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.

PARTICULATE EMISSION TEST REPORT

For a Gray Iron Cupola at

CHERRYVILLE FOUNDRY WORKS

Cherryville, North Carolina

Performed by the Source Testing Staff
of the
North Carolina Department
of Natural & Economic Resources
Division of Environmental Management
Air Quality Section
December 18, 1975, January 2, and
January 15, 1976

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INTRODUCTION

This report presents the results of tests performed on December 18, 1975, January 2, 1976, and January 15, 1976 on a gray iron cupola at Cherryville Foundry Works in Cherryville, North Carolina. Robert E. Wooten, Julius A. Shanklin, Victor D. Copelan, and Michael Y. Aldridge of the North Carolina Division of Environmental Managemant, Air Quality Section conducted particulate sampling to determine if this source was in compliance with the applicable emission standard. M. Gary Lindler, Robert Stenner, and F. Don Kabool of the Gaston County Air Pollution Control Agency were present at various times to monitor the operation of the cupola during testing.

Process Description

Cherryville Foundry Works uses a conventional cupola furnace to melt scrap iron for the production of municipal castings. Coke and iron are fed directly into the charge door without the use of a skip hoist. No fluxing agents are used in the melt.

The table on the following page lists the process rates during the three test runs made by the North Carolina Air Quality personnel. Allowable emission rates as determined from North Carolina Emission Standard 2.20 are also shown.

PROCESS RATES
AND
ALLOWABLE EMISSIONS

	Run #1	lb/hr	T/hr	Run #2			Run #3		
Initial coke load (lb)	1060						1500		
Coke fed during melt (lb)	620						800		
Total coke (lb)	1680			2332			2300		
Total iron (lb)	8720	6794.8	3.4	9265	6779.3	3.4	12100	9189.9	4.6
Total process input (lb)	10400			11597			14400		
Time of melt (min)	77			82			79		
*Hourly Process Rate (lb/hr)	8104			8486			10936		
Maximum allowable emission rate (lb/hr) from Emission Standard 2.20	14.42			14.88			17.61		

8.6 lb/ton ave

$$\text{*Hourly Process Rate} = \frac{\text{Total process input}}{\text{Time of melt}} \times 60 \text{ min/hr}$$

Sampling and Analytical Procedures

Particulate testing and analysis of samples was performed according to procedures developed by the U. S. Environmental Protection Agency and referred to as Method 5. Sampling port locations and the number of test points to be used were determined according to Method 1. The above federal test methods appear in their original form in the December 23, 1971 Federal Register (Reference 1), with updated versions appearing in the Environmental Reporter (Reference 2).

Test point locations and sampling port placement are shown in Appendix E.

The composition of the flue gas was determined by the following method: carbon dioxide measurements were made periodically during each run with a Bacharach Fyrite instrument. Percent oxygen was determined from a nomograph (Chart 9 in Reference 3). Carbon monoxide was assumed to be zero and percent nitrogen was determined by subtracting the percentages of carbon dioxide and oxygen from 100%. For two (2) of the runs oxygen measurements were also made with a fyrite instrument as a check against (Chart 9).

The process rate for the cupola was determined by weighing the coke and iron before it was fed into the unit.

Summary of Results

The table on the following page presents the final results of the particulate emissions testing and indicates that the subject source is not in compliance with North Carolina emission standard 2.20.

Michael Y. Aldridge

Michael Y. Aldridge, Engineer I
Air Quality Section
January 29, 1976

References

1. *Federal Register*, Standards of Performance for New Stationary Sources, Volume 36, Number 247, U. S. Government Printing Office, Washington, D. C. (December 23, 1971).

2. *Environmental Reporter*, pp 121:0401 - 121:0485 updated thru November 12, 1974, The Bureau of National Affairs, Washington, D. C.

3. Smith, Walter S., and D. James Grove, *Stack Sampling Nomographs for Field Estimations*, Entropy Environmentalists, Inc., Research Triangle Park, North Carolina, (1973).

TEST SUMMARY - CHERRYVILLE FOUNDRY WORKS

	Parameter	Run 1		Run 2		Run 3	
Q_s	Stack volume flow rate, acfm	16906		16887		18280	
Q_{std}	Stack volume flow rate, scfm	6659		6684		6705	
V_{std}	Sample volume, scf	28.8		30.1		27.6	
%I	Percent isokinetic	98		102		102	
pmr	Emission rate, lb/hr	33.3	.908	26.2	7.7	37.8	8.2
	Maximum allowable emission rate based on standard 2.20 lb/hr	14.4		14.9		17.6	
$\overline{pmr}$	Average emission rate lb/hr			32.4			
	Average allowable rate			15.6			

APPENDICES

Calculation Summary

APPENDIX A

SOURCE Cherryville Foundry Works

DATE 12-18-75 1-2-76 ~~1-15-76~~

LOCATION Cherryville N. C.

