

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/](http://www.epa.gov/ttn/chief/ap42/)

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TACONITE

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CRUSHER ENVIRONEERING

WET SCRUBBER DUST COLLECTORS

PARTICULATE EMISSIONS COMPLIANCE TESTING

HIBBING TACONITE COMPANY

CRUSHER ENVIRONEERING WET SCRUBBER DUST COLLECTOR

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Summary

Hibbing Taconite Company was required, as a condition of Installation Permit No. 541-81-I-3, to demonstrate that the recently installed Crusher Environneering Wet Scrubber Dust Collectors are capable of complying with MPCA rules and regulations. The exhaust from each of the two (2) installed wet scrubbers, one (1) in Crusher No. 1 and one (1) in Crusher No. 2, are combined to exhaust through a single stack. A letter was submitted to the MPCA on September 8, 1982, informing them of Hibbing Taconite's intent to stack sample the wet scrubbers. The Crusher wet scrubber dust collector stack exhaust was sampled on October 18, 1982, during which both crushers were in operation and normal process rates occurred.

The visual opacity and particulate emissions test results indicated low level emission rates. The average mass particulate emission rate was 2.96 lbs./hr. for the Crusher scrubber dust collectors.

Introduction

The Crusher scrubber dust collector particulate compliance test was run on October 18, 1982. This emissions source test was conducted to determine the compliance status of the scrubber dust collectors prior to the drafting of an application for an operating permit.

The recently installed Crusher dust collectors are two (2) Environneering, venturi rod wet scrubbers (model A34). These scrubbers, which complement the existing Crusher baghouse dust collectors, have their exhaust combined for emission through one (1) stack. The source location, stack configuration and

location of sampling ports are shown in the Appendix, Figures 1 and 2, respectively.

Messrs. S. G. Rogers, T. D. Anderson, G. J. Royer and W. J. Libro of Hibbing Taconite Company made up the emissions source sampling team which conducted this test. The visual emission evaluation was conducted by Mr. T. D. Anderson, a certified observer, certification date June 9, 1982.

#### Materials and Equipment

The test was run on the Crusher scrubber dust collector stack. The stack is equipped with two (2), four (4) inch sampling ports which have been placed 90° apart in accordance with EPA Test Method No. 5.

The sampling train used to stack sample was a Research Appliance Company, Model 2343 Staksamplr. The glass impingers were replaced with a condenser and a drying (silica gel) column.

All of the samples collected during testing were processed in the Environmental Laboratory at Hibbing Taconite.

The scrubber process rates for each of the three (3) test runs were as follows:

Test No. 1, Run No. 1	1,859.1 LTPH or 4,164,384 lbs./hr.	2082 TSW/HR
Test No. 1, Run No. 2	2,909.9 LTPH or 6,518,176 lbs./hr.	3259 TSW/HR
Test No. 1, Run No. 3	1,941.2 LTPH or 4,348,288 lbs./hr.	2174 TSW/HR

#### Procedure

The stack emission test was run according to the following EPA Sampling Test Methods:

- 1) Method 1 - Sample and velocity traverses.
- 2) Method 2 - Stack gas velocity and volumetric flow rate.
- 3) Method 3 - Gas analysis.
- 4) Method 5 - Concentration of particulate emissions and moisture determination.

5) Method 9 - Visual determination of emission opacity.

The Crusher scrubber dust collector stack was sampled using sixteen (16) traverse points based on previous pitot survey results, which indicated uniform flow.

These test methods utilized are described in the Federal Register, Volume 42, No. 160, dated Thursday, August 18, 1977, and entitled, "Standards of Performance for New Stationary Sources." These methods are in accordance with MPCA, APC 5, (e) entitled "Performance Test Methods".

