DATA ACCURACY ASSESSMENT REPORT

BOILER NO. 9

Annual Quality Assurance
Relative Accuracy Test Audit (RATA)

Performance Specification 2 and 3
Utilizing EPA Reference Methods 3A, 7E, and 19

Test Date(s): April 17, 2019
Facility ID: MIB1678
Source Location: Kalamazoo, Michigan
Permit: EGLE Permit No. MI-ROP-B1678-2015

Prepared For:

Graphic Packaging International, LLC
1500 North Pitcher Street • Kalamazoo, MI 49007

Prepared By:

Montrose Air Quality Services, LLC
P.O. Box 41156 • Cleveland, OH 44141
Phone: (440) 262-3760

Document Number: M011AS-554631-RT-3R0
Document Date: May 13, 2019
Scope ID / Project: 11658 / 190401

STAC STACK TESTING ACCREDITATION COUNCIL

A2LA ACCREDITED TO ASTM D7036 ONLY CERT #3925.01

MONTROSE AIR QUALITY SERVICES

TABLE OF CONTENTS

SECTION **PAGE**

LIST OF TABLES

LIST OF FIGURES

REVIEW AND CERTIFICATION

The results of the Data Accuracy Assessment for Continuous Emission Monitoring Systems (CEMS) conducted on April 17, 2019 are a product of the application of the United States Environmental Protection Agency (US EPA) Stationary Source Sampling Methods listed in 40 CFR Part 60, Appendix A, that were in effect at the time of this test in accordance with 40 CFR Part 60, Appendices B and F.

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature: _____ Date: 5/13/2019

Name: Jack Hoard Title: Field Project Manager

I have reviewed, technically and editorially, details, calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature: robert j lisy jr Date: 05/13/2019

Name: Robert J. Lisy, Jr. Title: District Manager

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

Graphic Packaging International, LLC (Facility ID: MIB1678), located in Kalamazoo, Michigan, contracted Montrose Air Quality Services (Montrose) of Cleveland, Ohio, to conduct the Annual Quality Assurance (QA) Relative Accuracy Test Audit (RATA) for the Continuous Emission Monitoring Systems (CEMS) associated with their Boiler No. 9. Testing was performed on April 17, 2019, for the purpose of evaluating the quality of the emissions data produced by Graphic Packaging International, LLC's CEMS in accordance with 40 CFR Part 60, Appendices B and F, and Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permit No. MI-ROP-B1678-2015.

Reference Method (RM) sampling for nitrogen oxides (NO_x) and oxygen (O_2) was performed at >50% load conditions in accordance with Performance Specification 2 (PS-2) and Performance Specification 3 (PS-3) to determine the Relative Accuracy (RA) of the CEMS associated with the Boiler No. 9 Exhaust Stack. RAs were determined for NO_x emissions (lb/MMBtu) (as NO_2), NO_x concentration (ppmvd), and O_2 concentration (%-dry).

For the RATA, ten (10) NO_x and O_2 runs were performed, and nine (9) were utilized in the RA calculations. Each concentration run was 21-minutes in duration.

The test methods that were conducted during this test were US EPA Reference Methods 3A, 7E, and 19 following the procedures contained within PS-2 and PS-3.

1.2 KEY PERSONNEL

The key personnel who coordinated this test program (and their phone numbers) were:

- Donald Krug, Environmental Engineer, Graphic Packaging International, LLC, 269-383-5000
- Loretta Lehrman, Air Toxics, US EPA - Region 5, 312-886-5482
- David Patterson, Environmental Quality Analyst, Michigan Department of Environment, Great Lakes and Energy (EGLE), 517-241-7469
- Karen Kajiya-Mills, Environmental Manager, Michigan Department of Environment, Great Lakes and Energy (EGLE), 517-256-0880
- Monica Brothers, Environmental Quality Analyst, Michigan Department of Environment, Great Lakes and Energy (EGLE), 269-567-3552
- Cody Yazzie, Environmental Engineer, Michigan Department of Environment, Great Lakes and Energy (EGLE), 269-567-3554
- John Hoard QI, Field Project Manager, Montrose, 800-372-2471

2.0 SUMMARY AND DISCUSSION OF TEST RESULTS

2.1 OBJECTIVES AND TEST MATRIX

The purpose of this test was to conduct the Annual QA RATA for the CEMS associated with Boiler No. 9. Ten (10) NO_x and O_2 RATA runs were performed at >50% load conditions in accordance with PS-2 and PS-3 to determine the RA between the CEMS and the applicable RMs. Testing was performed for the purpose of evaluating the quality of the emissions data produced by Graphic Packaging International's CEMS in accordance with 40 CFR Part 60, Appendices B and F, and EGLE Permit No. MI-ROP-B1678-2015.

