Report of ...

ROP Compliance Emission Testing

Performed for ...

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

On...

Various Sources

B4885

At the...

Tilden Mine
National Mine, Michigan

March 2020 & November - December, 2021

Project #: 053.54

Performed By:

Network Environmental, Inc.
Grand Rapids, MI

B4885_test_20211116

Performed for:

Cleveland-Cliffs, Inc.
Tilden Mining Company, L.C.
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Performed at the:

Tilden Mine
National Mine, MI

Performed by:

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I. INTRODUCTION

Network Environmental, Inc. was retained by Cleveland-Cliffs, Inc., Tilden Mining Company L.C. to perform ROP compliance emission testing at the Tilden Mine located in National Mine, Michigan. The particulate emissions were determined from Dryers 1 & 2 and various scrubbers associated with the ore crushing and finished pellet handling processes. The purpose of the testing was to document compliance with Michigan Department of Environment, Great Lakes and Energy (EGLE) - Air Quality Division ROP No. MI-ROP-B4885-2017b.

The total particulate sampling was conducted in accordance with U.S. EPA Reference Method 17. 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 periods of March 2020 and November - December 2021. 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..

II. PRESENTATION OF RESULTS

II.1 TABLE 1
PARTICULATE EMISSION RESULTS
DRYER 2
CLEVELAND-CLIFFS, INC.
TILDEN MINING COMPANY L.C.
NATIONAL MINE, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration		Mass Rate
					Lbs/1000 Lbs, Dry (2)	Grains/DSCF (3)	Lbs/Hr (4)
Dryer 2 South Exhaust Stack	1	11/16/21	11:27-13:34	40,277	0.0043	0.0023	0.79
	2	11/16/21	14:08-16:15	38,545	0.0028	0.0015	0.49
	3	11/16/21	16:37-19:17	38,961	0.0040	0.0022	0.72
	Average			**39,261**	**0.0037**	**0.0020**	**0.67**
Dryer 2 North Exhaust Stack	1	11/16/21	11:27-13:34	28,194	0.0057	0.0031	0.74
	2	11/16/21	14:08-16:15	27,649	0.0064	0.0034	0.80
	3	11/16/21	16:37-19:17	26,590	0.0091	0.0049	1.11
	Average			**27,478**	**0.0071**	**0.0038**	**0.88**
Dryer 2 Total	1	11/16/21	11:27-13:34	68,471	0.0049	0.0026	1.53
	2	11/16/21	14:08-16:15	66,194	0.0043	0.0023	1.29
	3	11/16/21	16:37-19:17	65,551	0.0061	0.0033	1.83
	Average			**66,739**	**0.0051**	**0.0027**	**1.55**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(2) Lbs/1000 Lbs, Dry = Pounds Of Particulate Per Thousand Pounds of Exhaust Gas On A Dry Basis
(3) Grains/DSCF = Grains Of Particulate Per Dry Standard Cubic Foot Of Exhaust Gas
(4) Lbs/Hr = Pounds Of Particulate Per Hour

II.2 TABLE 2
PARTICULATE EMISSION RESULTS
DRYER 1
CLEVELAND-CLIFFS, INC.
TILDEN MINING COMPANY L.C.
NATIONAL MINE, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration		Mass Rate
					Lbs/1000 Lbs, Dry (2)	Grains/DSCF (3)	Lbs/Hr (4)
Dryer 1	1	11/30/21	11:00-13:07	55,132	0.0038	0.0020	0.95
	2	11/30/21	13:55-16:00	54,081	0.0032	0.0017	0.80
	3	11/30/21	16:59-19:03	57,962	0.0021	0.0011	0.56
	Average			**55,725**	**0.0031**	**0.0016**	**0.77**

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(3) Grains/DSCF = Grains Of Particulate Per Dry Standard Cubic Foot Of Exhaust Gas
(4) Lbs/Hr = Pounds Of Particulate Per Hour

