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AIR QUALITY DIVISION

Relative Accuracy Test Audit

Performed for the...

Michigan Sugar Company
Caro, Michigan

On...

Gas Fired Boiler #4

December 1, 2022

Project #: 022.61

By...

Network Environmental, Inc.
Grand Rapids, MI

Performed For:

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TABLE OF CONTENTS

	<u>Page</u>
I. Introduction	1
II. Presentation of Results	2
II.1 Table 1 – NO _x (Lbs/MMBTU) Relative Accuracy Test Results	2
III. Discussion of Results	3
IV. Source Description	3
V. Continuous Monitoring System Description	3
VI. Sampling and Analytical Protocol	4-5
Figure 1 – NO _x & O ₂ Sampling Train Diagram	6

Appendices

Reference Method DAS Data	A
CEMS Data	B
Calibration Gas & Analyzer Specification Data	C
Calculations	D
Raw Data	E

I. INTRODUCTION

Network Environmental, Inc. was retained by the Michigan Sugar Company to conduct a relative accuracy test audit (RATA) on their Gas Fired Boiler #4 located in Caro, Michigan (SRN: B2875).

The CEMS on the boiler is for oxides of nitrogen (NO_x) and oxygen (O₂) and is required by Permit No. MI-ROP-B2875-2019. The RATA was conducted in accordance with 40 CFR Part 60 Appendix B Performance Specifications 2 for NO_x and 3 for O₂.

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

- Oxides of Nitrogen (NO_x) – U.S. EPA Method 7E
- Oxygen (O₂) – U.S. EPA Method 3A

The sampling was performed on December 1, 2022 by Richard D. Eerdmans and David D. Engelhardt of Network Environmental, Inc.. Assisting with the testing were Ms. Meaghan Martuch of the Michigan Sugar Company and the operating staff of the facility. Ms. Lindsey Wells and Mr. Nathanael Gentle of the Michigan Department of Environment, Great Lakes and Energy (EGLE) - Air Quality Division were present to observe the sampling and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
NO_x (LBS/MMBTU) RELATIVE ACCURACY TEST RESULTS
BOILER #4
MICHIGAN SUGAR COMPANY
CARO, MICHIGAN
DECEMBER 1, 2022

Run #	Time	REFERENCE METHOD			CEM	DIFF
		NO _x ⁽¹⁾	O ₂ ⁽²⁾	Lbs/MMBTU	Lbs/MMBTU	
1	11:39-12:04	88.2	3.3	0.109	0.104	0.005
2	12:28-12:53	88.6	3.3	0.109	0.104	0.005
3	13:06-13:31	87.8	3.3	0.108	0.104	0.004
4	13:48-14:13	87.8	3.3	0.108	0.104	0.004
5	14:27-14:52	87.4	3.3	0.108	0.103	0.005
6	15:03-15:28	87.7	3.2	0.108	0.103	0.005
7	15:40-16:05	87.1	3.3	0.107	0.103	0.004
8	16:17-16:42	87.9	3.2	0.108	0.103	0.005
9	16:58-17:23	88.4	3.2	0.108	0.103	0.005

Mean Reference Value 0.10811

Absolute Value of the Mean of the Difference 0.00467

Standard Deviation 0.00050

Confidence Co-efficient 0.00038

Relative Accuracy = 4.67% of the mean of the reference method

(1) = Concentration in terms of PPM by volume on a dry basis

(2) = Concentration in terms of %

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 in accordance with U.S. EPA Reference Method 19. The Lbs/MMBTU results were calculated using the formula found in Section 2.1 of Method 19 for O₂ 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 **4.67%** of the mean of the reference method samples.

According to Performance Specification 2 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 in terms of the units of the emission standard or 10 percent of the applicable standard, whichever is greater."

IV. SOURCE DESCRIPTION

Boiler 4 is a natural gas-fired boiler with a rated capacity of 146.5 MMBTU/Hr of heat input (maximum gas flow of 132,000 SCFH) and a steam output of 120,000 pounds per hour. The boiler was manufactured by Nebraska Boiler and is equipped with an economizer. Boiler 4 is used to provide process steam and heat to the facility. During the testing period, the boiler was operated at approximately 55.1% of capacity based on natural gas flow. Gas Flow data during the sampling can be found in Appendix B.