The specific test objectives for this test were as follows:

- Measure the concentration of NO_x and O_2 at the Boiler No. 9 Exhaust Stack at >50% load conditions in accordance with PS-2, PS-3, and U.S. EPA Reference Methods 3A and 7E.
- Utilize the above variables, in conjunction with EPA Method 19, to calculate the corresponding RA of the CEMS for NO_x emissions (lb/MMBtu) (as NO_2), NOx concentration (ppmvd), and O_2 concentration (%-dry) and evaluate the RAs against 40 CFR Part 60 requirements.

Table 2-1 presents the sampling matrix log for this test.

2.2 FIELD TEST CHANGES AND PROBLEMS

No field test changes or problems occurred during the performance of this test that would bias the accuracy of the results of this test.

2.3 PRESENTATION OF RESULTS

A single sampling train was utilized at >50% load conditions to determine the RA of the CEMS for NO_x emissions (lb/MMBtu) (as NO_2), NO_x concentration (ppmvd), and O_2 concentration (%-dry). This sampling train measured the stack gas concentrations of O_2 and NO_x.

Tables 2-2 to 2-4 display the results of this RATA.

Table 2-5 displays the specifications of the Boiler No. 8 CEMS and Reference Method analyzers utilized.

Table 2-6 displays the US EPA Protocol Gas Cylinders utilized to calibrate the Reference Method analyzers during this RATA.

Figure 2-1 schematically illustrates the concentration traverse point location utilized for this test.

2.4 RELATIVE ACCURACY CALCULATIONS

Confidence Coefficient =T-Value * Standard Deviation / Square Root of Number of Runs

0.00036 = 2.306 * 0.00046 / SQRT 9

RA = ((ABS (Mean Difference) + Confidence Coefficient) / Emission Standard) * 100

2.845 = ((ABS (-0.0014) + 0.00036) / 0.06) * 100

TABLE 2-1
>50% LOAD RATA - SAMPLING MATRIX OF TEST METHODS UTILIZED

Date	Run No.	Sampling Location	US EPA METHOD 3A (O_2) Sampling Time / Duration (min)		US EPA METHOD 7E (NO_x) Sampling Time / Duration (min)	
4/17/2019	1	Boiler No. 9 Exhaust Stack	7:04 - 7:25	/ 21	7:04 - 7:25	/ 21
4/17/2019	2	Boiler No. 9 Exhaust Stack	7:35 - 7:56	/ 21	7:35 - 7:56	/ 21
4/17/2019	3	Boiler No. 9 Exhaust Stack	8:07 - 8:28	/ 21	8:07 - 8:28	/ 21
4/17/2019	4	Boiler No. 9 Exhaust Stack	8:37 - 8:58	/ 21	8:37 - 8:58	/ 21
4/17/2019	5	Boiler No. 9 Exhaust Stack	9:07 - 9:28	/ 21	9:07 - 9:28	/ 21
4/17/2019	6	Boiler No. 9 Exhaust Stack	9:38 - 9:59	/ 21	9:38 - 9:59	/ 21
4/17/2019	7	Boiler No. 9 Exhaust Stack	10:10 - 10:31	/ 21	10:10 - 10:31	/ 21
4/17/2019	8	Boiler No. 9 Exhaust Stack	10:55 - 11:16	/ 21	10:55 - 11:16	/ 21
4/17/2019	9	Boiler No. 9 Exhaust Stack	11:27 - 11:48	/ 21	11:27 - 11:48	/ 21
4/17/2019	10	Boiler No. 9 Exhaust Stack	11:58 - 12:19	/ 21	11:58 - 12:19	/ 21

All times are Facility Time.

