.5
CO

METER READING

FINAL	870.800
INITIAL	829.146
NET	41.654

See Run 1

SCHEMATIC OF STACK X-SECTION
DISTANCE UPSTREAM ft
DISTANCE DOWNSTREAM ft
STACK DIAMETER in

AMBIENT TEMP. 65 °F
BAROMETRIC PRESS. 30.0 in. Hg
STATIC PRESS. 30.0 in. Hg (-.13)

NOZZLE CALIBRATION-	PRETEST	POST TEST
	.368 .3 in.	.368 in.
#13	.368 in.	.368 in.
	.368 in.	.368 in.
AVERAGE DIAMETER	.368 in.	.368 in.

PROBE HEATER SETTING 80
PROBE LINER MATERIAL Glass
LENGTH 3 ft.
LEAK RATE .011 cfm @ 12 in. Hg
FILTER NO. 236
NOMOGRAPH VALUES: $\Delta H@$ 1.95, T_m 88
$\%H_2O$ 20, P_s/P_m 1
K 9.91

Btd 2.0K 4.0K

Port# / Point#	Time	Gas Meter Volume (Ft.³)	Stack Velocity Head-Δp (in.-H_2O)	Orifice Velocity Head-ΔH (in.-H_2O)	Gas Meter Temp. T_m (°F) Inlet	Gas Meter Temp. T_m (°F) Outlet	Stack Temp. Ts (°F)	Oven Temp (°F)	Impinger Temp. (°F)	Vacuum (in.-Hg)
E 6	1355	829.146	.37	3.45	78	78	360	240	65	6
E 5	1400	834.1	.34	3.2	88	~~88~~ 78	360	250	58	7
E 4	1405	838.9	.29	2.72	96	80	370	265	64	7
E 3	1410	843.3	.25	2.35	98	80	370	265	70	6
E #2	1415	847.7	.23	2.17	100	82	370	270	70	6
E 1	1420	851.8	.20	1.89	100	84	370	275	65	6
		855.670								

Port# / Point#	Time	Gas Meter Volume (Ft.^{3})	Stack Velocity Head-Δp (in.-H_2O)	oven T $\sqrt{\Delta p}$	Orifice Velocity Head-ΔH (in.-H_2O)	Gas Meter Temp. Tm (^oF) Inlet	Gas Meter Temp. Tm (^oF) Outlet	Stack Temp. Ts (^oF)	Impinger Temp. (^oF)	Vacuum (in.-Hg)
W1	1425	855.670	.35	220	3.3	98	86	370	65	8.5
W2	1435	860.3	.34	265	3.25	96	86	360	58	9.0
W3	1440	864.9	.33	250	3.14	102	88	370	58	9.5
W4	1445	869.6	.30	275	2.9	106	88	360	58	
	1446:15	Plant Down								
		870.800								

1 min 15 sec into point W-4 plant went down for day

lost power, stop watch & pump shut down - restarted together

APPENDIX C

Plant Opelika Foundry

Date 11-30-77

Run No. 3

Filter No. 236

Amount liquid lost during transport

Acetone blank volume, ml 246

Acetone wash volume, ml 140

Acetone wash blank, mg (equation 5-5) 2.58 mg / 100 ml

WEIGHT OF PARTICULATE COLLECTED

CONTAINER NUMBER	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN
1	110.7283 ~~.6256~~	110.6256 ~~.7283~~	.1027
2	1.0411	.6845	.3566
TOTAL			.4593
Less acetone blank			.0032
Weight of particulate matter			.4561

1.0411
.6845
.3566

VOLUME OF LIQUID WATER COLLECTED

	IMPINGER VOLUME, ml.	SILICA GEL WEIGHT, g.	
FINAL	452	768.0	
INITIAL	200	748.9	
LIQUID COLLECTED	252	19.1	
TOTAL VOLUME COLLECTED	271.1	g*	ml

*CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER (1 g/ml):

$$\frac{\text{INCREASE, g}}{1\ \text{g/ml}} = \text{VOLUME WATER, ml}$$

Plant Opelika Foundry

Date 11-30-77

Run No. 1

Filter No. 2 38

Amount liquid lost during transport

Acetone blank volume, ml 246

Acetone wash volume, ml 343

Acetone wash blank, mg (equation 5-5) 2.28 mg/100 ml.

WEIGHT OF PARTICULATE COLLECTED

CONTAINER NUMBER	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN
1	95.3932	95.2561	.1371
2	1.1667	.6639	.5028
TOTAL			.6399
Less acetone blank			.0019
Weight of particulate matter			.638

1.1667
.6639
.5028

VOLUME OF LIQUID WATER COLLECTED

	IMPINGER VOLUME, ml.	SILICA GEL WEIGHT, g.	
FINAL	~~452~~ 516	733.7	
INITIAL	~~200~~ 200	717.3	
LIQUID COLLECTED	~~252~~ 316	16.4	
TOTAL VOLUME COLLECTED	332.4	g*	ml

*CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER (1 g/ml):

$$\frac{\text{INCREASE, g}}{1\ \text{g/ml}} = \text{VOLUME WATER, ml}$$

Plant Opelika Foundry

Date 11/30/77

Run No. 2

Filter No. 237

Amount liquid lost during transport

Acetone blank volume, ml 246

Acetone wash volume, ml 285

Acetone wash blank, mg (equation 5-5) 2.28 mg /100 ml

WEIGHT OF PARTICULATE COLLECTED

CONTAINER NUMBER	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN
1	102.5013	102.3557	.1456
2	1.2321	.6740	.5581
TOTAL			.7037
Less acetone blank			.0066
Weight of particulate matter			.6971

1.2321
.6740
.5581

VOLUME OF LIQUID WATER COLLECTED

	IMPINGER VOLUME, ml.	SILICA GEL WEIGHT, g.	
FINAL	426	763.5	
INITIAL	200	743.8	
LIQUID COLLECTED	226	19.7	
TOTAL VOLUME COLLECTED	245.7	g*	ml

*CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER (1 g/ml):

$$\frac{\text{INCREASE, g}}{1\ \text{g/ml}} = \text{VOLUME WATER, ml}$$

SAMPLE CHAIN OF CUSTODY

Plant OPELIKA FOUNDRY

Date Sampled 11-30-77 Test number 206-0006

Run number 1, 2, 3

Sample Recovery

Container Code	Description
RUN 1	Filter & Particulate Wash
RUN 2	" " "
RUN 3	" " "

Person engaged in Sample Recovery

Signature [illegible]

