Source Test Report for
2022 Compliance Emissions Testing

Combustion Turbines Nos. 1-4
(EUCOMBTURB01-EUCOMBTURB04)

CMS Generation Michigan Power LLC
Livingston Generation Station
Gaylord, Michigan

Prepared For:

CMS Generation Michigan Power LLC
Livingston Generation Station
North Townline Road
Gaylord, MI 49735

Prepared By:

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For Submission To:

Michigan Department of Environment, Great Lakes, and Energy
Air Quality Division-Technical Programs Unit
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Lansing, MI 48933

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TO ASTM D7036 ONLY
CERT #3971.01

Review and Certification

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: Todd Wessel **Date:** 06 / 20 / 2022

Name: Todd Wessel **Title:** Client 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:** 06 / 20 / 2022

Name: Robert J. Lisy, Jr. **Title:** Reporting Hub Manager

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1.0 Introduction

1.1 Summary of Test Program

CMS Generation Michigan Power LLC (CMS) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on the Combustion Turbines No. 1 (EUCOMBTURB01), No. 2 (EUCOMBTURB02), No. 3 (EUCOMBTURB03), and No. 4 (EUCOMBTURB04) at their Livingston Generation Station (LGS) facility (State Registration Number: N6526) located in Gaylord, Michigan. The tests were conducted on May 2-5, 2022, to satisfy the emissions testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit No. MI-ROP-N6526-2014a and 40 CFR Part 60, Subpart GG, and 40 CFR Part 75, Appendix E.

The specific objectives were to:

- Verify the emissions of nitrogen oxides (NO_x) and carbon monoxide (CO) from the EUCOMBTURB01, EUCOMBTURB02, EUCOMBTURB03, and EUCOMBTURB04 exhausts during four different operational loads (85, 90, 95, and 100 percent)
- Conduct the test program with a focus on safety

Montrose performed the tests to measure the emission parameters listed in Table 1-1.

Table 1-1
Summary of Test Program

Test Date(s)	Unit ID/ Source Name	Activity/Parameters	Test Methods	No. of Runs	Duration (Minutes)
5/2/2022	EUCOMBTURB01	O_2	EPA 3A	12	24
5/2/2022	EUCOMBTURB01	NO_x	EPA 7E	12	24
5/2/2022	EUCOMBTURB01	CO	EPA 10	12	24
5/3/2022	EUCOMBTURB02	O_2	EPA 3A	12	24
5/3/2022	EUCOMBTURB02	NO_x	EPA 7E	12	24
5/3/2022	EUCOMBTURB02	CO	EPA 10	12	24
5/4/2022	EUCOMBTURB03	O_2	EPA 3A	12	24
5/4/2022	EUCOMBTURB03	NO_x	EPA 7E	12	24
5/4/2022	EUCOMBTURB03	CO	EPA 10	12	24
5/5/2022	EUCOMBTURB04	O_2	EPA 3A	12	24
5/5/2022	EUCOMBTURB04	NO_x	EPA 7E	12	24
5/5/2022	EUCOMBTURB04	CO	EPA 10	12	24

To simplify this report, a list of Units and Abbreviations is included in Appendix C.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility and sampling locations, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to their respective permit limits in Tables 1-2 through 1-5. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The testing was conducted by the Montrose personnel listed in Table 1-6. The tests were conducted according to the test plan (protocol) dated March 31, 2022, that was submitted to and approved by EGLE.

Table 1-2
Summary of Average Compliance Results – EUCOMBTURB01

May 2, 2022

Parameter/Units	Average Results				Emission Limits
	85% Load	90% Load	95% Load	100% Load	
Nitrogen Oxides (NO_x)					
ppmvd @ 15% O_2	64	66	69	72	75
lb/MMBtu	0.23	0.24	0.25	0.27	--
Carbon Monoxide (CO)					
lb/MMBtu	0.40	0.34	0.31	0.27	0.48

Table 1-3
Summary of Average Compliance Results – EUCOMBTURB02

May 3, 2022

Parameter/Units	Average Results				Emission Limits
	85% Load	90% Load	95% Load	100% Load	
Nitrogen Oxides (NO_x)					
ppmvd @ 15% O_2	62	65	67	70	75
lb/MMBtu	0.23	0.24	0.25	0.26	--
Carbon Monoxide (CO)					
lb/MMBtu	0.41	0.37	0.34	0.31	0.48