TABLE 2-2
PRIMARY CEMS - >50% LOAD - NO_x (lb/MMBtu) RELATIVE ACCURACY

CEMS: **Primary**
Load: **>50%**
RATA: **NOx**
RATA Units: **lb/MMBtu**
RA Criteria: **10%**
RATA Label: **>50%-NOx-lb/MMBtu**

Run Number	RM All lb/MMBtu	RM Used lb/MMBtu	CEMS All lb/MMBtu	CEMS Used lb/MMBtu	Difference All lb/MMBtu	Difference Used lb/MMBtu	klb/hr Steam Flow	Used as Valid Test Run (yes/no)
1	0.027	0.027	0.028	0.028	-0.001	-0.001	106	yes
2	0.027	0.027	0.028	0.028	-0.001	-0.001	106	yes
3	0.026	0.026	0.027	0.027	-0.001	-0.001	106	yes
4	0.026	0.026	0.028	0.028	-0.002	-0.002	107	yes
5	0.026	0.026	0.028	0.028	-0.002	-0.002	107	yes
6	0.026		0.028		-0.002			no
7	0.026	0.026	0.028	0.028	-0.002	-0.002	106	yes
8	0.027	0.027	0.028	0.028	-0.001	-0.001	107	yes
9	0.026	0.026	0.028	0.028	-0.002	-0.002	107	yes
10	0.026	0.026	0.028	0.028	-0.002	-0.002	107	yes
Average	**0.026**	**0.026**		**0.028**		**-0.0014**	**106**	

Standard Deviation	0.00046	
T-Value	2.306	
Confidence Coefficient	0.00036	
Relative Accuracy (%)	**2.8450**	**(Based on an Applicable Emission Standard of 0.06 lb/MMBtu)**

TABLE 2-3
PRIMARY CEMS - >50% LOAD - NO_x (ppm) RELATIVE ACCURACY

CEMS: **Primary**
Load: **>50%**
RATA: **NOx**
RATA Units: **ppm**
RA Criteria: **20%**
RATA Label: **>50%-NOx-ppm**

Run Number	RM All ppm	RM Used ppm	CEMS All ppm	CEMS Used ppm	Difference All ppm	Difference Used ppm	Used as Valid Test Run (yes/no)
1	22.581	22.581	23.124	23.124	-0.543	-0.543	yes
2	22.581	22.581	23.095	23.095	-0.514	-0.514	yes
3	21.840	21.840	23.119	23.119	-1.279	-1.279	yes
4	21.869	21.869	23.090	23.090	-1.222	-1.222	yes
5	21.951	21.951	23.281	23.281	-1.330	-1.330	yes
6	21.787		23.352		-1.565		no
7	21.971	21.971	23.438	23.438	-1.467	-1.467	yes
8	21.909	21.909	23.390	23.390	-1.482	-1.482	yes
9	21.746	21.746	23.157	23.157	-1.411	-1.411	yes
10	21.649	21.649	23.129	23.129	-1.480	-1.480	yes
Average	**21.988**	**22.011**		**23.203**		**-1.192**	

Standard Deviation	0.38701	
T-Value	2.306	
Confidence Coefficient	0.29748	
Relative Accuracy (%)	**6.767**	**(Based on the Reference Method Mean)**

TABLE 2-4
PRIMARY CEMS - >50% LOAD - O_2 (%) RELATIVE ACCURACY

CEMS: **Primary**
Load: **>50%**
RATA: **O2**
RATA Units: **%**
RA Criteria: **1%**
RATA Label: **>50%-O2-%**

Run Number	RM All %	RM Used %	CEMS All %	CEMS Used %	Difference All %	Difference Used %	Used as Valid Test Run (yes/no)
1	2.670	2.670	2.681	2.681	-0.011	-0.011	yes
2	2.670	2.670	2.783	2.783	-0.113	-0.113	yes
3	2.663	2.663	2.657	2.657	0.006	0.006	yes
4	2.662	2.662	2.700	2.700	-0.038	-0.038	yes
5	2.671	2.671	2.681	2.681	-0.010	-0.010	yes
6	2.668	2.668	2.748	2.748	-0.079	-0.079	yes
7	2.664	2.664	2.681	2.681	-0.017	-0.017	yes
8	3.394		2.662		0.732		no
9	2.645	2.645	2.795	2.795	-0.151	-0.151	yes
10	2.646	2.646	2.724	2.724	-0.078	-0.078	yes
Average	**2.735**	**2.662**		**2.717**		**-0.054**	

Standard Deviation	0.05361	
T-Value	2.306	
Confidence Coefficient	0.04121	
Relative Accuracy (%)	**0.054**	**(Calculated as the Absolute Mean Difference)**