Title Engineer

Location at which Recovery Mobile Lab

Was done OPELIKA FOUNDRY

Date and time of Recovery 11-30-77 (930, 1230, 1530)

Sample(s) ~~recipient~~ transportation, upon recovery if not Recovery person

Signature Sally N. Bourie

Title Co-operative Education Student

Date and time of receipt 1:01 pm - 12-1-77

Sample storage jars (4) and 3 petri dishes

Laboratory person receiving Sample

Signature

Title

Date and time of receipt

Sample storage

Analysis

Container code	Method of analysis	Date and time of analysis	Signature of analyst

DEC 30 1977
Alabama Air Pollution Control Commission

Table 6. CHAIN OF CUSTODY SHEET

B-39

APPENDIX D

PARTICULATE EMISSION TEST

FOUNDRY OPERATING DATA *

(Type of Source)

Owner OPELIKA FOUNDRY Run No. 1, 2, 3

Source I.D. 206-0006 Date 11-30-77

Maximum Continuous Process Weight (Manufacturer's Rating) 4.5 ~~Lbs~~ T./Hr.

Historical Average Process Weight _____ Lbs./Hr.

Historical Maximum Process Weight _____ Lbs./Hr.

Type and Sources of Fuels Normally Burned Coke

Approximate Quantities of Each of Above Fuels Burned Annually 475 TON/YEAR

Recycling Capability: Yes _____ No _____

Process Data During Run (Averaged)

Process Weight (Dry) 10,842 Lbs./Hr.

Percent Moisture _____ %

Process Weight (Wet) _____ Lbs./Hr.

How Process Weight Determined WT. of IRON, COKE, MANGANESE, CARBO., AND LIMESTONE FOR SEVEN (7) HRS RUNNING TIME DIVIDED BY 7 FOR lbs PER. HR.

Type of Fuel Burned During Run COKE

Recycling in Progress: Yes _____ No _____

Person Responsible for Data: _____

Signature: Ray E. Hampton

Title/Position: Foundry Superintendent

*Averages of operating data taken during actual test run unless requested otherwise.

APPENDIX E

CALIBRATION FORM A
(Must Be Included With Field Data Sheet)

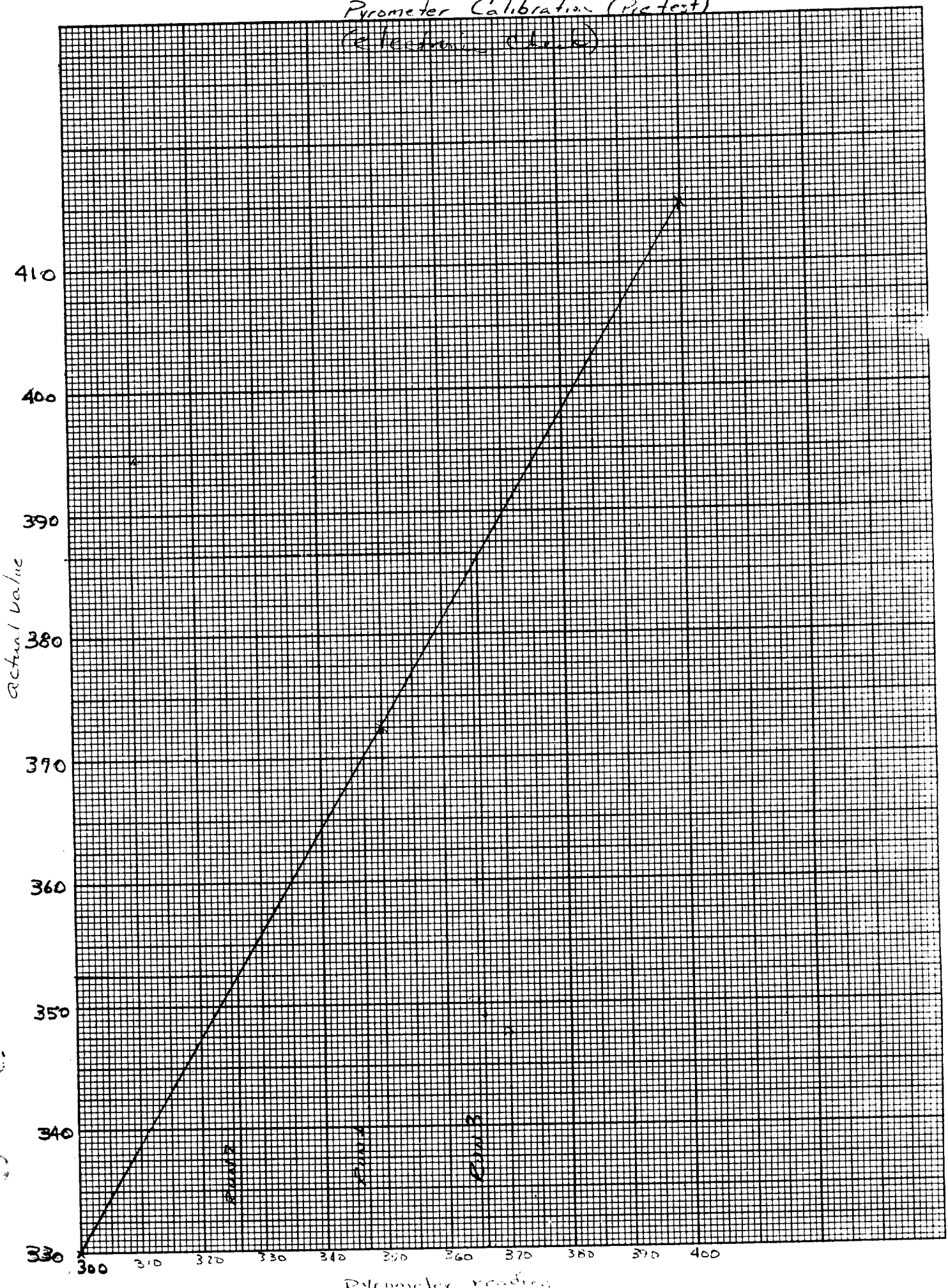
Gauge	Average Test Condition Temperature	Gauge Reading	Reference Reading	Difference
Impinger (Pre)	65	73	72	+1
Meter In (Pre)	85	72	72	—
Meter Out (Pre)	75	72	72	—
Filter Heated Area (Pre)	240	268	272	-4
Stack (Post)	346	352	356	-4

1-23-78

Post Test	Run 1	Run 2	Run 3
Train Leak Rate	✓	✓	✓
Pitot Leak Check	✓	✓	✓
Pre Test			
Orsat Leak Check	N/A		
Metering System Leak Check	✓		
Barometer Calibrated	Used Airport Reading		
Sample Bag Leak Check (if used)	N/A		

Signature [illegible] Title Engineer Date 1-23-78

Calibration data for dry gas meter, orifice, nozzle, pitot, and differential pressure gauge (if other than manometer) must be available for inspection at the time of the test and must be included in the stack test report.