Table 1-4
Summary of Average Compliance Results – EUCOMBTURB03

May 4, 2022

Parameter/Units	Average Results				Emission Limits
	85% Load	90% Load	95% Load	100% Load	
Nitrogen Oxides (NO_x)					
ppmvd @ 15% O_2	60	67	73	72	75
lb/MMBtu	0.22	0.25	0.27	0.27	--
Carbon Monoxide (CO)					
lb/MMBtu	0.41	0.35	0.31	0.29	0.48

Table 1-5
Summary of Average Compliance Results – EUCOMBTURB04

May 5, 2022

Parameter/Units	Average Results				Emission Limits
	85% Load	90% Load	95% Load	100% Load	
Nitrogen Oxides (NO_x)					
ppmvd @ 15% O_2	66	72	67	70	75
lb/MMBtu	0.24	0.26	0.25	0.26	--
Carbon Monoxide (CO)					
lb/MMBtu	0.35	0.29	0.27	0.24	0.48

1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location:	CMS Generation Michigan Power LLC Livingston Power Station North Townline Road Gaylord, MI 49735	
Project Contact:	Adam Brentlinger	Theon Heisserer IV
Role:	Facility Manager	EHS Coordinator
Company:	CMS-Livingston Generation Station	CMS Energy Enterprises
Telephone:	989-705-2552	313-336-7189 Ext. 250
Email:	Adam.Brentlinger@cmsenergy.com	Theon.HeissererIV@cmsenergy.com

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Agency Information

Regulatory Agency:	EGLE
Agency Contact:	Tammy Bell
Telephone:	313-330-0105
Email:	bellT4@michigan.gov

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	Todd Wessel	Robert J. Lisy, Jr.
Title:	Client Project Manager	Reporting Hub Manager
Telephone:	248-548-8070	440-262-3760
Email:	twessel@montrose-env.com	rlisy@montrose-env.com

Test personnel and observers are summarized in Table 1-7.

Table 1-7
Test Personnel and Observers

Name	Affiliation	Role/Responsibility
Todd Wessel	Montrose	Client Project Manager, QI
Dave Koponen	Montrose	Field Technician
Theon Heisserer IV	CMS Energy	Observer/Client Liaison/Test Coordinator
Kathryn Cunningham	CMS Energy	Observer/Client Liaison
Adam Brentlinger	CMS Energy	Observer
Jeremy Howe	EGLE	Observer
Becky Radulski	EGLE	Observer
Daniel Droste	EGLE	Observer

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

The CMS-Livingston Generation Station facility located in Gaylord, Michigan, operates four Dresser-Rand combustion turbines (EUCOMBTURB01, EUCOMBTURB02, EUCOMBTURB03, and EUCOMBTURB04) that fire natural gas (NG) as their primary fuel. Each turbine is nominally rated at an output of 39 Megawatts (MW). The turbine generator consists of a compressor, combustion turbine, and generator. Energy is generated at the combustion turbine by drawing in ambient air by means of burning fuel and expanding the hot combustion gases in a three-stage turbine. A water injection system minimizes the emissions of NO_x from the turbines, while the emissions of CO and SO_2 are minimized by the efficient combustion of low sulfur-bearing, clean-burning fuels.

All four turbines were in operation for this test event. Since the maximum output of 39 MW cannot be achieved during the summer months, a maximum output of approximately 33 MW was utilized during this test.

2.2 Flue Gas Sampling Locations

The turbine exhaust ducts were rectangular, measuring 137.75-inches by 173.75-inches with a height of 468-inches. Each turbine exhaust duct had eight port that were 85.5-inches in length and located equidistant from one another in a cone-shaped transition section of the exhaust duct. The sampling location at this transition section is 117.0-inches by 173.75-inches.

For each turbine, a twenty-four (24) point stratification test was performed during Run 1. A three-point traverse (located at 16.7, 50.0, and 83.3 percent of the measurement line) was performed in each port. The EUCOMBTURB01, EUCOMBTURB02, and EUCOMBTURB04 sampling locations were minimally stratified and met the Stratification Acceptance Criteria for a three-point traverse as specified in EPA Method 7E, Section 8.1.2. The EUCOMBTURB03 sampling location was unstratified and met the Stratification Acceptance Criteria for a single-point traverse as specified in EPA Method 7E, Section 8.1.2.

