

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.

AP-42 Section	11.23
Reference	29
Report Sect.	4
Reference	29

Interpoll Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014

Telephone (612)786-6020
Facsimile (612)786-7854

RESULTS OF THE MAY 21 AND 22, 1987
PARTICULATE AND SO2/SO3 EMISSION
COMPLIANCE TESTS ON THE LINE 2
INDURATION FURNACE WASTE GAS SYSTEMS
AT THE EVELETH TACONITE PLANT
IN EVELETH, MINNESOTA

COAL-COKE

Submitted to:

EVELETH TACONITE COMPANY
P. O. Box 180
Eveleth, Minnesota 55734

Attention: Ken Coen

ACCORDING TO MPCA, THIS
FURNACE WAS FIRED WITH
PETROLEUM COKE. SEE
6/20/96 LETTER, COMMENT NO. 4

Approved by:


Perry Lommes, Ph.D.
President

Report Number 7-2374
June 25, 1987

TABLE OF CONTENTS

	ABBREVIATIONS	iii
1	INTRODUCTION	1
2	SUMMARY AND DISCUSSION	4
3	RESULTS	7
	3.1 Results of Orsat and Moisture Analyses	8
	3.2 Results of Particulate Loading Determinations	15
	3.3 Results of Sulfur Dioxide Determinations	18
	3.4 Results of Sulfuric Acid Mist Determinations	23
	3.5 Results of Opacity Observations	28

APPENDICES:

- A - Sampling Train Calibration Data
- B - Location of Test Ports
- C - Methods 2-5 Field Data Sheets
- D - Method 8 Field Data Sheets
- E - Method 9 Field Data Sheets
- F - Laboratory Data Sheets for Particulate Analyses
- G - Laboratory Data Sheets for SO₂/SO₃ Analyses
- H - MPCA Exhibit C
- I - Process Rate Data
- J - Results of Fuel Analyses
- K - Procedures
- L - Calculation Equations
- M - Results of EPA QA Sample Analyses

ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (°F)	degrees Fahrenheit
DIA.	diameter
FT/SEC	feet per second
g	gram
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g/dscm	grams per dry standard cubic meter
HP	horsepower
HRS	hours
IN.	inches
IN. HG.	inches of mercury
IN. WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/10 ⁶ BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
LTPD	long tons per day
MW	megawatt
mg/DSCM	milligrams per dry standard cubic meter
microns (um)	micrometer
MIN.	minutes
ng	nanograms
ohm-cm	ohm-centimeter
PM	particulate matter
PPH	pounds per hour
PPM	parts per million
ppmC	parts per million carbon
ppm,d	parts per million, dry
ppm,w	parts per million, wet
ppt	parts per trillion
PSI	pounds per square inch
SQ. FT.	square feet
ug	micrograms
v/v	percent by volume
w/w	percent by weight

Standard conditions are defined as 68 °F (20 °C) and 29.92 IN. of mercury pressure.

INTRODUCTION

On May 21 and 22, 1987, Interpoll Inc. personnel conducted particulate and SO₂/SO₃ emission compliance tests on the Eveleth Taconite Company (EXCO) Induration Furnace Line 2 Stacks ("A" and "B") at the EXCO Plant in Eveleth, Minnesota. On-site testing was performed by E. Trowbridge, R. Rosenthal, C. Mosser and R. Downs. Coordination between plant operation and testing activities was provided by Bob Anderson. The tests were witnessed by Bob Beresford of the Minnesota Pollution Control Agency.

The Line 2 pellet induration furnace is an Allis-Chalmers rotary kiln (Serial No. B-41301) which is 130 feet in length with a 21'-6" diameter. It may be fired with No. 2 or 6 oil, natural gas or coal. The kiln is rated to produce pellets as follows:

Five year average:	481 LTONS/HR
Maximum annual average:	495 LTONS/HR
Test rate:	492 LTONS/HR = 551 T/HR

In the process, gases from the kiln and cooling process are used to preheat and dry the green pellets on a traveling grate prior to entering into the rotary kiln. The exit gas from the kiln (1900 °F) is drawn through the bed of green pellets which results in a temperature reduction to approximately 775 °F. This gas is then mixed with recouped hot air from the pellet cooler giving a combined stream with a temperature of ca. 660 °F. This gas is drawn through an initial green pellet bed (first stage of preheating) to dry the 10% moisture-laden feed. A wet feed rate of 585.7 LTONS/HR results in a finished pellet production rate of 492 LTONS/HR with 262 GAL/HR of moisture and 225 °F gas which passes through the grate box before exiting into the wet scrubber system (see Appendix B for scrubber system diagram).

The wet scrubber system is divided into Side A and Side B which are essentially identical. Each side contains a venturi followed

by two drum demisters. The scrubbed and demisted gas is then drawn into the respective I.D. fans and exhausted through the Side "A" and Side "B" stacks.

Evaluations were performed in accordance with EPA Methods 1-5, 8 and 9, CFR Title 40, Part 60, Appendix A (revised July 1, 1986). A preliminary determination of the gas linear velocity profile was made before the first particulate determination to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. An Interpoll sampling train which meets or exceeds specifications in the above-cited reference was used to collect the samples by means of heated stainless steel-lined probes. Sulfur dioxide/sulfur trioxide testing was performed using the EPA Method 8 sampling train. Visible emissions could not be read due to overcast skies.

An integrated flue gas sample was extracted simultaneously with each particulate and sulfur dioxide/sulfur trioxide sample using a specially designed gas sampling system. Integrated flue gas samples were collected in 44-liter Tedlar bags. After sampling was complete, the bags were sealed and returned to the laboratory for Orsat analysis. Prior to sampling, the Tedlar bags are leak checked at 15 IN.HG. vacuum with an in-line rotameter. Bags with any detectable inleakage are discarded.

Testing at each stack was conducted from four test ports oriented at 90 degrees located more than seven stack diameters downstream of a transition breeching and more than two stack diameters upstream of the stack outlet. A 12-point traverse was used to collect representative particulate and SO₂/SO₃ samples from the stack. Each traverse point was sampled five minutes to give a total sampling time of 60 minutes per run.