TABLE 2-5
ANALYZER SPECIFICATIONS

BOILER NO. 9 CEMS

Parameter	NO_x Analyzer	O_2 Analyzer
Analyzer Manufacturer	Horiba	Horiba
Analyzer Model Number	CMA-EC622	CMA-EC622
Analyzer Serial Number	42108510081	42108510081
System Type	Straight-Extractive	Straight-Extractive
Analyzer Span Value	100-ppm	25.00%

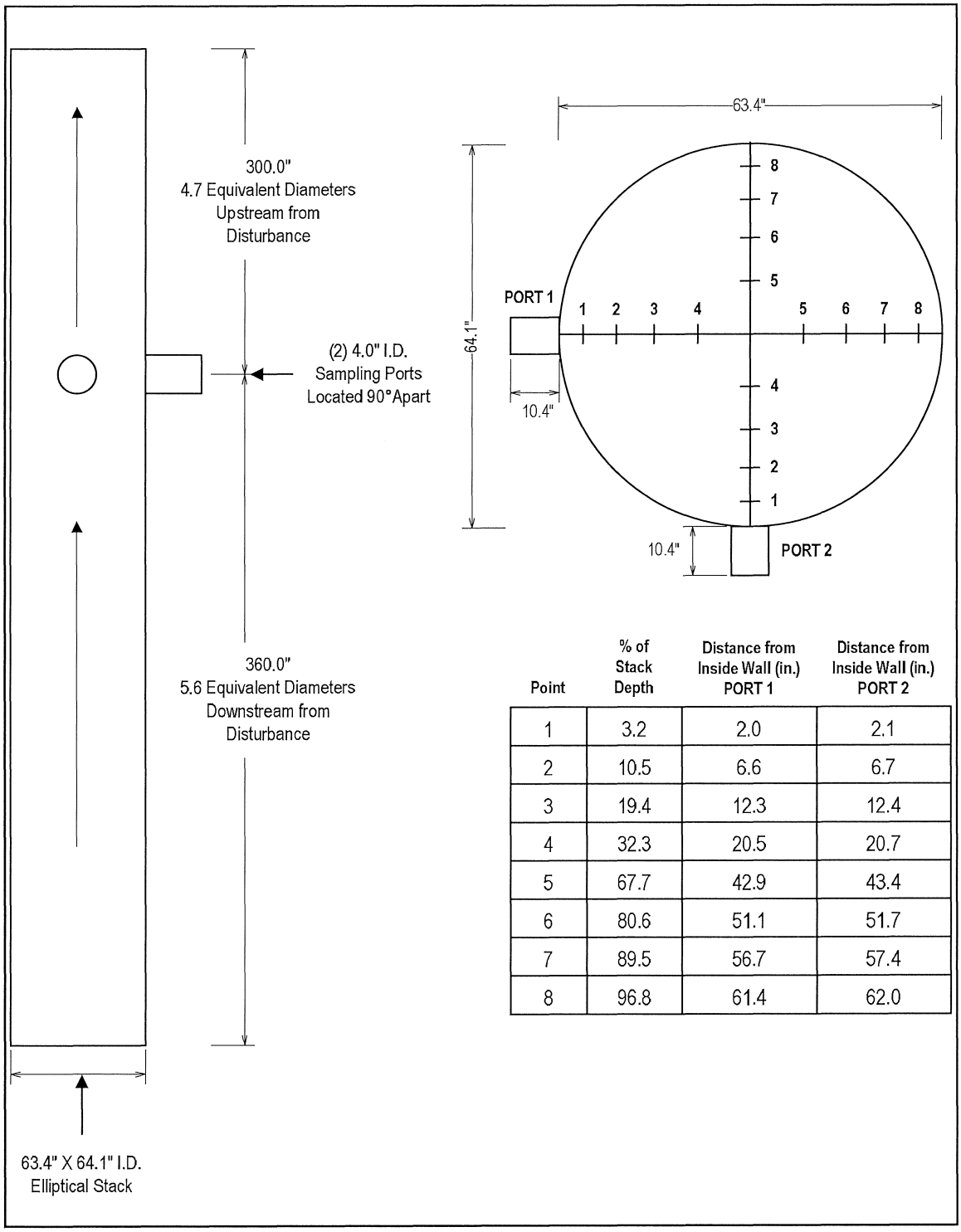
REFERENCE METHOD CEMS

Parameter	NO_x Analyzer	O_2 Analyzer
Analyzer Manufacturer	Thermo	Servomex
Analyzer Model Number	42C	1400
Analyzer Serial Number	42CHL-66127-351	01440D1/4049
Analyzer Type	Extractive	Extractive
Analyzer Technique	Chemiluminescent Reaction	Paramagnetic
Analyzer Span Value	112.3-PPM	22.93%

