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Report of...

Compliance Emission Sampling

performed for...

Michigan Sugar Company
Croswell, Michigan

on the

#4 Riley Boiler

February 17, 2016

022.38

Network Environmental, Inc.
Grand Rapids, MI

performed for

Michigan Sugar Company
2600 S. Euclid
Bay City, MI 48706
Contact: Steven Smock
Phone: (989) 686-1549 Ext. 236
steven.smock@michigansugar.com

peformed at

Michigan Sugar Company
Croswell, Michigan

performed by

Network Environmental, Inc.
2629 Remico Street, Suite B
Grand Rapids, MI 49509
Contact: David D. Engelhardt
Telephone: (616) 530-6330
Fax: (616) 530-0001
e-mail: netenviro@aol.com

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I. INTRODUCTION

Michigan Sugar Company of Bay City, Michigan, retained Network Environmental, Inc., to perform compliance emission sampling at their Croswell facility. The purpose of the sampling was to demonstrate compliance with their Permit to Install 21-15A. The following sampling was conducted at the facility:

Parameter Sampled	Test Method	Source Sampled
Oxides of Nitrogen (NO_x)	U.S. EPA Method 7E	#4 Riley Boiler
Exhaust Gas Parameters (air flow rate, temperature, moisture & density)	U.S. EPA Methods 1 through 4	#4 Riley Boiler

The sampling was performed on February 17, 2016 by Stephan K. Byrd and David D. Engelhardt of Network Environmental, Inc. Assisting with the sampling was Mr. Steven Smock of the Michigan Sugar Company. Ms. Sharon LeBlanc of the MDEQ-Air Quality Division was present to observe the testing and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
TOTAL OXIDES OF NITROGEN (NO_x) EMISSION RESULTS SUMMARY
MICHIGAN SUGAR COMPANY
CROSWELL, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration PPM (2)	Mass Emission Rate	
						Lbs/Hr (3)	Lbs/MMBTU (4)
#4 Riley Boiler	1	2/17/16	08:45-09:45	27,373	80.2	15.62	0.103
	2	2/17/16	09:55-10:55	26,206	78.9	14.72	0.104
	3	2/17/16	11:05-12:05	26,620	81.5	15.44	0.105
	Average			**26,733**	**80.2**	**15.26**	**0.104**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (Standard Temperature & Pressure = 68 °F & 29.92 in. Hg)
(2) PPM = Parts Per Million (v/v) On A Dry Basis
(3) Lbs/Hr = Pounds Per Hour
(4) Lbs/MMBTU = Pounds Per Million BTU Of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 8,710 DSCF/MMBTU)

III. DISCUSSION OF RESULTS

The results of the emission sampling are summarized in Table 1 (Section II.1). The results are presented as follows:

III.1 NO_x

Table 1– Oxides of Nitrogen (NO_x) Emission Results Summary

- Source
- Sample
- Date
- Time
- Air Flow Rate (DSCFM) – Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- NO_x Concentration (PPM) – Parts Per Million (v/v) on a Dry Basis
- NO_x Mass Emission Rate (Lbs/Hr) – Pounds of NO_x Per Hour
- NO_x Mass Emission Rate (Lbs/MMBTU) – Pounds of NO_x Per Million BTU of Heat Input

All the NO_x sample data was calibration corrected using Equation 7E-1 from U.S. EPA Method 7E. The NO_x Lbs/MMBTU results were calculated using Equation 2.1 from U.S. EPA Method 19. The F Factor used for the Lbs/MMBTU calculations was 8,710 DSCF/MMBTU.

IV. SOURCE DESCRIPTION

The #4 Boiler is a natural gas fired boiler rated capacity gas flow of 179,000 SCFH and a steam output of 150,000 pounds per hour. The boiler was manufactured by Riley and is equipped with an economizer. Boiler 4 is used to provide steam and heat to the facility. The boiler was operated at approximately 110,000 pounds of steam per hour during the testing. Source operating data during the sampling can be found in Appendix B.

V. SAMPLING AND ANALYTICAL PROTOCOL

Sampling was conducted on the 74.5 inch by 74.5 inch exhaust duct at a location greater than 5 duct diameters downstream and greater than 2 duct diameters upstream from the nearest disturbances.

There are five (5) sampling ports. Twenty (20) sampling points (four per port) were used for the air flow determinations.