For Runs 2 through 12, four ports were traversed utilizing a three-point traverse (located at 16.7, 50.0, and 83.3 percent of the measurement line).

See Appendix A.1 for more information.

2.3 Operating Conditions and Process Data

Emission tests were performed while the turbines were operating at four different operational conditions (85, 90, 95, and 100 percent of load).

Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. The process data that was provided is presented in Appendix B. Data collected includes the following parameters:

- Load, MW
- Natural gas flow, mscfh
- Water injection rate
- Compressor temperature
- Discharge pressure
- Water-to-fuel ratio

3.0 Sampling and Analytical Procedures

3.1 Test Methods

The test methods for this test program have been presented in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

3.1.1 EPA Method 1, Sample and Velocity Traverses for Stationary Sources

EPA Method 1 is used to assure that representative measurements of volumetric flow rate are obtained by dividing the cross-section of the stack or duct into equal areas, and then locating a traverse point within each of the equal areas. Acceptable sample locations must be located at least two stack or duct equivalent diameters downstream from a flow disturbance and one-half equivalent diameter upstream from a flow disturbance.

3.1.2 EPA Method 3A, Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 3A is an instrumental test method used to measure the concentration of O_2 and CO_2 in stack gas. The effluent gas is continuously or intermittently sampled and conveyed to analyzers that measure the concentration of O_2 and CO_2. The performance requirements of the method must be met to validate data.

The typical sampling system is detailed in Figure 3-1.

3.1.3 EPA Method 7E, Determination of Nitrogen Oxides Emissions from Stationary Source (Instrumental Analyzer Procedure)

EPA Method 7E is an instrumental test method used to continuously measure emissions of NO_x as NO_2. Conditioned gas is sent to an analyzer to measure the concentration of NO_x. NO and NO_2 can be measured separately or simultaneously together but, for the purposes of this method, NO_x is the sum of NO and NO_2. The performance requirements of the method must be met to validate the data.

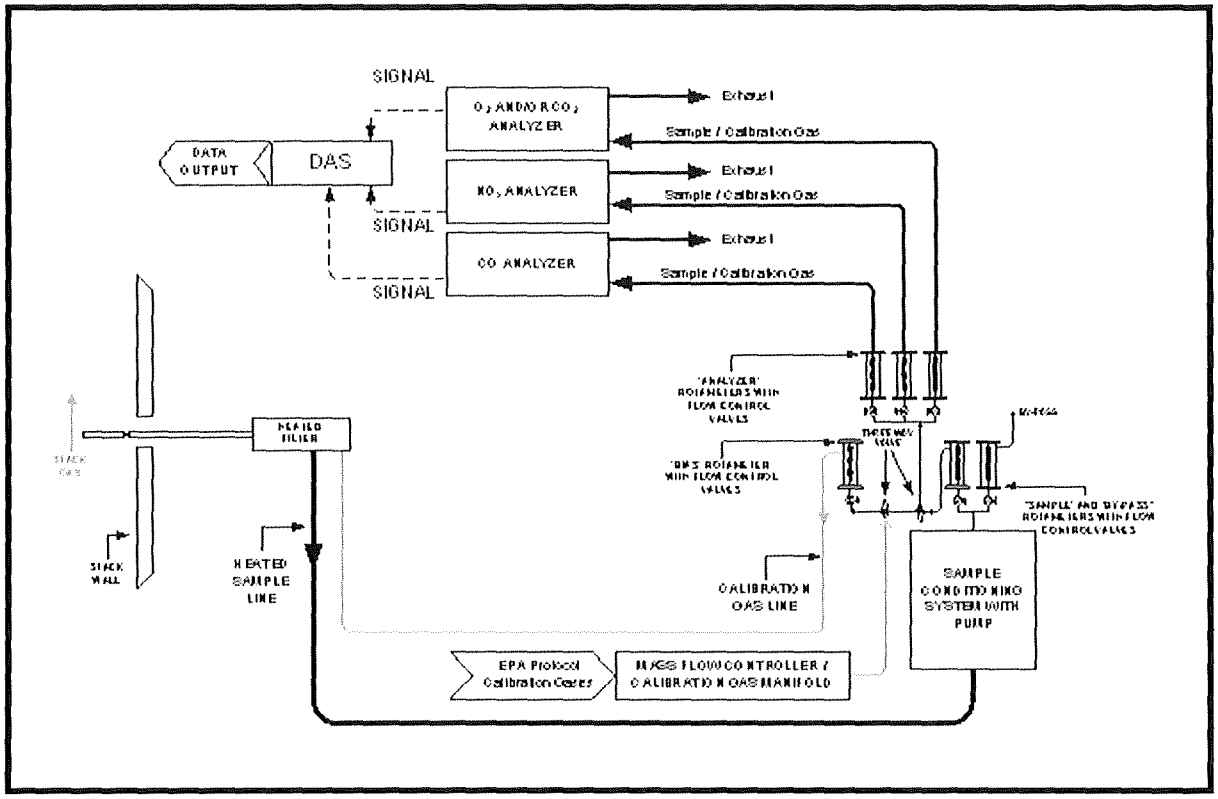
The typical sampling system is detailed in Figure 3-1.