ENTRY	RUN 1	RUN 2	RUN 3	ANSWER
Ave. ΔH (in H_2O)	0.5760	0.5670	0.5600	
P_{atm} (in Hg)	29.0500	29.1900	29.2700	
	29.0923	29.2316	29.3111	P_m (in Hg)
P_s (gage) (in H_2O)	− 0.0550	− 0.0550	− 0.0550	
	29.0459	29.1859	29.2659	P_s (in Hg)
T_m (°R)	497.0000	519.0000	513.0000	
V_m (ft^3)	27.7450	29.6820	26.9940	
	28.7624	29.6072	27.3150	$V_{m_{std}}$ (ft^3)
V_{lq} (ml)	0.9000	10.5000	5.3000	
	0.0425	0.4964	0.2506	$V_{v_{std}}$ (ft^3)
	28.8049	30.1037	27.5656	V_{std} (ft^3)
	0.1477	1.6492	0.9091	%M
	0.9985	0.9835	0.9909	M_d
MW_d	29.5700	29.6700	29.5200	
	29.5529	29.4775	29.4152	M
T_s (°R)	1306.0000	1306.0000	1413.0000	
	1.2334	1.2320	1.2811	
$\Sigma\sqrt{\Delta p}$	8.5067	9.0073	8.3345	
$n_{\Delta p}$	34.0000	36.0000	32.0000	
	0.2501	0.2502	0.2604	Ave $\sqrt{\Delta p}$
C_p	0.8500	0.8500	0.8500	
	22.4230	22.3982	24.2446	v_s (ft/sec)
D_s (in)	48.0000	48.0000	48.0000	
	12.5660	12.5660	12.5660	A_s (ft^2)
	16906.0890	16887.4286	18279.5377	Q_s (ft^3/min)
	6658.9263	6683.6366	6705.0855	Q_{std} (ft^3/min)
W_t (gm)	1.0975	0.8820	1.1612	
	33.5660	25.9071	37.3682	pmr_c (lb/hr)
D_n (in)	0.3750	0.3750	0.3750	
	0.1104	0.1104	0.1104	A_n (in^2)
θ (min)	72.0000	72.0000	66.0000	
	33.0378	26.5506	38.1331	pmr_a (lb/hr)
	98.4261	102.4837	102.0467	%I
	33.3019	26.2289	37.7506	pmr_{avg} (lb/hr)
%CO				
$\%N_2$				
$\%O_2$				
F factor				%EA
				HI (10^6 BTU)
				pmr_u (lbs/10^6BTU)

EQUATIONS

1. Absolute Pressure in Dry Gas Meter - P_m (in. Hg.)

$$P_m = P_{atm} + \frac{\Delta H}{13.6}$$

2. Absolute Stack Pressure - P_s (in. Hg.)

$$P_s = P_{atm} + \frac{P_{s(gage)}}{13.6}$$

3. Sample Volume at Standard Conditions - $V_{m_{std}}$ (ft^3)

$$V_{m_{std}} = V_m \frac{T_{std}}{T_m} \frac{P_m}{P_{std}}$$

4. Volume of Water Vapor Collected, Corrected to Standard Conditions - $V_{v_{std}}$ (ft^3)

$$V_{v_{std}} = K_2 V_{lq} \frac{T_{std}}{P_{std}} \qquad K_2 = 0.00267 \text{ (units conversion)}$$

5. Total Sample Volume at Standard Conditions - V_{std} (ft^3)

$$V_{std} = V_{m_{std}} + V_{v_{std}}$$

6. Percent Moisture in Stack Gas - %M

$$\%M = \frac{V_{v_{std}}}{V_{std}} \times 100$$

7. Mole Fraction of Dry Gas - M_d

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

8. Molecular Weight of Wet Gas - M (lb/lb mole)

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

9. Stack Velocity - v_s (ft/sec)

$$v_s = K_p C_p \sqrt{\frac{T_s}{P_s M}} \frac{\Sigma\sqrt{\Delta p}}{n_{\Delta p}}$$

$$K_p = 85.48 \text{ (units conversion factor)}$$

10. Stack Volume Flow Rate - Q_s (ft^3/min)

$$Q_s = K_1 v_s A_s' \qquad K_1 = 60 \text{ (units conversion)}$$

11. Stack Volume Flow Rate at Standard Conditions - Q_{std} (ft^3/min)

$$Q_{std} = \frac{T_{std}}{P_{std}} \frac{P_s}{T_s} Q_s$$

12. Pollutant Mass Rate Based on Particulate Concentration - pmr_c (lb/hr)

$$pmr_c = K_3 \frac{W_t Q_{std}}{V_{std}} \qquad K_3 = 0.1323 \text{ (units conversion)}$$