In the case of the inlet test site, only one port on each of the four venturi scrubber inlets was used to collect SO₂/SO₃ samples.

Each of the four ports were sampled 15 minutes (using a five minutes/point three-point traverse) to give a 60-minute sample to correspond to the 60-minute stack sample.

The important results of the tests are summarized in Section 2. Detailed results are presented in Section 3. Field data and all other supporting information are presented in the appendices.

SUMMARY AND DISCUSSION

The important results of the SO_2/SO_3 emission compliance test are summarized in Table 1. As will be noted, the removal efficiency for the Line 2 scrubbing system averaged 30.9% for sulfur dioxide and 41.7% for sulfur trioxide.

The particulate emission results are summarized in Table 2. The particulate emission rate averaged 36.3 LB/HR for Stack A and 20.2 LB/HR for Stack B.

In the case of the SO_3 samples, no end-point was detectable using the Method 6 Thorin I barium perchlorate titration procedure (most likely due to interference caused by metal ions). The samples were subsequently analyzed successfully by ion chromatography using a Dionex Model 10 Chromatograph equipped with a conductivity detector, a membrane background suppression system and an electronic data acquisition system.

No other difficulties were encountered in the field or in the laboratory evaluation of the samples. On the basis of this fact and a complete review of the entire data and results, it is our opinion that the concentrations and emission rates reported herein are accurate and closely reflect the actual values which existed at the time the tests were performed.

Table 1. Summary of the Results of the May 21 and 22, 1987 Sulfur Dioxide and Sulfuric Acid Emission Compliance Test on the Line 2 Induration Furnace Stacks at the Eveleth Taconite Plant in Eveleth, Minnesota (EPA Method 8).

Test/Run	Sulfur Dioxide		
	Mass Rate (LB/HR)		Removal (%)
	Inlet*	Stack	
"A" SIDE			
1/1	534	354	33.7
1/2	537	355	33.9
1/3	487	315	35.3
Average:	519	341	34.3
"B" SIDE			
3/1	532	369	30.6
3/2	526	388	26.2
3/3	509	376	26.1
Average:	522	378	27.6
Line 2 Average:			30.9
Test/Run	Sulfuric Acid		
	Mass Rate (LB/HR)		Removal (%)
	Inlet*	Stack	
"A" SIDE			
1/1	45.2	28.7	36.5
1/2	42.7	27.2	36.3
1/3	39.2	25.0	36.2
Average:	42.4	27.0	36.3
"B" SIDE			
3/1	52.5	27.8	47.0
3/2	45.3	24.7	45.5
3/3	55.6	30.0	46.0
Average:	51.1	27.5	46.2
Line 2 Average:	93.5	54.5	41.7

*Emission rates at the inlet were calculated using the volumetric flow rates from the respective stacks.

TABLE 2. Summary of the Results of the May 21, 1987, Particulate Emission Compliance Test on the EXCO Induration Line 2 A & B Stacks at the Eveleth Taconite Plant Located in Eveleth, Minnesota.

ITEM	RUN 1		RUN 2		RUN 3	
	Stack A	Stack B	Stack A	Stack B	Stack A	Stack B
Date of test	05-21-87	05-21-87	05-21-87	05-21-87	05-21-87	05-21-87
Time runs were done (HRS)	1535/1647	1535/1641	1700/1807	1700/1806	1827/1932	1821/1926
Process rate (LT/HR)	493.8	493.8	491.1	491.1	492.8	492.8
Volumetric flow (ACFM) actual	345869	357986	346812	359783	348865	368567
standard (DSCFM)	254596	268092	256924	261509	260412	268970
Gas temperature (DEG-F)	130	140	127	138	126	137
Moisture content (TV/V)	13.04	12.40	12.69	12.92	12.14	13.47
Gas composition (TV/V, dry)						
carbon dioxide	1.60	1.60	1.60	1.60	1.60	1.60
oxygen	18.60	18.70	18.70	18.70	18.70	18.70
carbon monoxide	0.00	0.00	0.00	0.00	0.00	0.00
nitrogen	79.80	79.70	79.70	79.70	79.70	79.70
Isokinetic variation (%)	100.9	99.7	99.7	100.2	99.2	100.3
Particulate concentration (GR/ACF) actual	0.0119	0.0072	0.0126	0.00651	0.0121	0.00595
standard (GR/DSCF)	0.0162	0.0099	0.0170	0.00896	0.0161	0.00822
Part. emission rate (LB/HR)	35.40	22.21	37.50	20.09	36.02	18.39

* Dry catch only

RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition results (Orsat and moisture) are presented first followed by the computer printout of the particulate, sulfur dioxide, sulfuric acid and opacity observations. Preliminary measurements including test port locations are given in the appendices.

The results have been calculated on a Sperry PC Computer using programs written in Extended BASIC specifically for source testing calculations. EPA-published equations have been used as the basis of the calculation techniques in these programs.

The particulate emission rate has been calculated using the product of the concentration times flow method (as recommended by the EPA) rather than the ratio of areas method. The dry particulate emission factor has been calculated by the Oxygen F-Factor Method using the latest EPA-published dry F-Factor for the stated fuel.

3.1 Results of Orsat and Moisture Analyses

Test No. 1
 Side A Scrubber Inlet

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

Date of run	Run 1 05-21-87	Run 2 05-21-87	Run 3 05-21-87
Dry basis (orsat)			
carbon dioxide.....	1.70	1.60	1.70
oxygen.....	18.50	18.70	18.60
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.80	79.70	79.70
Wet basis (orsat)			
carbon dioxide.....	1.56	1.45	1.56
oxygen.....	16.93	16.99	17.05
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	73.05	72.41	73.05
water vapor.....	8.46	9.15	8.35
Dry molecular weight.....	29.01	29.00	29.02
Wet molecular weight.....	28.08	28.00	28.10
Specific gravity.....	0.970	0.967	0.971

Interpoll Report No. 7-2374
 Eveleth Taconite Company
 Eveleth, Minnesota

Test No. 1
 EXCO Ind. Line 2 Stack A (ESPP46 East)

