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Relative Accuracy Test
Audit Test Report

Lansing Board of Water and Light
REO Town Facility
HRSG #2 Stack
Lansing, Michigan
Project No. M241102B
March 14, 2024

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Relative Accuracy Test Audit
Test Report

Lansing Board of Water and Light
REO Town Facility
HRSG #2 Stack
Lansing, Michigan
March 14, 2024

Report Submittal Date
April 9, 2024

Project No. M241102B

Crown Point, IN | Mendota Heights, MN | Denver, CO | Henderson, NV

Corporate Headquarters
888 Industrial Drive
Elmhurst, Illinois 60126
630-993-2100

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1.0 EXECUTIVE SUMMARY

Mostardi Platt conducted a Continuous Emissions Monitoring System (CEMS) Relative Accuracy Test Audit (RATA) test program for Lansing Board of Water and Light at the REO Town Facility in Lansing, Michigan, on the HRSG #2 Stack on March 14, 2024. This report summarizes the results of the test program and test methods used in accordance with the Mostardi Platt Protocol P241102 dated December 20, 2023. Mostardi Platt is a self-certified air emissions testing body (AETB). A copy of Mostardi Platt's self-certification can be found in Appendix A.

The test location, test date, and test parameters are summarized below.

TEST INFORMATION		
Test Location	**Test Date**	**Test Parameters**
HRSG #2 Stack	March 14, 2024	Oxygen (O_2) and Nitrogen Oxides (NO_X)

The purpose of the test program was to determine the relative accuracies of the HRSG #2 Stack O_2 and NO_X analyzers during the specified operating conditions. The test results from this test program indicate that each CEMS component meets the United States Environmental Protection Agency (USEPA) annual performance specification for relative accuracy as published in 40 Code of Federal Regulations Part 75 (40CFR75) and 40 Code of Federal Regulations (40CFR60).

RATA RESULTS						
Test Location	**Date**	**Parameters**	**Units**	**Relative Accuracy Acceptance Criteria**	**Relative Accuracy (RA)**	**Bias Adjustment Factor (BAF)**
HRSG #2 Stack	1/1/2024	NO_X	lb/mmBtu	± 0.015 lb/mmBtu mean difference	0.009 lb/mmBtu mean difference	1.111
		NO_X	ppm @ 15% O_2	≤ 20.0% of the mean reference value	19.15%	N/A
		O_2	% dry	≤ 7.5% of the mean reference value	1.04%	N/A

The gas cylinders used to perform the RATA are summarized below.

GAS CYLINDER INFORMATION				
Parameter	**Gas Vendor**	**Cylinder Serial Number**	**Cylinder Value**	**Expiration Date**
NO_X	Airgas	CC334263	0 ppm	8/22/2031
NO_X	Airgas	ALM-042610	13.12 ppm	5/1/2026
NO_X	Airgas	CC240182	25.29 ppm	11/3/2026
O_2	Airgas	ALM-042610	0%	5/1/2026
O_2	Airgas	CC334263	12.03%	8/22/2031
O_2	Airgas	CC407478	21.93%	7/7/2030

No deviations, additions, or exclusions from the test methods, test protocol, the Mostardi Platt Quality Manual, or the ASTM D7036-12 occurred. The specific test conditions encountered did not interfere with the collection of the data.

The identifications of the individuals associated with the test program are summarized below.

TEST PERSONNEL INFORMATION		
Location	**Address**	**Contact**
Test Coordinator	Lansing Board of Water and Light 1232 Haco Drive P.O. Box 13007 Lansing, Michigan 48912	Mr. Nathan Hude Environmental Compliance Specialist (517) 702-6170 nathan.hude@lbwl.com
Test Facility	Lansing Board of Water and Light REO Town Facility 1201 S. Washington Ave. Lansing, Michigan 48917	
Testing Company Supervisor	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Mr. Christopher E. Jensen Senior Project Manager 630-993-2100 (phone) cjensen@mp-mail.com QI Group V (certified on 1/4/2023)
Testing Company Personnel		Malik Gordon Test Technician

Copies of the QI certifications for test personnel are included in Appendix B.