13. Pollutant Mass Rate Based on the Ratio of the Cross Sectional Area of the Stack and the Sampling Nozzle - pmr_a (lb/hr)

$$pmr_a = K_3 \frac{W_t A_s}{\theta A_n} \qquad K_3 = 0.1323 \text{ (units conversion)}$$

14. Percent Isokineticity - %I

$$\%I = \frac{pmr_a}{pmr_c} \times 100$$

15. Average Pollutant Mass Rate - pmr_{avg} (lb/hr)

$$pmr_{avg} = \frac{pmr_a + pmr_c}{2}$$

16. Percent Excess Air - %EA

$$\%EA = \frac{\%O_2 - .5(\%CO)}{.264(\%N_2) - \%O_2 + .5(\%CO)}$$

17. Heat Input Rate - HI (10^6 BTU/hr)

$$HI = \frac{60 \; Q_{std} \; M_d}{F(100 + \%EA)}$$

18. Specific Emission Rate - pmr_u (lb/10^6 BTU)

$$pmr_u = \frac{pmr_{avg}}{HI}$$

NOMENCLATURE

A_n	(in^2), Cross sectional area of nozzle
A_s	(in^2), Cross sectional area of stack
A_s'	(ft^2), Cross sectional area of stack
C_p	Pitot tube calibration coefficient
%EA	Percent Excess Air
F	(scfd/10^4 BTU), F factor
ΔH	(in H_2O), Average orifice meter reading
HI	(10^6 BTU/hr), Heat Input Rate
%I	Percent Isokineticity
M	(lb/lb mole), Molecular Weight of wet gas
%M	Percent Moisture
M_d	Mole fraction of dry gas
MW_d	(lb/lb mole) Molecular weight of dry gas
$n_{\Delta p}$	Number of Δp readings
P_{atm}	(in Hg), Local atmospheric pressure
P_m	(in Hg), Absolute pressure in dry gas meter
P_s	(in Hg), Absolute stack pressure
$P_{s(gage)}$	(in H_2O), Measured static stack pressure
P_{std}	(29.92 in Hg), Standard pressure
pmr_a	(lb/hr), Pollutant mass rate based on ratio of areas
pmr_{avg}	(lb/hr), Average pollutant mass rate
pmr_c	(lb/hr), Pollutant mass rate based on concentration
pmr_u	(lb/10^6 BTU), Specific emission rate
Δp	(in H_2O), Velocity pressure
Q_s	(ft^3/min), Actual stack volume flow rate
Q_{std}	(ft^3/min), Stack volume flow rate at standard conditions

T_m (^oR), Average dry gas meter temperature

T_s (^oR), Average stack temperature

T_{std} (530 ^oR), Standard temperature

V_{lq} (ml), Liquid volume

V_m (ft^3), Sample volume measured by dry gas meter

$V_{m_{std}}$ (ft^3), Sample volume at standard conditions

V_{std} (ft^3), Total sample volume at standard conditions

$V_{v_{std}}$ (ft^3), Volume of water vapor collected, corrected to standard conditions

v_s (ft/sec), Stack velocity

W_t (gm), Total weight of particulate collected

θ (min), Duration of test

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Cherryville Foundry Works
DATE
SAMPLING LOCATION Cupola Stack
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Repeated Grab Samples
ANALYTICAL METHOD Fyrite
AMBIENT TEMPERATURE
OPERATOR R.W. Wooten V.D. Copelan

COMMENTS: Run #1 Oxygen instrument gave low values. Reagent was not fresh. O_2 value was taken from Chart 9 in Reference 2
Run #2 Measured O_2 value agrees with value from Chart 9
Run #3 O_2 was not measured. Value shown is from Chart 9

Run #1 18-Dec-75

													Average Volume	Multiplier	Molecular Weight M_d
Time															
$\%CO_2$	7.5	7.5	6.5	5.0	6.0	6.0	5.5						6.3	.44	2.77
$\%O_2$	12.5	13.0	13.5	14.0	12.5	10.5	7.0	Ave	11.9			★	14.1	.32	4.51
$\%N_2$													79.6	.28	22.29
															29.57