Pyrometer Calibration (Pretest)
(electronic check)
Actual value
410
400
390
380
370
360
350
340
330
300
310
320
330
340
350
360
370
380
390
400
Run 2
Run 1
Run 3
Pyrometer readings
20FJ-61N 20X20 PER INCH
LITHO IN U.S.A.
TELEDYNE POST

APPENDIX H

PITOT CALIBRATION FORM

Date 10-19-77 Probe # 301

Calibrated by Sanders Owen

.80

SIDE A

Run #	ΔP_{std} in. H_2O Standard	$\Delta P(s)$ in. H_2O Type "s"	$C_p(s)$	Deviation $C_p(s) - \bar{C}_p(A)$
1	0.6	.93	.799	.001
2	0.6	.93	.795	.003
3	0.6	.92	.799	.001
		$\bar{C}_p$ (A)	.798	

SIDE B

Run #	ΔP_{std} in. H_2O Standard	$\Delta P(s)$ in. H_2O Type "s"	$C_p(s)$	Deviation $C_p(s) - \bar{C}_p(B)$
1	0.6	0.92	.799	.001
2	0.6	0.93	.795	.003
3	0.6	.92	.799	.001
		$\bar{C}_p$ (B)	.798	

CALCULATIONS

$$C_p(s) = 0.99 \sqrt{\frac{\Delta P_{std}}{\Delta P(s)}}$$

$$\text{Average Deviation} = \frac{\Sigma \left| C_p(s) - \bar{C}_p(A \text{ or } B) \right|}{3} \longleftarrow \text{Must be} \leq 0.01$$

$$\left| \bar{C}_p(A) - \bar{C}_p(B) \right| \longleftarrow \text{Must be} \leq 0.01$$

T 12-7 b JSO

METER/ORIFICE CALIBRATION 1-15-66

Company AAPCC Date 9-30-77

Conducted By Joe Sander Barometric Pressure 29.72

Meter Box Number S-1511

	1.9+1.8	1.9+1.8	1.9+1.9	2+1.9	
Δ H2O WTM	3.7	3.7	3.8	3.9	3.9
T in WTM	65.0	66	66.5	66.5	67.0
T out WTM	66.0	66	66.5	67.0	67
T avg WTM	65.5	66	66.5	67	67
Final Vol WTM	18.000	37.000	55.000	94.000	108.00
Initial Vol WTM	00.000	19.000	38.000	56.000	95.00
VOLUME WTM	18.000	18.000	17.000	38.000	13.00
Δ H2O DGM	.49	1.0	1.5	2.0	2.5
Inlet Temp initial	70	~~93.0~~	96	94	102
Inlet Temp final	94	99	101	103	106
INLET TEMPERATURE	82	96	98	99	104
Outlet Temp initial	66	85	89	89	91
Outlet Temp final	84	90	90	91	92
OUTLET TEMPERATURE	75	87.5	90	90	91
INITIAL VOLUME	188.120	207.791	222.828	246.845	287.99
FINAL VOLUME	206.744	226.772	245.786	286.944	301.717
TIME	46' 30" 2790	33' 42" ~~1022~~ 2022	26' 34" 1594 ~~814~~	51' 05" 3065	15' 33" 933
MPC(.983)	.980	0.983	.983	.983	.986
Km	.709	.690	.676	.679	.683
Δ H@	1.95	34			

METER/ORIFICE CALIBRATION

Company AAPCC

Date 12-6-77

Conducted By TSO

Barometric Pressure 29.76

Meter Box Number 1511

vac. 10" Hg

Δ H20 WTM	.9	.9	.9		
T in WTM	62	61	61		
T out WTM	61	61	61		
T avg WTM	61.5	61	61		
Final Vol WTM	44.0	22.0	38.0		
Initial Vol WTM	0.0	0.0	0.0		
VOLUME WTM	44.0	22.0	38.0		
Δ H20 DGM	2.7	2.7	2.7		
Inlet Temp initial	80	93	94		
Inlet Temp final	93	94	94		
INLET TEMPERATURE	86.5	93.5	94		
Outlet Temp initial	67	78	79		
Outlet Temp final	78	79	80		
OUTLET TEMPERATURE	72.5	78.5	79.5		
INITIAL VOLUME	899.502	945.909	969.278		
FINAL VOLUME	945.869	969.278	009.739		
TIME	51.36 3096	25.44 1544	44.16 2656		
	.973	.978	.977	.976	

APPENDIX F

RECORD OF VISUAL DETERMINATION OF OPACITY

Company Opelika Foundry

Location Opelika

Test Number 1 Date 11/29/77

Type Facility Grey Iron Foundry Control Device Baghouse

Facility Number

Observer Certification Date Oct. 1977

Observer Affiliation AAPCC

Point of Emissions Baghouse Stack

Height of Discharge Point 35'

Record the following information prior to and upon completion of observations at each source. If observations are made over an extended period of time, additional recordings should be made as applicable.

Clock Time Initial ___:___ a.m. / 1:30 p.m. Final ___:___ a.m. / 2:22 p.m.

OBSERVER LOCATION
Distance to Discharge 200'
Direction from Discharge SW
Height of Observation Point Ground

BACKGROUND DESCRIPTION Rusty Ductwork

WEATHER CONDITIONS
Wind Direction South East Wind
Wind Speed 20-25 mph
Ambient Temperature 75°F

SKY CONDITIONS (clear, overcast, % clouds, etc.) Partly Cloudy

PLUME DESCRIPTION
Color White
Distance Visible 300'

MINUTES OF NONCOMPLIANCE 52

OBSERVER SIGNITURE Glen Kolson

APC-133
7/76

OBSERVATION RECORD

Company Opelika Foundry

Location Opelika

Test Number 1

Date 11/29/77

Observer Colson

Type of Facility Cupola Foundry

Point of Emissions Cupola Stack

Hr.	Min.	Seconds 0	15	30	45	STEAM PLUME (check if applicable) Attached	Detached	Comments
	0	50	50	50	50			
	1	50	50	50	55			
	2	50	50	50	50			
	3	50	50	50	50			
	4	55	55	55	50			
	5	50	50	40	45			
	6	45	35	35	45			
	7	45	45	45	45			
	8	45	45	50	45			
	9	45	45	40	45			
	10	45	45	45	45			
	11	50	45	45	50			
	12	45	50	40	45			
	13	45	50	45	45			
	14	45	40	45	45			
	15	45	40	45	45			
	16	45	50	50	45			
	17	45	45	45	45			
	18	45	45	45	45			
	19	45	45	45	45			
	20	45	50	45	50			
	21	45	45	45	45			
	22	45	45	45	45			
	23	45	45	45	45			
	24	40	40	40	45			
	25	40	45	45	40			
	26	45	45	45	45			
	27	45	45	45	45			
	28	45	45	45	45			
	29	45	45	45	45			