TABLE 2-6
US EPA PROTOCOL GAS CERTIFICATIONS

Component	Certified Concentration	Cylinder Number	Certification Date	Expiration Date
Oxygen	14.07 ± 0.14%	XC031575B	3/13/2018	3/13/2026
Oxygen	22.93 ± 0.22%	CC72446	12/31/2018	12/31/2026
Nitrogen Dioxide	50.39 ± 1.00 PPM	CC501876	3/27/2018	3/27/2021
Nitrogen Oxides	112.3 ± 1.45 PPM	CC29760	1/11/2019	1/11/2027

FIGURE 2-1
BOILER NO. 9 EXHAUST TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	2.0	2.1
2	10.5	6.6	6.7
3	19.4	12.3	12.4
4	32.3	20.5	20.7
5	67.7	42.9	43.4
6	80.6	51.1	51.7
7	89.5	56.7	57.4
8	96.8	61.4	62.0

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 TEST METHODS

3.1.1 US EPA Method 3A: "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"

Principle: A gas sample is continuously extracted from the effluent stream. A portion of the sample stream is conveyed to an instrumental analyzer(s) for determination of O_2 and CO_2 concentration(s). Performance specifications and test procedures are provided to ensure reliable data. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

3.1.2 US EPA Method 7E: "Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)"

Principle: A gas sample is continuously extracted from the effluent stream. A portion of the sample stream is conveyed to an instrumental analyzer for determination of NO_x concentration. NO and NO_2 may be measured separately or simultaneously. For the purposes of this method, NO_x is the sum of NO and NO_2. Performance specifications and test procedures are provided to ensure reliable data. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

3.1.3 US EPA Method 19: "Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxides

Principle: This method is applicable for (a) determining Particulate Matter (PM), Sulfur Dioxide (SO_2), and Nitrogen Oxides (NO_x) emission rates; (b) determining sulfur removal efficiencies of fuel pretreatment and SO_2 control devices; (c) determining overall reduction of potential SO_2 emissions from steam generating units or other sources as specified in applicable regulations; and (d) determining SO_2 rates based on fuel sampling and analysis procedures.

3.1.4 US EPA Performance Specification 2: "Specifications and Test Procedures for SO_2 and NO_x Continuous Emission Monitoring Systems in Stationary Sources"

Principle: This specification is for evaluating the acceptability of SO_2 and NO_x continuous emission monitoring systems (CEMS) at the time of installation or soon after and whenever specified in the regulations. The CEMS may include, for certain stationary sources, a diluent (O_2 or CO_2) monitor. This specification was utilized as per the procedures outlined in 40 CFR Part 60, Appendix B.

3.1.5 US EPA Performance Specification 3: "Specification and Test Procedures for O_2 and CO_2 Continuous Emissions Monitoring Systems in Stationary Sources"

This specification is for evaluating acceptability of O_2 and CO_2 continuous emission monitoring systems (CEMS) at the time of installation or soon after and whenever specified in an applicable subpart of the regulations. This specification applies to O_2 or CO_2 monitors that are not included under Performance Specification 2 (PS-2). This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix B.

3.2 PROCEDURES FOR OBTAINING PROCESS DATA

All relevant process and CEMS data was recorded by personnel and was furnished to Montrose at the conclusion of this testing event.

4.0 INTERNAL QA/QC ACTIVITIES

4.1 QA AUDITS

Tables 4-1 to 4.5 illustrate the QA audits that were performed during this test.

Tables 4-1 to 4-4 illustrate the analyzer calibration audits which were performed during this test (and integral to performing U.S. EPA Method 3A and 7E correctly) were all within the Measurement System Performance Specifications of ±3% of span for the Zero and Calibration Drift Checks, ±5% of span for the System Calibration Bias Checks, and ±2% of span for the Calibration Error Checks.