2.0 TEST METHODOLOGY

Emission testing was conducted following the United States Environmental Protection Agency (USEPA) methods specified in 40CFR75 and 40CFR60, Appendix A in addition to the Mostardi Platt Quality Manual and the test protocol. Schematics of the test section diagrams and sampling trains used are included in Appendix C and D respectively. Calculation and nomenclature are included in Appendix E. Copies of analyzer print-outs for each test run are included in Appendix F. CEM data and process data as provided by Lansing Board of Water and Light are included in Appendix G.

The following methodologies were used during the test program:

Method 3A Oxygen (O_2) Determination

Stack gas O_2 concentrations and emission rates were determined in accordance with USEPA Method 3A, 40CFR60, Appendix A. A Servomex analyzer was used to determine the O_2 concentrations in the manner specified in the Method. The instrument has a paramagnetic detector and the O_2 operates in the nominal range of 0% to 25% with the specific range determined by the high-level calibration gas of 21.93%. High-range calibrations were performed using USEPA Protocol gas. Zero nitrogen (a low ppm pollutant in balance nitrogen calibration gases) was introduced during other instrument calibrations to check instrument zero. High- and a mid-range % O_2 levels in balance nitrogen were also introduced. Zero and mid-range calibrations were performed using USEPA Protocol gas after each test run. Copies of the gas cylinder certifications are found in Appendix I. This testing met the performance specifications as outlined in the Method.

Method 7E Nitrogen Oxides (NO_x) Determination

Stack gas NO_x concentrations and emission rates were determined in accordance with USEPA Method 7E, 40CFR60, Appendix A. A Thermo Scientific Model 42i-HL High level Chemiluminescence Nitrogen Oxides Analyzer was used to determine nitrogen oxides concentrations, in the manner specified in the Method. The instrument operated in the nominal range of 0 ppm to 50 ppm with the specific range determined by the high-level span calibration gas of 25.29 ppm.

The Model 42i-HL High level is based on the principle that nitric oxide (NO) and ozone (O_3) react to produce a characteristic luminescence with an intensity linearly proportional to the NO concentration. Infrared light emission results when electronically excited nitrogen dioxide (NO_2) molecules decay to lower energy states. Specifically,

$$NO+O_3 \rightarrow NO_2+O_2+h\upsilon$$

NO_2 must first be transformed into NO before it can be measured using the chemiluminescent reaction. NO_2 is converted to NO by a stainless steel NO_2-to-NO converter heated to about 641 °C. The flue gas air sample is drawn into the Model 42i-HL High level through the sample bulkhead. The sample flows through a particulate filter, a capillary, and then to the mode solenoid valve. The solenoid valve routes the sample either straight to the reaction chamber (NO mode) or through the NO_2-to-NO converter and then to the reaction chamber (NOx mode).

Dry air enters the Model 42i-HL High level through the dry air bulkhead, through a flow sensor, and then through a silent discharge ozonator. The ozonator generates the necessary ozone concentration needed for the chemiluminescent reaction. The ozone reacts with the NO in the ambient air sample to produce electronically excited NO_2 molecules. A photomultiplier tube (PMT) housed in a thermoelectric cooler detects the NO_2 luminescence.

The NO and NO_x concentrations calculated in the NO and NO_x modes are stored in memory. The difference between the concentrations is used to calculate the NO_2 concentration. The Model 42i-HL outputs NO, NO_2, and NO_x concentrations to both the front panel display and the analog outputs.

Stack gas was delivered to the analyzer via a Teflon® sampling line, heated to a minimum temperature of 250°F. Excess moisture in the stack gas was removed using a refrigerated condenser. The entire system was calibrated in accordance with the Method, using USEPA Protocol gases introduced at the probe, before and after each test run. This testing met the performance specifications as outlined in the Method.

A list of calibration gases used and the results of all calibration and other required quality assurance checks are found in Appendix H. Copies of the gas cylinder certifications are found in Appendix I. The NO_2 to NO converter test can be found in Appendix J. This testing met the performance specifications as outlined in the Method.