OBSERVER'S SIGNATURE Glen Colson

APC-134

OBSERVATION RECORD

Company Opelika Foundry

Observer Golson

Location Opelika

Type Facility Grey Iron Foundry

Test Number 1

Point of Emissions Baghouse Stack

Date 11/29/77

Hr.	Min.	Seconds 0	15	30	45	STEAM PLUME (check if applicable) Attached	Detached	COMMENTS
	30	40	40	40	45			5min. break in readings Begin
	31	45	45	45	45			again @ 2:05
	32	45	45	45	45			
	33	45	45	45	45			
	34	45	45	45	45			
	35	45	50	45	45			
	36	50	50	50	45			
	37	45	45	45	45			
	38	45	45	45	50			
	39	45	45	45	50			
	40	50	50	50	50			
	41	50	50	50	50			
	42	45	50	45	50			
	43	45	45	50	45			
	44	45	45	45	45			
	45	45	45	45	45			
	46	45	45	50	50			
	47	45	45					Cupola Not Being Charged 2:22
	48							Hole in bottom
	49							
	50							
	51							
	52							
	53							
	54							
	55							
	56							
	57							
	58							
	59							

Glen Golson

RECORD OF VISUAL DETERMINATION OF OPACITY

Company Opelika Foundry

Location Opelika

Test Number 2 Date 11/30/77

Type Facility Grey Iron Foundry Control Device Baghouse

Facility Number

Observer Certification Date October '77

Observer Affiliation AAPCC

Point of Emissions Baghouse Stack

Height of Discharge Point 35'

Record the following information prior to and upon completion of observations at each source. If observations are made over an extended period of time, additional recordings should be made as applicable.

Clock Time Initial 8:20 a.m. ___:___ p.m. Final 9:20 a.m. ___:___ p.m.

OBSERVER LOCATION
Distance to Discharge 200'
Direction from Discharge SW
Height of Observation Point Ground

BACKGROUND DESCRIPTION Rust, Ductwork

WEATHER CONDITIONS
Wind Direction From E to West
Wind Speed 14-24 MPH
Ambient Temperature 62

SKY CONDITIONS (clear, overcast, % clouds, etc.) Overcast 100% Clouds

PLUME DESCRIPTION
Color Light Tan
Distance Visible 400'

MINUTES OF NONCOMPLIANCE 60

OBSERVER SIGNITURE Glen Golson

APC-133
7/76

OBSERVATION RECORD

Company Opelika Foundry

Location Opelika

Test Number 2

Date 11/30/77

Observer Golson

Type of Facility [illegible]

Point of Emissions [illegible]

Hr.	Min.	Seconds 0	15	30	45	STEAM PLUME (check if applicable) Attached	Detached	Comments
	0	50	45	50	50			
	1	55	50	50	50			
	2	50	45	50	45			
	3	45	45	45	50			
	4	45	50	50	50			
	5	50	50	45	50			
	6	45	50	50	45			
	7	45	50	50	50			
	8	55	50	50	50			
	9	55	50	50	50			
	10	50	50	50	50			
	11	50	50	50	55			
	12	50	50	50	50			
	13	50	50	45	50			
	14	50	50	50	50			
	15	50	50	50	50			
	16	50	50	50	50			
	17	50	50	50	50			
	18	50	50	50	50			
	19	50	50	50	50			
	20	45	45	50	50			
	21	50	45	45	50			
	22	50	50	45	45			
	23	50	50	50	50			
	24	45	50	50	50			
	25	50	50	50	50			
	26	50	50	50	50			
	27	50	50	50	55			
	28	50	50	50	45			
	29	50	50	55	50			

OBSERVER'S SIGNATURE Glen Golson

APC-134
7/76

OBSERVATION RECORD

Company Opelika Foundry

Observer Golson

Location Opelika

Type Facility Grey Iron Foundry

Test Number 2

Point of Emissions Baghouse Stack

Date 11/30/77

Hr.	Min.	Seconds 0	15	30	45	STEAM PLUME (check if applicable) Attached	Detached	COMMENTS
	30	50	50	50	50			
	31	50	50	50	45			
	32	50	50	50	50			
	33	55	50	50	50			
	34	50	50	50	50			
	35	50	50	50	50			
	36	50	50	50	50			
	37	50	50	55	50			
	38	50	50	50	50			
	39	50	50	50	50			
	40	50	50	50	50			
	41	50	50	50	55			
	42	50	50	50	50			
	43	50	50	50	50			
	44	50	50	50	50			
	45	50	50	50	50			
	46	50	50	50	50			
	47	50	45	50	50			
	48	50	50	50	50			
	49	50	50	50	50			
	50	50	50	50	50			
	51	50	50	50	55			
	52	55	55	50	50			
	53	50	55	50	50			
	54	50	50	50	50			
	55	55	50	55	50			
	56	55	50	55	50			
	57	50	55	55	50			
	58	55	50	50	55			
	59	55	55	55	50			

Glen Golson

RECORD OF VISUAL DETERMINATION OF OPACITY

Company Opelika Foundry

Location Opelika

Test Number 3 Date 11/30/77

Type Facility Grey Iron Foundry Control Device Baghouse

Facility Number 206-0006

Observer Certification Date 10/77

Observer Affiliation AAPCC

Point of Emissions Baghouse Stack

Height of Discharge Point 35'

Record the following information prior to and upon completion of observations at each source. If observations are made over an extended period of time, additional recordings should be made as applicable.

Clock Time Initial 10:40 a.m. ___:___ p.m. Final ___:___ a.m. ___:___ p.m.

