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I. INTRODUCTION

Network Environmental, Inc. was retained by National Energy of McBain, Michigan to perform a Relative Accuracy Test Audit (RATA) on the Continuous Emissions Monitoring System (CEMS) that services their wood fired boiler. The CEMS is for oxides of nitrogen (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2) and oxygen (O_2).

The RATA was performed on August 25, 2023. Richard D. Eerdmans and David D. Engelhardt of Network Environmental, Inc. conducted the RATA in accordance with 40 CFR Part 60 Appendix B Performance Specifications 2 for NO_x and SO_2, 3 for O_2 and 4 for CO. Assisting with the RATA were Mr. Matt Doolittle, Mr. Kyle Foster and the operating staff of National Energy McBain. Mr. Dave Bowman and Mr. Daniel J. Droste of the Michigan Department of Environment, Great Lakes & Energy (EGLE) - Air Quality Division were present to observe the testing and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
NO_x (LBS/MMBTU) RELATIVE ACCURACY TEST AUDIT RESULTS
WOOD FIRED BOILER
NATIONAL ENERGY
McBAIN, MICHIGAN
AUGUST 25, 2023

Run #	Time	REFERENCE METHOD			CEM	DIFF
		NO_x(1)	O_2(2)	Lbs/MMBTU	Lbs/MMBTU	
1	08:17-08:42	130.9	6.4	0.214	0.192	0.022
2	09:01-09:26	125.9	6.3	0.204	0.187	0.017
3	09:44-10:09	134.3	6.9	0.226	0.207	0.019
4	10:28-10:53	138.9	6.8	0.232	0.211	0.021
5	11:10-11:35	144.9	7.3	0.252	0.232	0.020
6	11:54-12:19	142.8	7.1	0.244	0.222	0.022
7	12:43-13:07	135.9	6.8	0.227	0.211	0.016
8	13:28-13:53	129.8	6.8	0.217	0.203	0.014
9	14:10-14:35	125.4	6.9	0.211	0.189	0.022

Mean Reference Value 0.22522

Absolute Value of the Mean of the Difference 0.01922

Standard Deviation 0.00295

Confidence Co-efficient 0.00227

Relative Accuracy = 9.54% of the mean of the reference method

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

II.2 TABLE 2
NO_x (PPM) RELATIVE ACCURACY TEST AUDIT RESULTS
WOOD FIRED BOILER
NATIONAL ENERGY
McBAIN, MICHIGAN
AUGUST 25, 2023

Run #	Time	REFERENCE METHOD	CEM	DIFF
		NO_x (1)	NO_x (1)	
1	08:17-08:42	130.9	117.9	13.0
2	09:01-09:26	125.9	115.6	10.3
3	09:44-10:09	134.3	124.0	10.3
4	10:28-10:53	138.9	126.6	12.3
5	11:10-11:35	144.9	134.5	10.4
6	11:54-12:19	142.8	131.5	11.3
7	12:43-13:07	135.9	127.1	8.8
8	13:28-13:53	129.8	121.7	8.1
9	14:10-14:35	125.4	114.8	10.6

Mean Reference Value = 134.31111

Absolute Value of the Mean of the Difference = 10.56667

Standard Deviation = 1.53460

Confidence Co-efficient = 1.17960

Relative Accuracy = 8.75% of the mean of the reference method

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

II.3 TABLE 3
CO (LBS/MMBTU) RELATIVE ACCURACY TEST AUDIT RESULTS
WOOD FIRED BOILER
NATIONAL ENERGY
McBAIN, MICHIGAN
AUGUST 25, 2023

Run #	Time	REFERENCE METHOD			CEM	DIFF
		CO(1)	O_2(2)	Lbs/MMBTU	Lbs/MMBTU	
1	08:17-08:42	57.9	6.4	0.058	0.060	-0.002
2	09:01-09:26	72.2	6.3	0.071	0.073	-0.002
3	09:44-10:09	62.9	6.9	0.065	0.066	-0.001
4	10:28-10:53	59.3	6.8	0.060	0.062	-0.002
5	11:10-11:35	63.5	7.3	0.067	0.069	-0.002
6	11:54-12:19	60.2	7.1	0.063	0.064	-0.001
7	12:43-13:07	58.2	6.8	0.059	0.061	-0.002
8	13:28-13:53	56.0	6.8	0.057	0.059	-0.002
9	14:10-14:35	53.2	6.9	0.055	0.056	-0.001

Mean Reference Value 0.06167

Absolute Value of the Mean of the Difference 0.00167

Standard Deviation 0.00050

Confidence Co-efficient 0.00038

Relative Accuracy = 0.82% of the emission limit (0.25 Lbs/MMBTU)