Run #2 2-Jan-76

Time														
$\%CO_2$	8.5	8.5	7.0	6.0	7.0	6.5	7.0	7.0	6.0	4.0	6.5	6.7	.44	2.95
$\%O_2$	15.5	15.0	15.0	16.0	16.0	14.5	14.0	14.5	15.0	14.5		★ 15.0	.32	4.80
$\%N_2$												78.3	.28	21.92
														29.67

Run #3 15-Jan-76

Time														
$\%CO_2$	6.0	6.0	7.5	5.0	6.0	6.0	6.0	5.0	6.5	6.0		6.0	.44	2.64
$\%O_2$												★ 14.2	.32	4.54
$\%N_2$												79.8	.28	22.34
														29.52

★ From Chart 9 of Reference 2

APPENDIX B

ANALYTICAL DATA

Lab No. 4318

Plant Cherryville Foundry Works

Run Number 1 Date 18 Dec 1975

Location Cherryville N.C.

FILTER WEIGHTS				TOTALS
Filter Number	52285			
Final Weight (g)				*
Tare Weight (g)	0.3872			

WASHINGS				TOTALS
Beaker Number	N	Q (cyclone catch)		
Volume (Acetone)	300	-0-		300
Final Weight (g)	181.4947	184.0408		365.5355
Tare Weight (g)	180.3093	183.7277		364.0370

ACETONE BLANK		TOTAL PARTICULATE CATCH	
Lot Number	745176	Filter Final Weight	*
Beaker Number	S-8	+ Washings, Final Weight	365.5355
Volume (ml)	300	- Filter Tare	0.3872
Final Weight (g)	174.7445	- Beaker Tare (Washings)	364.0370
Tare Weight (g)	174.7307	- Corrected Blank	0.0138
Blank Residue (g)	0.0138	= Total Particulate (g)	1.0975

BLANK CORRECTION =

$$\frac{(\text{Vol. Washings})}{(\text{Vol. Blank})} \times (\text{Blank Residue})$$

$$\frac{(300)}{(300)} \times (0.0138) = 0.0138$$

IMPINGERS (1, 2, 3)		SILICA GEL	
Final Volume (ml)	196	Final Weight (g)	205.9
Initial Volume (200 ml)	200	Initial Weight (g)	200.0
Water Collected (ml)	-5	Moisture Collected (g)	5.9

Total Water Collected (ml) 0.9

*These blocks will be blank if filter is weighed together with the washings.

ANALYTICAL DATA

Lab No. _____

Plant: Cherryville Foundry

Run Number: 2 Date: 2 Jan. '76

Location: Cherryville, NC.

FILTER WEIGHTS

				TOTALS
Filter Number	52286			
Final Weight (g)				* —
Tare Weight (g)	0.3880			

WASHINGS

				TOTALS
Beaker Number	BHF-4	AA (cyclone catch)		
Volume (Acetone)	350	0 ml (DRY (PARTICULATES))		350
Final Weight (g)	169.5791	171.0379		340.6170
Tare Weight (g)	168.7503	170.5864		339.3367

ACETONE BLANK

Lot Number	
Beaker Number	V
Volume (ml)	300
Final Weight (g)	171.4091
Tare Weight (g)	171.4003
Blank Residue (g)	.0088

TOTAL PARTICULATE CATCH

Filter Final Weight	* —
+ Washings, Final Weight	340.6170
- Filter Tare	- 0.3880
- Beaker Tare (Washings)	-339.3367
- Corrected Blank	- .0103
= Total Particulate (g)	0.8820

BLANK CORRECTION =

$$\frac{(\text{Vol. Washings})}{(\text{Vol. Blank})} \times (\text{Blank Residue})$$

$$\left(\frac{350}{300}\right) \times (.0088) = 0.0103$$

IMPINGERS (1, 2, 3)

Final Volume (ml)	205
Initial Volume (200 ml)	200
Water Collected (ml)	5

SILICA GEL

Final Weight (g)	205.5
Initial Weight (g)	200.0
Moisture Collected (g)	5.5

Total Water Collected (ml) 10.5

*These blocks will be blank if filter is weighed together with the washings.

ANALYTICAL DATA

Lab No. 0234

Plant Cherryville Foundry Works

Run Number 3 Date 15 Jan. 75

Location Cherryville, N.C.