Results of Orsat & Moisture Analyses—Methods 3 & 4(%v/v)

Date of run	Run 1 05-21-87	Run 2 05-21-87	Run 3 05-21-87
-------------	-------------------	-------------------	-------------------

Dry basis (orsat)

carbon dioxide.....	1.60	1.60	1.60
oxygen.....	18.60	18.60	18.60
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.80	79.80	79.80

Wet basis (orsat)

carbon dioxide.....	1.45	1.45	1.44
oxygen.....	16.84	16.81	16.69
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	72.23	72.11	71.59
water vapor.....	9.48	9.64	10.28
Dry molecular weight.....	29.00	29.00	29.00
Wet molecular weight.....	27.96	27.94	27.87
Specific gravity.....	0.966	0.965	0.963

Test No. 2
 EXCO Ind. Line 2 Stack A (ESPP46 East)

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

Date of run	Run 1 05-21-87	Run 2 05-21-87	Run 3 05-21-87
-------------	-------------------	-------------------	-------------------

Dry basis (orsat)

carbon dioxide.....	1.60	1.60	1.60
oxygen.....	18.60	18.70	18.70
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.80	79.70	79.70

Wet basis (orsat)

carbon dioxide.....	1.39	1.40	1.41
oxygen.....	16.17	16.33	16.43
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	69.40	69.59	70.03
water vapor.....	13.04	12.69	12.14
Dry molecular weight.....	29.00	29.00	29.00
Wet molecular weight.....	27.57	27.61	27.67
Specific gravity.....	0.952	0.954	0.956
Water mass flow.....(LB/HR)	107194	104868	101031

Test No. 2
 EXCO Ind. Line 2 Stack B (ESPP47 West)

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

	Run 1	Run 2	Run 3
Date of run	05-21-87	05-21-87	05-21-87

Dry basis (orsat)

carbon dioxide.....	1.60	1.60	1.60
oxygen.....	18.70	18.70	18.70
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.70	79.70	79.70

Wet basis (orsat)

carbon dioxide.....	1.40	1.39	1.38
oxygen.....	16.38	16.28	16.18
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	69.82	69.40	68.97
water vapor.....	12.40	12.92	13.47
Dry molecular weight.....	29.00	29.00	29.00
Wet molecular weight.....	27.64	27.58	27.52
Specific gravity.....	0.955	0.953	0.951
Water mass flow.....(LB/HR)	103624	108911	114028

Test No. 3
 Side B Scrubber Inlet

Results of Orsat & Moisture Analyses——Methods 3 & 4(%v/v)

Date of run	Run 1 05-22-87	Run 2 05-22-87	Run 3 05-22-87
Dry basis (orsat)			
carbon dioxide.....	1.70	1.70	1.70
oxygen.....	18.50	18.50	18.50
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.80	79.80	79.80
Wet basis (orsat)			
carbon dioxide.....	1.54	1.54	1.54
oxygen.....	16.79	16.78	16.76
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	72.42	72.36	72.30
water vapor.....	9.25	9.32	9.40
Dry molecular weight.....	29.01	29.01	29.01
Wet molecular weight.....	27.99	27.99	27.98
Specific gravity.....	0.967	0.967	0.966

Test No. 3
 EXCO Ind. Line 2 Stack B (ESPP47 West)

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

Date of run	Run 1 05-22-87	Run 2 05-22-87	Run 3 05-22-87
Dry basis (orsat)			
carbon dioxide.....	1.60	1.60	1.60
oxygen.....	18.40	18.50	18.50
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	80.00	79.90	79.90
Wet basis (orsat)			
carbon dioxide.....	1.46	1.43	1.43
oxygen.....	16.82	16.57	16.58
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	73.15	71.56	71.60
water vapor.....	8.56	10.44	10.38
Dry molecular weight.....	28.99	29.00	29.00
Wet molecular weight.....	28.05	27.85	27.85
Specific gravity.....	0.969	0.962	0.962

3.2 Results of Particulate Loading Determinations

Test No. 2
 EXCO Ind. Line 2 Stack A (ESPP46 East)

Results of Particulate Loading Determinations-----Method 5

	Run 1 05-21-87	Run 2 05-21-87	Run 3 05-21-87
Date of run			
Time run start/end.....(HRS)	1535/1647	1700/1807	1827/1932
Static pressure.....(IN.WC)	-0.35	-0.35	-0.35
Cross sectional area (SQ.FT)	113.10	113.10	113.10
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	100.0	112.0	100.0
impingers.....(GRAMS)	0.0	0.0	0.0
desiccant.....(GRAMS)	49.0	32.0	38.0
total.....(GRAMS)	149.0	144.0	138.0
Total particulate material..			
.....collected(grams)	0.0492	0.0515	0.0492
Gas meter coefficient.....	0.9956	0.9956	0.9956
Barometric pressure...(IN.HG)	28.31	28.31	28.31
Avg. orif.pres.drop...(IN.WC)	2.22	2.18	2.20
Avg. gas meter temp...(DEF-F)	77.3	72.8	68.9
Volume through gas meter....			
at meter conditions...(CF)	50.29	49.72	49.76
standard conditions.(DSCF)	46.80	46.66	47.04
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.251	.251	.251
Avg.stack gas temp...(DEG-F)	130	127	126
Volumetric flow rate.....			
actual.....(ACFM)	345869	346012	348065
dry standard.....(DSCFM)	254596	256924	260412
Isokinetic variation.....(%)	100.9	99.7	99.2
Particulate concentration...			
actual.....(GR/ACF)	0.01193	0.01264	0.01207
dry standard.....(GR/DSCF)	0.01622	0.01703	0.01614
Particle mass rate...(LB/HR)	35.40	37.50	36.02

Test No. 2
 EXCO Ind. Line 2 Stack B (ESPP47 West)