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

II.4 TABLE 4
SO_2 (LBS/MMBTU) RELATIVE ACCURACY TEST AUDIT RESULTS
WOOD FIRED BOILER
NATIONAL ENERGY
McBAIN, MICHIGAN
AUGUST 25, 2023

Run #	Time	REFERENCE METHOD			CEM	DIFF
		SO_2(1)	O_2(2)	Lbs/MMBTU	Lbs/MMBTU	
1	08:17-08:42	114.0	6.4	0.259	0.257	0.002
2	09:01-09:26	111.2	6.3	0.251	0.253	-0.002
3	09:44-10:09	91.2	6.9	0.214	0.214	0.000
4	10:28-10:53	101.2	6.8	0.235	0.236	-0.001
5	11:10-11:35	95.9	7.3	0.232	0.234	-0.002
6	11:54-12:19	103.0	7.1	0.245	0.248	-0.003
7	12:43-13:07	109.4	6.8	0.254	0.255	-0.001
8	13:28-13:53	95.1	6.8	0.221	0.222	-0.001
9	14:10-14:35	98.4	6.9	0.230	0.225	0.005

Mean Reference Value 0.23789

Absolute Value of the Mean of the Difference 0.00033

Standard Deviation 0.00245

Confidence Co-efficient 0.00188

Relative Accuracy = 0.93% of the mean of the reference method

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

III. DISCUSSION OF RESULTS

III.1 NO_x (LBS/MMBTU) RATA - The results of the NO_x RATA in terms of Lbs/MMBTU 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 12.2.1 (Equation 19-1) of Method 19 for O_2 on a dry basis. The F factor used was 9,475. Nine (9), twenty-five (25) minute samples were collected from the boiler exhaust.

The relative accuracy for the NO_x CEMS in terms of Lbs/MMBTU was 9.54% 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 NO_x (PPM) RATA - The results of the NO_x RATA in terms of PPM (v/v) on a dry basis can be found in Table 2 (Section II.2). The relative accuracy calculations were performed in terms of PPM Dry. Nine (9), twenty-five (25) minute samples were collected from the boiler exhaust. All reference method data was corrected using Equation 7E-5 (U.S. EPA Method 7E) prior to performing the RATA calculations.

The relative accuracy for the NO_x CEMS in terms of PPM was 8.75% 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.3 CO (LBS/MMBTU) RATA - The results of the CO RATA can be found in Table 3 (Section

II.3). 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 12.2.1 (Equation 19-1) of Method 19 for O_2 on a dry basis. The F factor used was 9,475. Nine (9), twenty-five (25) minute samples were collected from the boiler exhaust.

The relative accuracy for the CO CEMS was 0.82% of the emission limit (0.25 Lbs/MMBTU).

According to Performance Specification 4 in 40 CFR Part 60 Appendix B, "The relative accuracy (RA) of the CEMS shall be no greater than 10 percent of the mean value of the reference method test data in terms of the units of the emission standard or 5 percent of the applicable standard, whichever is greater."

III.4 SO_2 (LBS/MMBTU) RATA - The results of the SO_2 RATA can be found in Table 4 (Section II.4). 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 12.2.1 (Equation 19-1) of Method 19 for O_2 on a dry basis. The F factor used was 9,475. Nine (9), twenty-five (25) minute samples were collected from the boiler exhaust.

The relative accuracy for the SO_2 CEMS was 0.93% 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

The CEMS services a wood fired boiler with a capacity of 600 tons per day of fuel. The exhaust is controlled by an electrostatic precipitator. The boiler was operated at approximately 100% of load during the testing period. The waste wood was supplemented by tire derived fuel (TDF) during the RATA.

V. CEMS DESCRIPTION

The NO_x monitor is a Thermo Scientific Model 42i-HL NO_x analyzer, Serial # 1172830013, CAE Asset # 210408. The monitor records data on a dry basis. The span range is 0-500 PPM. This is a rental monitor that is in temporary use while a new monitor is on order. Because this is a temporary monitor the RATA was calculated on a PPM (v/v) Dry basis in addition to the LBS/MMBTU.

The CO monitor is a Thermo Scientific Model 48I-ANSCA, Serial # JC1606001770. The monitor records data on a dry basis. The span range is 0-1000 PPM.

The SO_2 monitor is a Bovar Western Research Model # 721-M SO_2 analyzer, Serial # VE-721-721M-8653-3. The monitor records on a dry basis. The span range is 0-250 PPM.

The O_2 monitor is a Ametek Model RM CEM O2-IQ, Serial # 10210202. The monitor records data on a dry basis. The span range is 0-21 %.