OBSERVER LOCATION
Distance to Discharge 200'
Direction from Discharge SW
Height of Observation Point Ground

BACKGROUND DESCRIPTION Rusty Ductwork

WEATHER CONDITIONS
Wind Direction From East
Wind Speed 20 mph
Ambient Temperature 65°F

SKY CONDITIONS (clear, overcast, % clouds, etc.) Overcast 100% Clouds

PLUME DESCRIPTION
Color White
Distance Visible 400'

MINUTES OF NONCOMPLIANCE 27

OBSERVER SIGNITURE Glen Solson

APC-133
7/76

OBSERVATION RECORD

Company Opelika Foundry

Observer Golson

Location Opelika

Type of Facility Grey Iron Foun

Test Number 3

Point of Emissions Baghouse St

Date 11/30/77

Hr.	Min.	Seconds 0	15	30	45	STEAM PLUME (check if applicable) Attached	Detached	Comments
	0	50	50	50	50			
	1	55	50	50	50			
	2	50	50	55	50			
	3	55	55	50	55			
	4	55	55	50	50			
	5	50	50	55	55			
	6	50	50	50	50			
	7	50	50	50	50			
	8	50	50	50	50			
	9	50	50	50	50			
	10	50	50	50	50			
	11	50	50	50	50			
	12	50	50	50	45			
	13	50	50	50	50			
	14	50	50	50	50			
	15	50	50	50	50			
	16	50	50	50	50			
	17	50	50	50	50			
	18	50	55	50	50			
	19	55	50	55	50			
	20	55	50	50	55			
	21	50	50	50	50			
	22	50	50	50	55			
	23	50	50	55	55			
	24	55	55	55	55			
	25	50	50	50	50			
	26	50	50	50	50			
	27							[illegible]
	28							
	29							11:07

OBSERVER'S SIGNATURE Glen Golson

APC-134
7/76

RECORD OF VISUAL DETERMINATION OF OPACITY

Company Opelika Foundry

Location Opelika

Test Number 4 Date 11/30/77

Type Facility Grey Iron Foundry Control Device Baghouse

Facility Number 206-0006

Observer Certification Date 10/77

Observer Affiliation APCC

Point of Emissions Baghouse Stack

Height of Discharge Point 35'

Record the following information prior to and upon completion of observations at each source. If observations are made over an extended period of time, additional recordings should be made as applicable.

Clock Time Initial ___:___ a.m. 2:00 p.m. Final ___:___ a.m. ___:___ p.m.

OBSERVER LOCATION
Distance to Discharge 200'
Direction from Discharge SW
Height of Observation Point Ground

BACKGROUND DESCRIPTION Rusty Ductwork

WEATHER CONDITIONS
Wind Direction From SE
Wind Speed 19 - 29 mph
Ambient Temperature 65

SKY CONDITIONS (clear, overcast, % clouds, etc.) Overcast 100% clouds

PLUME DESCRIPTION
Color White
Distance Visible 400'

MINUTES OF NONCOMPLIANCE 45

OBSERVER SIGNITURE Glen Golson

APC-133
7/76

OBSERVATION RECORD

Company: Opelika Foundry

Observer: Gelson

Location: Opelika

Type of Facility: Gray Iron Foundry

Test Number: 4

Point of Emissions: Baghouse Cupola

Date: 11/30/77

Hr.	Min.	Seconds 0	15	30	45	STEAM PLUME (check if applicable) Attached	Detached	Comments
	0	50	50	45	45			
	1	50	45	50	50			
	2	50	45	50	50			
	3	50	50	45	45			
	4	45	45	50	45			
	5	45	45	45	45			
	6	45	45	45	45			
	7	45	45	45	50			
	8	50	50	50	45			
	9	45	50	50	50			
	10	45	45	45	45			
	11	50	50	50	50			
	12	45	45	50	45			
	13	45	50	45	50			
	14	45	45	45	45			
	15	45	50	50	45			
	16	50	45	45	45			
	17	50	50	45	50			
	18	50	45	50	45			
	19	45	50	50	50			
	20	50	45	50	45			
	21	45	50	45	50			
	22	45	50	50	50			
	23	50	50	45	45			
	24	45	45	50	50			
	25	50	50	50	50			
	26	45	50	50	45			
	27	50	50	50	50			
	28	50	50	50	50			
	29	50	50	50	50			

OBSERVER'S SIGNATURE: Glen Gelson

APC-134
7/76

OBSERVATION RECORD

Company _____ Observer _____

Location _____ Type Facility _____

Test Number _____ Point of Emissions _____

Date _____

Hr.	Min.	Seconds 0	15	30	45	STEAM PLUME (check if applicable) Attached	Detached	COMMENTS
	30	50	50	50	50			
	31	50	50	50	50			
	32	50	50	50	50			
	33	50	50	50	50			
	34	50	50	45	[illegible]			
	35	50	50	50	50			
	36	50	50	50	50			
	37	50	50	50	50			
	38	50	50	50	50			
	39	50	50	50	50			
	40	50	50	45	50			
	41	50	[illegible]	50	50			
	42	50	50	50	50			
	43	50	50	50	50			
	44	55	55	55				
	45							Capola Down
	46							Through For the Day
	47							
	48							
	49							
	50							
	51							
	52							
	53							
	54							
	55							
	56							
	57							
	58							
	59							

Glen Golson

PART II

Particle Sizing

Particle Sizing

As a result of mass emissions testing and visible emissions evaluations performed at Opelika Foundry November 30, 1977, subsequent particle size evaluation was performed. Particle sizing was performed using an Andersen Mark III inertial impactor. The evaluation was made in situ and at isokinetic conditions.

Two determinations were performed. Mean particle size based on the effective aerodynamic diameter* for the two runs were 0.48 micrometers and 1.0 micrometers, respectively. Although some discrepency exists between the two determinations, both samples have a large percentage of particles with diameters in the visible region of light. These particles cause the greatest amount of visibility reduction and may explain the excess opacity values while mass emission rates were well below the allowable rates for a gray iron foundry with Opelika Foundry's process weight.

*The effective aerodynamic diameter is the diameter of a spherical unit density particle which has the same aerodynamic properties as the particle under analysis.

