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 Constitution Hall, 2nd Floor, South 525 West Allegan Street Lansing, MI 48933

INTROSE

Document Number: MW049AS-016467-RT-1002 Test Dates: May 2-5, 2022 Submittal Date: June 24, 2022







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.

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	ЕРА ЗА	12	24
5/3/2022	EUCOMBTURB02	NO _x	EPA 7E	12	24
5/3/2022	EUCOMBTURB02		EPA 10	12	24
5/4/2022	EUCOMBTURB03	O ₂	ЕРА ЗА	12	24
5/4/2022	EUCOMBTURB03	NO _x	EPA 7E	12	24
5/4/2022	EUCOMBTURB03	СО	EPA 10	12	24
5/5/2022	EUCOMBTURB04	O ₂	ЕРА ЗА	12	24
5/5/2022	EUCOMBTURB04	NO _x	EPA 7E	12	24
5/5/2022	EUCOMBTURB04		EPA 10	12	24

Table 1-1 Summary of Test Program

CMS Generation Michigan Power LLC-Livingston Generation Station 2022 Compliance Emissions Test Report



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

Baramotor/Unite		Emission			
Parameter/ Units	85% Load	90% Load	95% Load	100% Load	Limits
Nitrogen Oxides (N	D _x)			1	1
ppmvd @ 15% O ₂	64	66	69	72	75
lb/MMBtu	0.23	0.24	0.25	0.27	
Carbon Monoxide (C	:0)	Baranya, papananana mangan popanana kanang papanana kanang papanan	£	gran and a final first and a first a fi	
lb/MMBtu	0.40	0.34	0.31	0.27	0.48

Table 1-3

Summary of Average Compliance Results – EUCOMBTURB02

May 3, 2022

Daxameter/Ilaite		Emission			
Parameter/ Units	85% Load	90% Load	95% Load	100% Load	Limits
Nitrogen Oxides (N	O _x)				k.
ppmvd @ 15% O ₂	62	65	67	70	75
lb/MMBtu	0.23	0.24	0.25	0.26	
Carbon Monoxide (C	CO)				
lb/MMBtu	0.41	0.37	0.34	0.31	0.48

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Table 1-4

Summary of Average Compliance Results - EUCOMBTURB03

May 4, 2022

Danamator / Unite		Emission				
Parameter/ Units	85% Load	90% Load	95% Load	100% Load	Limits	
Nitrogen Oxides (N	0 _x)			· ·		
ppmvd @ 15% O₂	60	67	73	72	75	
lb/MMBtu	0.22	0.25	0.27	0.27		
Carbon Monoxide (CO)	A commente non accounter of a maximum of the case of the first of the set		an a		
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 /Unite		Emission								
Farameter/ Units	85% Load	90% Load	95% Load	100% Load	Limits					
Nitrogen Oxides (NO _x)										
ppmvd @ 15% O₂	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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Email:	Adam.Brentlinger@cmsenergy.com	Theon.HeissererIV@cmsenergy.com

Agency Information

Regulatory	EGLE
Agency:	
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 RECEIVEL
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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 SO₂ 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.

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2.3 Operating Conditions and Process Data

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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

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3.0 Sampling and Analytical Procedures

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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.

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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, SO₂, and NO_x emission rates; (b) sulfur removal efficiencies of fuel pretreatment and SO₂ control devices; and (c) overall reduction of potential SO₂ 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.

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4.0 Test Discussion and Results

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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.

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

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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 *	n juni kulon (je godino na presi ka populari kulon na populari kulon ka ka populari kulon (je godino na presi k			
fuel flow, scfh	450,523	444,356	442,784	445,888
Sampling & Flue Gas Paramet	ers	in a star and an and the star of the star of the star of the star and the star of the star and the star of the		nadara dalar dalar yang dalar dalar 1997 yang manadara dalar 1994 yang manadara dalar dalar dalar dalar dalar d
sample duration, minutes	24	24	24	ganangadddolorof, gyganaaniaddilof y y gyganiaddolorof or y ana arbiful dolor
O ₂ , % volume dry	17.17	17.17	17.18	17.17
Nitrogen Oxides (NO _x)		\$*************************************	kennetterre genaamstatterre mennenner er mennennetter (nammandetter kannen het soller en soller soller soller s	
ppmvd	40	40	41	40
ppmvd @ 15% O₂	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)	annald 61999 <mark>0</mark> 0, ann an Mille II muise, muile II d'i 1996 gug à air de an 1999, gun mai d'an 1997 By ann ann an 19		รี้สะขางไข่ของมากการสารที่สำรัญการสารที่สารที่สารที่สารที่สารที่สารที่สารที่สารที่สารที่สารที่สารที่สารที่สารที	
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.

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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 *	annen die feit. Einen auf die ferstennen ander die meiningen einen mehr gewannen ander die gewannen die die ge	angeneren professionen and Soften weak (1995) for providing SSE SA for an SSE SA	สิงงากของ 2000 การการการการการการการการการการการการการก	
fuel flow, scfh	459,989	459,729	459,767	459,828
Sampling & Flue Gas Parame	ters	ndir had di Kili kun na dali di Kili kun dan kada kada meridian di kul ma ana kana kana kada kana kada kana kun	Retrict in a construction of an inclusion of the transmission of the second second second second second second	
sample duration, minutes	24	24	24	
O ₂ , % volume dry	17.09	17.10	17.13	17.11
Nitrogen Oxides (NO _x)	ad and differ the address of the second of the Gaudier of the Haussen and Hit haussen and the second of the	and the Control Annual Colored (control Colored) and a Colored (control Colored Propagation and the second sec	δια το Ουργοριατικό το ματιστροποιού το ματιστροποιού το ματιστροποιού το ματιστροποιού το ματιστροποιού το μα Η ποι το Ουργοριατικό το ματιστροποιού το ματιστροποιού το ματιστροποιού το ματιστροποιού το ματιστροποιού το μα	
ppmvd	42	42	42	42
ppmvd @ 15% O₂	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)	eersennen flagen en eense maar van de serveren eersen aan de servere eersen de servere eerse eersen de servere	nille e manimum da une e primario de emminante concerni da de concerni da de concerni da de concerni da de conc	Recon-summet 2010 in successful de contre successful de la Contre successful de contre successful de contre su	
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.