II.3 TABLE 3
PARTICULATE EMISSION RESULTS
VARIOUS SOURCES
ORE CRUSHING AND FINISHED PELLET HANDLING
CLEVELAND-CLIFFS, INC.
TILDEN MINING COMPANY L.C.
NATIONAL MINE, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration		Mass Rate
					Lbs/1000 Lbs, Dry (2)	Grains/DSCF (3)	Lbs/Hr (4)
13A to 17.1 Conveyor	1	3/3/20	10:41-12:44	6,165	0.0107	0.0056	0.28
	2	3/3/20	13:01-15:09	6,161	0.0096	0.0051	0.25
	3	3/3/20	15:28-17:31	6,454	0.0024	0.0012	0.06
	Average			**6,260**	**0.0076**	**0.0040**	**0.20**
Unit 2 Cooler	1	3/5/20	08:53-10:56	22,779	0.0025	0.0013	0.25
	2	3/5/20	11:10-13:14	22,469	0.0014	0.0007	0.14
	3	3/5/20	13:25-15:27	21,693	0.0052	0.0027	0.50
	Average			**22,313**	**0.0031**	**0.0016**	**0.30**
Unit 2 LHF	1	3/5/20	09:04-11:15	19,726	0.0032	0.0017	0.28
	2	3/5/20	11:46-13:49	19,740	0.0027	0.0014	0.23
	3	3/5/20	14:03-16:06	20,170	0.0008	0.0004	0.07
	Average			**19,879**	**0.0022**	**0.0012**	**0.19**
Unit 2 Product Conveyor	1	3/5/20	09:12-11:17	9,350	0.0016	0.0008	0.064
	2	3/5/20	11:37-13:42	9,279	0.0018	0.0009	0.072
	3	3/5/20	13:58-16:02	8,927	0.0018	0.0009	0.069
	Average			**9,185**	**0.0017**	**0.0009**	**0.069**

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(3) Grains/DSCF = Grains Of Particulate Per Dry Standard Cubic Foot Of Exhaust Gas
(4) Lbs/Hr = Pounds Of Particulate Per Hour

II.3 TABLE 3 (CONTINUED)
PARTICULATE EMISSION RESULTS
VARIOUS SOURCES
ORE CRUSHING AND FINISHED PELLET HANDLING
CLEVELAND-CLIFFS, INC.
TILDEN MINING COMPANY L.C.
NATIONAL MINE, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration		Mass Rate
					Lbs/1000 Lbs, Dry (2)	Grains/DSCF (3)	Lbs/Hr (4)
12A to 13 Conveyor	1	3/10/20	11:46-13:50	2,666	0.0014	0.0007	0.016
	2	3/10/20	14:08-16:13	2,627	0.0007	0.0004	0.008
	3	3/10/20	16:28-18:31	2,665	0.0006	0.0003	0.006
	Average			**2,653**	**0.0009**	**0.0005**	**0.010**
12B to 13 Conveyor	1	3/10/20	11:51-13:54	1,529	0.0018	0.0009	0.012
	2	3/10/20	14:13-16:17	1,505	0.0023	0.0012	0.015
	3	3/10/20	16:33-18:37	1,510	0.0014	0.0007	0.009
	Average			**1,514**	**0.0018**	**0.0009**	**0.012**
Primary Crusher	1	3/11/20	09:12-11:14	23,034	0.0029	0.0015	0.29
	2	3/11/20	11:28-13:31	23,037	0.0023	0.0012	0.23
	3	3/11/20	13:48-15:50	22,883	0.0010	0.0005	0.10
	Average			**22,985**	**0.0020**	**0.0011**	**0.21**
4B Conveyor	1	3/12/20	09:36-11:40	13,596	0.0284	0.0148	1.69
	2	3/12/20	12:10-14:14	12,162	0.0371	0.0195	1.99
	3	3/12/20	14:51-16:54	13,229	0.0186	0.0097	1.06
	Average			**12,995**	**0.0280**	**0.0147**	**1.58**

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(3) Grains/DSCF = Grains Of Particulate Per Dry Standard Cubic Foot Of Exhaust Gas
(4) Lbs/Hr = Pounds Of Particulate Per Hour