Results

The test results are presented on the following pages of the report:

<u>Description</u>	<u>Page No.</u>
Preliminary Velocity Traverse, Test No. 1, Run Nos. 1-3	7
EPA Method 5 Field Data Sheet	
Test No. 1, Run No. 1	8
Test No. 1, Run No. 2	9
Test No. 1, Run No. 3	10
Sample Log Sheet - Particulate, Moisture and Gas Analysis	
Test No. 1, Run No. 1	11
Test No. 1, Run No. 2	12
Test No. 1, Run No. 3	13
Visible Emissions Evaluation Field Data, Test No. 1	14
Gas Analysis Results - EPA Method 3	
Test No. 1, Run Nos. 1-3	15
Flow Determination Results - EPA method 2	
Test No. 1	16

## Particulate Concentration Determination Results

EPA Method 5, Test No. 1, Run Nos. 1-3	17
Summary of Particulate Emission Testing	
Results, Test No. 1, Run Nos. 1-3	18
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Figure 1 - Source Location	20
Figure 2 - Sample Port Locations	21
Visible Emission Evaluation Certificate	22
Submitted MPCA Letter	23

### Discussion

As noted in the field raw data sheets, a sixteen (16) point pitot traverse was used when sampling the Crusher scrubber dust collector exhaust stack. The design rate of the two (2) Enviroengineering wet scrubbers is 40,000 acfm. The preliminary test results indicated a volumetric rate of 39,381 acfm. The results from the preliminary pitot traverse raw data indicated a volumetric flow rate of 37,253 dscfm.

The raw data presented in both the field data sheets and the sample log sheets for Run Nos. 1-3 are used in determining the exhaust stack particulate concentration. The average stack gas dry molecular weight, based on each individual run, was 28.80. The respective percent by volume moistures for Run Nos. 1-3 were 1.47, 1.24 and 1.67 averaging 1.46. For Run Nos. 1-3, the dry standard particulate concentrations were 0.0102, 0.0100 and 0.0073, respectively, averaging 0.0092 gr/dscf.

The particulate emissions summary shows that the isokinetic variation in the three (3) individual test runs varied from 97.47 to 98.19%, which is within the prescribed range of 90-110%. For Run Nos. 1-3, the mass

particulate emission rates were 3.3312, 3.2140 and 2.3449, respectively, averaging 2.96 lbs./hr.

The readings from the visible emissions evaluation testwork indicate that all results were zero (0) percent opacities.

#### Conclusions

The results of the compliance source testing indicate low level emission rates. The Crusher scrubber dust collector averaged a mass particulate emission rate of 2.96 lbs./hr. The process rates were 4,164,384 lbs./hr., 6,518,176 lbs./hr. and 4,348,288 lbs./hr. for Run Nos. 1-3, respectively.

TEST RESULTS









SOURCE CRUSHER SCRUBBER DUST COLLECTOR

DATE 10/18/82

TEST 1

RUN 1

Sample Train: Leak Check: < 0.02 cfm at 15 In. Hg. (vac)

Particulate Sample Type and Number	Weights		
	Final	Tare	Difference
FILTER	0.3451	0.3446	0.0005
PREFILTER WASH	109.027	108.993*	0.034
Total (M <sub>n</sub> )			0.0345

Impinger  Condenser

Impinger Number	Weights		
	Final	Tare	Difference
CONDENSER	1041.2	1035.4	5.8
DRYING COLUMN	1445.3	1434.6	10.7
Total (M <sub>wo</sub> )			16.5

Orsat	Carbon Dioxide	Oxygen	Carbon Monoxide
1			
2			
3			
4			
5			
6			
7			
8			
Average	- 0 -	20.1	- 0 -

\* INCLUDES ACETONE WASH BLANK FOR PREFILTER WASH.

H-507

SOURCE CRUSHER SCRUBBER DUST COLLECTOR

DATE 10/18/82

TEST 1

RUN 2

Sample Train: Leak Check: < 0.02 cfm at 15 In. Hg. (vac)

Particulate Sample Type and Number	Weights		
	Final	Tare	Difference
FILTER	0.3379	0.3375	0.0004
PREFILTER WASH	120.772	120.739 *	0.033
Total (M <sub>n</sub> )			0.0334

Impinger  Condenser

Impinger Number	Weights		
	Final	Tare	Difference
CONDENSER	1040.1	1035.4	4.7
DRYING COLUMN	1454.4	1445.3	9.1
Total (M <sub>wo</sub> )			13.8

Orsat	Carbon Dioxide	Oxygen	Carbon Monoxide
1			
2			
3			
4			
5			
6			
7			
8			
Average	- 0 -	20.1	- 0 -

\* INCLUDES ACETONE WASH BLANK FOR PREFILTER WASH

H-507

SOURCE CRUSHER SCRUBBER DUST COLLECTOR

DATE 10/18/82

TEST 1

RUN 3

Sample Train: Leak Check: < 0.02 cfm at 15 In. Hg. (vac)