Table 4-5 displays the NO_2 to NO converter efficiency check. The converter efficiency check was conducted as per the procedures contained in US EPA Method 7E, Section 8.2.4.1 which require a conversion of at least 90%. As shown, an average converter efficiency of 98.02% was achieved for the NO_x analyzer utilized at the Boiler No. 9 Exhaust Stack.

4.2 QA/QC PROBLEMS

No QA/QC problems occurred during this test event.

4.3 QUALITY STATEMENT

Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04 which are conducted by the American Association for Laboratory Accreditation (A2LA). All testing performed by Montrose is supervised on site by at least one Qualified Individual (QI) as defined in D7036-04 Section 8.3.2. Data quality objectives for estimating measurement uncertainty within the documented limits in the test methods are met by using approved test protocols for each project as defined in D7036-04 Sections 7.2.1 and 12.10. Additional quality assurance information is presented in the report appendices.

TABLE 4-1
US EPA REFERENCE METHOD 3A (O2) ANALYZER CALIBRATION AND QA

OXYGEN ANALYZER	RUN 1	Acceptable	RUN 2	Acceptable	RUN 3	Acceptable	RUN 4	Acceptable	RUN 5	Acceptable
Analyzer Span During Test Run (%)	22.9	YES	22.9	YES	22.9	YES	22.9	YES	22.9	YES
Initial System Calibration Response for Zero Gas (%)	0.21	N/A	0.20	N/A	0.18	N/A	0.19	N/A	0.17	N/A
Final System Calibration Response for Zero Gas (%)	0.20	N/A	0.18	N/A	0.19	N/A	0.17	N/A	0.18	N/A
Actual Concentration of the Upscale Calibration Gas (%)	11.00	N/A	11.00	N/A	11.00	N/A	11.00	N/A	11.00	N/A
Initial System Calibration Response for Upscale Gas (%)	11.01	N/A	11.00	N/A	10.98	N/A	10.98	N/A	10.96	N/A
Final System Calibration Response for Upscale Gas (%)	11.00	N/A	10.98	N/A	10.98	N/A	10.96	N/A	10.96	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.87	YES	0.83	YES	0.74	YES	0.78	YES	0.70	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.83	YES	0.74	YES	0.78	YES	0.70	YES	0.74	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.22	YES	-0.26	YES	-0.35	YES	-0.35	YES	-0.44	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.26	YES	-0.35	YES	-0.35	YES	-0.44	YES	-0.44	YES
System Drift for Zero Gas (% of Span)	-0.04	YES	-0.09	YES	0.04	YES	-0.09	YES	0.04	YES
System Drift for Upscale Gas (% of Span)	-0.04	YES	-0.09	YES	0.00	YES	-0.09	YES	0.00	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.04	YES	0.04	YES	0.04	YES	0.04	YES	0.04	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.26	YES	0.26	YES	0.26	YES	0.26	YES	0.26	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.04	YES	-0.04	YES	-0.04	YES	-0.04	YES	-0.04	YES

TABLE 4-2
US EPA REFERENCE METHOD 3A (O2) ANALYZER CALIBRATION AND QA

OXYGEN ANALYZER	RUN 6	Acceptable	RUN 7	Acceptable	RUN 8	Acceptable	RUN 9	Acceptable	RUN 10	Acceptable
Analyzer Span During Test Run (%)	22.9	YES	22.9	YES	22.9	YES	22.9	YES	22.9	YES
Initial System Calibration Response for Zero Gas (%)	0.18	N/A	0.17	N/A	0.21	N/A	0.17	N/A	0.17	N/A
Final System Calibration Response for Zero Gas (%)	0.17	N/A	0.21	N/A	0.17	N/A	0.17	N/A	0.17	N/A
Actual Concentration of the Upscale Calibration Gas (%)	11.00	N/A	11.00	N/A	11.00	N/A	11.00	N/A	11.00	N/A
Initial System Calibration Response for Upscale Gas (%)	10.96	N/A	10.98	N/A	10.99	N/A	10.95	N/A	10.94	N/A
Final System Calibration Response for Upscale Gas (%)	10.98	N/A	10.99	N/A	10.95	N/A	10.94	N/A	10.95	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.74	YES	0.70	YES	0.87	YES	0.70	YES	0.70	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.70	YES	0.87	YES	0.70	YES	0.70	YES	0.70	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.44	YES	-0.35	YES	-0.31	YES	-0.48	YES	-0.52	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.35	YES	-0.31	YES	-0.48	YES	-0.52	YES	-0.48	YES
System Drift for Zero Gas (% of Span)	-0.04	YES	0.17	YES	-0.17	YES	0.00	YES	0.00	YES
System Drift for Upscale Gas (% of Span)	0.09	YES	0.04	YES	-0.17	YES	-0.04	YES	0.04	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.04	YES	0.04	YES	0.04	YES	0.04	YES	0.04	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.26	YES	0.26	YES	0.26	YES	0.26	YES	0.26	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.04	YES	-0.04	YES	-0.04	YES	-0.04	YES	-0.04	YES

