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RESULTS OF THE DECEMBER 17, 1981 COMPLIANCE TEST ON THE D-2 FURNACE DUST CONTROL SYSTEM AT THE ERIE MINING CO. PELLET PLANT NEAR HOYT LAKES, MINNESOTA

Submitted to:

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Approved by:

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President

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APPENDICES:

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 December 17, 1981, Interpoll Inc. personnel conducted a compliance test on the D-2 Pellet Induration Furnace top gas dust collector at the Erie Mining Company (EMC) Pellet Plant located in Hoyt Lakes, Minnesota. The objective of this test was to establish the collection efficiency of the present top gas mechanical dust collector. On-site testing was performed by a four-man team under the direction of Dr. P. Lonnes. Coordination between furnace operation and testing activities was provided by L. Peterson of EMC. The test was witnessed by Bob Berrisford of the Minnesota Pollution Control Agency (MPCA).

Evaluations were performed in accordance with EPA Methods 1-5, CFR Title 40, Part 60, Appendix A (Revised July 1, 1980). Previous data collected at both the dust collector inlet and stack test sites was used to select the appropriate nozzle diameter required for isokinetic sample withdrawal. Interpoll sampling trains which meet or exceed specifications in the above-cited reference were used to extract particulate samples. A heated glass-lined probe was used at the stack test site. At the inlet test site, a stainless-steel filter holder assembly was used in place of the normal EPA Method 5 sampling train to better accommodate the difficult geometrical constraints.

Testing at the inlet to the collector was performed in a 1'-4" x 14'-10" rectangular vertically-oriented duct just downstream of a cross sectional convergence on the small dimension and just upstream of a 90 degree direction change on the small dimension side of the duct. A row of 9 test ports on the 14'-10" side of the duct were used for entry to perform 36-point traverse particulate samplings. Each traverse point was sampled two minutes to give a total of 72 minutes per run. Extreme temperature variations are normally encountered at this site.

Testing on the D-2 Furnace Top Gas stack was conducted from two test ports oriented at 90 degrees on the stack. A 20-point traverse was used to extract representative particulate samples. Each traverse point was sampled three minutes to give a total sampling time of 60 minutes per run.(See Appendix B). A visual emission determination could not be performed due to inclement weather and steam plumes from other nearby stacks.

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 dust collector compliance test on the D-2 Furnace top gas mechanical dust collector are summarized in Table 1. As will be noted, the collection efficiency ranged from 89.5 to 94.1 with an average of 91.1%.

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 mass rates reported herein are accurate and closely reflect the actual values which existed at the time the tests were performed.