II.3 TABLE 3 (CONTINUED)
PARTICULATE EMISSION RESULTS
VARIOUS SOURCES
ORE CRUSHING AND FINISHED PELLET HANDLING
CLEVELAND-CLIFFS, INC.
TILDEN MINING COMPANY L.C.
NATIONAL MINE, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration		Mass Rate
					Lbs/1000 Lbs, Dry (2)	Grains/DSCF (3)	Lbs/Hr (4)
1 to 2 Conveyor	1	11/17/21	10:34-12:38	7,208	0.0029	0.0015	0.094
	2	11/17/21	13:08-15:11	6,899	0.0022	0.0012	0.068
	3	11/17/21	15:28-17:31	7,138	0.0026	0.0013	0.082
	Average			**7,082**	**0.0026**	**0.0013**	**0.082**
17 Conveyor (17.1-17.2)	1	11/30/21	12:25-14:34	7,277	0.0151	0.0079	0.49
	2	11/30/21	14:58-17:48	7,256	0.0135	0.0071	0.44
	3	11/30/21	18:09-20:16	7,316	0.0146	0.0076	0.48
	Average			**7,283**	**0.0144**	**0.0075**	**0.47**
Unit 1 Bentonite Feeder	1	11/30/21	12:08-14:15	4,049	0.0054	0.0028	0.098
	2	11/30/21	14:35-16:41	3,843	0.0026	0.0014	0.044
	3	11/30/21	17:00-19:06	4,081	0.0030	0.0015	0.054
	Average			**3,991**	**0.0037**	**0.0019**	**0.066**
15.8 to 15.9 Conveyor	1	12/1/21	10:41-12:47	3,590	0.0153	0.0080	0.25
	2	12/1/21	13:24-15:27	3,558	0.0146	0.0076	0.23
	3	12/1/21	15:44-17:48	3,423	0.0151	0.0079	0.23
	Average			**3,524**	**0.0150**	**0.0078**	**0.24**

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(3) Grains/DSCF = Grains Of Particulate Per Dry Standard Cubic Foot Of Exhaust Gas
(4) Lbs/Hr = Pounds Of Particulate Per Hour

II.3 TABLE 3 (CONTINUED)
PARTICULATE EMISSION RESULTS
VARIOUS SOURCES
ORE CRUSHING AND FINISHED PELLET HANDLING
CLEVELAND-CLIFFS, INC.
TILDEN MINING COMPANY L.C.
NATIONAL MINE, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration		Mass Rate
					Lbs/1000 Lbs, Dry (2)	Grains/DSCF (3)	Lbs/Hr (4)
16.1 to 17.1 Conveyor	1	12/1/21	10:59-13:04	3,655	0.0015	0.00080	0.025
	2	12/1/21	13:27-15:31	3,493	0.0013	0.00065	0.020
	3	12/1/21	15:48-17:52	3,569	0.0022	0.00116	0.035
	Average			**3,572**	**0.0017**	**0.00087**	**0.027**
4A to 4A1 Conveyor	1	12/2/21	10:20-12:23	4,517	0.0029	0.00152	0.059
	2	12/2/21	12:40-14:43	4,549	0.0012	0.00062	0.024
	3	12/2/21	15:11-17:14	4,558	0.0017	0.00089	0.035
	Average			**4,541**	**0.0019**	**0.00101**	**0.039**
4C to 4D &4S Conveyor	1	12/2/21	09:53-12:06	3,320	0.0159	0.0083	0.24
	2	12/2/21	12:28-14:34	3,385	0.0085	0.0044	0.13
	3	12/2/21	14:51-16:58	3,377	0.0112	0.0058	0.17
	Average			**3,361**	**0.0119**	**0.0062**	**0.18**

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(3) Grains/DSCF = Grains Of Particulate Per Dry Standard Cubic Foot Of Exhaust Gas
(4) Lbs/Hr = Pounds Of Particulate Per Hour

III. DISCUSSION OF RESULTS

The results of the testing are summarized in Tables 1 through 3 (Sections II.1 through II.3).

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)
- Particulate Concentrations in terms of Pounds Per Thousand Pounds on a Dry Basis (Lbs/1000 Lbs, Dry) & Grains Per Dry Standard Cubic Foot (Grains/DSCF)
- Particulate Mass Rates in terms of Pounds Per Hour (Lbs/Hr)

The Taconite MACT Limits are as follows:

1. Existing ore crushing and handling emission units = 0.008 Grains/DSCF
2. Finished pellet handling emission units = 0.008 Grains/DSCF
3. Existing ore dryer = 0.052 Grains/DSCF

In addition to the Taconite MACT Limits, the ROP has established the following limits:

1. Dryers 1 & 2 = 0.10 Lbs/1000 Lbs, Dry
2. Dust Collectors = 0.10 Lbs/1000 Lbs, Dry

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

IV. SAMPLING AND ANALYTICAL PROTOCOL

IV.1 Total Particulate – The particulate emission sampling was conducted in accordance with U.S. EPA Reference Method 17. Method 17 is an in-stack filtration method.

Three (3) samples were collected from each exhaust. Each sample was one hundred twenty (120) minutes in duration. Sampling for the Dryer 2 North and South exhausts was conducted simultaneously.