3.0 TEST RESULT SUMMARIES

Client: Lansing Board of Water & Light
Facility: REO Town Facility
Project #: M241102
Fuel Type: Natural Gas

Location: HRSG #2 Stack
Date: 3/14/24
Test Method: 7E, 3A
Fuel Factor: 8710

O2 based NOx lb/mmBtu RATA

CEM Analyzer Information

NO_x Monitor/Model:	Thermo Fisher Scientific 41iQ-LS	**NO_x Serial # :**	1200416212
O2 Monitor/Model:	Thermo Fisher Scientific 41iQ-LS	**O2 Serial # :**	1200416212

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x lb/MMBtu	CEM NO_x lb/MMBtu	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	03/14/24	05:45	06:05	0.055	0.046	0.009	0.000081
1	2	03/14/24	06:20	06:40	0.054	0.047	0.007	0.000049
0	3	03/14/24	06:57	07:17	0.055	0.044	0.011	0.000121
1	4	03/14/24	07:33	07:53	0.053	0.044	0.009	0.000081
1	5	03/14/24	08:06	08:26	0.052	0.043	0.009	0.000081
1	6	03/14/24	08:38	08:58	0.051	0.043	0.008	0.000064
1	7	03/14/24	09:12	09:32	0.050	0.041	0.009	0.000081
1	8	03/14/24	09:44	10:04	0.049	0.039	0.010	0.000100
1	9	03/14/24	10:17	10:37	0.047	0.037	0.010	0.000100
1	10	03/14/24	10:51	11:11	0.049	0.039	0.010	0.000100

n	**9**	
t(0.025)	**2.306**	
Mean Reference Method Value	**0.051**	**RM avg**
Mean CEM Value	**0.042**	**CEM avg**
Sum of Differences	**0.081**	**di**
Mean Difference	**0.009**	**d**
Sum of Differences Squared	**0.001**	**di^2**
Standard Deviation	**0.001**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.001**	**cc**
Relative Accuracy - APS	**0.009**	**lb/mmBtu difference [A]**
Bias Adjustment Factor	**1.111**	**BAF[B]**

[A] Relative accuracy for low emission sources with NO_x emissions of ≤ 0.200 lbs/mmBtu based on a mean difference of +/- 0.015 lbs/mmBtu for annual RATA testing, or +/- 0.020 lbs/mmBtu for semi-annual RATA testing.

[B] Maximum Bias Adjutment Factor

Client: Lansing Board of Water & Light
Facility: REO Town Facility
Project #: M241102

Location: HRSG #2 Stack
Date: 3/14/24
Test Method: 7E, 3A

NOx ppmvd @ 15% O2 RATA

CEM Analyzer Information

NO_x Monitor/Model:	Thermo Fisher Scientific 41iQ-LS	**NO_x Serial # :**	1200416212
O_2 Monitor/Model:	Thermo Fisher Scientific 41iQ-LS	**O_2 Serial # :**	1200416212

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NOx ppmvd @ 15 %O2	CEM NOx ppmvd @ 15 %O2	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	03/14/24	05:45	06:05	15.0	12.6	2.4	5.76
1	2	03/14/24	06:20	06:40	14.7	12.7	2.0	4.00
0	3	03/14/24	06:57	07:17	14.9	11.8	3.1	9.61
1	4	03/14/24	07:33	07:53	14.5	11.8	2.7	7.29
1	5	03/14/24	08:06	08:26	14.2	11.5	2.7	7.29
1	6	03/14/24	08:38	08:58	13.9	11.5	2.4	5.76
1	7	03/14/24	09:12	09:32	13.5	11.2	2.3	5.29
1	8	03/14/24	09:44	10:04	13.2	10.6	2.6	6.76
1	9	03/14/24	10:17	10:37	12.7	10.2	2.5	6.25
1	10	03/14/24	10:51	11:11	13.2	10.5	2.7	7.29

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**13.878**	**RM avg**
Mean CEM Value	**11.400**	**CEM avg**
Sum of Differences	**22.300**	**di**
Mean Difference	**2.478**	**d**
Sum of Differences Squared	**55.690**	**di^2**
Standard Deviation	**0.233**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.179**	**cc**
Relative Accuracy	**19.15**	**RA**

Client: Lansing Board of Water & Light
Facility: REO Town Facility
Project #: M241102

