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RESULTS OF THE JULY 9, 1981 PARTICULATE EMISSION COMPLIANCE TEST ON THE KILN COOLER EXHAUST STACK AT EVELETH MINES, EVELETH, MINNESOTA

Submitted to:

EVELETH MINES
P. O. Box 180
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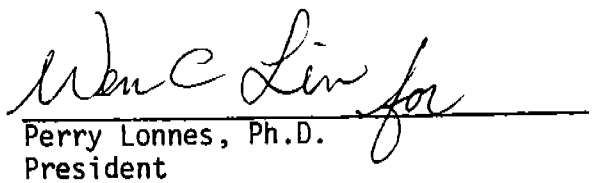
Attention: H. H. Vaughan
Chief Environmental Engineer

Approved by:



Perry Lonnes, Ph.D.
President

Report Number 1-1068
July 22, 1981

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TACON 19

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Source category:	Taconite ore processing					Date:	So
Plant name :	Eveleth Mines					Location:	Pla
Test date :	July 9, 1981					Ref. No.:	Tes
Process :	Kiln cooler				Basis for process rate :		Pro

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	19.06	519.00	0.018	0.037	Kiln coo
		filt. PM	2	32.76	519.00	0.032	0.063	
		filt. PM	3	33.53	519.00	0.032	0.065	
		AVERAGE				0.027	0.055	

CO2 not analyzed. CO2

(NO CONTROL DEVICE INDICATED)

ABBREVIATIONS

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

Standard conditions are defined as 68^oF (20^oC) and 29.92 in. of mercury pressure.

1 INTRODUCTION

On July 9, 1981, 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 a two-man team under the direction of D. VanHoever. Coordination between plant operation and testing activities was provided by Dan Jarvis of Eveleth Mines. The test was 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 inconel-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 and mutually agreed to by MPCA and EXCO prior to the test. A visible emission determination was performed on this source by D. VanHoever, 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 .018 to .031 GR/DSCF. A process difficulty caused the plant to void the first test after its completion.

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 and emission rates reported herein are accurate and closely reflect the actual values which existed at the time the test was conducted.

Table 1. Summary of the Results of the July 9, 1981 Particulate Emission Compliance Test on the Siln Cooler Exhaust Stack at the Eveleth Mines Plant, located near Eveleth, Minnesota

ITEM	PRELIMINARY	RUN 2	RUN 3	RUN 4
Time of test (HRS)	0800	1302-1431	1501-1626	1658-1819
Kiln feed rate (Long TONS/HR)		463	463	463
Volumetric flow				
ACTUAL (ACFM)	242000	295000	297000	306000
STANDARD (DSCFM)	107000	126000	124000	131000
Gas temperature (DEG-F)	670	703	735	705
Gas moisture content (% v/v)	1.12	1.29	1.13	.94
Gas composition (% v/v, dry)*				
carbon dioxide		.03	.03	.03
oxygen		20.90	20.90	20.90
nitrogen		79.07	79.07	79.07
Isokinetic variation (%)		100.2	99.5	99.1
Particulate emission rate (LB/HR)		19.1 (1)	32.8 (2)	33.5 (3)
Particulate concentration				
ACTUAL (GR/ACF)		.008	.013	.013
STANDARD (GR/DSCF)		.018	.031	.030

* Not analyzed - composition of normal air

(1) (2) (3) Using $E = 17.31\ P^{0.16}$

$463\ [LT/HR] = 518.56\ [ST/HR]$

$E = (518.56)^{0.16}(17.31)$

$= 47.06\ [LBS/HR]$

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 DEC PDP-11 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 MINES

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TEST NO. 1 KILN COOLER EXHAUST STACK

3.1 RESULTS OF ORSAT & MOISTURE ANALYSES -- METHOD 3 & 4 (% V/V)

	RUN 2	RUN 3	RUN 4
DATE OF RUN	07/09/81	07/09/81	07/09/81
DRY BASIS (ORSAT)			
CARBON DIOXIDE *	0.03	0.03	0.03
OXYGEN *	20.90	20.90	20.90
CARBON MONOXIDE*	0.00	0.00	0.00
NITROGEN	79.07	79.07	79.07
WET BASIS (ORSAT)			
CARBON DIOXIDE	0.03	0.03	0.03
OXYGEN	20.63	20.66	20.70
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	78.05	78.18	78.32
MOISTURE CONTENT	1.29	1.13	0.94
DRY MOLECULAR WEIGHT	28.84	28.84	28.84
WET MOLECULAR WEIGHT	28.70	28.72	28.74
SPECIFIC GRAVITY (RELATIVE TO AIR)	0.9914	0.9920	0.9927
FO	0.00	0.00	0.00

* Not analyzed - composition of normal air used

JOB: EVELETH MINES

INTERPOLL REPORT NO. 1-1068

TEST NO. 1 KILN COOLER EXHAUST STACK

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

	RUN 2	RUN 3	RUN 4
DATE OF RUN	07/09/81	07/09/81	07/09/81
TIME RUN START/END(HRS)	1305/1431	1501/1626	1658/1819
PITOT TUBE COEFFICIENT	0.844	0.844	0.844
WATER IN SAMPLE			
CONDENSATE (ML)	0.0	0.0	0.0
SILICA GEL (GRAMS)	20.0	17.0	15.0
TOTAL PARTICULATE MATERIAL COLLECTED(GRAMS) *	0.0825	0.1413	0.1444
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (CF)	78.11	76.34	80.46
STANDARD CONDITIONS (SCF)	72.13	70.35	74.24
TOTAL SAMPLING TIME (MIN)	80.0	80.0	80.0
NOZZLE DIAMETER (IN)	0.500	0.500	0.500
AVERAGE STACK GAS TEMPERATURE DURING DETERMINATION (DEG-F)	703.	735.	705.
VOLUMETRIC FLOW**			
ACTUAL ..... (ACFM)	294566.	296926.	306116.
DRY STANDARD ... (DSCFM)	125736.	123542.	130886.
ISOKINETIC VARIATION (%)	100.2	99.5	99.1
PARTICLE CONCENTRATION			
ACTUAL ..... (GR/ACF)	0.0076	0.0130	0.0129
DRY STANDARD ... (GR/DSCF)	0.0177	0.0310	0.0300
PARTICLE MASS FLOW (LB/HR)	19.06	32.76	33.53

* DRY CATCH ONLY

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

JOB: Eveleth Mines

TEST NO. 1 SOURCE: Exco 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: Duane VanHoever

CERT. DATE: 6-3-81

DATE OF OBSERVATION 7-9-81

TIME OF OBSERVATION 1845-1945

S-0083RRL