Report of ...

Lead (Pb) Emission Testing

Performed for ...

Cleveland-Cliffs, Inc.
Tilden Mining Company, L.C.
Ishpeming, Michigan

On...

Units 1 & 2

At the...

Tilden Mine
National Mine, Michigan

July 24 - 26, 2018

Project #: 053.37

Performed By:

Network Environmental, Inc.
Grand Rapids, MI

I. INTRODUCTION

Network Environmental, Inc. was retained by Cleveland-Cliffs, Inc., Tilden Mining Company L.C. to perform lead (Pb) emission testing at the Tilden Mine located in National Mine, Michigan. The purpose of the testing was to document the lead (Pb) emissions from indurating furnace Units 1 & 2 (EUKILN 1 & EUKILN 2).

The lead (Pb) sampling was conducted in accordance with U.S. EPA Reference Method 29. Exhaust gas parameters (air flow rate, temperature, moisture and density) were determined by employing U.S. EPA Reference Methods 1 through 4.

The testing was performed over the period of July 24-26, 2018. Stephan K. Byrd, R. Scott Cargill, Richard D. Eerdmans and David D. Engelhardt of Network Environmental, Inc. conducted the emission sampling. Assisting with the on-site coordination and data collection was Mr. Thomas O'Brien of Cleveland-Cliffs, Inc.. Mr. Mark Dziadosz of the MDEQ - Air Quality Division was present to observe the sampling and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
LEAD (Pb) EMISSION RESULTS
UNIT 2 (EUKILN 2) INDURATING FURNACE (HEMATITE)
CLEVELAND-CLIFFS, INC.
TILDEN MINING COMPANY L.C.
NATIONAL MINE, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration	Mass Rate
					Mg/M^3 (2)	Lbs/Hr (3)
Unit 2 South Waste Gas Stack	1	7/25/18	14:47-17:00	440,042	0.00218	0.00359
	2	7/26/18	09:04-11:17	425,266	0.00256	0.00407
	3	7/26/18	12:10-14:21	425,705	0.00145	0.00231
	Average			**430,338**	**0.00206**	**0.00332**
Unit 2 North Waste Gas Stack	1	7/25/18	14:47-17:00	252,026	0.00526	0.00497
	2	7/26/18	09:04-11:16	235,059	0.00473	0.00417
	3	7/26/18	12:10-14:21	236,390	0.00466	0.00413
	Average			**241,158**	**0.00489**	**0.00442**
Unit 2 Total	1	7/25/18	14:47-17:00	692,068	0.00330	0.00856
	2	7/26/18	09:04-11:17	660,325	0.00333	0.00824
	3	7/26/18	12:10-14:21	662,095	0.00260	0.00643
	Average			**671,496**	**0.00308**	**0.00774**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(2) Mg/M^3 = Milligrams Of Pb Per Dry Standard Cubic Meter
(3) Lbs/Hr = Pounds Of Pb Per Hour

II.2 TABLE 2
LEAD (Pb) EMISSION RESULTS
UNIT 1 (EUKILN 1) INDURATING FURNACE (HEMATITE)
CLEVELAND-CLIFFS, INC.
TILDEN MINING COMPANY L.C.
NATIONAL MINE, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration	Mass Rate
					Mg/M^3 (2)	Lbs/Hr (3)
Unit 1 South Waste Gas Stack	1	7/24/18	12:28-14:58	440,228	0.00489	0.00805
	2	7/24/18	15:36-17:46	440,056	0.00432	0.00713
	3	7/25/18	09:05-11:17	441,019	0.00346	0.00571
	Average			**440,434**	**0.00422**	**0.00696**
Unit 1 North Waste Gas Stack	1	7/24/18	12:28-14:58	209,341	0.00524	0.00411
	2	7/24/18	15:36-17:50	210,173	0.00425	0.00334
	3	7/25/18	09:05-11:21	210,900	0.00396	0.00313
	Average			**210,138**	**0.00448**	**0.00353**
Unit 1 Total	1	7/24/18	12:28-14:58	649,569	0.00500	0.01216
	2	7/24/18	15:36-17:50	650,229	0.00430	0.01047
	3	7/25/18	09:05-11:21	651,919	0.00362	0.00884
	Average			**650,572**	**0.00431**	**0.01049**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(2) Mg/M^3 = Milligrams Of Pb Per Dry Standard Cubic Meter
(3) Lbs/Hr = Pounds Of Pb Per Hour

III. DISCUSSION OF RESULTS

The results of the testing are summarized in Tables 1 through 2 (Sections II.1 through II.2).

The tables consist of the following test information:

- Sample Dates & Times
- Air Flow Rates in terms of Dry Standard Cubic Feet Per Minute (DSCFM) (STP = 68 °F & 29.92 in. Hg)
- Lead (Pb) Concentrations in terms of Milligrams of Pb Per Dry Standard Cubic Meter (Mg/M^3)
- Pb Mass Rates in terms of Pounds Per Hour (Lbs/Hr)

The units were processing hematite during the testing.

A more detailed breakdown of each individual sample can be found in Appendix A.

IV. SAMPLING AND ANALYTICAL PROTOCOL

IV.1 Lead (Pb) – The Pb emission sampling was determined by employing U.S. EPA Method 29 (multiple metals train). Method 29 is an out of stack filtration method.