Results of Particulate Loading Determinations-----Method 5

	Run 1 05-21-87	Run 2 05-21-87	Run 3 05-21-87
Date of run			
Time run start/end.....(HRS)	1535/1641	1700/1806	1821/1926
Static pressure.....(IN.WC)	-0.35	-0.35	-0.35
Cross sectional area (SQ.FT)	113.10	113.10	113.10
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	64.0	80.0	80.0
impingers.....(GRAMS)	0.0	0.0	0.0
desiccant.....(GRAMS)	76.0	68.0	75.0
total.....(GRAMS)	140.0	148.0	155.0
Total particulate material..			
.....collected(grams)	0.0300	0.0273	0.0250
Gas meter coefficient.....	0.9962	0.9962	0.9962
Barometric pressure...(IN.HG)	28.31	28.31	28.31
Avg. orif.pres.drop...(IN.WC)	2.16	2.21	2.19
Avg. gas meter temp...(DEF-F)	68.0	72.5	71.6
Volume through gas meter....			
at meter conditions...(CF)	49.20	50.02	49.85
standard conditions.(DSCF)	46.62	47.00	46.92
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.249	.249	.249
Avg.stack gas temp...(DEG-F)	140	138	137
Volumetric flow rate.....			
actual.....(ACFM)	357986	359783	360567
dry standard.....(DSCFM)	260892	261509	260970
Isokinetic variation.....(%)	99.7	100.2	100.3
Particulate concentration...			
actual.....(GR/ACF)	0.00723	0.00651	0.00595
dry standard.....(GR/DSCF)	0.00993	0.00896	0.00822
Particle mass rate...(LB/HR)	22.21	20.09	18.39

3.3 Results of Sulfur Dioxide Determinations

Test No. 1
 Side A Scrubber Inlet

Results of Sulfur Dioxide Determinations-----Method 8

	Run 1	Run 2	Run 3
Date of run	05-21-87	05-21-87	05-21-87
Time run start/end.....(HRS)	0810-0915	1020-1130	1225-1348
Barometric pressure...(IN.HG)	28.45	28.45	28.45
Meter temperature....(DEG-F)	79.70	81.10	82.00
Meter correction coefficient	1.0090	1.0090	1.0090
Volume through gas meter....			
at meter conditions...(CF)	40.600	40.880	41.400
standard conditions...(SCF)	38.243	38.408	38.835
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	8.46	9.15	8.35
Oxygen content....(%V/V DRY)	18.50	18.70	18.60
Milliequivalents of SO4 in..			
gas sample.....	18.2513	18.4499	16.8611
<u>Sulfur dioxide concentration</u>			
(GR/DSCF).....	0.2359	0.2374	0.2146
(MG/DSCM).....	540	543	491
(PPM-DRY).....	203	204	185
(PPM-WET).....	186	186	169

Interpoll Report No. 7-2374
 Eveleth Taconite Company
 Eveleth, Minnesota

Test No. 1
 Indurating Line 2 - Stack A

Results of Sulfur Dioxide Determinations-----Method 8

	Run 1	Run 2	Run 3
Date of run	05-21-87	05-21-87	05-21-87
Time run start/end.....(HRS)	0810-0920	1020-1127	1225-1358
Barometric pressure...(IN.HG)	28.31	28.31	28.31
Meter temperature....(DEG-F)	63.20	76.20	80.10
Meter correction coefficient	0.9956	0.9956	0.9956
Volume through gas meter....			
at meter conditions...(CF)	48.510	49.790	50.650
standard conditions...(SCF)	46.354	46.429	46.897
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	9.48	9.64	10.28
Oxygen content....(%V/V DRY)	18.60	18.60	18.60
Milliequivalents of SO4 in..			
gas sample.....	14.6765	14.7262	13.1870
<u>Sulfur dioxide concentration</u>			
(GR/DSCF).....	0.1565	0.1568	0.1390
(MG/DSCM).....	358	359	318
(PPM-DRY).....	135	135	120
(PPM-WET).....	122	122	107
SO2 Emission rate....(LB/HR)	354.02	354.59	315.21

Test No. 3
 Side B Scrubber Inlet

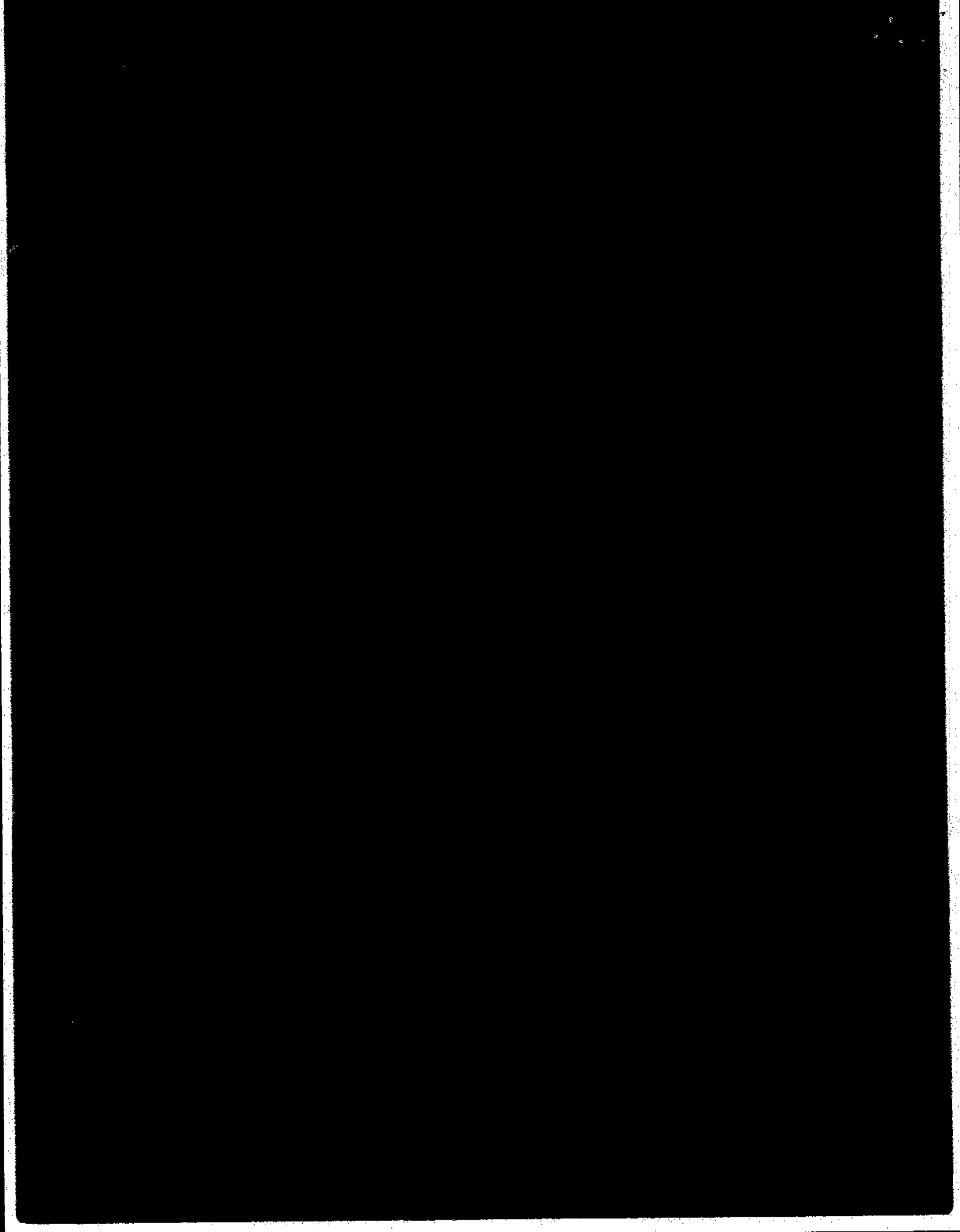
Results of Sulfur Dioxide Determinations-----Method 8

