Performed For:

Michigan Sugar Company
2600 S. Euclid
Bay City, MI 48706
Contact: Angel Pichla
Phone: (989) 686-0164 Ext. 216
Cell: (989) 225-0092
e-mail: Angel. Pichla@Michigansugar.com

Performed by:

Network Environmental, Inc.
2629 Remico, Suite B
Grand Rapids, MI 49519
Contact: David D. Engelhardt
Phone: (616) 530-6330
Fax: (616) 530-0001
e-mail: netenviro@aol.com

TABLE OF CONTENTS

Appendices

I. INTRODUCTION

Network Environmental, Inc. was retained by the Michigan Sugar Company to perform a Relative Accuracy Test Audit (RATA) on the Continuous Emissions Monitoring Systems (CEMS) that services Boiler #8 (EUBOILER #8) at their Bay City, Michigan facility (SRN: B1493 - Bay County). The CEMS on the boiler is for oxides of nitrogen (NO_x) and oxygen (O_2) as required by ROP No. MI-ROP-1493-2021. In addition to the RATA, a relative accuracy test (RAT) was conducted on the new oxygen (O_2) analyzer.

The RATA and RAT were performed on April 6, 2023. Richard D. Eerdmans and David D. Engelhardt of Network Environmental, Inc. conducted the RATA and RAT in accordance with 40 CFR Part 60 Appendix B Performance Specifications 2 for NO_x and 3 for O_2.

Assisting with the RATA were Ms. Angel Pichla and Mr. Eric Rupprecht of the Michigan Sugar Company and the operating staff of the facility.

II. PRESENTATION OF RESULTS

<div style="border:1px solid">

II.1 TABLE 1
NOₓ (LBS/MMBTU) RELATIVE ACCURACY TEST RESULTS
BOILER #8
MICHIGAN SUGAR COMPANY
BAY CITY, MICHIGAN
APRIL 6, 2023

Run #	Time	REFERENCE METHOD			CEM	DIFF
		$NOx^{(1)}$	$O_2^{(2)}$	Lbs/MMBtu	Lbs/MMBtu	
1	08:40-09:05	34.2	3.9	0.044	0.042	0.002
2	09:16-09:41	34.1	3.9	0.044	0.042	0.002
3	09:51-10:16	34.1	3.9	0.044	0.042	0.002
4	10:26-10:51	34.0	3.9	0.043	0.042	0.001
5	11:00-11:25	33.7	3.9	0.043	0.042	0.001
6	11:35-12:00	33.7	3.9	0.043	0.042	0.001
7	12:10-12:35	34.0	4.0	0.044	0.042	0.002
8	12:45-13:10	34.2	3.9	0.044	0.042	0.002
9	13:19-13:44	34.2	3.9	0.044	0.043	0.001

Mean Reference Value 0.04367

Absolute Value of the Mean of the Difference 0.00156

Standard Deviation 0.00053

Confidence Co-efficient 0.00041

Relative Accuracy = 4.49% of the mean of the reference method

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

</div>

II.2 TABLE 2
O_2 (%) RELATIVE ACCURACY TEST RESULTS
BOILER #8
MICHIGAN SUGAR COMPANY
BAY CITY, MICHIGAN
APRIL 6, 2023

Run #	Time	REFERENCE METHOD O_2 [1]	CEM O_2 [1]	DIFF
1	08:40-09:05	3.9	3.9	0.0
2	09:16-09:41	3.9	3.8	0.1
3	09:51-10:16	3.9	3.8	0.1
4	10:26-10:51	3.9	3.8	0.1
5	11:00-11:25	3.9	3.8	0.1
6	11:35-12:00	3.9	3.8	0.1
7	12:10-12:35	4.0	3.8	0.2
8	12:45-13:10	3.9	3.8	0.1
9	13:19-13:44	3.9	3.8	0.1

Mean Reference Value 3.91111

Absolute Value of the Mean of the Difference 0.10000

Standard Deviation 0.05000

Confidence Co-efficient 0.03843

Relative Accuracy = 3.54% of mean of reference method

(1) = Concentration in terms of %

3

III. DISCUSSION OF RESULTS

III.1 Boiler #8 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 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 **4.49%** 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."

III.2 Boiler #8 O$_2$ (%) RAT – The results of the O$_2$ RAT can be found in Table 2 (Section II.2). The relative accuracy calculations were performed in terms of %. Nine (9) samples were collected from the boiler exhaust. Raw DAS output results were corrected per Equation 7E-5.

The relative accuracy for the O$_2$ CEMS using % was **3.54%** of the mean of the reference method samples.

According to Performance Specification 3 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 or a difference of 1 percent oxygen, whichever is greater."

III.3 Calibration Drift Test – The highest percent calibration drift (CD) for the new O$_2$ monitor on Boiler #8 was 0.26% for the high level and 0.03% for the low level during the seven day drift test. The drift test was conducted by Michigan Sugar staff over the period of February 20-26, 2023 and can be found in Appendix B.