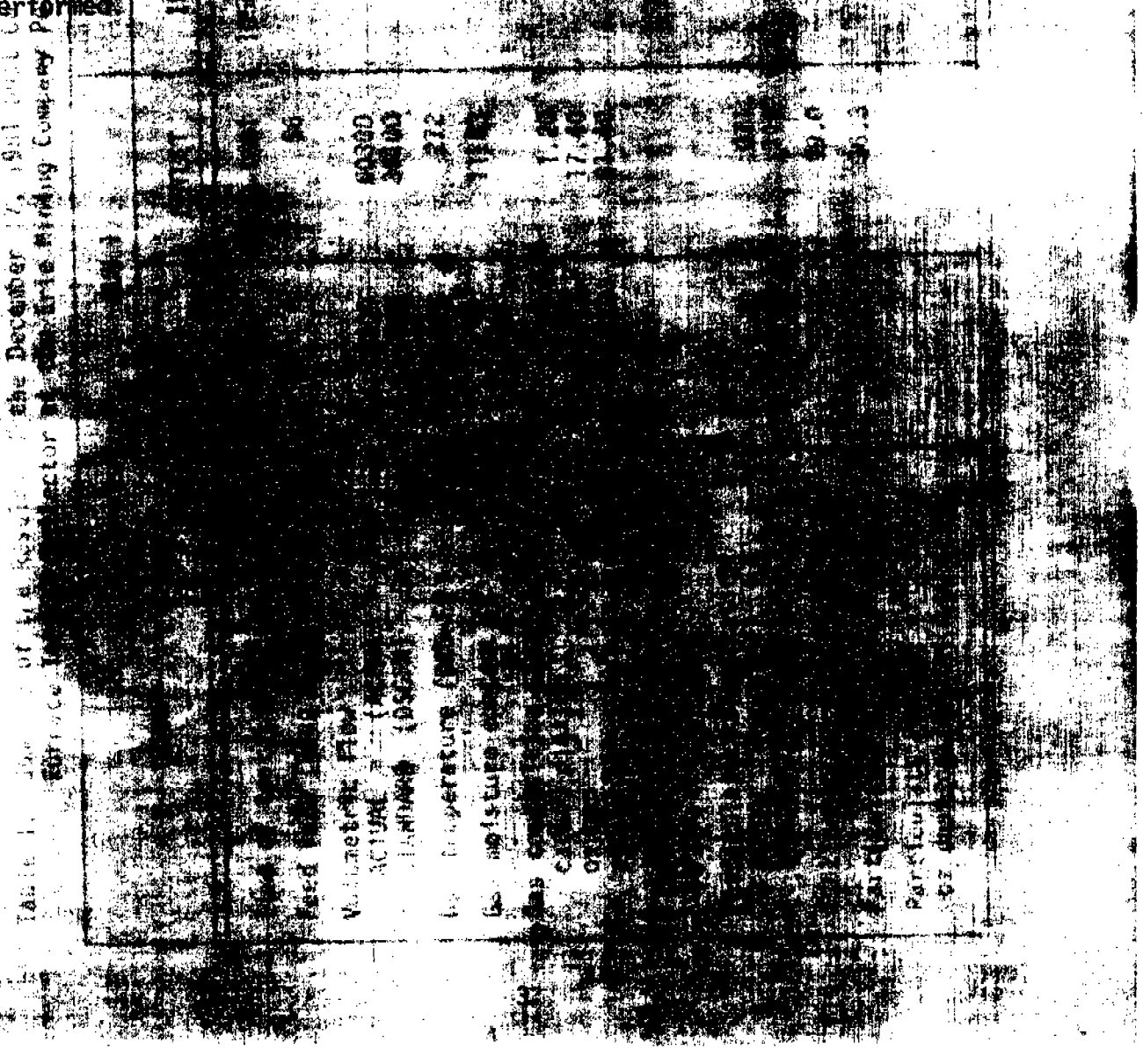

Table 1. Summary of the Results of the December 15 1981 Dust Collector Emission Complaince Test on the D-2 Furnace [illegible] Dust Collector at the Erie Mining Company Pellet Plant located in Hoyt Lakes, Minnesota.

ITEM	RUN 1		RUN 2		RUN 3	
	OUTLET	INLET	OUTLET	INLET	OUTLET
Time	1001	1058-1218	1106-1209	1240-1356	1240-1343
Feed rate	56		56		63 Tons = 56
Volumetric Flow					
ACTUAL	60300	55100	62900	54800	62400
STANDARD (DSCFM)	34100	32400	36900	32900	37200
Gas temperature (°F)	277	256	274	247	272
Gas moisture	13.20	15.20	13.20	14.64	12.28
Gas [illegible]			1.20	2.00	1.20
			17.40	17.20	17.40
			81.40	80.80	81.40
			17.42	17.34	17.27
		.616	.055	.660	.060
		1.04	.093	1.10	.100
		97.8	101.3	95.7	99.3
	36.3	286.5	29.6	302.5	31.7
Particulate [illegible]					
Particulate removal efficiency	94.08		89.68		89.53
[illegible] of dust collector					

3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition (Orsat and moisture) are presented first, followed by the computer printout of particulate emission data. 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.