	Run 1	Run 2	Run 3
Date of run	05-22-87	05-22-87	05-22-87
Time run start/end.....(HRS)	0830-0938	1027-1134	1245-1352
Barometric pressure...(IN.HG)	28.80	28.80	28.80
Meter temperature....(DEG-F)	73.50	75.60	79.40
Meter correction coefficient	1.0090	1.0090	1.0090
Volume through gas meter....			
at meter conditions...(CF)	38.360	38.680	39.080
standard conditions...(SCF)	36.988	37.152	37.273
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	9.25	9.32	9.40
Oxygen content....(%V/V DRY)	18.50	18.50	18.50
Milliequivalents of SO ₄ in..			
gas sample.....	16.0667	16.0667	15.8681
<u>Sulfur dioxide concentration</u>			
(GR/DSCF).....	0.2147	0.2138	0.2104
(MG/DSCM).....	491	489	482
(PPM-DRY).....	185	184	181
(PPM-WET).....	168	167	164

Test No. 3
 Indurating Line 2 - Stack B

Results of Sulfur Dioxide Determinations-----Method 8

	Run 1	Run 2	Run 3
Date of run	05-22-87	05-22-87	05-22-87
Time run start/end.....(HRS)	0830-0941	1027-1134	1222-1329
Barometric pressure..(IN.HG)	28.70	28.70	28.70
Meter temperature....(DEG-F)	45.30	52.80	58.70
Meter correction coefficient	0.9956	0.9956	0.9956
Volume through gas meter....			
at meter conditions...(CF)	50.170	51.930	51.610
standard conditions...(SCF)	50.351	51.372	50.469
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	8.56	10.44	10.38
Oxygen content....(%V/V DRY)	18.40	18.50	18.50
Milliequivalents of SO4 in..			
gas sample.....	15.1730	16.3646	15.8681
<u>Sulfur dioxide concentration</u>			
(GR/DSCF).....	0.1489	0.1574	0.1554
(MG/DSCM).....	341	360	356
(PPM-DRY).....	128	135	134
(PPM-WET).....	117	121	120
SO2 Emission rate....(LB/HR)	368.91	387.60	375.83



3.4 Results of Sulfuric Acid Mist Determinations

Test No. 1
 Side A Scrubber Inlet

Results of Sulfuric Acid Mist Determinations-----Method B

	Run 1	Run 2	Run 3
Date of run	05-21-87	05-21-87	05-21-87
Time run start/end.....(HRS)	0810-0915	1020-1130	1225-1348
Barometric pressure...(IN.HG)	28.45	28.45	28.45
Meter temperature....(DEG-F)	79.70	81.10	82.00
Meter correction coefficient	1.0090	1.0090	1.0090
Volume through gas meter....			
at meter conditions...(CF)	40.60	40.880	41.400
standard conditions..(SCF)	38.24	38.408	38.835
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	8.46	9.15	8.35
Oxygen content....(%V/V DRY)	18.50	18.70	18.60
Milliequivalents of SO4 in..			
gas sample.....	1.0109	0.9612	0.8867
<u>Sulfuric acid concentration</u>			
(GR/DSCF).....	0.0200	0.0189	0.0173
(MG/DSCM).....	46	43	40
(PPM-DRY).....	11	11	10
(PPM-WET).....	10	10	9

Interpoll Report No. 7-2374
 Eveleth Taconite Company
 Eveleth, Minnesota

Test No. 1
 EXCO Ind. Line 2 Stack A (ESPP46 East)

Results of Sulfuric Acid Mist Determinations-----Method 8

	Run 1	Run 2	Run 3
Date of run	05-21-87	05-21-87	05-21-87
Time run start/end.....(HRS)	0810-0920	1020-1127	1225-1358
Barometric pressure...(IN.HG)	28.31	28.31	28.31
Meter temperature....(DEG-F)	63.20	76.20	80.10
Meter correction coefficient	0.9956	0.9956	0.9956
Volume through gas meter....			
at meter conditions...(CF)	48.51	49.790	50.650
standard conditions...(SCF)	46.35	46.429	46.897
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	9.48	9.64	10.28
Oxygen content....(%V/V DRY)	18.60	18.60	18.60
Milliequivalents of SO4 in..			
gas sample.....	0.7775	0.7378	0.6832
<u>Sulfuric acid concentration</u>			
(GR/DSCF).....	0.0127	0.0120	0.0110
(MG/DSCM).....	29	28	25
(PPM-DRY).....	7	7	6
(PPM-WET).....	6	6	6
H2SO4 emission rate...(LB/HR)	28.71	27.20	25.00