Location: HRSG #2 Stack
Date: 3/14/24
Test Method: 3A

O_2 % (dry) RATA

CEM Analyzer Information

O_2 Monitor/Model:	Thermo Fisher Scientific 41iQ-LS	O_2 Serial # :	1200416212

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM O_2 % (dry)	CEM O_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	03/14/24	05:45	06:05	15.3	15.3	0.0	0.00
1	2	03/14/24	06:20	06:40	15.1	15.3	-0.2	0.04
1	3	03/14/24	06:57	07:17	15.2	15.3	-0.1	0.01
1	4	03/14/24	07:33	07:53	15.2	15.3	-0.1	0.01
1	5	03/14/24	08:06	08:26	15.2	15.3	-0.1	0.01
1	6	03/14/24	08:38	08:58	15.2	15.3	-0.1	0.01
1	7	03/14/24	09:12	09:32	15.1	15.3	-0.2	0.04
0	8	03/14/24	09:44	10:04	15.1	15.3	-0.2	0.04
1	9	03/14/24	10:17	10:37	15.1	15.2	-0.1	0.01
1	10	03/14/24	10:51	11:11	15.1	15.2	-0.1	0.01

n	9	
t(0.025)	2.306	
Mean Reference Method Value	15.167	RM avg
Mean CEM Value	15.278	CEM avg
Sum of Differences	-1.000	di
Mean Difference	-0.111	d
Sum of Differences Squared	0.140	di^2
Standard Deviation	0.060	sd
Confidence Coefficient 2.5% Error (1-tail)	0.046	cc
Relative Accuracy	1.04	RA

4.0 CERTIFICATION

Mostardi Platt is pleased to have been of service to Lansing Board of Water and Light. If you have any questions regarding this test report, please do not hesitate to contact us at 630-993-2100.

As the program manager, I hereby certify that this test report represents a true and accurate summary of emissions test results and the methodologies employed to obtain those results. The test program was performed in accordance with the test protocol, test methods, the Mostardi Platt Quality Manual, and the ASTM D7036-12, as applicable.

MOSTARDI PLATT

Christopher E. Jensen — Program Manager

Scott W. Banach — Quality Assurance

APPENDICES

Appendix A - Company AETB Certification

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March 23, 2012

Effective immediately, Mostardi Platt self-certifies that all Part 75 test projects conform to the ASTM D 7036-04 Standard Practice. The following contact information is provided as required by the Standard:

Mostardi Platt
888 Industrial Drive
Elmhurst, Illinois 60126

630-993-2100

tplatt@mp-mail.com

Also, attached is a list of each Qualified Individual (QI) with the type of exam (e.g., Group I, II, III IV and/or V), the date the exam was taken and the name and email address of the exam provider.

Should you have any questions or need additional information, please contact Thomas Platt, P.E. at 630-993-2683.

Approved:

By: _____
Robert J. Platt
Chief Executive Officer

QSTI AETB Import Data

QI Last Name [REQUIRED]	QI First Name [REQUIRED]	QI Middle Initial	AETB Name [REQUIRED]	AETB Phone Number [REQUIRED]	AETB Email [REQUIRED]	Exam Date mm/dd/yyyy [REQUIRED]	Exam Provider Name [REQUIRED]	Exam Provider Email [REQUIRED]	Comment
Beckham	Kenneth	J	Mostard Platt	630-993-2100	tplatt@mp-mail.com	5/18/2023	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Benninghoff	Aaron	W	Mostard Platt	630-993-2100	tplatt@mp-mail.com	9/8/2023	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Burton	Stuart	L	Mostard Platt	630-993-2100	tplatt@mp-mail.com	1/4/2023	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Carlisle	Robert	W	Mostard Platt	630-993-2100	tplatt@mp-mail.com	1/8/2021	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Coleman	Paul	F	Mostard Platt	630-993-2100	tplatt@mp-mail.com	3/22/2023	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Crivlare	Jeffrey	M	Mostard Platt	630-993-2100	tplatt@mp-mail.com	1/4/2023	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Crooks	Nate	J	Mostard Platt	630-993-2100	tplatt@mp-mail.com	11/9/2023	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Dunn	Christian	P	Mostard Platt	630-993-2100	tplatt@mp-mail.com	10/27/2023	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
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Gross	Jeffery	M	Mostard Platt	630-993-2100	tplatt@mp-mail.com	1/19/2024	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Hendricks	Benjamin	W	Mostard Platt	630-993-2100	tplatt@mp-mail.com	1/30/2020	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Howe	Jacob	W	Mostard Platt	630-993-2100	tplatt@mp-mail.com	2/17/2021	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Jensen	Christopher	E	Mostard Platt	630-993-2100	tplatt@mp-mail.com	1/4/2023	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
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Kossack	Daniel	J	Mostard Platt	630-993-2100	tplatt@mp-mail.com	11/11/2021	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
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Russ	Timothy	E	Mostard Platt	630-993-2100	tplatt@mp-mail.com	4/8/2020	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Sands	Stuart	T	Mostard Platt	630-993-2100	tplatt@mp-mail.com	1/5/2023	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Sather	Michael	P	Mostard Platt	630-993-2100	tplatt@mp-mail.com	2/7/2020	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Sollars	Richard	J	Mostard Platt	630-993-2100	tplatt@mp-mail.com	7/28/2023	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Sorce	Angelo	M	Mostard Platt	630-993-2100	tplatt@mp-mail.com	2/18/2022	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)
Trezak	Christopher	S	Mostard Platt	630-993-2100	tplatt@mp-mail.com	4/14/2020	Source Evaluation Society	qstiprogram@gmail.com	Group V (Part 75)

