Report of a ...

PEMS RATA

Performed for ...

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

On...

Boiler 4 (EU-BOILER4)

At the...

Tilden Mine
National Mine, Michigan

June 13, 2023

Project #: 053.61

Performed By:

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Grand Rapids, MI

B4885_test_20230613

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I. INTRODUCTION

Network Environmental, Inc. was retained by the Tilden Mining Company, L.C. of Ishpeming, Michigan to perform a relative accuracy test audit (RATA) at the Tilden Mine located in National Mine, Michigan.

The purpose of the testing was to conduct a Relative Accuracy Test Audit (RATA) on the Predictive Emission Monitoring System (PEMS) that services the Gas Fired Boiler #4 (EU-BOILER4). The PEMS on the boiler is for oxides of nitrogen (NO_x) and oxygen (O_2). The PEMS was installed and the RATA was performed in order to meet the requirements of Michigan Department of Environment, Great Lakes & Energy (EGLE), Air Quality Division ROP No. MI-ROP-B4885-2017b.

The RATA was conducted in accordance with 40 CFR Part 60 Appendix B Performance Specification 16 (PS-16).

The following reference test methods were used to conduct the sampling:

- Oxides of Nitrogen (NO_x) – U.S. EPA Method 7E
- Oxygen (O_2) – U.S. EPA Method 3A

The sampling was performed on June 13, 2023 by Stephan K. Byrd and David D. Engelhardt of Network Environmental, Inc.. Assisting with the testing were Mr. Thomas O'Brien of the Tilden Mining Company, L.C. and the operating staff of the facility. Mr. Daniel J. Droste of the Michigan Department of Environment, Great Lakes & Energy (EGLE) - Air Quality Division was present to observe the sampling and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
NO_x (LBS/MMBTU) RELATIVE ACCURACY TEST AUDIT RESULTS
BOILER #4 (EU-BOILER4)
TILDEN MINING COMPANY, L.C.
NATIONAL MINE, MICHIGAN
JUNE 13, 2023

Run #	Time	REFERENCE METHOD			PEMS	DIFF
		NO_x (1)	O_2 (2)	Lbs/MMBTU	Lbs/MMBTU	
1	07:48-08:13	20.2	4.2	0.026	0.026	0.000
2	08:23-08:48	20.2	4.2	0.026	0.026	0.000
3	09:00-09:25	20.1	4.3	0.026	0.026	0.000
4	09:36-10:01	20.0	4.3	0.026	0.026	0.000
5	10:13-10:38	20.1	4.4	0.026	0.026	0.000
6	10:49-11:14	20.0	4.3	0.026	0.026	0.000
7	11:25-11:50	20.2	4.3	0.026	0.026	0.000
8	12:00-12:25	20.1	4.4	0.026	0.026	0.000
9	12:35-13:00	20.2	4.3	0.026	0.026	0.000

Mean Reference Value = 0.02600

Mean of the Difference = 0.00000

Standard Deviation = 0.00000

Confidence Co-efficient = 0.00000

Relative Accuracy (RA) = 0.00% of the mean of the reference method

(1) Concentration in term of PPM by volume on a dry basis
(2) Concentration in terms of % on a dry basis
(3) RA needs to be less than 20%.

III. DISCUSSION OF RESULTS

III.1 NO_x (LBS/MMBTU) RATA – The results of the NO_x Lbs/MMBTU RATA can be found in Table 1 (Section II.1). The relative accuracy calculations were performed in terms of Lbs/MMBTU. The Lbs/MMBTU results were calculated using the formula found in Section 2.1 of Method 19 for O_2 on a dry basis. The F factor used was 8,710. Nine (9) twenty-five (25) minute samples were collected from the boiler exhaust. Raw DAS output results were corrected per Equation 7E-5.

The relative accuracy for the NO_x CEMS using Lbs/MMBTU was **0.00%** of the mean of the reference method samples.

According to Performance Specification 16 in 40 CFR Part 60 Appendix B, "The relative accuracy (RA) of the CEMS shall be no greater than 20 percent of the mean value of the reference method test data."

IV. SOURCE DESCRIPTION

Boiler 4 is a natural gas-fired boiler with a rated capacity of 225 KLbs/Hr of steam. The boiler is equipped with low NO_x burners. Boiler 4 is used to provide process steam to the facility. During the testing periods, the boiler was operated at approximately 50% of capacity. Steam Load and Gas Flow data during the sampling can be found in Appendix B.

The PEMS is a Wunderlich-Malec, Model No. PowerEMS, Serial No. SWCEM EU-BOILER4.

The boiler is exhausted to a stack through a four (4) foot by eight (8) foot breaching. A schematic diagram of the source and sampling location can be found in Appendix E.

V. SAMPLING AND ANALYTICAL PROTOCOL

The sampling methods used for the reference method determinations were as follows:

V.1 Oxides of Nitrogen – The NO_x sampling was conducted in accordance with U.S. EPA Reference Method 7E. A Thermo Environmental Model 42H gas analyzer was used to monitor the boiler exhaust. A

heated probe was used to extract the sample gases from the exhaust stack. A heated Teflon sample line was used to transport the exhaust gases to a gas conditioner to remove moisture and reduce the temperature. From the gas conditioner stack gases were passed to the analyzer. The analyzer produces instantaneous readouts of the NO_x concentrations (PPM).