Particulate Sample Type and Number	Weights		
	Final	Tare	Difference
FILTER	0.3351	0.3348	0.0003
PREFILTER WASH	107.431	107.407 *	0.024
Total (M <sub>n</sub> )			0.0243

Impinger  Condenser

Impinger Number	Weights		
	Final	Tare	Difference
CONDENSER	1042.4	1035.4	7.0
DRYING COLUMN	1466.0	1454.4	11.6
Total (M <sub>wo</sub> )			18.6

Orsat	Carbon Dioxide	Oxygen	Carbon Monoxide
1			
2			
3			
4			
5			
6			
7			
8			
Average	- 0 -	20.1	- 0 -

\* INCLUDES ACETONE WASH BLANK FOR PREFILTER WASH

Visible Emission Evaluation Form  
for

Crusher Scrubber  
Dust Collector

Observation:  
Date 10/18/82  
Time Began 0832 hours  
Time Ended 0932 hours  
Duration 60 minutes

Source: Crusher Scrubber  
Dust Collector

Observation Point: Crusher Roof

Distance From: 25 feet  
Direction From: South  
Source Height: 6 feet  
Wind, Direction From: EAST  
Wind Speed: 10 MPH  
Sky Condition: Partly Cloudy  
Background: Broken Sky  
Ambient Air Temperature °F: 50  
Humidity: 75%  
Color of Emissions: N/A  
Reading Conditions: Excellent \_\_\_\_\_  
Good X \_\_\_\_\_  
Fair \_\_\_\_\_

Remarks:

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

Observer's Signature Tom Anderson

Certification Date 6/9/82

PARTICULATE EMISSIONS COMPLIANCE TESTING  
TEST NO. 1 - CRUSHER SCRUBBER DUST COLLECTOR  
ORSTAT GAS ANALYSIS RESULTS - METHOD 3

Dry Basis	Run No. 1	Run No. 2	Run No. 3
Carbon Dioxide	0.00	0.00	0.00
Oxygen	20.10	20.10	20.10
Carbon Monoxide	0.00	0.00	0.00
Nitrogen	79.90	79.90	79.90
Dry Molecular Weight	28.80	28.80	28.80
Wet Basis			
Carbon Dioxide	0.00	0.00	0.00
Oxygen	19.80	19.85	19.76
Carbon Monoxide	0.00	0.00	0.00
Nitrogen	78.73	78.91	78.57
Moisture	1.47	1.24	1.67
Wet Molecular Weight	28.65	28.67	28.62

PARTICULATE EMISSIONS COMPLIANCE TESTING  
TEST NO. 1 - CRUSHER SCRUBBER DUST COLLECTOR  
FLOW DETERMINATION RESULTS - EPA METHOD 2

Date	10/18/82
Barometric Pressure (in. Hg)	28.36
Pitot Tube Coefficient	0.823
Number of Sampling Ports	2
Total Number of Points Sampled	16
Stack Diameter (in.)	36
Cross Sectional Area (sq. ft.)	7.069
Direction of Flow	Vertical, Up
Static Pressure (in. WC)	1.2
Average Gas Temperature (°F)	63
Absolute Gas Pressure (in. Hg)	28.45
Average Moisture Content (% V/V)	1.46
Average Linear Velocity (fps)	92.85
Volumetric Flow	
Actual (ACFM)	39,381
Standard Dry (DSCFM)	37,253
Mass Flow - Wet (lb./hr.)	168,477