FILTER WEIGHTS				TOTALS
Filter Number	52283			
Final Weight (g)				*
Tare Weight (g)	0.3859			

WASHINGS				TOTALS
Beaker Number	H	S-2 (cyclone catch)		
Volume (Acetone)	300	-0-		300
Final Weight (g)	174.4295	175.4047		349.8342
Tare Weight (g)	173.1322	175.1457		348.2779

ACETONE BLANK

Lot Number	745176
Beaker Number	E
Volume (ml)	200
Final Weight (g)	170.1590
Tare Weight (g)	170.1529
Blank Residue (g)	0.0061

TOTAL PARTICULATE CATCH

Filter Final Weight	*
+ Washings, Final Weight	349.8342
- Filter Tare	0.3859
- Beaker Tare (Washings)	348.2779
- Corrected Blank	0.0092
= Total Particulate (g)	1.1612

BLANK CORRECTION =

$$\frac{(\text{Vol. Washings})}{(\text{Vol. Blank})} \times (\text{Blank Residue})$$

$$\frac{(300)}{(200)} \times (0.0061) = 0.0092$$

IMPINGERS (1, 2, 3)

Final Volume (ml)	199
Initial Volume (200 ml)	200
Water Collected (ml)	-1

SILICA GEL

Final Weight (g)	206.3
Initial Weight (g)	200.0
Moisture Collected (g)	6.3

Total Water Collected (ml) 5.3

*These blocks will be blank if filter is weighed together with the washings.

10-23-75

AIR QUALITY DIVISION
SOURCE SAMPLING FIELD DATA

Plant Cherryville Foundry
Date 12-18-75
Location Cherryville
Sample Type Particulate
Run Number 1
Operator JHS
Sample Box No. 1
Meter Box No. 2

Meter $\Delta H_@$ 1.846
C Factor 1.04
Probe Type Stainless Steel
Probe Length 5' min.
Probe Tip Dia., In. 3/8
Probe Heater Setting NA
Heater Box Setting 225
Assumed Moisture % 4

Ambient Temperature
Barometric Pressure, In. Hg. 29.05
Static Pressure (P_s), -.055
Stack Dimension(s) 48"φ
Distance: Disturbance to port 13'4"
Distance: Port to exit 3'4"
Reference Δp Varies
Filter number(s) 522[illegible]

Remarks:

TRAVERSE POINT NUMBER	SAMPLING TIME, min / CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
A1	0	795.663	[illegible]		.36	720					
2	2					1055					
3	4	796.7[illegible]	.06		.46	965		32	4	80	35
4	6		[illegible]		.31	1025		32	3	80	34
5	8		[illegible]		.40	955		32	4	75	34
6	10	798.[illegible]	.06		.50	935		32	4		
7	12	[illegible].0	.055		.47	925		33	4	100	34
8	14	800.42	[illegible]		[illegible]	1100		[illegible]	5	110	34
9	16	[illegible]	[illegible]		[illegible]	1110		[illegible]	5	112	34
10	18	[illegible]	[illegible]		[illegible]	1045		[illegible]	5		
11	20	802.69	[illegible]		[illegible]	890			5	140	35
12	22	[illegible]	[illegible]		[illegible]	830		34	[illegible]		
13	24		[illegible]		.64	735		34	[illegible]	130	34
14	26	[illegible]	[illegible]		.74	830		34	7½	140	34
15	28	[illegible]	[illegible]		.56	800		34	9	150	35
16	30	[illegible]	.08		.70	875		34	[illegible]	160	36

AQ-44

12-15-72

Plant Merryville Foundry Run No. 1 Date _____

TRAVERSE POINT NUMBER	SAMPLING TIME min / CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	900		[illegible]	[illegible]	115	36
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	815					
[illegible]	[illegible]	[illegible]									
[illegible]	[illegible]				[illegible]	790				160	35
2	[illegible]	[illegible]	[illegible]	[illegible]		725		[illegible]	[illegible]	160	35
[illegible]	4[illegible]	[illegible]				765		[illegible]	[illegible]	120	34
[illegible]	42	[illegible]	[illegible]		[illegible]	765		[illegible]	9½	135	34
5	4[illegible]		[illegible]		[illegible]	975		33	[illegible]	130	35
6	4[illegible]		[illegible]		[illegible]	805		[illegible]	[illegible]	140	35
7	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]		140	35
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	935			[illegible]	120	35
9	[illegible]	[illegible]	[illegible]		[illegible]	955		[illegible]	[illegible]	130	35
[illegible]	[illegible]		[illegible]		51	925		[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	830			[illegible]	120	36
1	56	[illegible]	[illegible]		[illegible]	790		[illegible]	15	130	36
12	5[illegible]	[illegible]	[illegible]		63	740		[illegible]	[illegible]	140	36
13	[illegible]	[illegible]	[illegible]		[illegible]	730			[illegible]	155	38
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	655		[illegible]	[illegible]	160	40
15	[illegible]		[illegible]		[illegible]	540			[illegible]	155	40
16	[illegible]		[illegible]		[illegible]	535			[illegible]	160	42
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	630			15½	155	44
[illegible]	[illegible]	[illegible]									
	72 min.	27.745			.576	846 °F		33°F	+4°F = 37		
						1306 °R		493°	R		
		$\Sigma \sqrt{\Delta p} = 8.5067$									
		$n_p = 34$									

AQ-44 (con.)