3.2.1 TEST NO. 1 D-2 TOP GAS COLLECTOR INLET

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

	RUN 1	RUN 2	RUN 3
DATE OF RUN	12/17/81	12/17/81	12/17/81
TIME RUN START/END(HRS)	900/1021	1050/1218	1240/1356
PITOT TUBE COEFFICIENT	0.845	0.845	0.845
WATER IN SAMPLE			
CONDENSATE (ML)	110.0	110.0	100.0
SILICA GEL (GRAMS)	35.0	38.0	40.0
TOTAL PARTICULATE MATERIAL COLLECTED(GRAMS) *	5.6476	2.6133	2.7317
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (CF)	42.47	42.25	42.28
STANDARD CONDITIONS (SCF)	38.97	38.62	38.43
TOTAL SAMPLING TIME (MIN)	72.0	72.0	72.0
NOZZLE DIAMETER (IN)	0.248	0.248	0.248
AVERAGE STACK GAS TEMPERATURE DURING DETERMINATION (DEG-F)	270.	256.	247.
VOLUMETRIC FLOW**			
ACTUAL ..... (ACFM)	56438.	55093.	54827.
DRY STANDARD ... (DSCFM)	32662.	32387.	32866.
ISOKINETIC VARIATION (%)	97.6	97.6	95.7
PARTICLE CONCENTRATION			
ACTUAL ..... (GR/ACF)	1.2993	0.6163	0.6601
DRY STANDARD ... (GR/DSCF)	2.2360	1.0441	1.0968
PARTICLE MASS FLOW (LB/HR)	618.92	286.48	302.46

* DRY CATCH ONLY

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

3.2.2 TEST NO. 1 D-2 FURNACE STACK

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

	RUN 1	RUN 2	RUN 3
DATE OF RUN	12/17/81	12/17/81	12/17/81
TIME RUN START/END(HRS)	900/1001	1106/1209	1240/1343
PITOT TUBE COEFFICIENT	0.849	0.849	0.849
WATER IN SAMPLE			
CONDENSATE (ML)	85.0	86.0	90.0
SILICA GEL (GRAMS)	33.0	54.0	37.0
TOTAL PARTICULATE MATERIAL COLLECTED(GRAMS) *	0.3191	0.2604	0.2764
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (CF)	39.76	42.39	41.93
STANDARD CONDITIONS (SCF)	41.41	43.35	42.74
TOTAL SAMPLING TIME (MIN)	60.0	60.0	60.0
NOZZLE DIAMETER (IN)	0.246	0.246	0.246
AVERAGE STACK GAS TEMPERATURE DURING DETERMINATION (DEG-F)	272.	274.	272.
VOLUMETRIC FLOW**			
ACTUAL ..... (ACFM)	60297.	62913.	62440.
DRY STANDARD ... (DSCFM)	36096.	36948.	37158.
ISOKINETIC VARIATION (%)	99.0	101.3	99.3
PARTICLE CONCENTRATION			
ACTUAL ..... (GR/ACF)	0.0715	0.0547	0.0596
DRY STANDARD ... (GR/DSCF)	0.1189	0.0927	0.0998
PARTICLE MASS FLOW (LB/HR)	36.63	29.56	31.68

* DRY CATCH ONLY

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

Source category: Taconite ore processing Date: 10/23/96
Plant name : Erie Mining Company Location: Hoyt Lakes, MN
Test date : December 17, 1981 Ref. No.: 13
Process : Induration furnace Basis for process rate : prod.

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor kg/Mg	Emission factor lb/ton	Emission factor rating
D-2 vertical shaft Induration furnace top gas stack (natural gas fired)	Mechanical collector	filt. PM	1	36.63	57.1	0.32	0.64	
		filt. PM	2	29.56	57.1	0.26	0.52	
		filt. PM	3	31.68	57.1	0.28	0.56	
				AVERAGE		0.29	0.57	C
		CO2	1	2973.5	57.1	26	52	
		CO2	2	3039.4	57.1	27	53	
		CO2	3	3064.1	57.1	27	54	
				AVERAGE		27	53	C
D-2 descending shaft Induration furnace (natural gas fired)	None	filt. PM	1	618.92	57.1	5.4	10.8	
		filt. PM	2	286.48	57.1	2.5	5.0	
		filt. PM	3	302.46	57.1	2.6	5.3	
				AVERAGE		3.5	7.1	C
		CO2	1	4489.1	57.1	39	79	
		CO2	2	4447.9	57.1	39	78	
		CO2	3	4516.5	57.1	40	79	
				AVERAGE		39	79	C

Notes: Test report presents feed rate; production rate estimated as 91% of feed rate, based on information presented in References 56 and 57 for same plant.