Three (3) samples were collected from each exhaust. Each sample was one hundred twenty (120) minutes in duration. Sampling for the North and South exhausts for each unit was conducted simultaneously.

The samples were collected isokinetically on quartz filters and in a nitric acid/hydrogen peroxide solution. A heated probe and filter system (maintained at 250 °F plus or minus 25 °F) was used to collect the samples.

The front half (nozzle/probe rinse & filter) and the nitric acid/hydrogen peroxide solutions (impingers) were analyzed for lead (Pb) by inductively coupled argon plasma mass spec (ICAP/MS) analysis. All the quality assurance and quality control procedures listed in the method were incorporated in the sampling and analysis. A diagram of the Pb sampling train is shown in Figure 1.

IV.2 Exhaust Gas Parameters – The exhaust gas parameters (air flow rate, temperature, moisture and density) were determined in conjunction with the other sampling by employing U.S. EPA Methods 1 through 4. Air flow rates, temperatures and moistures were determined using the Method 29 train. Bag samples

were collected from the Method 29 sampling trains and analyzed for oxygen (% O_2) and carbon dioxide (% CO_2) by Orsat. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis.

This report was prepared by:

David D. Engelhardt
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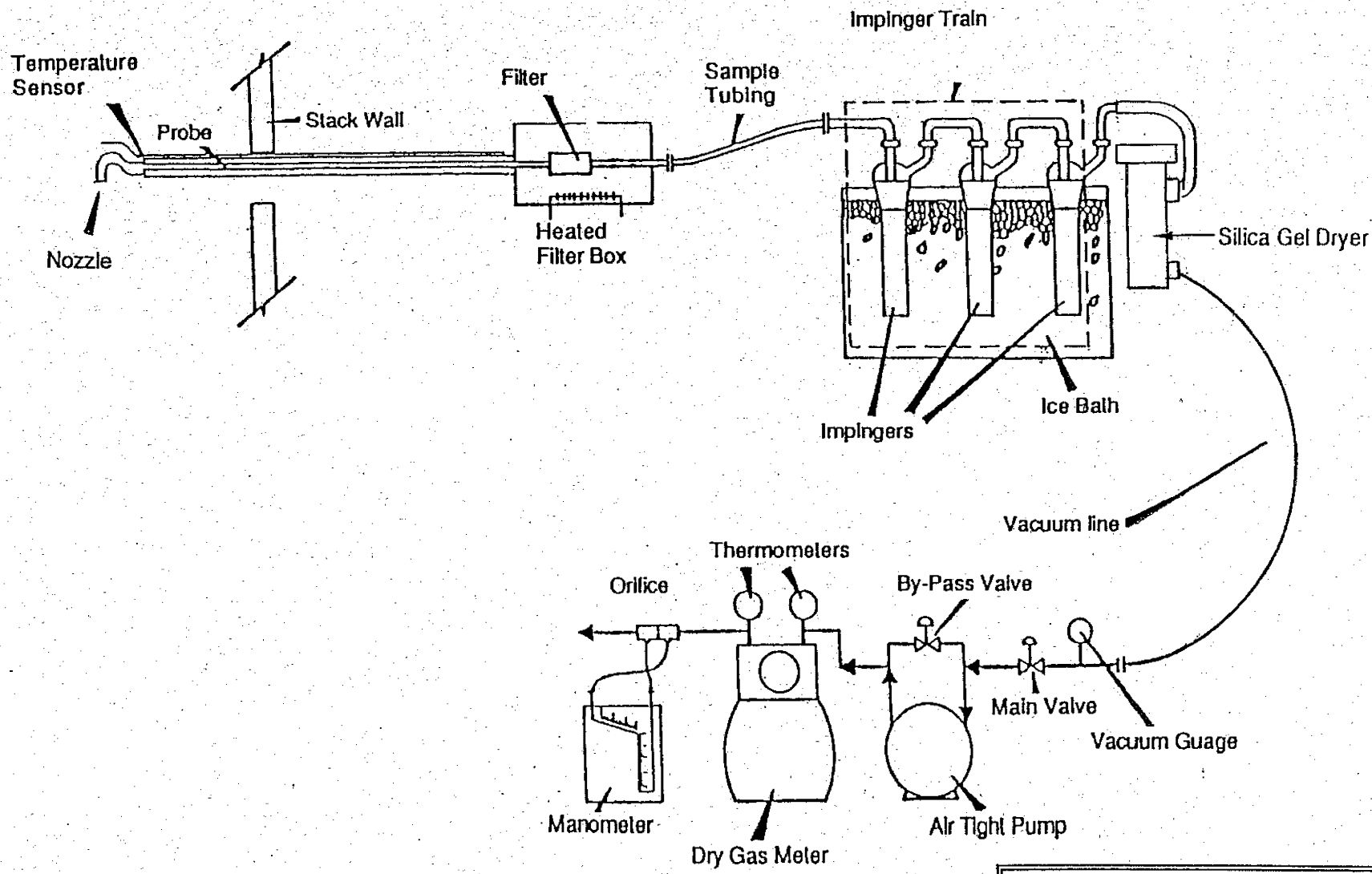

Figure 1

Lead (Pb)
Sampling Train