12-15-72

AIR QUALITY DIVISION
SOURCE SAMPLING FIELD DATA

Plant Cherryville Pdy.
Date 2 Jan 76
Location Cherryville
Sample Type Particulate
Run Number 2
Operator VDS
Sample Box No. 2
Meter Box No. 2

Meter $\Delta H_@$ [illegible]
C Factor 1.04
Probe Type S/S
Probe Length 5'
Probe Tip Dia., In. 3/8
Probe Heater Setting N/A
Heater Box Setting 225
Assumed Moisture % 4

Ambient Temperature 40 F
Barometric Pressure, In. Hg. [illegible] - 29.18
Static Pressure (P_s), -.055 in
Stack Dimension(s) 48" dia
Distance: Disturbance to port 13'-4"
Distance: Port to exit 3'-4" (S) [illegible] (-.055 in static)
Reference Δp [illegible]
Filter number(s) 2226 (F) .004 [illegible] 19 in

Remarks:

TRAVERSE POINT NUMBER	SAMPLING TIME, min / CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
		~~823.546~~									
A 1		823.540	.03		.52	655		46	1	225	42
2	2	823.7	.055		.58	630		48	2½	230	40
3	4	824.72	.075		.80	1060		48	3	232	38
4	6	825.67	.045		.45	715		49	2½	232	37
5	8		.065		.55	950		49	2½	234	38
6	10	827.24	.070		.54	1100		50	2½	234	38
7	12	828.66	.080		.60	1175		50	2½	237	38
8	14	828.91	.080		.60	1170		50	3	234	38
9	16	829.79	.085		.62	1135		51	3	236	38
10	18	830.62	.095		.70	1185		51	4	235	39
11	20	831.55	.080		.60	1090		52	3	237	39
12	22	832.42	.065		.48	815		53	2½	237	39
13	24	833.18	.065		.62	730		53	3	238	40
14	26		.080		.78	825		54	4	234	40
15	28	835.06	.065		.62	610		54	-	234	40
A 16	30	835.92	.050		.54	680		55	4	234	40

AQ-44

12-15-72

29.18

Plant Cherryville Foundry Run No. 2 Date 2 Jan '76

TRAVERSE POINT NUMBER	SAMPLING TIME min / CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m) ft³	VELOCITY HEAD (Δp_s) in H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in H_2O ACTUAL	STACK TEMPERATURE (T_s) °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$) °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$) °F	PUMP VACUUM in Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F
A17	~~836.75~~	836.75	.065		.59	855		55	4	236	42
A18	34	837.63	.060		.54	800		56	4	236	42
A19	36	838.466									
B1	36	838.466	.055		.55	645		56	3	242	43
2	38	839.110	.045		.45	835		56	-	246	43
3	40	839.88	.040		.36	670		56	2½	246	43
4	42	840.48	.050		.44	730		56	3	248	42
5	44	841.58	.070		.58	920		56	4½	248	42
6	46	842.00	.070		.58	900		57	-	248	42
7	48	842.55	.065		.55	1000		57	4	246	42
8	50	843.68	.055		.54	765		58	4½	247	42
9	2	844.51	.052		.48	815		58	-	246	42
10	4	845.29	.055		.54	870		59	4	246	42
11	6	846.12	.065		.62	860		59	4½	247	42
12	8	847.00	.065		.58	835		59	4½	247	43
13	10	847.86	.10		.86	925		60	5½	247	43
14	12	848.99	.08		.78	745		60	5	248	43
15	14	849.98	.075		.65	780		60	5	248	43
16	16	850.79	.060		.52	705		60	4½	247	44
17	18	851.00	.050		.54	625		61	4½	246	44
18	20	852.40	.050		.54	660		61	5	246	45
B18	72	853.230									
									★		
	72 min	29.682			.567	846°F		55° + 4° = 59°F			
						1306°R		519°R			