PARTICULATE EMISSIONS COMPLIANCE TESTING

TEST NO. 1 - CRUSHER SCRUBBER DUST COLLECTOR

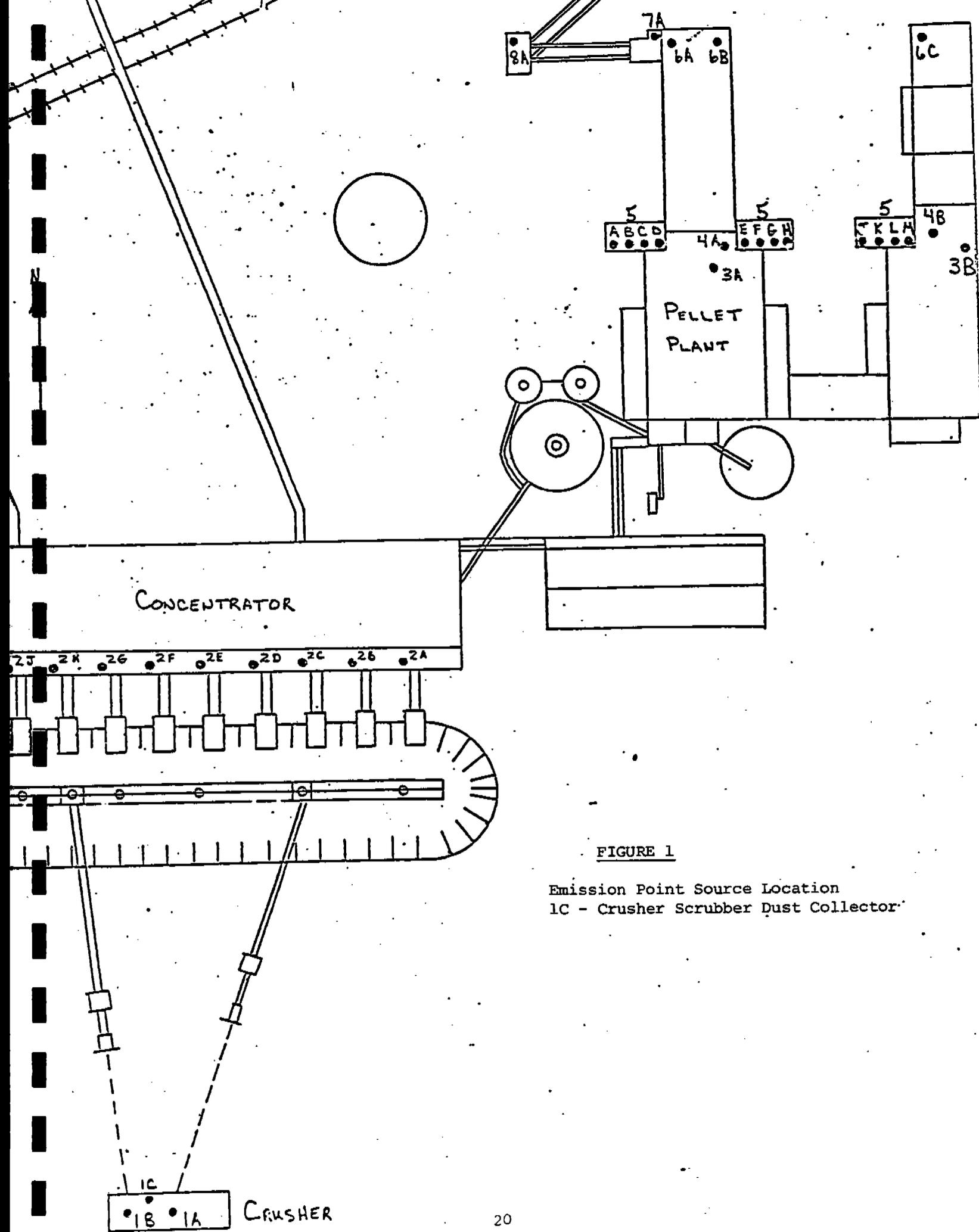
PARTICULATE CONCENTRATION DETERMINATION RESULTS - EPA METHOD 5

	Run No. 1	Run No. 2	Run No. 3
Date	10/18/82	10/18/82	10/18/82
Time Started	0832	1018	1218
Pitot Tube Coefficient	0.823	0.823	0.823
Average Stack Gas Temperature (°F)	63	63	63
Total Moisture (grams)	16.5	13.8	18.6
Total Particulate Material (grams)	0.0345	0.0334	0.0243
Volume Through Gas Meter (MCF)	54.16	54.16	54.70
Total Sampling Time (min.)	64	64	64
Nozzle Diameter (in.)	0.169	0.169	0.169
Isokinetic Variation	98.19	98.04	97.47
Particulate Concentration			
Actual (gr/ACF)	0.0098	0.0095	0.0069
Standard, Dry (gr/DSCF)	0.0102	0.0100	0.0073
Mass Flow (lb./hr.)	3.3312	3.2140	2.3449
Dry Standard Flow (DSCFM)	37,510	37,420	37,425