The samples were collected isokinetically from the exhausts and analyzed for particulate by gravimetric analysis. All the quality assurance and quality control procedures listed in the method were incorporated in the sampling and analysis. Figure 1 is a diagram of the Method 17 particulate sampling train.

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 17 train. Bag samples were collected from the Method 17 sampling trains on Dryers 1 & 2 and analyzed for oxygen (% O_2) and carbon dioxide (% CO_2) by Orsat. The ambient default values (20.9 % O_2 & 0.0 % CO_2) were used for all of the other scrubber testing. 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
Vice President

This report was reviewed by:

R. Scott Cargill
Project Manager

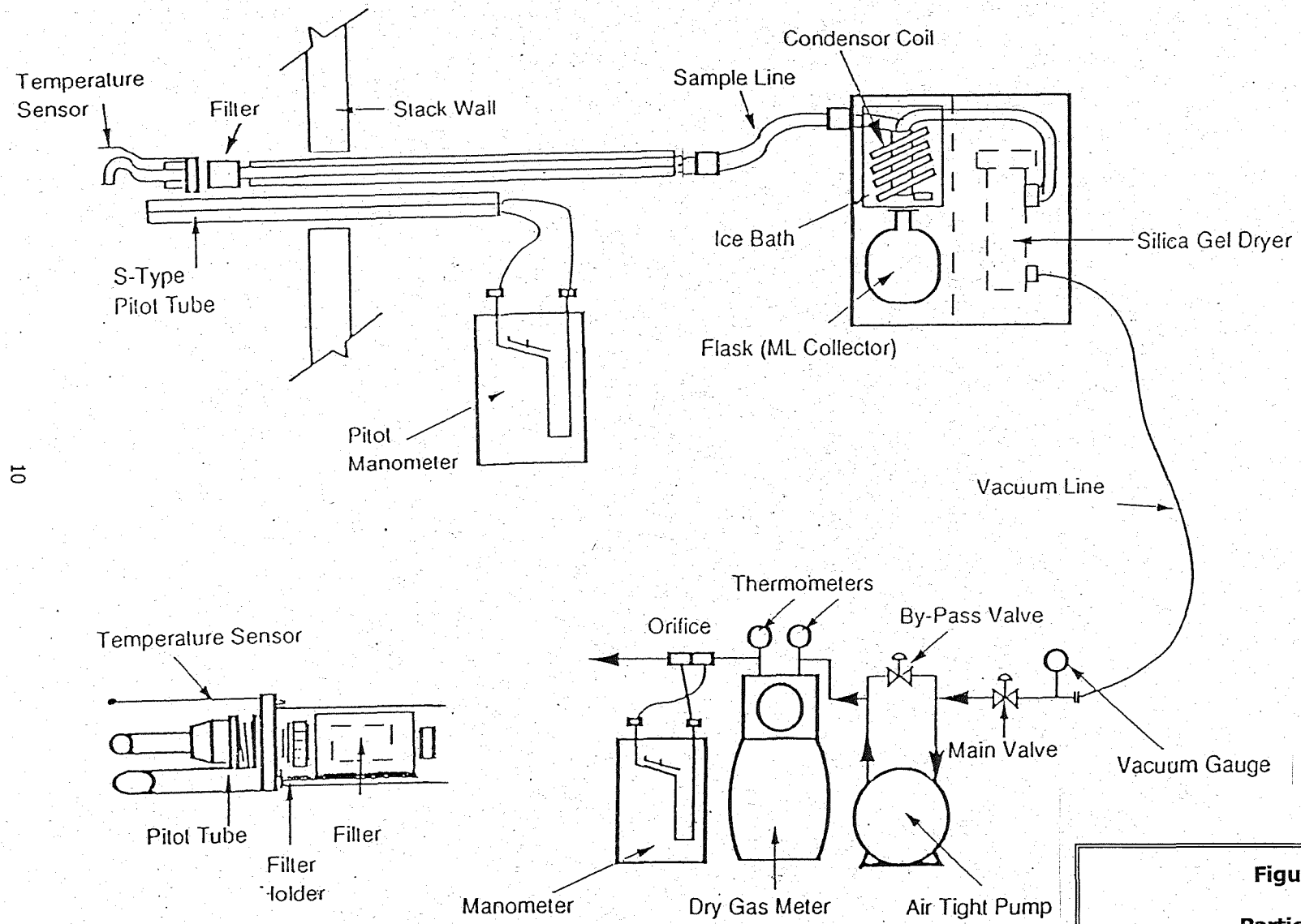

Figure 1

Particulate Sampling Train