VI. SAMPLING AND ANALYTICAL PROTOCOL

The RATA was performed in accordance with 40 CFR Part 60 Appendix B Performance Specifications 2 for NO_x and SO_2, 3 for O_2 and 4 for CO.

The sampling was conducted on the 71 inch I.D. exhaust stack at a location that exceeds 8 duct diameters downstream and 2 duct diameters upstream from the nearest disturbances (U.S. EPA Reference Method 1 requirement).

The RATA was performed in accordance with the protocol approved by EGLE-Air Quality Division. Prior testing has shown no stratification in the exhaust stack. One (1) point (50% of diameter) sampling was used to collect the exhaust gas from the stack.

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. Sample gas was extracted through a heated probe. 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 101.0 PPM and 55.6 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 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.

VI.2 Carbon Monoxide

The CO sampling was conducted in accordance with U.S. EPA Reference Method 10. A Thermo Environmental Model 48C gas analyzer was used to monitor the boiler exhaust. Sample gas was extracted through a heated probe. 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 CO concentrations (PPM).

The analyzer was calibrated by direct injection prior to the testing. A span gas of 168.0 PPM was used to establish the initial instrument calibration. Calibration gases of 92.9 PPM and 51.1 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 51.1 PPM gas to determine the system bias. After each sample, a system zero and system injection of 51.1 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.

VI.3 Sulfur Dioxide

The SO_2 sampling was conducted in accordance with U.S. EPA Reference Method 6C. A Bovar Model 721M gas analyzer was used to monitor the boiler exhaust. Sample gas was extracted through a heated probe. 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 SO_2 concentrations (PPM).

The analyzer was calibrated by direct injection prior to the testing. A span gas of 269.0 PPM was used to establish the initial instrument calibration. Calibration gases of 95.2 PPM and 148.0 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 95.2 PPM gas to determine the system bias. After each sample, a system zero and system injection of 95.2 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.

VI.4 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. Sample gas was extracted through a heated probe. 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 6.03% and 11.8% 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.

This report was prepared by:

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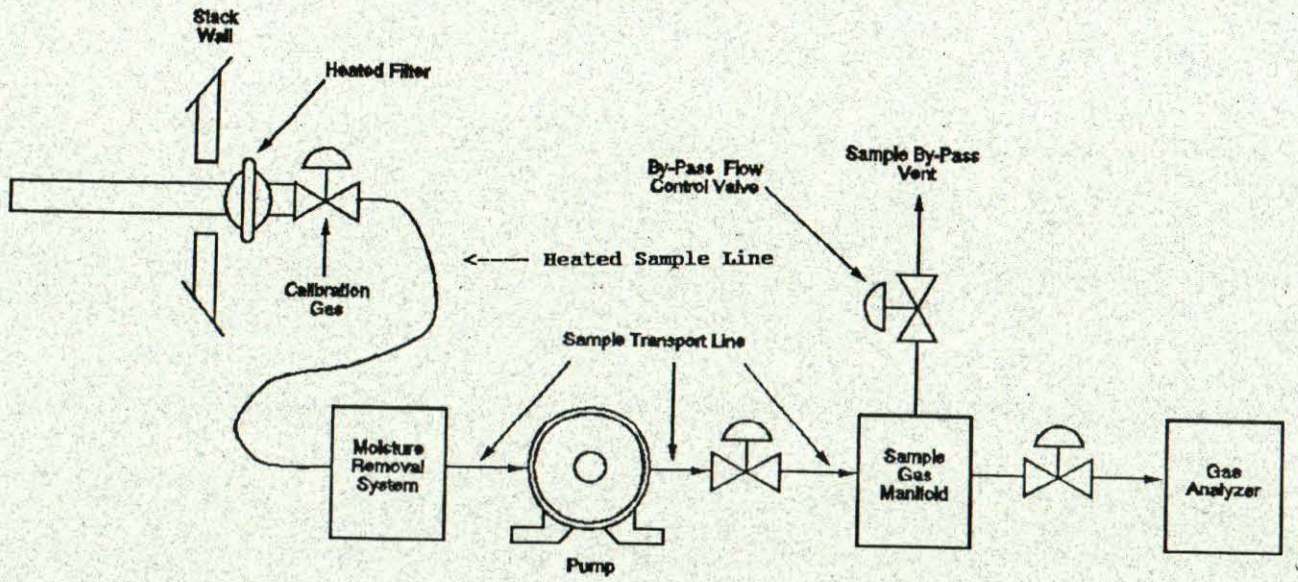

Figure 1

NO_x, CO, SO_2 & O_2 Sampling Train