PARTICULATE EMISSIONS COMPLIANCE TESTING  
SUMMARY OF PARTICULATE EMISSIONS TESTING RESULTS -  
CRUSHER SCRUBBER DUST COLLECTOR

	Preliminary	Run No. 1	Run No. 2	Run No. 3
Process Rate (lb./hr., Dry)		4,164,384	6,518,176	4,348,288
Volumetric Flow				
Actual (ACFM)	39,381			
Standard Dry (DSCFM)	37,253	37,510	37,420	37,425
Gas Temperature (°F)	63	63	63	63
Gas Moisture Content (%V/V)	1.46	1.47	1.24	1.67
Gas Composition (%V/V, Dry)				
Carbon Dioxide		0.00	0.00	0.00
Oxygen		20.10	20.10	20.10
Nitrogen		79.90	79.90	79.90
Particulate Concentration				
Actual (gr/ACF)		0.0098	0.0095	0.0069
Standard Dry (gr/DSCF)		0.0102	0.0100	0.0073
Isokinetic Variation		98.19	98.04	97.47
Particulate Emission Rate (lb./hr.)		3.3312	3.2140	2.3449

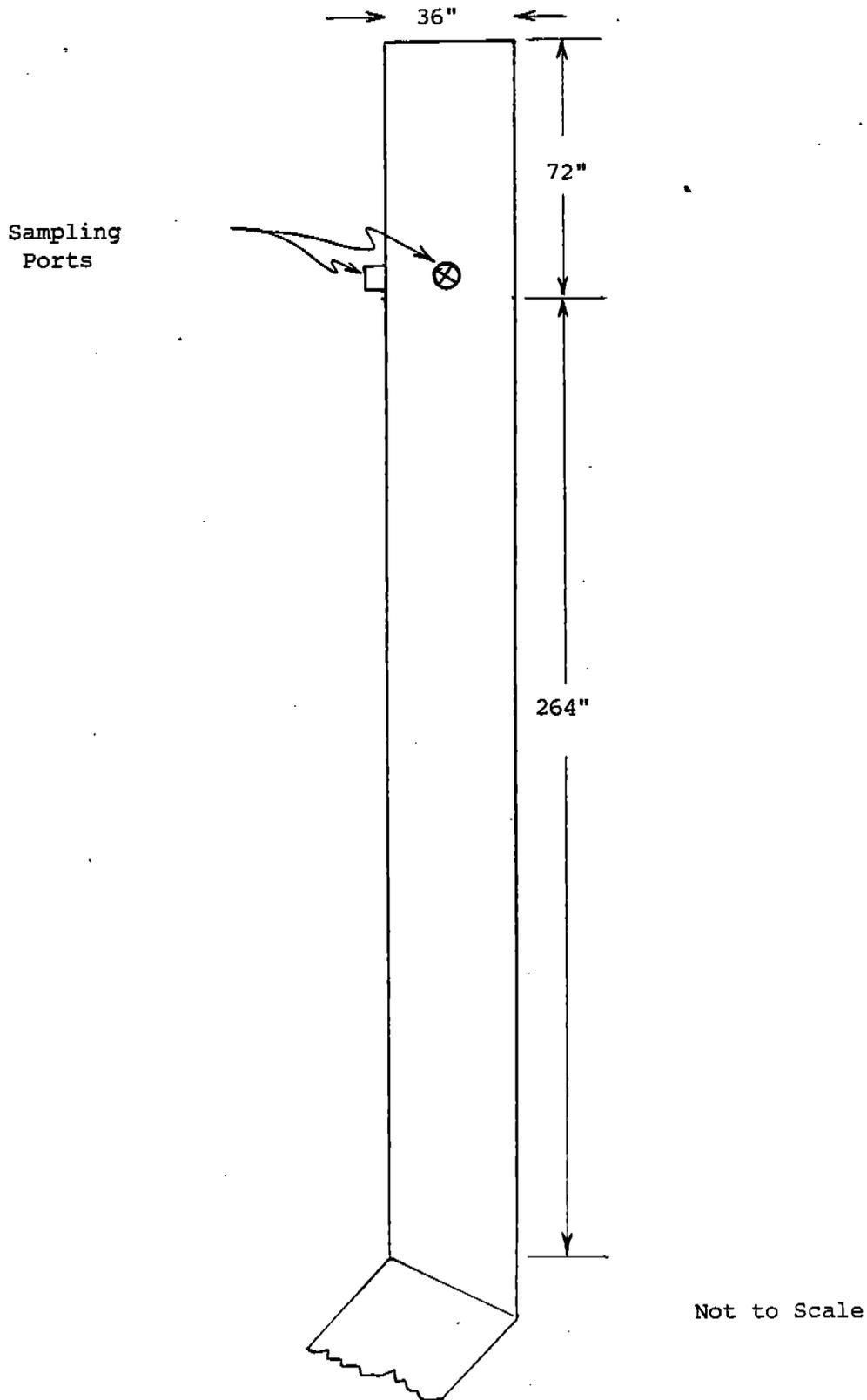
APPENDIX

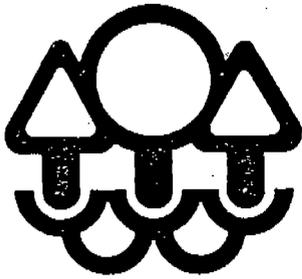


**FIGURE 1**  
 Emission Point Source Location  
 1C - Crusher Scrubber Dust Collector

FIGURE 2

CRUSHER SCRUBBER DUST COLLECTOR EXHAUST STACK





# Minnesota Pollution Control Agency

612-296-7274

*This is to certify that*

**TOM D. ANDERSON**

*attended and fulfilled the requirements of the*  
**VISIBLE EMISSION EVALUATION CERTIFICATION COURSE**  
*offered by*

**THE MINNESOTA POLLUTION CONTROL AGENCY**

Division of Air Quality  
In Conjunction with the  
Air Pollution Control Association

*on*

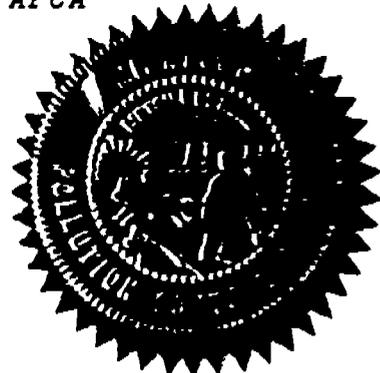
**JUNE 9, 1982**

*During the course of the test an average deviation of less than 7.5% for a set of 25 white smoke and a set of 25 black smoke was maintained and none of the readings deviated by 20% or more.*