3.1.4 EPA Method 10, Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 10 is an instrumental test method used to continuously measure emissions of CO. Conditioned gas is sent to an analyzer to measure the concentration of CO. The performance requirements of the method must be met to validate the data.

The typical sampling system is detailed in Figure 3-1.

Figure 3-1
EPA Methods 3A, 7E, and 10 Sampling Train



3.1.5 EPA Method 19, Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates

EPA Method 19 is a manual method used to determine (a) PM, SO_2, and NO_x emission rates; (b) sulfur removal efficiencies of fuel pretreatment and SO_2 control devices; and (c) overall reduction of potential SO_2 emissions. This method provides data reduction procedures, but does not include any sample collection or analysis procedures.

EPA Method 19 is used to calculate mass emission rates in units of lb/MMBtu. EPA Method 19, Table 19-2 contains a list of assigned fuel factors for different types of fuels, which can be used for these calculations.

3.2 Process Test Methods

The test plan did not require that process samples be collected during this test program; therefore, no process sample data are presented in this test report.

4.0 Test Discussion and Results

4.1 Field Test Deviations and Exceptions

No field deviations or exceptions from the test plan or test methods occurred during this test program.

4.2 Presentation of Results

The average results are compared to the permit limits in Tables 1-2 through 1-6. The results of individual compliance test runs performed are presented in Tables 4-1 through 4-16. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

Table 4-1
NO_x, CO Emissions Results -
EUCOMBTURB01 – 85% LOAD

Run Number	1	2	3	Average
Date	5/2/2022	5/2/2022	5/2/2022	--
Time	6:54-7:48	8:06-8:43	8:58-9:36	--
Process Data *				
fuel flow, scfh	450,523	444,356	442,784	445,888
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	17.17	17.17	17.18	17.17
Nitrogen Oxides (NO_x)				
ppmvd	40	40	41	40
ppmvd @ 15% O_2	64	63	64	64
lb/hr (as NO_2)	110	108	109	109
lb/MMBtu (as NO_2)	0.23	0.23	0.24	0.23
Carbon Monoxide (CO)				
ppmvd	120	112	102	111
lb/MMBtu	0.43	0.40	0.36	0.40

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-2
NO_x, CO Emissions Results -
EUCOMBTURB01 – 90% LOAD

Run Number	1	2	3	Average
Date	5/2/2022	5/2/2022	5/2/2022	--
Time	9:51-10:27	10:43-11:20	11:36-12:16	--
Process Data *				
fuel flow, scfh	459,989	459,729	459,767	459,828
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	17.09	17.10	17.13	17.11
Nitrogen Oxides (NO_x)				
ppmvd	42	42	42	42
ppmvd @ 15% O_2	65	66	66	66
lb/hr (as NO_2)	115	116	116	115
lb/MMBtu (as NO_2)	0.24	0.24	0.24	0.24
Carbon Monoxide (CO)				
ppmvd	97	98	99	98
lb/MMBtu	0.34	0.34	0.35	0.34