Appendix B - QI Certification(s) for Field Personnel

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Qualified Individual

Christopher E. Jensen

Has satisfactorily completed the requirements of

ASTM D 7036 – 04, Section 8.3

Standard Practice for Competence of Air Emission Testing Bodies

Examinations provided by Source Evaluation Society: www.sesnews.org, (919) 544-6338

All Part 75 test methods, under my supervision, shall conform to the company's Quality Manual and to this practice, in all respects.

Passed Group V on 1/4/2023

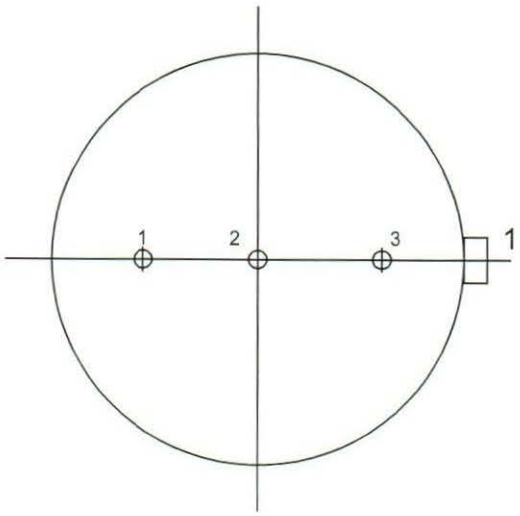
Expiration Date: Group V on 1/4/2028

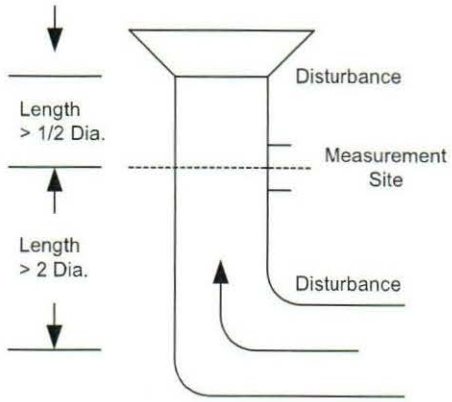
Signature: _____ Date: 1/9/2023

Quality Manager: _____ Technical Director: _____

Appendix C - Test Section Diagram

GASEOUS TRAVERSE FOR ROUND DUCTS





Job: Lansing Board of Water and Light
REO Town Facility
Lansing, Michigan

Date: March 14, 2024

Test Location: HRSG #2 Stack

Stack Diameter: 9.67 Feet

Stack Area: 73.44 Square Feet

No. Sample Points: 3

Port Length: 12 inches

Distance from Inside Wall
To Traverse Point:

1. 83.3 % of diameter
2. 50.0 % of diameter
3. 16.7 % of diameter

Appendix D - Sample Train Diagram

USEPA Methods 3A and 7E Extractive Gaseous Sampling Diagram