*By achieving the above accuracy, certification as a "Smoke Reader" is granted for a period of six months from the date of the test.*

**JAMES L. KOLAR**  
Instructor  
Visible Emissions Program  
MPCA / APCA

**F. MARTIN OSBORN**  
Instructor  
Visible Emissions Program  
MPCA / APCA



Phone: 612-296-7274

1935 West County Road B2, Roseville, Minnesota 55113  
Regional Offices · Duluth/Brainerd/Detroit Lakes/Marshall/Rochester  
Equal Opportunity Employer

# Pickands Mather



Pickands Mather & Co.  
Suite 811 - 200 West Superior Street  
Duluth MN 55802

September 8, 1982

Louis M. Chamberlain  
Minnesota Pollution Control Agency.  
1935 West County Road B2  
Roseville, Minnesota 55113

Dear Mr. Chamberlain:

Re: Hibbing Taconite Company  
Installation Permit No. 541-81-I-3

On February 19, 1982, in a letter from B. W. Stunkard, General Manager of Hibbing Taconite Company, we notified you that the two wet scrubber dust collection systems had been installed in the crusher building. The collectors were installed in accordance with the provisions of the installation permit.

We intended that the February 19, 1982 letter constitute a request for an operating permit. However, in the event that there is confusion on that point, we are hereby making our formal written request. As you know, the plant is near the end of a ten-week shutdown period. Production is expected to begin again on September 12. After that date we will run stack tests and submit to you the technical data which is required by APC 3(b) (2).

Yours truly,

PICKANDS MATHER & CO.

Charles B. Hoffman  
Environmental Counsel

CBH/plk

cc: Robert Beresford  
Robert Berg  
Peter J. Gillen  
O. W. Borgeson ✓  
P. D. Brick