The analyzer was calibrated by direct injection prior to the testing. A span gas of 55.6 PPM was used to establish the initial instrument calibration. A calibration gas of 25.1 PPM was used to determine the calibration error of the analyzer. A direct injection of 50.9 PPM nitrogen dioxide (NO_2) was performed to show the conversion efficiency of the monitor. The conversion efficiency data can be found in Appendix A. The sampling system (from the back of the stack probe to the analyzer) was injected using the 25.1 PPM gas to determine the system bias. After each sample, a system zero and system injection of 25.1 PPM were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the boiler. A diagram of the NO_x sampling train is shown in Figure 1.

V.2 Oxygen – The O_2 sampling was conducted in accordance with U.S. EPA Reference Method 3A. A Servomex Model 1400M portable stack gas analyzer was used to monitor the boiler exhaust. A heated probe was used to extract the sample gas from the stack. A heated Teflon sample line was used to transport the exhaust gases to a gas conditioner to remove moisture and reduce the temperature. From the gas conditioner stack gases were passed to the analyzer. The analyzer produces instantaneous readouts of the O_2 concentrations (%).

The analyzer was calibrated by direct injection prior to the testing. A span gas of 21.0% was used to establish the initial instrument calibration. Calibration gases of 12.0% and 6.03% were used to determine the calibration error of the analyzer. The sampling system (from the back of the stack probe to the analyzer) was injected using the 6.03% gas to determine the system bias. After each sample, a system zero and system injection of 6.03% were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the boiler. A diagram of the O_2 sampling train is shown in Figure 1.

V.3 Sampling Locations – Prior to the initial RATA sampling (05/19), a twenty-four (24) point stratification test (as described in U.S. EPA Method 7E) was performed for the exhaust breaching. The breaching is 48 inches deep by 96 inches high with 4 sampling ports. The dimensions used for the stratification test were as follows:

Traverse Point	Dimension (Inches)
1	4.00
2	12.00
3	20.00
4	28.00
5	36.00
6	44.00

The stratification test showed no stratification (< 5%), so a single sampling point (Port 3 - Point 3) was used for the gas sampling. The results of the stratification test can be found in Appendix A.

This report was prepared by:

David D. Engelhardt
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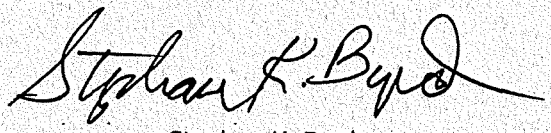

Stephan K. Byrd
President

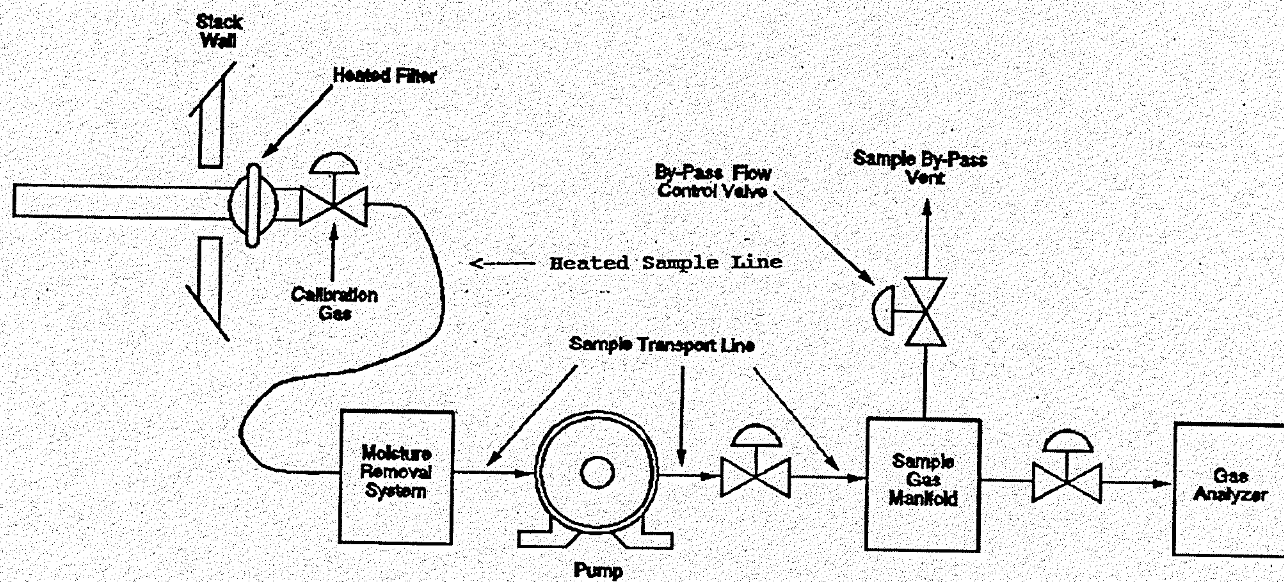

Figure 1

NO_x & O_2
Sampling Train