TRCON 20
(17)

Interpoll Inc.
2982 North Cleveland Avenue
St. Paul, Minnesota 55113

(612) 636-6866

RESULTS OF THE MARCH 11, 1980 PARTICULATE EMISSION COMPLIANCE TEST ON THE KILN COOLER EXHAUST STACK AT EVELETH MINES, EVELETH, MINNESOTA

Submitted to:

EVELETH MINES
P.O. Box 180
Eveleth, Minnesota 55734

Attention: D.S. Coyle
Chief Metallurgist

Approved by:

Perry Lonnes

Perry Lonnes, Ph.D.
Director of Environmental
Measurements Section

Report Number 0-730
April 18, 1980
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TACON 20

Source category: Taconite ore processing Date:
Plant name : Eveleth Mines Location:
Test date : March 11, 1980 Ref. No. (17)
Process : Kiln cooler Basis for process rate :

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor kg/Mg	Emission factor lb/ton
Kiln cooler		filt. PM	1	98.55	550.00	0.090	0.18
		filt. PM	2	57.19	550.00	0.052	0.10
		filt. PM	3	84.69	550.00	0.077	0.15
				AVERAGE		0.073	0.15

CO2 not analyzed.

NO CONTROL DEVICE SPECIFIED

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SYMBOLS AND ABBREVIATIONS

ACFM	actual cubic feet per minute
DSCFM	standard cubic foot of dry gas per minute
DEG-F	degrees Fahrenheit
FT/SEC	feet per second
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g	gram
HRS	hours
IN.	inches
IN. H.G.	inches of mercury
IN. W.C.	inches of water
LB	pound
LB/HR	pounds per hour
LB/10^6BTU	million British Thermal Units heat input
microns (μm)	micrometer
MIN	minutes
SQ. FT.	square feet
v/v	percent by volume
mg/DSCM	milligrams per dry standard cubic meter
LB/DSCF	pounds per dry standard cubic foot
MWH	megawatt hours
ohm-cm	ohm-centimeter
HP	horsepower
PSI	pounds per square inch
w/w	percent by weight

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

1 INTRODUCTION

On March 11, 1980, Interpoll Inc. personnel conducted a particulate emission compliance test on the kiln cooler exhaust stack at Eveleth Mines located near Eveleth, Minnesota. On-site testing was performed by J. Stock and R. Yaritz. Coordination between plant operation and testing activities was provided by Dan Jarvis of Eveleth Mines. The tests were not witnessed by a member of the Minnesota Pollution Control Agency (MPCA).

Particulate evaluations were performed in accordance with EPA Methods 1-5, CFR Title 40, Part 60, Appendix A (Revised July 1, 1979). A preliminary determination of the gas linear velocity profile was made before the start of 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 extract representative particulate samples by means of a heated stainless-steel lined probe.

Testing on the kiln cooler exhaust stack was conducted from existing test ports located on the stack. The testing protocol was based upon EPA Method 1 reccommendations. A visible emission determination was performed on this source by J. Stock, a currently certified observer, however, no visible emissions were detected.

The important results of the test are summarized in Section 2. Detailed results are presented in Section 3. Results of preliminary measurements, field data and all other supporting information are presented in the appendices.

2 SUMMARY AND DISCUSSION

The important results of the particulate emission compliance test on the kiln cooler exhaust stack are presented in Table 1. As will be noted, the particulate concentration measured ranged from .050 to .091 GR/DSCF. In the interpretation of these results, it should be noted in the case of Run 3, that a significant quantity of material larger than 264 microns was collected.* These particles were separated by a wet sieve analysis and are reported independently in Appendix C. The mass of particles larger than 264 microns was not included in the total mass when the particulate concentration and emission rate were calculated.

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

60 MESH = 250 MICRONS

Table 1. Summary of the Results of the March 11, 1980 Particulate Emission Compliance Test on the Kiln Cooler Exhaust Stack at Eveleth Mines, Eveleth, Minnesota.

ITEM	PRELIMINARY	RUN 1	RUN 2	RUN 3 *	
Date of test	3-11-80	3-11-80	3-11-80	3-11-80	
Time of test	0700	0725-0850	0907-1032	1042-1210	
Green ball feed rate (TONS/HR)		550	550	550	
Volumetric flow					
ACTUAL (ACFM)	224000	248000	274000	273000	265,000
STANDARD (DSCFM)	126000	126000	134000	135000	
Gas temperature (DEG-F)	425	527	559	550	545
Gas moisture content (% v/v)	.89	.81	.99	.88	
Gas composition (% v/v, dry)*					
carbon dioxide		.03	.03	.03	
oxygen		20.90	20.90	20.90	
nitrogen		79.07	79.07	79.07	
Particulate concentration					
ACTUAL (GR/ACF)		.046	.024	.036	
STANDARD (GR/DSCF)		.091	.050	.073	.071
Isokinetic variation (%)		101.7	99.6	99.5	
Particulate emission rate (LB/HR)		98.6	57.2	84.7	80.2

*not analyzed - composition of normal air

APC 5
Table 1. $E = (17.31)(550)^{0.16} = 47.51$ [LBS/HR]

* +60M PARTICLES NOT INCLUDED FOR RUN #3 ; P.2.