$\Sigma\sqrt{\Delta p} = 9.0073$

$n_p = 36$

AQ-44 (con.) ★ 4°F = Therometer correction

12-15-72

AIR QUALITY DIVISION

SOURCE SAMPLING FIELD DATA

Plant Cherryville Foundry
Date 15 January 1976
Location Cherryville, N.C.
Sample Type Particulate
Run Number 3
Operator JDS
Sample Box No. 2
Meter Box No. 2

Meter $\Delta H_@$ 1.846
C Factor 1.02
Probe Type S/S
Probe Length 5'
Probe Tip Dia., In. 3/8"
Probe Heater Setting N/A
Heater Box Setting 225
Assumed Moisture % 4

Ambient Temperature 55 F
Barometric Pressure, In. Hg. 29.27 - 29.22
Static Pressure (P_s), -.055
Stack Dimension(s) 48" dia
Distance: Disturbance to port 13'-4"
Distance: Port to exit 3'-4"
Reference Δp varies
Filter number(s) 52283

Remarks:

Leak rate @ 15 in
nil

TRAVERSE POINT NUMBER	SAMPLING TIME, min / CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\ out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	%CO_2
A1	0 1235	853.517	.04		.36	1180		44	2	60	48	6
2	2	854.12	.05		.44	1270		44	2	60	43	-
3	4	854.81	.05		.44	1280		45	2	85	41	
4	6	855.43	.08		.70	1210		45	3	96	41	6
5	8	856.57	.10		.69	1130		45	3½	115	40	-
6	10	857.40	.10		.71			46	4½	135	40	
7	12	858.38	.10		.71	1140		46	5	154	40	-
8	14	859.30	.105		.76			46	5½	170	40	-
9	16	860.23	.085		.65	1050		47	5	180	42	7.5
10	18	861.12	.075		.51			47	5	180	42	
11	20	861.10	.075		.51	905		47	5	192	41	-
12	22	862.77	.070		.49			47	5½	210	42	-
13	24	863.45	.070		.54	985		48	5½	210	42	-
14	26							48	6	210	42	
15	28	865.09	.075		.74	795		49	8	210	42	5
16	30	866.00	.070		.64	845		49	8	220	42	-

AQ-44

12-15-72

Plant Cleveryville Foundry Run No. 3 Date 1-15-76

TRAVERSE POINT NUMBER	SAMPLING TIME min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m) ft^3	VELOCITY HEAD (Δp_s) in H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH) in H_2O ACTUAL	STACK TEMPERATURE (T_s) °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$) °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$) °F	PUMP VACUUM in Hg	SAMPLE BOX TEMPERATURE °F	IMPINGER TEMPERATURE °F	%CO_2
A 17	32		866.86	.05		.48	835		49	7	230	43	
18	34		867.76	.05		.49	840		50	7½	228	43	6
A 18	36		868.440			–	–		–	–	–	–	
			Discontinuing sampling at 1 minute to empty bottom										
B 1	34	.337	868.440	.025		.25	670		50	5	≈46	51	
2	38		869.01	.035		.32	815		51	6	≈32	47	6
3	40		869.64	.04		.36	780		51	6½	≈35	45	
4	42		870.31	.055		.50	760		51	8	≈26	44	
5	44		871.17	.055		.51	840		51	8	≈26	43	6
6	46		871.99	.055		.49	870		51	8	≈32	43	
7	48		872.63	.06		.51	1020		51	8½	≈35	44	
8	50		873.41	.06		.51	910		52	10	≈25	44	5
9	52		874.22	.06		.48	1005		53	10	225	44	
10	54		874.98	.075		.61	905		53	12	226	45	
11	56		875.82	.110		.81	1010		54	15	226	44	6.5
12	58			.14 .10		1.1/.76	1090		54	18½	210	44	
13	60		876	.11			1025		55	19½	208	44	6
14	62		878.73	.095		.80	925		55	20	207	44	
15	64			.035		.45	525		55	17½	208	45	
16	66		880.511	<							Stopped due to engine shut-down		
17	68												
18	70												
B 18	72												
	66 min.		26.994			.56	953°F		49	★ 4° =	53°F		
							1413°R		513°R				
			$\Sigma \sqrt{\Delta p} = 8.3345$										
			$m\rho = 32$										