V. CONTINUOUS MONITORING SYSTEM DESCRIPTION

Boiler #4 – The NO_x monitor is a Thermo Environmental, Model 42iLS, Serial No. 1417862249, with a span of 0-250 PPM full scale. The O₂ monitor is a Brand Gaus Model 4705, Serial No. 11325), with a span of 0-25% full scale. Both analyzers measure concentrations on a dry basis.

VI. SAMPLING AND ANALYTICAL PROTOCOL

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

VI.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 191.0 PPM was used to establish the initial instrument calibration. Calibration gases of 54.6 PPM and 101.0 PPM were used to determine the calibration error of the analyzer. A direct injection of 50.9 PPM nitrogen dioxide (NO₂) 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 101.0 PPM gas to determine the system bias. After each sample, a system zero and system injection of 101.0 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.

VI.2 Oxygen – The O₂ 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 O₂ concentrations (%).

The analyzer was calibrated by direct injection prior to the testing. A span gas of 20.85% 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

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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.

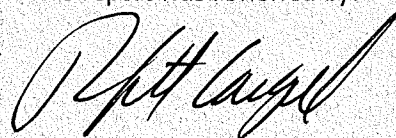
The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the boiler. A diagram of the O₂ sampling train is shown in Figure 1.

This report was prepared by:

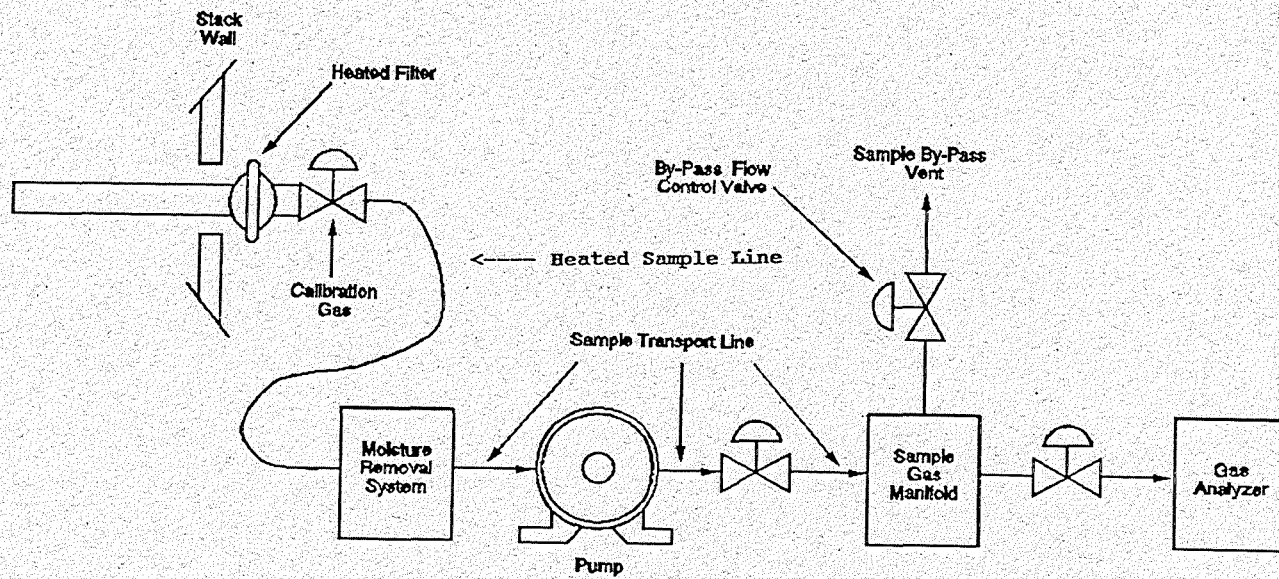


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9

Figure 1
NO_x & O₂
Sampling Train