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-3
NO_x, CO Emissions Results -
EUCOMBTURB01 – 95% LOAD

Run Number	1	2	3	Average
Date	5/2/2022	5/2/2022	5/2/2022	--
Time	12:30-13:08	13:23-14:02	14:15-14:51	--
Process Data *				
fuel flow, scfh	478,744	479,497	478,742	478,994
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	17.02	17.03	17.02	17.03
Nitrogen Oxides (NO_x)				
ppmvd	44	46	46	45
ppmvd @ 15% O_2	68	70	70	69
lb/hr (as NO_2)	124	128	129	127
lb/MMBtu (as NO_2)	0.25	0.26	0.26	0.25
Carbon Monoxide (CO)				
ppmvd	92	90	90	91
lb/MMBtu	0.31	0.31	0.31	0.31

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-4
NO_x, CO Emissions Results -
EUCOMBTURB01 – 100% LOAD

Run Number	1	2	3	Average
Date	5/2/2022	5/2/2022	5/2/2022	--
Time	15:03-15:40	15:55-16:31	16:45-17:21	--
Process Data *				
fuel flow, scfh	503,501	503,176	503,063	503,247
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	16.88	16.86	16.87	16.87
Nitrogen Oxides (NO_x)				
ppmvd	49	49	49	49
ppmvd @ 15% O_2	72	72	72	72
lb/hr (as NO_2)	139	139	140	139
lb/MMBtu (as NO_2)	0.27	0.27	0.27	0.27
Carbon Monoxide (CO)				
ppmvd	82	79	81	81
lb/MMBtu	0.27	0.26	0.27	0.27

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-5
NO_x, CO Emissions Results -
EUCOMBTURB02 – 85% LOAD

Run Number	1	2	3	Average
Date	5/3/2022	5/3/2022	5/3/2022	--
Time	6:54-7:46	7:59-8:36	8:54-9:32	--
Process Data *				
fuel flow, scfh	445,932	443,371	443,424	444,242
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	17.20	17.16	17.16	17.17
Nitrogen Oxides (NO_x)				
ppmvd	40	39	39	39
ppmvd @ 15% O_2	63	62	62	62
lb/hr (as NO_2)	108	106	105	106
lb/MMBtu (as NO_2)	0.23	0.23	0.23	0.23
Carbon Monoxide (CO)				
ppmvd	115	115	114	115
lb/MMBtu	0.41	0.41	0.40	0.41

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-6
NO_x, CO Emissions Results -
EUCOMBTURB02 – 90% LOAD

Run Number	1	2	3	Average
Date	5/3/2022	5/3/2022	5/3/2022	--
Time	9:46-10:22	10:37-11:14	11:28-12:06	--
Process Data *				
fuel flow, scfh	457,599	457,022	457,168	457,263
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	17.09	17.09	17.09	17.09
Nitrogen Oxides (NO_x)				
ppmvd	42	41	42	42
ppmvd @ 15% O_2	65	64	65	65
lb/hr (as NO_2)	113	112	115	113
lb/MMBtu (as NO_2)	0.24	0.23	0.24	0.24
Carbon Monoxide (CO)				
ppmvd	107	107	107	107
lb/MMBtu	0.37	0.37	0.37	0.37

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-7
NO_x, CO Emissions Results -
EUCOMBTURB02 – 95% LOAD

Run Number	1	2	3	Average
Date	5/3/2022	5/3/2022	5/3/2022	--
Time	12:25-13:01	13:18-13:58	14:13-14:49	--
Process Data *				
fuel flow, scfh	479,080	477,834	476,602	477,839
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	16.98	17.00	17.00	16.99
Nitrogen Oxides (NO_x)				
ppmvd	45	44	44	44
ppmvd @ 15% O_2	67	66	67	67
lb/hr (as NO_2)	123	121	122	122
lb/MMBtu (as NO_2)	0.25	0.24	0.25	0.25
Carbon Monoxide (CO)				
ppmvd	101	100	101	101
lb/MMBtu	0.34	0.34	0.34	0.34

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-8
NO_x, CO Emissions Results -
EUCOMBTURB02 – 100% LOAD