V.1 Oxides of Nitrogen – The NO_x sampling was conducted in accordance with U.S. EPA Reference Method 7E. A Thermal Environmental Model 42H gas analyzer was used to monitor the boiler exhaust. 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 170.3 PPM was used to establish the initial instrument calibration. Calibration gases of 98.93 PPM and 54.58 PPM 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 98.93 PPM gas to determine the system bias. After each sample, a system zero and system injection of 98.93 PPM were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified. A NO_2 gas of 51.97 PPM was used to challenge the analyzer to show conversion efficiency. The results were 94.29% conversion.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the boiler. The analyzer averages were corrected for calibration error and drift using formula EQ.7E-1 from 40 CFR Part 60, Appendix A, Method 7E. A diagram of the sampling train is shown in Figure 1.

V.2 Oxygen & Carbon Dioxide – The O_2 & CO_2 sampling was conducted in accordance with U.S. EPA Reference Method 3A. Servomex Model 1400M portable stack gas analyzers were used to monitor the boiler exhaust. 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 analyzers. The analyzers produce instantaneous readouts of the O_2 & CO_2 concentrations (%).

The analyzers were calibrated by direct injection prior to the testing. Span gases of 20.96% O_2 and 20.42% CO_2 were used to establish the initial instrument calibrations. Calibration gases of 11.99% O_2/6.02% CO_2 and 5.942% O_2/12.01% CO_2 were used to determine the calibration error of the analyzers. The sampling system (from the back of the stack probe to the analyzers) was injected using the 11.99% O_2/6.02% CO_2 gas to determine the system bias. After each sample, a system zero and system injection of 11.99% O_2/6.02% CO_2 were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified.

The analyzers were calibrated to the output of the data acquisition system (DAS) used to collect the data from the boiler. The analyzer averages were corrected for calibration error and drift using formula EQ.7E-1 from 40 CFR Part 60, Appendix A, Method 7E. A diagram of the sampling train is shown in Figure 1.

V.3 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. Airflow rates, temperatures and moistures were determined by performing pitot traverses during each of the three test runs. One moisture sample was collected. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis.

This report was prepared by:
Stephan K. Byrd
Stephan K. Byrd
President

This report was reviewed by:
David D. Engelhardt
David D. Engelhardt
Vice President

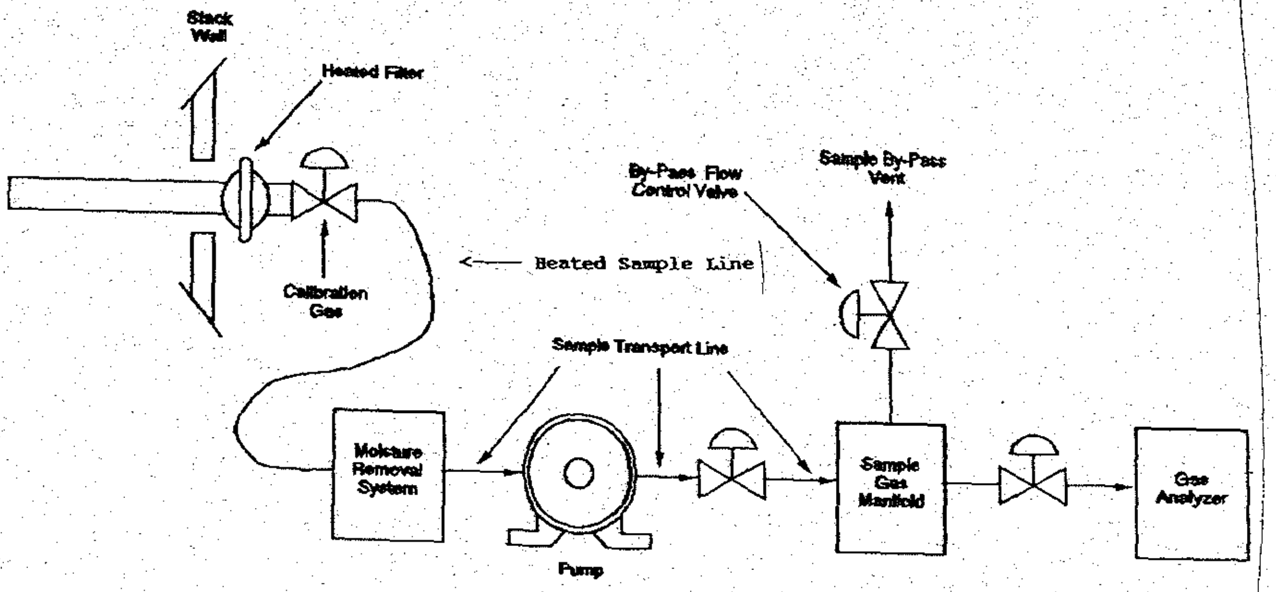

Figure 1

NO_x, O_2 & CO_2 Sampling Train