TABLE 4-3
US EPA REFERENCE METHOD 7E ANALYZER CALIBRATION AND QA

NITROGEN OXIDES ANALYZER	RUN 1	Acceptable	RUN 2	Acceptable	RUN 3	Acceptable	RUN 4	Acceptable	RUN 5	Acceptable
Analyzer Span During Test Run (ppm)	112	YES	112	YES	112	YES	112	YES	112	YES
Initial System Calibration Response for Zero Gas (ppm)	0.54	N/A	0.48	N/A	0.83	N/A	0.51	N/A	0.75	N/A
Final System Calibration Response for Zero Gas (ppm)	0.48	N/A	0.83	N/A	0.51	N/A	0.75	N/A	0.80	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	55.0	N/A	55.0	N/A	55.0	N/A	55.0	N/A	55.0	N/A
Initial System Calibration Response for Upscale Gas (ppm)	55.1	N/A	56.3	N/A	56.4	N/A	56.6	N/A	56.5	N/A
Final System Calibration Response for Upscale Gas (ppm)	56.3	N/A	56.4	N/A	56.6	N/A	56.5	N/A	56.3	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.27	YES	0.21	YES	0.53	YES	0.24	YES	0.45	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.21	YES	0.53	YES	0.24	YES	0.45	YES	0.50	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.07	YES	1.01	YES	1.05	YES	1.26	YES	1.13	YES
Final System Calibration Bias for Upscale Gas (% of Span)	1.01	YES	1.05	YES	1.26	YES	1.13	YES	0.98	YES
System Drift for Zero Gas (% of Span)	-0.05	YES	0.31	YES	-0.28	YES	0.21	YES	0.04	YES
System Drift for Upscale Gas (% of Span)	1.08	YES	0.04	YES	0.21	YES	-0.13	YES	-0.15	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.21	YES	0.21	YES	0.21	YES	0.21	YES	0.21	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.16	YES	0.16	YES	0.16	YES	0.16	YES	0.16	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.06	YES	-0.06	YES	-0.06	YES	-0.06	YES	-0.06	YES

TABLE 4-4
US EPA REFERENCE METHOD 7E ANALYZER CALIBRATION AND QA

NITROGEN OXIDES ANALYZER	RUN 6	Acceptable	RUN 7	Acceptable	RUN 8	Acceptable	RUN 9	Acceptable	RUN 10	Acceptable
Analyzer Span During Test Run (ppm)	112	YES	112	YES	112	YES	112	YES	112	YES
Initial System Calibration Response for Zero Gas (ppm)	0.80	N/A	0.78	N/A	0.49	N/A	0.85	N/A	0.84	N/A
Final System Calibration Response for Zero Gas (ppm)	0.78	N/A	0.49	N/A	0.85	N/A	0.84	N/A	0.85	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	55.0	N/A	55.0	N/A	55.0	N/A	55.0	N/A	55.0	N/A
Initial System Calibration Response for Upscale Gas (ppm)	56.3	N/A	56.2	N/A	56.2	N/A	56.0	N/A	55.8	N/A
Final System Calibration Response for Upscale Gas (ppm)	56.2	N/A	56.2	N/A	56.0	N/A	55.8	N/A	55.7	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.50	YES	0.48	YES	0.22	YES	0.54	YES	0.53	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.48	YES	0.22	YES	0.54	YES	0.53	YES	0.54	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	0.98	YES	0.91	YES	0.94	YES	0.75	YES	0.54	YES
Final System Calibration Bias for Upscale Gas (% of Span)	0.91	YES	0.94	YES	0.75	YES	0.54	YES	0.49	YES
System Drift for Zero Gas (% of Span)	-0.02	YES	-0.26	YES	0.32	YES	-0.01	YES	0.01	YES
System Drift for Upscale Gas (% of Span)	-0.07	YES	0.04	YES	-0.20	YES	-0.20	YES	-0.05	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.21	YES	0.21	YES	0.21	YES	0.21	YES	0.21	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.16	YES	0.16	YES	0.16	YES	0.16	YES	0.16	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.06	YES	-0.06	YES	-0.06	YES	-0.06	YES	-0.06	YES