Test No. 3
 Side B Scrubber Inlet

Results of Sulfuric Acid Mist Determinations-----Method B

	Run 1	Run 2	Run 3
Date of run	05-22-87	05-22-87	05-22-87
Time run start/end.....(HRS)	0830-0938	1027-1134	1245-1352
Barometric pressure...(IN.HG)	28.80	28.80	28.80
Meter temperature....(DEG-F)	73.50	75.60	79.40
Meter correction coefficient	1.0090	1.0090	1.0090
Volume through gas meter....			
at meter conditions...(CF)	38.36	38.680	39.080
standard conditions...(SCF)	36.99	37.152	37.273
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	9.25	9.32	9.40
Oxygen content....(%V/V DRY)	18.50	18.50	18.50
Milliequivalents of SO4 in..			
gas sample.....	1.0357	0.9016	1.1350
<u>Sulfuric acid concentration</u>			
(GR/DSCF).....	0.0212	0.0184	0.0230
(MG/DSCM).....	48	42	53
(PPM-DRY).....	12	10	13
(PPM-WET).....	11	9	12

Test No. 3
 EXCO Ind. Line 2 Stack B (ESPP47 West)

Results of Sulfuric Acid Mist Determinations-----Method B

	Run 1	Run 2	Run 3
Date of run	05-22-87	05-22-87	05-22-87
Time run start/end.....(HRS)	0830-0941	1027-1134	1222-1329
Barometric pressure...(IN.HG)	28.70	28.70	28.70
Meter temperature....(DEG-F)	45.30	52.80	58.70
Meter correction coefficient	0.9956	0.9956	0.9956
Volume through gas meter....			
at meter conditions...(CF)	50.17	51.930	51.610
standard conditions...(SCF)	50.35	51.372	50.469
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	8.56	10.44	10.38
Oxygen content....(%V/V DRY)	18.40	18.50	18.50
Milliequivalents of SO4 in..			
gas sample.....	0.7477	0.6832	0.8272
<u>Sulfuric acid concentration</u>			
(GR/DSCF).....	0.0112	0.0101	0.0124
(MG/DSCM).....	26	23	28
(PPM-DRY).....	6	6	7
(PPM-WET).....	6	5	6
H2SO4 emission rate...(LB/HR)	27.83	24.77	29.99

3.5 Results of Opacity Observations

Interpoll Report No. 7-2374
Eveleth Taconite Company
Eveleth, Minnesota

Test No. 2
EXCO Induration Line 2 Stack A (ESPP46 East)

Results of Opacity Observations - EPA Method 9*

Percent Opacity	Optical Density	Relative Frequency (%)
0	.0000	
5	.0223	
10	.0458	
15	.0706	
20	.0969	
25	.1249	
30	.1549	
35	.1871	
40	.2219	
45	.2596	
50	.3010	
55	.3468	
60	.3979	
65	.4559	
70	.5229	
75	.6021	
80	.6990	
85	.8239	
90	1.0000	
95	1.3010	
99	2.0000	

Time Average

Observer: C. Mosser
Cert Date: 4/23/87
Date of Observation: 5/21/87
Time of Observation:

*Unable to perform due to overcast skies.

Interpoll Report No. 7-2374
Eveleth Taconite Company
Eveleth, Minnesota

Test No. 2
EXCO Induration Line 2 Stack B (ESPP47 West)

Results of Opacity Observations - EPA Method 9*

Percent Opacity	Optical Density	Relative Frequency (%)
0	.0000	
5	.0223	
10	.0458	
15	.0706	
20	.0969	
25	.1249	
30	.1549	
35	.1871	
40	.2219	
45	.2596	
50	.3010	
55	.3468	
60	.3979	
65	.4559	
70	.5229	
75	.6021	
80	.6990	
85	.8239	
90	1.0000	
95	1.3010	
99	2.0000	

Time Average

Observer: C. Mosser
Cert Date: 4/23/87
Date of Observation: 5/21/87
Time of Observation:

*Unable to perform due to overcast skies.

Source category:

Taconite ore processing

Date:

Plant name :

Eveleth Taconite Company

Location:

Test date :

May 21-22, 1987

Ref. No. (29)