3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition results are presented first, followed by the computer printout of particulate emission data and results of visible emission determinations. Preliminary measurements including traverse point description are given in Appendix A and B.

The results have been calculated on a CDC 3300 computer using standard Fortran programs. EPA-published equations have been used as the basis of the calculation techniques in these programs. It should be noted in interpreting these results that the particulate emission rates have been calculated by both the "concentration X flow" and the "ratio of areas" methods and the average reported. The average is the best estimate of the true value, since the bias introduced by an isokinetic sampling is approximately equal but of opposite sign in the two calculation techniques and thus cancels in the average.

JOB: EVELETH EXPANSION CO.

INTERPOLL REPORT NO. 0-730

TEST NO. 1 KILN COOLER EXHAUST - STACK

3.1 RESULTS OF GAS ANALYSES -- METHOD 3 (PERCENT BY VOLUME)

	RUN 1	RUN 2	RUN 3
DATE OF RUN	03/11/80	03/11/80	03/11/80
DRY BASIS (ORSAT)			
CARBON DIOXIDE	.03	.03	.03
OXYGEN	20.90	20.90	20.90
CARBON MONOXIDE	0	0	0
NITROGEN	79.07	79.07	79.07
WET BASIS (ORSAT)			
CARBON DIOXIDE	.03	.03	.03
OXYGEN	20.73	20.69	20.72
CARBON MONOXIDE	0	0	0
NITROGEN	78.43	78.29	78.38
MOISTURE CONTENT	.81	.99	.88
DRY MOLECULAR WEIGHT	28.84	28.84	28.84
WET MOLECULAR WEIGHT	28.75	28.73	28.75
SPECIFIC GRAVITY (RELATIVE TO AIR)	.9932	.9925	.9929
FO	0	0	0

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TEST NO. 1 KILN COOLER EXHAUST - STACK

3.2 RESULTS OF PARTICLE LOADING DETERMINATIONS -- METHOD 5(BE)

	RUN 1	RUN 2	RUN 3
DATE OF RUN	03/11/80	03/11/80	03/11/80
TIME RUN START/END(HRS)	725/ 850	907/1032	1042/1210
PITOT TUBE COEFFICIENT	.846	.846	.846
TOTAL MOISTURE IN GAS SAMPLE (GRAMS)	7.0	9.0	8.0
TOTAL PARTICULATE MATERIAL COLLECTED(GRAMS) *	.2380	.1367	.2023
VOLUME THROUGH GAS METER			
METER CONDITION (CF)	38.14	39.98	40.55
STANDARD CONDITION (SCF)	40.51	42.30	42.62
TOTAL SAMPLING TIME (MIN)	80.0	80.0	80.0
NOZZLE DIAMETER (IN)	.372	.372	.372
AVERAGE STACK GAS TEMPERATURE DURING DETERMINATION (DEG-F)	527	559	550
VOLUMETRIC FLOW**			
ACTUAL ..... (ACFM)	248070	273573	273147
DRY STANDARD ... (DSCFM)	125693	134028	135136
ISOKINETIC VARIATION (%)	101.7	99.6	99.5
PARTICLE CONCENTRATION			
ACTUAL ..... (GR/ACF)	.0459	.0244	.0362
DRY STANDARD ... (GR/DSCF)	.0906	.0498	.0732
PARTICLE MASS FLOW (LB/HR)	98.55	57.19	84.69

* DRY CATCH ONLY
** CALCULATED ON THE BASIS OF VELOCITY PRESSURES MEASURED DURING THIS PARTICULATE DETERMINATION.

TEST NO. 1 SOURCE: Kiln Cooler Exhaust Stack

3.3 RESULTS OF OPACITY OBSERVATIONS - EPA METHOD 9

PERCENT OPACITY	OPTICAL DENSITY	RELATIVE FREQUENCY (%)
0	0	100
5	.0223	0
10	.0458	0
15	.0706	0
20	.0969	0
25	.1249	0
30	.1549	0
35	.1871	0
40	.2219	0
45	.2596	0
50	.3010	0
55	.3468	0
60	.3979	0
65	.4559	0
70	.5229	0
75	.6021	0
80	.6990	0
85	.8239	0
90	1.000	0
95	1.301	0
100		0
0	0	TIME AVERAGE

OBSERVER: Jeff Stock
CERTIFICATION DATE: 11-6-80
DATE OF OBSERVATION: 3-11-80
TIME OF OBSERVATION: 1215

APPENDIX A

RESULTS OF PRELIMINARY MEASUREMENTS