Run Number	1	2	3	Average
Date	5/3/2022	5/3/2022	5/3/2022	--
Time	15:05-15:45	15:59-16:38	16:57-17:34	--
Process Data *				
fuel flow, scfh	501,610	501,818	501,039	501,489
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	16.88	16.88	16.89	16.88
Nitrogen Oxides (NO_x)				
ppmvd	48	48	47	48
ppmvd @ 15% O_2	71	71	69	70
lb/hr (as NO_2)	137	136	133	135
lb/MMBtu (as NO_2)	0.26	0.26	0.25	0.26
Carbon Monoxide (CO)				
ppmvd	94	96	95	95
lb/MMBtu	0.31	0.31	0.31	0.31

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-9
NO_x, CO Emissions Results -
EUCOMBTURB03 – 85% LOAD

Run Number	1	2	3	Average
Date	5/4/2022	5/4/2022	5/4/2022	--
Time	6:54-7:38	7:52-8:28	8:42-9:20	--
Process Data *				
fuel flow, scfh	441,343	439,800	439,854	440,332
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	17.20	17.17	17.16	17.18
Nitrogen Oxides (NO_x)				
ppmvd	38	38	38	38
ppmvd @ 15% O_2	60	60	60	60
lb/hr (as NO_2)	102	101	102	102
lb/MMBtu (as NO_2)	0.22	0.22	0.22	0.22
Carbon Monoxide (CO)				
ppmvd	118	117	114	116
lb/MMBtu	0.42	0.41	0.40	0.41

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-10
NO_x, CO Emissions Results -
EUCOMBTURB03 – 90% LOAD

Run Number	1	2	3	Average
Date	5/4/2022	5/4/2022	5/4/2022	--
Time	9:34-10:12	10:27-11:06	11:21-11:58	--
Process Data *				
fuel flow, scfh	457,461	457,618	461,262	458,780
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	17.06	17.05	17.01	17.04
Nitrogen Oxides (NO_x)				
ppmvd	42	44	45	44
ppmvd @ 15% O_2	65	67	68	67
lb/hr (as NO_2)	114	118	119	117
lb/MMBtu (as NO_2)	0.24	0.25	0.25	0.25
Carbon Monoxide (CO)				
ppmvd	106	103	100	103
lb/MMBtu	0.36	0.35	0.34	0.35

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-11
NO_x, CO Emissions Results -
EUCOMBTURB03 – 95% LOAD

Run Number	1	2	3	Average
Date	5/4/2022	5/4/2022	5/4/2022	--
Time	12:15-12:52	13:07-13:45	13:59-14:35	--
Process Data *				
fuel flow, scfh	481,151	480,981	481,301	481,144
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	16.92	16.90	16.89	16.90
Nitrogen Oxides (NO_x)				
ppmvd	49	49	49	49
ppmvd @ 15% O_2	72	73	73	73
lb/hr (as NO_2)	133	135	134	134
lb/MMBtu (as NO_2)	0.26	0.27	0.27	0.27
Carbon Monoxide (CO)				
ppmvd	95	95	93	94
lb/MMBtu	0.32	0.31	0.31	0.31

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-12
NO_x, CO Emissions Results -
EUCOMBTURB03 – 100% LOAD

Run Number	1	2	3	Average
Date	5/4/2022	5/4/2022	5/4/2022	--
Time	15:09-15:44	15:59-16:36	16:51-17:28	--
Process Data *				
fuel flow, scfh	504,018	504,924	505,553	504,832
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	16.80	16.76	16.76	16.78
Nitrogen Oxides (NO_x)				
ppmvd	51	50	50	50
ppmvd @ 15% O_2	73	72	71	72
lb/hr (as NO_2)	141	139	138	139
lb/MMBtu (as NO_2)	0.27	0.26	0.26	0.27
Carbon Monoxide (CO)				
ppmvd	92	91	92	92
lb/MMBtu	0.30	0.29	0.29	0.29

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-13
NO_x, CO Emissions Results -
EUCOMBTURB04 – 85% LOAD