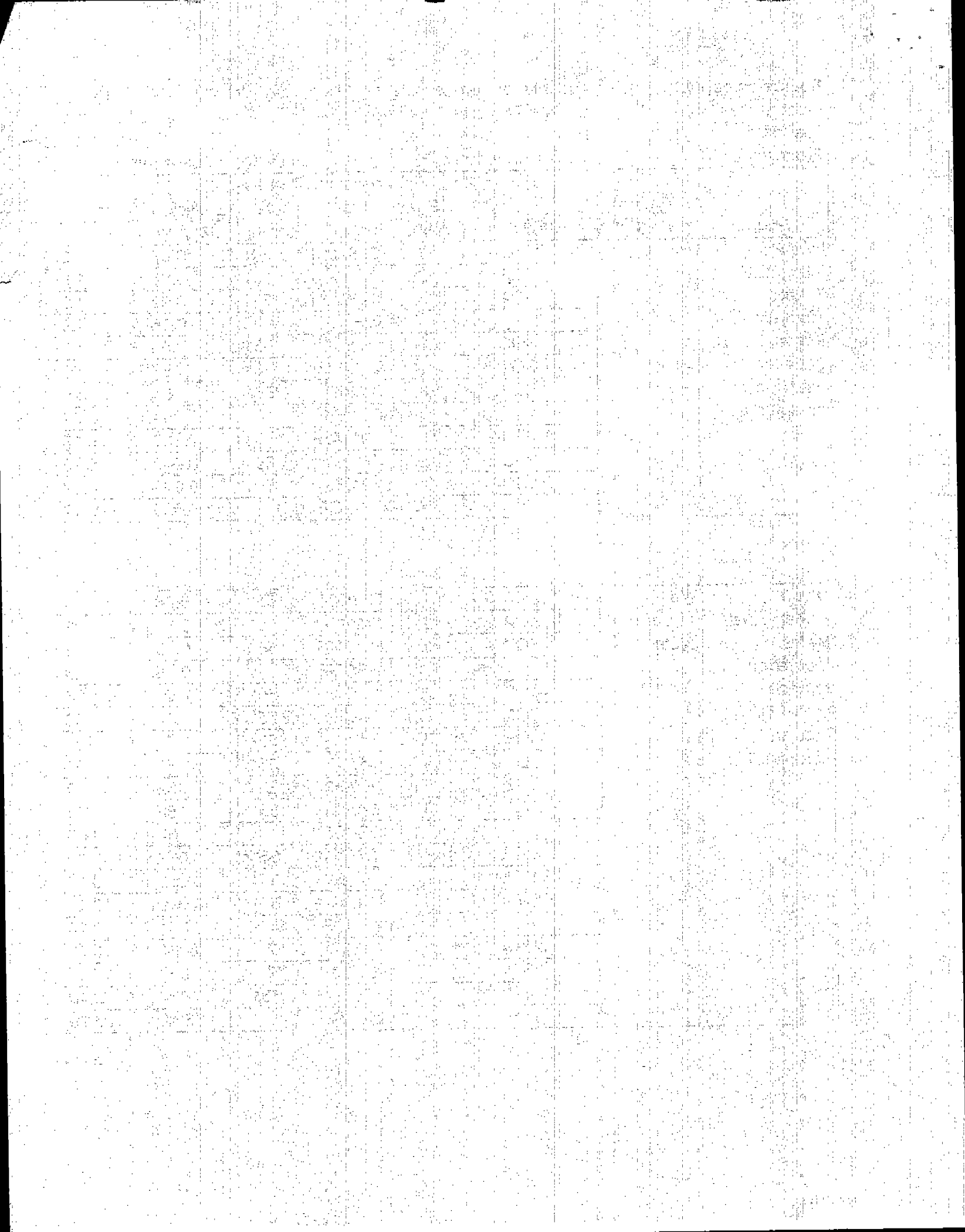
Process :

Induration furnace

Basis for process rate :

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor	
						kg/Mg	lb/ton
Line 2 Inlet, Total Pellet Induration furnace, grate/kiln coal and coke-fired	None	SO2	1	1066.00	551	0.97	1.9
		SO2	2	1063.00	551	0.96	1.9
		SO2	3	996.00	551	0.90	1.8
		AVERAGE				0.95	1.9
		CO2	1	60151	551	55	109
		CO2	2	58731	551	53	107
		CO2	3	60839	551	55	110
		AVERAGE				54	109
		H2SO4	1	97.70	551	0.089	0.18
		H2SO4	2	88.00	551	0.080	0.16
		H2SO4	3	94.80	551	0.086	0.17
		AVERAGE				0.085	0.17

Line 2 Outlet, Total Pellet Induration furnace, grate/kiln coal and coke-fired	Wet scrubber system	SO2	1	722.93	551	0.66	1.3
		SO2	2	742.19	551	0.67	1.3
		SO2	3	691.04	551	0.63	1.3
		AVERAGE				0.65	1.3
		CO2	1	56613	551	51	103
		CO2	2	56936	551	52	103
		CO2	3	57260	551	52	104
		CO2	4	56613	551	51	103
		CO2	5	56936	551	52	103
		CO2	6	57260	551	52	104
		AVERAGE				52	103
		Filt. PM	1	57.61	551	0.052	0.10
		Filt. PM	2	57.59	551	0.052	0.10
		Filt. PM	3	54.41	551	0.049	0.10
		AVERAGE				0.051	0.10
		H2SO4	1	56.54	551	0.051	0.10
		H2SO4	2	51.97	551	0.047	0.094
		H2SO4	3	54.99	551	0.050	0.10
		AVERAGE				0.049	0.099



Source category:

Taconite ore processing

Date:

Plant name :

Eveleth Taconite Company

Location:

Test date :

May 21-22, 1987

Ref. No. (29)

Process :