APPENDIX G

Opelika Foundry
Run 1 1-4-78

ANDERSEN SAMPLER DATA

Flow: Final 27.431 13.17

Initial 23.271 1307

4.160 Cu.Ft.

Point W-4 chosen as representative from velocity traverse

Time 10 m 0 s

Flowrate 4.16 CFM
(4.2)

Filter #	Plate	Final (g)	Tare (g)	Net (g)	%	Σ%	ECD (μ)
11	1	15.4808	15.4765	4.7	14.0	100	14.5
25	2	15.0841	15.0858	—	—	86	9.2
9	3	15.3444	15.3427	2.1	6.3	86	6.1
26	4	15.1543	15.1569	—	—	79.7	4.3
5	5	15.2783	15.2752	3.5	10.4	79.7	2.8
1	6	15.3168	15.3164	.8	2.4	69.3	1.4
7	7	15.3325	15.3270	5.9	17.6	66.9	.98
27	8	15.5372	15.5315	6.1	18.2	49.3	.59
A5	Filter	15.2618	15.2518	10.4	31.0	31.1	
				33.5			

ISOKINETIC SAMPLING DATA

ΔP= .25 " H_2O T_a= 60 °F % H_2O= 25

Δh= .50 " H_2O T_m= 66.5 °F D_{nozzle}= .244 "

P_s= 29.6 " Hg T_s= 250 °F D_{stack} = 29 1/2 "

P_b= 29.6 " Hg

Vac("Hg max) 5 1/2 "

I = 103.8 %

Comments: 8 E

Tin 65 64.5 68.5 72
Tout 64 66.5 65

VE taken during Run 1

only one After burner in operation

Opelika Foundry
Run #2
1-4-78

Run 2

ANDERSEN SAMPLER DATA

Flow: Final 29.942 1402

Initial 27.802 1357

2.140 Cu.Ft.

Time 5 m 0 s

Flowrate .43 CFM

File #	Plate	Final (g)	Tare (g)	Net (g)	%	Σ%	ECD (μ)
02	1	15.3760	15.3701	6.3	23.6	100	18.5
21	2	15.3343	15.3318	2.9	10.9	76.4	9.2
06	3	15.3784	15.3793	–	–	65.5	6.1
24	4	15.3610	15.3625	–	–	65.5	4.3
10	5	15.6701	15.6683	2.2	8.2	65.5	2.8
23	6	15.1817	15.1797	2.4	9.0	57.3	1.4
08	7	15.4872	15.4838	3.4	12.7	48.3	.86
22	8	15.4347	15.4307	4.4	16.5	35.6	.58
A-3	Filter	15.3366	15.3319	5.1	19.2	19.1	
				26.7			

ISOKINETIC SAMPLING DATA

ΔP= .25 " H_2O T_a= 60 °F % H_2O= 25

Δh= .58 " H_2O T_m= 66 °F D_{nozzle}= .244 "

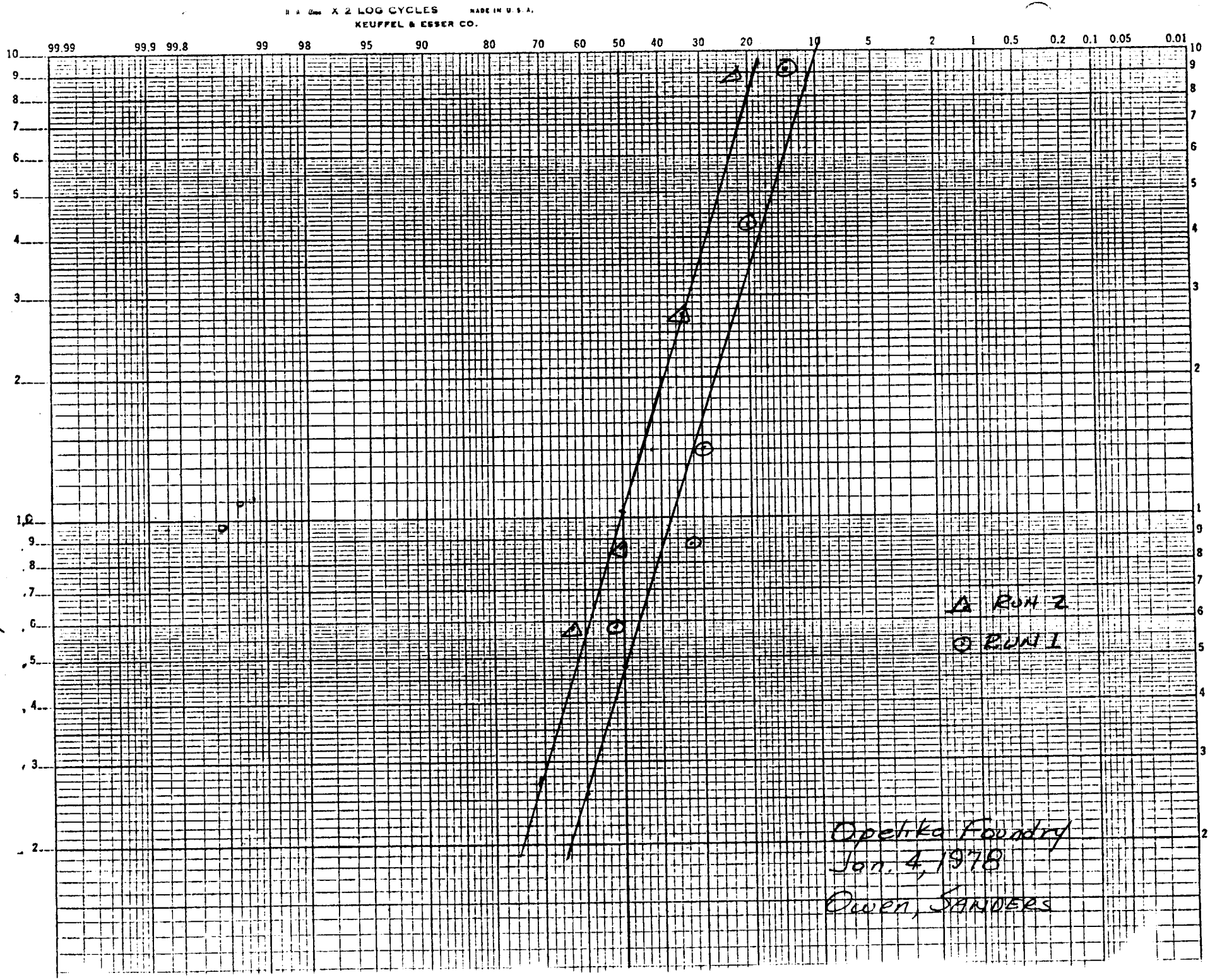
P_s= 29.6 " Hg T_s= 250 °F D_{stack} = 29½ "

P_b= 29.6 " Hg

I = 106.8

Comments:

particle size of nickel emitted from stack during first part of run.