4

IV. SOURCE DESCRIPTION

Boiler #8 is a Cleaver-Brooks natural gas-fired high pressure boiler with a rated capacity of 243 MMBTU/Hr and a steam output of 200,000 pounds per hour. The boiler is equipped with a low NO_x burner and flue gas recirculation. Boiler 8 is used to provide process steam and heat to the facility. Boiler #8 was operated during the testing period at approximately 54.1% of rated capacity.

Steam Flow and Gas Flow data during the sampling for the boiler can be found in Appendix B.

V. CONTINUOUS MONITORING SYSTEM DESCRIPTION

The continuous emission monitoring systems (CEMS) servicing the boiler are comprised of NO_x and O_2 monitors as follows:

Boiler #8 – The NO_x monitor is a Thermo Fisher, Model 42iHL, Serial No. 609716090, with a span of 0-80 PPM full scale. The O_2 monitor is a Brand-Gaus, Model 4710, Serial No. 11857, with a span of 0-25% full scale. All analyzers measure concentrations on a dry basis.

The data produced by the CEMS is collected on a computer system that converts one minute analog averages to the appropriate hourly average in terms of the emission limits for the boiler (Lbs/MMBTU). The system also produces a thirty-day average for daily NO_x emissions.

VI. SAMPLING AND ANALYTICAL PROTOCOL

The RATA's were performed in accordance with 40 CFR Part 60 Appendix B Performance Specifications 2 for NO_x and 3 for O_2. 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 54.6 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.

VI.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 gases 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 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 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.

VI.3 Sampling Location – The sampling location met the minimum requirement of Performance
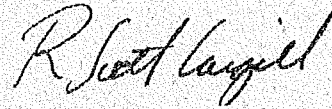
Specification 2 (2 duct diameters downstream and 0.5 duct diameter upstream from the nearest disturbances).

This report was prepared by:

David D. Engelhardt
Vice President

This report was reviewed by:
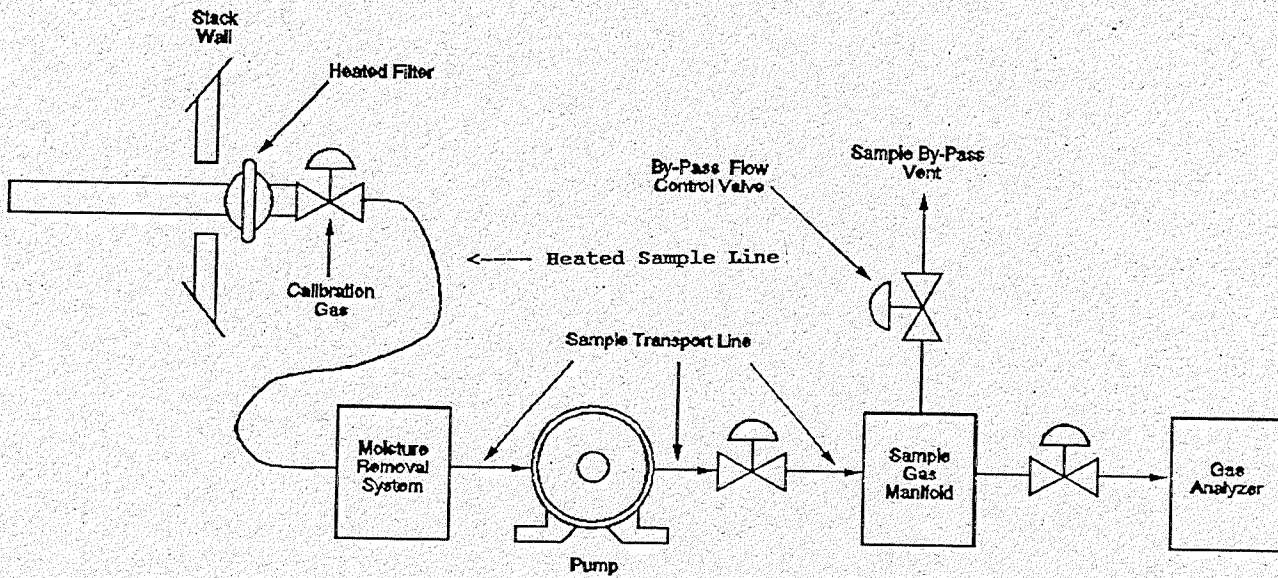
R. Scott Cargill
Project Manager

Figure 1

NO$_x$ & O$_2$
Sampling Train

Stack Wall

Heated Filter

Calibration Gas

Heated Sample Line

By-Pass Flow Control Valve

Sample By-Pass Vent

Sample Transport Line

Moisture Removal System

Pump

Sample Gas Manifold

Gas Analyzer

8