Induration furnace

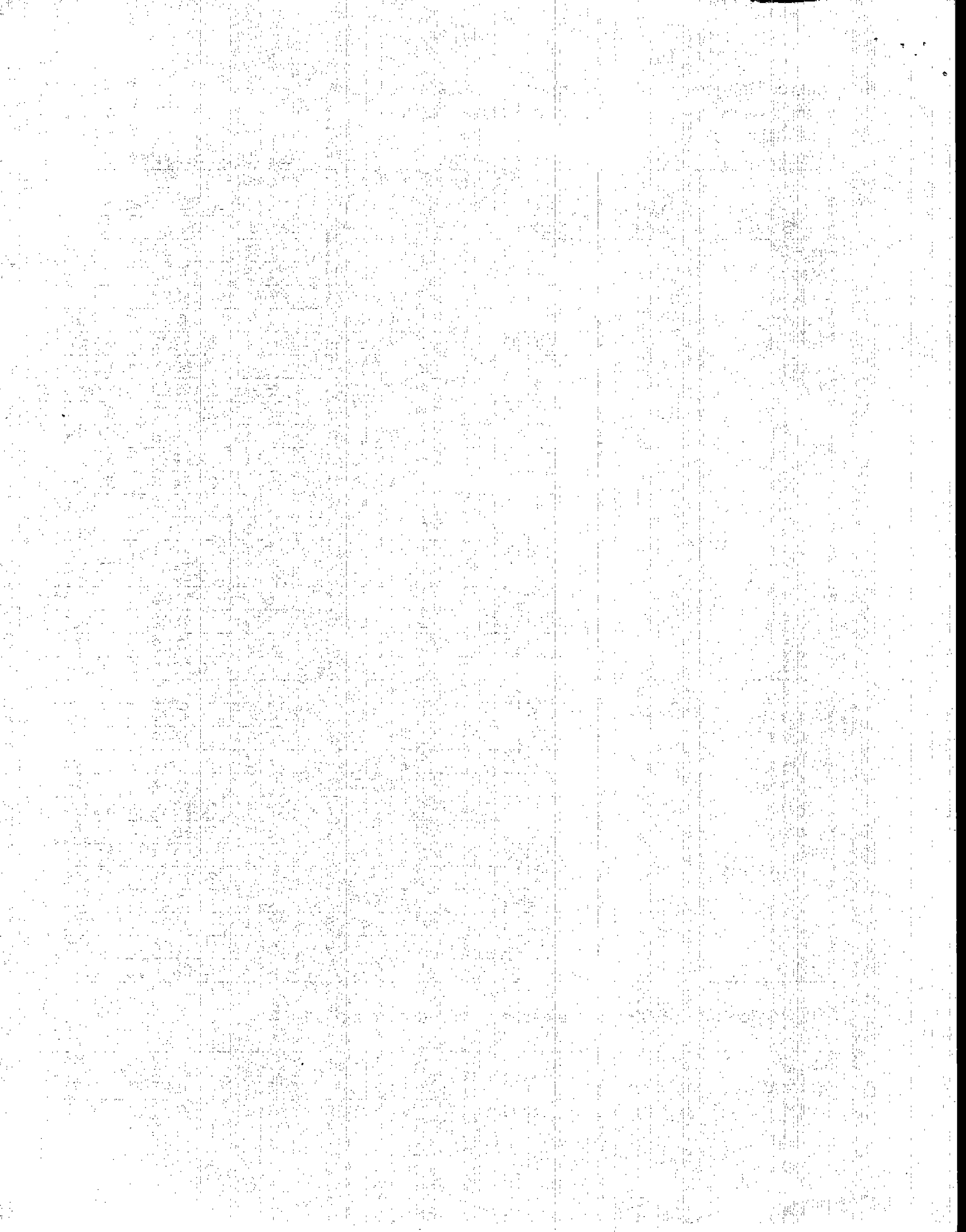
Basis for process rate

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor	
						kg/Mg	lb/ton
Line 2 Stack A Pellet Induration furnace, rotary kiln <i>GRATE/KILN</i>	Wet scrubber system	SO2	1	354.02	551	0.32	0.64
		SO2	2	354.59	551	0.32	0.64
		SO2	3	315.21	551	0.29	0.57
		AVERAGE				0.31	0.62
		CO2	1	27960.8	551	25.3727	50.7455
		CO2	2	28216.4	551	25.6047	51.2095
		CO2	3	28599.5	551	25.9523	51.9047
		CO2	4	27960.8	551	25.3727	50.7455
		CO2	5	28216.4	551	25.605	51.209
		CO2	6	28599.5	551	25.952	51.905
		AVERAGE				25.6433	51.287
		Filt. PM	1	35.40	551	0.03	0.06
		Filt. PM	2	37.50	551	0.03	0.07
		Filt. PM	3	36.02	551	0.03	0.07
		AVERAGE				0.0329	0.066
		H2SO4	1	28.71	551	0.03	0.05
		H2SO4	2	27.20	551	0.02	0.05
		H2SO4	3	25.00	551	0.02	0.05
		AVERAGE				0.0245	0.049

Line 2 Stack A Pellet Induration furnace, rotary kiln <i>GRATE/KILN</i>	None	SO2	1	534.00	551	0.48	0.97
		SO2	2	537.00	551	0.49	0.97
		SO2	3	487.00	551	0.44	0.88
		AVERAGE				0.47	0.94
		CO2	1	29708.3	551	26.9585	53.9171
		CO2	2	28216.4	551	25.6047	51.2095
		CO2	3	30387.0	551	27.574	55.149
		AVERAGE				26.7125	53.425
		H2SO4	1	45.20	551	0.04	0.08
		H2SO4	2	42.70	551	0.04	0.08
		H2SO4	3	39.20	551	0.04	0.07
		AVERAGE				0.0384	0.077

No inlet flow rates; CO2 data are based on outlet flow rates

Line 2 Stack B Pellet	Wet scrubber system	SO2	1	368.91	551	0.33	0.67
		SO2	2	387.60	551	0.35	0.70
		SO2	3	375.83	551	0.34	0.68



Source category:

Taconite ore processing

Date:

Plant name :

Eveleth Taconite Company

Location:

Test date :

May 21-22, 1987

Ref. No.: 29

Process :

Induration furnace

Basis for process rate :

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor	
						kg/Mg	lb/ton
Induration furnace, rotary kiln <i>GRATE / KILN</i>		AVERAGE				0.34	0.69
		CO2	1	28652.2	551	26.0002	52.0004
		CO2	2	28720.0	551	26.0617	52.1233
		CO2	3	28660.8	551	26.0080	52.0159
		CO2	4	28652.2	551	26.0002	52.0004
		CO2	5	28720.0	551	26.062	52.123
		CO2	6	28660.8	551	26.008	52.016
		AVERAGE				26.0233	52.047
		Filt. PM	1	22.21	551	0.02	0.04
		Filt. PM	2	20.09	551	0.02	0.04
		Filt. PM	3	18.39	551	0.02	0.03
		AVERAGE				0.0184	0.037
		H2SO4	1	27.83	551	0.03	0.05
		H2SO4	2	24.77	551	0.02	0.04
		H2SO4	3	29.99	551	0.03	0.05
		AVERAGE				0.0250	0.050

Line 2 Stack B Pellet Induration furnace, rotary kiln <i>GRATE/KILN</i>	None	SO2	1	532.00	551	0.48	0.97
		SO2	2	526.00	551	0.48	0.95
		SO2	3	509.00	551	0.46	0.92
		AVERAGE				0.47	0.95
		CO2	1	30443.0	551	27.6252	55.2504
		CO2	2	30515.0	551	27.6905	55.3811
		CO2	3	30452.1	551	27.633	55.267
		AVERAGE				27.6497	55.299
		H2SO4	1	52.50	551	0.05	0.10
		H2SO4	2	45.30	551	0.04	0.08
		H2SO4	3	55.60	551	0.05	0.10
		AVERAGE				0.0464	0.093

No inlet flow rates; CO2 based on outlet flow rate.

*There are only 2 stacks -**Q - how to combine data for stacks*