X 2 LOG CYCLES
MADE IN U.S.A.
KEUFFEL & ESSER CO.
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
Δ RUN 2
⊙ RUN 1
Opelika Foundry
Jan. 4, 1978
Owen, Sanders

D_p'

APPENDIX H

ALABAMA AIR POLLUTION CONTROL COMMISSION

FIELD SURVEILLANCE VISIBLE EMISSION OBSERVATION FORM

Facility Number: ___ - ___

Facility Name: Opelika Foundry

Location: Opelika

Type Facility: Foundry

Emission Source: Stack

Control Device: Baghouse

Stack Height: 30 ft

Estimated Distance from Source: 600 ft

Direction from Source: SW

Date: 1-4-78

Clock Time: ~~12:03~~ PM 1:12 PM

Wind Direction: SE

Wind Speed: 3-5 MPH

Ambient Temperature: 60°F

Sky Condition: Clear

Sky Color: Blue

Plume Background: Blue Sky

Color of Plume: White

		Seconds				Steam Plume		
	MIN	00	15	30	45	Attached	Detached	Comments
:12 ~~:03~~	0	30	35	35	40			Mob during Item I &
	1	30	35	30	35			Anderson
	2	30	25	20	30			
:15	3	30	40	35	30			
	4	35	35	40	35			
:17	5	40	40	35	40			
	6	45	30	35	30			
	7	30	30	30	35			
:20	8	30	35	40	30			
	9	25	30	40	30			
	10	25	30	35	20			
:23	11	25	35	35	30			

Readings Ranged from ____% to ____% Opacity

Six-Minute Average (24 Consecutive Observations): ____% Opacity

Observer and Certification Date Joseph C. Sanders Signature Joseph C. Sanders

APC 099
5/77

Report of Particulate Emissions Testing

At

Opelika Foundry

Opelika, Alabama

206-0006

November 30, 1977

January 4, 1978

Test Report Prepared By:

Alabama Air Pollution Control Commission

Technical Services Section

Montgomery, Alabama

No files

State of Alabama
Department of Public Health
State Office Building
Montgomery, Alabama 36130

March 15, 1978

IRA L. MYERS, M. D.
STATE HEALTH OFFICER

M E M O R A N D U M

TO: Ken Barrett KAB

FROM: Joe L. Marsh JLM

SUBJECT: Opelika Foundry Stack Samples

After making an additional run on the samples from the Opelika Foundry, we found the following weights may be added to Runs 1, 2, and 3:

Run # 1 - 0.0041 g
Run # 2 - 0.0012
Run #3 - 0.0000

If you have any questions concerning these date, please feel free to contact me.

JLM:fj

DLC
RECEIVED
MAR 16 1978
Alabama Air Pollution
Control Commission

7-13-06

Summary of Results

Emissions results for the test are displayed in Table 1. Particulate emission rates were 8.6, 10.0, and 7.7 pounds per hour for the three runs, respectively. Average emissions for the test were 8.8 pounds per hour.

Process weight during the test period was 10,800 pounds per hour, averaged over the entire day. Section 4.5.1, Table 4-3 of the Alabama Air Pollution Control Commission allows 17.5 pounds per hour for a small foundry cupola with the previously mentioned process weight.

Visible emissions evaluations were made during all runs. Run 1 corresponds to the preliminary particulate run on November 29, 1977, and visible emissions evaluations 2, 3, and 4 correspond to particulate runs 1, 2, 3, respectively. Emissions ranged from 40% to 55% opacity.

COMPANY NAME Opelika Foundry FACILITY NO. 206-0006

TEST BY: AAPCC DATE: 11-30-77

TEST ON: Cupola Baghouse

Parameter	Run I	Run II	Run III
Production Rate	5.4 T/HR	5.4 T/HR	5.4 T/HR
$\overline{\Delta H}$	2.51	2.71	2.83
$\overline{\sqrt{\Delta P}}$	.531	.547	.545
$\overline{t_m}$	83	88	89
$\overline{t_s}$	370	352	386
P_b	30.01	30.01	30.01
P_s	30.00	30.00	30.00
V_m .976	50.669 ~~[illegible]~~ 49.453	53.539 52.254	41.654 40.654
$\%CO_2$	8.2	9.0	11.0
$\%O_2$	11.3	11.8	10.8
$\%N_2$	80.5	79.2	78.2
%CO	0	0	0
V_{1c}	332.4	245.7	271.1
M_n	~~456.1~~ 632.0	697.1	456.1
C_p	.80	.80	.80
~~A_s~~ d_s	2'5¼"	2'5¼"	2'5¼"
~~A_n~~ d_n	.368	.368	.368
θ	60	60	46.25

Source Operation

Opelika Foundry has a Whiting (Morris Steel Products) Model 3 cupola furnace with a manufacturer's design capacity of 4.5 tons/hour. The cupola furnace is charged with metal, limestone, and coke. The metal charge consists of 75% per cent scrap metal and 25% pig iron. Coke is added at a rate of 10 pounds per 100 pounds of metal and limestone at a rate of one pound per 150 pounds of metal. The cupola is operated continuously from 7:00 a.m. to 3:30 p.m. daily with materials added in batch modes. Molten metal is periodically tapped from the cupola and cast into various molds. 90.4

Effluent gases from the cupola are exited through an afterburner section to oxidize carbon monoxide emissions. The gas stream is then passed through a quench tower where gases are cooled to reduce the air volume and to protect the baghouse from excessive temperatures. The gas stream is cleaned by an American Air Filter baghouse. The baghouse is a negative pressure design and employs pulsed air cleaning of the bags. The cleaned air is then drawn through a fan and exhausted through the stack.

Particle Sizing

As a result of mass emissions testing and visible emissions evaluations performed at Opelika Foundry November 30, 1977, subsequent particle size evaluation was performed. Particle sizing was performed using an Andersen Mark III inertial impactor. The evaluation was made in situ and at isokinetic conditions.

Two determinations were performed. Mean particle size based on the effective aerodynamic diameter* for the two runs were 0.48 micrometers and 1.0 micrometers, respectively. Although some discrepency exists between the two determinations, both samples have a large percentage of particles with diameters in the visible region of light. These particles cause the greatest amount of visibility reduction and may explain the excess opacity values while mass emission rates were well below the allowable rates for a gray iron foundry with Opelika Foundry's process weight.

*The effective aerodynamic diameter is the diameter of a spherical unit density particle which has the same aerodynamic properties as the particle under analysis.

Opelika Foundry
Run 1 1-4-78

ANDERSEN SAMPLER DATA

Flow: Final 27.431 13.17
Initial 23.271 1307
4.160 Cu.Ft.