TABLE 4-5
US EPA METHOD 7E NO_x CONVERTER CHECK

Date / Time	Certified Cylinder Concentration (ppm NO_2)	Analyzer Concentration (ppm NO_x)	Conversion Efficiency (%)	Required Conversion Efficiency (%)	Acceptable
4/16/2019 8:30	50.39	48.30	95.85	90.00	Yes
4/16/2019 8:31	50.39	49.18	97.60	90.00	Yes
4/16/2019 8:32	50.39	49.63	98.49	90.00	Yes
4/16/2019 8:33	50.39	49.79	98.81	90.00	Yes
4/16/2019 8:34	50.39	50.05	99.33	90.00	Yes
AVERAGE	50.39	49.39	98.02	90.00	Yes

Analyzer Serial Number: 42CHL-66127-351
Cylinder Number: CC501876

APPENDIX

APPENDIX CHECKLIST - M011AS-554631-RT-3R0

A-REFERENCE METHOD AVERAGES

- [x] US EPA Reference Method Averages

B-FACILITY DATA

- [x] CEMS Averages-HIGH/NORMAL LOAD
- [ ] CEMS Averages-MID LOAD
- [ ] CEMS Averages-LOW LOAD
- [x] Facility CEMS Information Verification
- [x] Process Data

C-FIELD DATA

- [x] Calculation Spreadsheet(s) and Example Calculations

- [x] Test Log (CEMS Methods)
- [ ] Sample Recovery & Calibration Check Data
- [ ] US EPA Method 3 / Dry MW Calculation
- [ ] US EPA Method 2 Flow Data Sheets
- [ ] US EPA Method 1 Cyclonic Flow
- [x] US EPA Method 1 Preliminary Field Data

D-CALIBRATIONS AND CERTIFICATIONS

D.1-CEMS ANALYZERS

- [x] Analyzer Calibration Error, System Bias, and System Drift
- [x] US EPA Method 7E Converter Efficiency Check
- [x] US EPA Method 205 Calibration Gas Dilution System Evaluation

D.2-FIELD EQUIPMENT

- [ ] Pre-Test Pitot Tube / Probe Inspections
- [ ] Post-Test Pitot Tube / Probe Inspections

- [ ] Pre-Test Thermocouple System Audit
- [ ] Post-Test Thermocouple Check

- [ ] 10-Minute Calibrations
- [ ] Pre-Test Meter Box Calibration
- [ ] Pre-Test Dry Gas Meter / Orifice Calibration

- [ ] Post-Test Dry Gas Meter / Orifice and Console Calibration

- [ ] Post-Test Mini Meter / Orifice and Console Calibration

- [x] Calibration Kit (C-CTK-002) Audit

- [ ] Digital Pressure Gauge / Barometer Audit
- [ ] Thermometer Audit

- [x] Equipment Calibration Histories

D-CALIBRATIONS AND CERTIFICATIONS (continued)

D.3-REFERENCE EQUIPMENT/STANDARDS

- [x] Calibration Gas Certifications
- [x] Calibration Gas Diluter Certifications
- [x] True Primary Flow Standard Certification

- [ ] Field Balance Calibration Weights Certifications
- [ ] Field / Shop Balance Calibration Certifications
- [ ] Daily Field/Shop Balance Audit

- [ ] Micromanometer Certificate

- [ ] Reference Meter Calibration
- [ ] Reference Field Hygrometer Calibration

- [ ] VE Azimuth Tables
- [ ] VE Declination
- [ ] VE Certificates

- [x] Reference Digital Pressure Gauge Certification
- [x] Reference Thermometer (Omega) Certification
- [x] Reference Ruler Certification
- [x] Reference Protractor Certification
- [x] Reference Caliper Certification

D.4-MONTROSE STAC & PERSONNEL

- [x] Montrose - Accreditation Certificate
- [x] Montrose Personnel - QI/QSTI Certificates/Conformance Documents

D.5-ITT / TEST PROTOCOL / TEST PLAN

- [x] EGLE Approval Letter / Test Protocol