AQ-44 (con.) ★ 4°F = Thermometer Correction

12-15-72

Preliminary Field Data

Plant Cherryville Foundry

Date 12-18-75 1-2-76 1-15-76

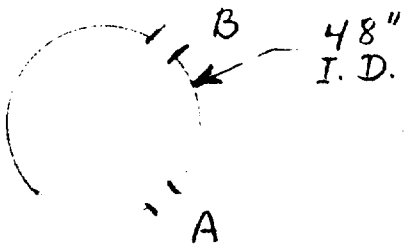
Port Location Cupola Stack

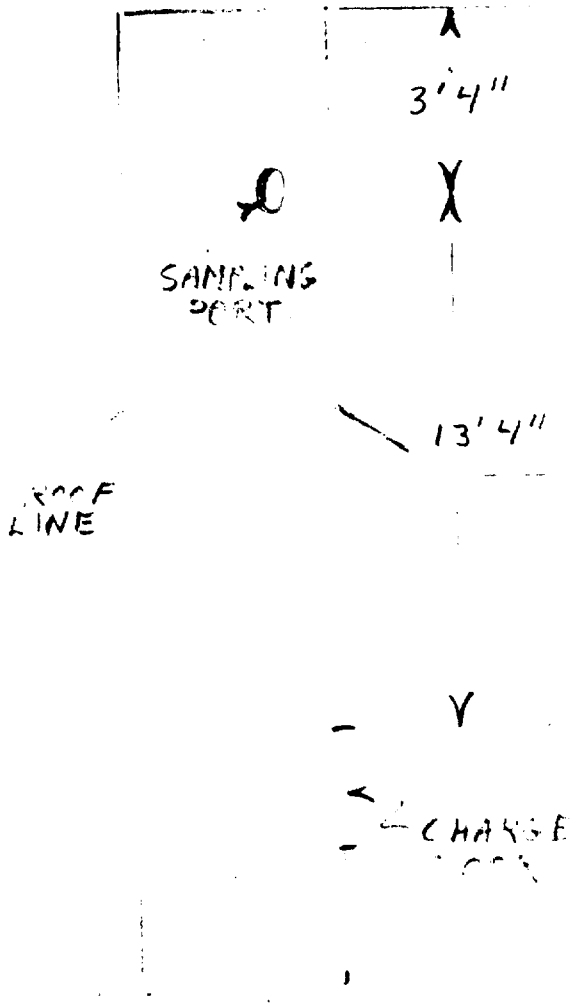
Nearest Disturbance:

Before Port 13' 4"

After Port 3' 4"

Duct Diameter 48"





Sketch of stack or duct showing location of sampling ports

Point Number	% of Diameter	Distance From Near Wall
1	1.4	1
2	4.4	2 1/8
3	7.5	3 5/8
4	10.9	5 1/4
5	14.6	7
6	18.8	9
7	23.6	11 5/16
8	29.6	14 1/4
9	38.2	18 5/16
10	61.8	29 11/16
11	70.4	33 3/4
12	76.4	36 11/16
13	81.2	39
14	85.4	41
15	89.1	42 3/4
16	92.5	44 7/16
17	95.6	45 7/8
18	98.6	47

NOMOGRAPH DATA

PLANT Cherryville Foundry

DATE 12-18-75 1-2-76 1-15-76

SAMPLING LOCATION Cupola Stack

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.846
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	70°F
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	4
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.05
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	-.055
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	≈ 1
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	900
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	.07
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	.035
C FACTOR		1.04
CALCULATED NOZZLE DIAMETER, in.		.5
ACTUAL NOZZLE DIAMETER, in. ★		.375
REFERENCE Δp, in. H_2O		

EPA (Dur) 234
4-72

3/8 Nozzle was selected to keep vacuum within a managable range. Time would not permit stopping to change filters.

NORTH CAROLINA EMISSION STANDARD
FOR FERROUS JOBBING FOUNDRIES

2.20 Control and Prohibition of Particulate Emissions From Existing Ferrous Jobbing Foundries

No person shall cause, suffer, permit or allow the emission of particulate matter which will exceed the limits specified in the following table from any ferrous jobbing foundry cupola in operation on or prior to January 1, 1972. Any existing foundry having a capacity greater than shown in the table and any new foundry regardless of size shall control particulate emission in accordance with the limits specified in 2.30 Control and Prohibition Of Particulate Emissions From Miscellaneous Industrial Processes.

Particulate Emissions
From Existing
Ferrous Jobbing Foundries

Process Weight (Lb/Hr)	Maximum Allowable Emission Rate (Lbs/Hr)
1,000	3.05
2,000	4.70
3,000	6.35
4,000	8.00
5,000	9.58
6,000	11.30
7,000	12.90
8,000	14.30
9,000	15.50
10,000	16.65
12,000	18.70
16,000	21.60
18,000	23.40
20,000	25.10