Point W-4 chosen as representative from velocity traverse

Time 10 m 0 s

Flowrate 4.16 CFM
(4.2)

	Plate	Final (g)	Tare (g)	Net ~~(g)~~ 29	%	Σ%	ECD (μ)
11	1	15.4808	15.4765	4.7	14.0	100	14.5
25	2	15.0841	15.0858	—	—	86	9.2
9	3	15.3444	15.3427	2.1	6.3	86	6.1
26	4	15.1543	15.1569	—	—	79.7	4.3
5	5	15.2783	15.2752	3.5	10.4	79.7	2.8
1	6	15.3168	15.3164	.8	2.4	69.3	1.4
7	7	15.3325	15.3270	5.9	17.6	66.9	.88
27	8	15.5372	15.5315	6.1	18.2	49.3	.59
A5	Filter	15.2618	15.2518	10.4	31.0	31.1	
				33.5			

ISOKINETIC SAMPLING DATA

ΔP= .25 " H_2O T_a= 60 °F % H_2O= 25

Δh= .50 " H_2O T_m= 66.5 °F D_{nozzle}= .244 "

P_s= 29.6 " Hg T_s= 250 °F D_{stack} = 29 1/2 "

P_b= 29.6 " Hg Vac("Hg max) 5 1/2 "

I = 103.8

B Comments: E

Tin 65 64.5 68.5 72
Tout 64 66.5 65

VE taken during Run 1

only one After burner in operation

Opelika Foundry
Run #2
1-4-78

Run 2

ANDERSEN SAMPLER DATA

Flow: Final 29.942 1402

Initial 27.802 1357

2.140 Cu.Ft.

Time 5 m 0 s

Flowrate .43 CFM

	Plate	Final (g)	Tare (g)	Net (g)	%	Σ%	ECD (μ)
02	1	15.3760	15.3701	6.3	23.6	100	14.5
21	2	15.3343	15.3318	2.9	10.9	76.4	9.2
06	3	15.3784	15.3793	–	–	65.5	6.1
24	4	15.3610	15.3625	–	–	65.5	4.3
10	5	15.6701	15.6683	2.2	8.2	65.5	2.8
23	6	15.1817	15.1797	2.4	9.0	57.3	1.4
08	7	15.4872	15.4838	3.4	12.7	48.3	.86
22	8	15.4347	15.4307	4.4	16.5	35.6	.58
A-3	Filter	15.3366	15.3319	5.1	19.2	19.1	
				26.7			

ISOKINETIC SAMPLING DATA

ΔP= .25 " H_2O T_a= 60 °F % H_2O= 25

Δh= .58 " H_2O T_m= 66 °F D_{nozzle}= .244 "

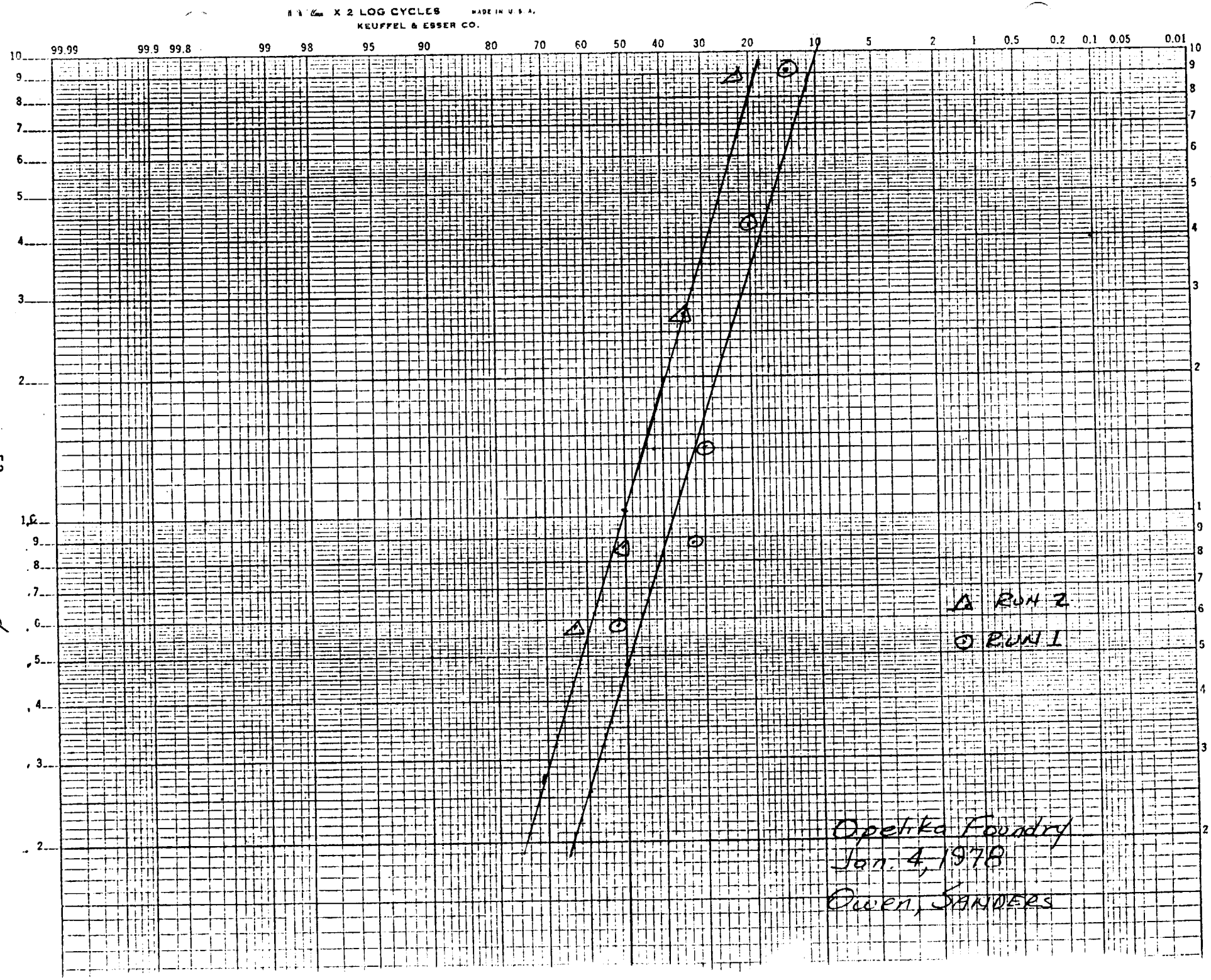
P_s= 29.6 " Hg T_s= 250 °F D_{stack} = 29½ "

P_b= 29.6 " Hg

I = 106.8

Comments:

particle size of nickel emitted from stack during first part of run.


X 2 LOG CYCLES
MADE IN U.S.A.
KEUFFEL & ESSER CO.
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
△ RUN 2
⊙ RUN 1
Opelika Foundry
Jan. 4, 1978
Owen, SANDERS