Run Number	1	2	3	Average
Date	5/5/2022	5/5/2022	5/5/2022	--
Time	6:53-7:45	8:00-8:37	8:55-9:33	--
Process Data *				
fuel flow, scfh	450,955	451,414	452,773	451,714
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	17.30	17.24	17.23	17.25
Nitrogen Oxides (NO_x)				
ppmvd	40	41	42	41
ppmvd @ 15% O_2	65	66	67	66
lb/hr (as NO_2)	112	114	117	114
lb/MMBtu (as NO_2)	0.24	0.24	0.25	0.24
Carbon Monoxide (CO)				
ppmvd	103	96	90	97
lb/MMBtu	0.38	0.35	0.33	0.35

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-14
NO_x, CO Emissions Results -
EUCOMBTURB04 – 90% LOAD

Run Number	1	2	3	Average
Date	5/5/2022	5/5/2022	5/5/2022	--
Time	9:52-10:29	10:44-11:21	11:37-12:16	--
Process Data *				
fuel flow, scfh	469,387	469,196	471,114	469,899
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	17.15	17.12	17.11	17.13
Nitrogen Oxides (NO_x)				
ppmvd	46	46	46	46
ppmvd @ 15% O_2	72	72	72	72
lb/hr (as NO_2)	129	129	131	129
lb/MMBtu (as NO_2)	0.26	0.26	0.27	0.26
Carbon Monoxide (CO)				
ppmvd	84	81	79	81
lb/MMBtu	0.30	0.28	0.28	0.29

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-15
NO_x, CO Emissions Results -
EUCOMBTURB04 – 95% LOAD

Run Number	1	2	3	Average
Date	5/5/2022	5/5/2022	5/5/2022	--
Time	12:57-13:35	13:49-14:25	14:39-15:14	--
Process Data *				
fuel flow, scfh	492,249	492,238	493,260	492,582
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	17.02	16.98	16.97	16.99
Nitrogen Oxides (NO_x)				
ppmvd	44	44	45	44
ppmvd @ 15% O_2	67	66	68	67
lb/hr (as NO_2)	126	124	128	126
lb/MMBtu (as NO_2)	0.25	0.24	0.25	0.25
Carbon Monoxide (CO)				
ppmvd	81	80	79	80
lb/MMBtu	0.28	0.27	0.27	0.27

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-16
NO_x, CO Emissions Results -
EUCOMBTURB04 – 100% LOAD

Run Number	1	2	3	Average
Date	5/5/2022	5/5/2022	5/5/2022	--
Time	15:28-16:06	16:22-16:59	17:14-17:51	--
Process Data *				
fuel flow, scfh	514,837	516,277	515,757	515,624
Sampling & Flue Gas Parameters				
sample duration, minutes	24	24	24	--
O_2, % volume dry	16.85	16.85	16.85	16.85
Nitrogen Oxides (NO_x)				
ppmvd	48	48	49	48
ppmvd @ 15% O_2	70	70	71	70
lb/hr (as NO_2)	139	138	140	139
lb/MMBtu (as NO_2)	0.26	0.26	0.26	0.26
Carbon Monoxide (CO)				
ppmvd	74	74	74	74
lb/MMBtu	0.24	0.24	0.24	0.24

* Process data was provided by CMS-Livingston Generation Station personnel.

Table 4-17
NO_x (lb/hr) Emissions Results -
Combined Turbines

Load	85%	90%	95%	100%
EUCOMBTURB01				
lb/hr (as NO_2)	108.9	115.5	126.9	139.3
EUCOMBTURB02				
lb/hr (as NO_2)	106.2	113.3	122.1	135.1
EUCOMBTURB03				
lb/hr (as NO_2)	101.6	117.3	133.7	139.3
EUCOMBTURB04				
lb/hr (as NO_2)	114.1	129.5	125.9	138.9
Combined Turbines				
lb/hr (as NO_2)	430.8	475.6	508.6	552.5

5.0 Internal QA/QC Activities

5.1 QA/QC Audits

EPA Method 3A, 7E, and 10 calibration audits were all within the measurement system performance specifications for the calibration drift checks, system calibration bias checks, and calibration error checks.

The NO_2 to NO converter efficiency checks of the analyzer were conducted per the procedures in EPA Method 7E, Section 8.2.4. The conversion efficiencies met the criteria.

5.2 QA/QC Discussion

All QA/QC criteria were met during this test program.

5.3 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 included in the report appendices. The content of this report is modeled after the EPA Emission Measurement Center Guideline Document (GD-043).