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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 *	un en	denne i cala anne e freigiad a chonnaista ann an thairtean ann an thairtean ann an thairtean ann an thairtean a	lla en	, parametri (1997), pamane (1997), parametri (1
fuel flow, scfh	478,744	479,497	478,742	478,994
Sampling & Flue Gas Parame	ters	devertysopelandesette Conjuncted to reform a synthetic oppryside at the opposite of the synthetic opposite of the synthet		
sample duration, minutes	24	24	24	
O2, % volume dry	17.02	17.03	17.02	17.03
Nitrogen Oxides (NO _x)	uu jaan kooloo kuu ja muu koon kuu kooloo kuu kuu kuu kuu kuu kuu kuu kuu kuu k			nen del del del 2014 marco di la facilità del 1000 (campa damenta del 1944 campita del del del 1014 (campa
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)	nno ježe konzerne sveje 1990 o na na prosladno na na na posladno konzerne na do do na konzerne na 200 do na po	Жолл у цар и и и и и и и и и и и и и и и и и и и	Saaaaan ay gaalaa ahaa ahaa gaalaa ahaa gaalaa ahaa gaalaa ahaa gaalaa ahaa gaalaa ahaa giboo giboo giboo giboo	al na fanan yn yr Clana fan an ynan yn Clan dy ann yn yn Clan dyn yn gynadol yn yn yn gynadol yn yn yn yn yn yn
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.



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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 *	aus et all that the design of the second	film 1999 to be a set of the second of the 1999 second shall be a second shall be ready as a set of the ready a		
fuel flow, scfh	503,501	503,176	503,063	503,247
Sampling & Flue Gas Parame	ters	Annen (),), in a second contraction of the second s	€enn (yy y y zanan till gyd y y synn i Gyn y y y print till y y gyn y gyn y gyn y gyn gyn y gyn y gyn y gyn y	
sample duration, minutes	24	24	24	
O ₂ , % volume dry	16.88	16.86	16.87	16.87
Nitrogen Oxides (NO _x)	la farannar (fri danar part ann an	Gananaan garaan ahaa ka k	generitettette 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000	
ppmvd	49	49	49	49
ppmvd @ 15% O ₂	72	72	72	72
lb/hr (as NO₂)	139	139	140	139
lb/MMBtu (as NO ₂)	0.27	0.27	0.27	0.27
Carbon Monoxide (CO)	anna ann an tha ann an tha ann an tha na ann ann ann ann ann ann ann ann an	Bandari (canana donterana anno () (kananan mini (ananan mini (ananan))	den han en	
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.

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

Pup Number	1		2	Average
Date	5/3/2022	5/3/2022	5/3/2022	Average
	6, 54 7, 46	7.50 0.36	0.54 0.22	
	0:34-7:40	7:59-8:30	8:54-9:52	
Process Data *				
fuel flow, scfh	445,932	443,371	443,424	444,242
Sampling & Flue Gas Paramet	ters	gen na an	gli ber hennel foll och sen en foll following and an an	
sample duration, minutes	24	24	24	yyy () ar fan hef fel i fel yw yr dan med fel fel y y yr ann ar fel i fel y yr yn ar fel i fel yn yr yn ar fel
O ₂ , % volume dry	17.20	17.16	17.16	17.17
Nitrogen Oxides (NO _x)			Bernnel Anton (School Scholarson (Stationers), Stational School School School School School School School School	
ppmvd	40	39	39	39
ppmvd @ 15% O₂	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)	anna daranan filomana darana darana ang ang ang ang ang ang ang ang ang		Arren versammen er en anne verser versammen versammen v _{er El} opolean er	
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.

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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 *		a 19 - Tanàna Manasa dia kaominina dia kaominina dia kaominina dia kaominina dia kaominina dia kaominina dia k	Between and a second second and a second	naming provide a second se
fuel flow, scfh	457,599	457,022	457,168	457,263
Sampling & Flue Gas Paramet	ers		der	dala an fan fan fan fan fan fan fan fan fan
sample duration, minutes	24	24	24	
O ₂ , % volume dry	17.09	17.09	17.09	17.09
Nitrogen Oxides (NO _x)			##100m2000000000000000000000000000000000	
ppmvd	42	41	42	42
ppmvd @ 15% O₂	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)	na a an		Man and the and an an an and an and an	
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.

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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 *	egymen vyh 6 All angeren i en handel kill and generale and kill and generale with the second s	ferny fa fan de ferret gegregen yn de ferfal fa ferfal i gegen yn yn oede af de ferret yn gegen yn yn de ferret		t (Chandrand, gyronner Leid e hand i dramm f Leid an order beammer f Leid ad an order
fuel flow, scfh	479,080	477,834	476,602	477,839
Sampling & Flue Gas Parame	ters		99 mar - 20 g - 20 mar - 20 ma - 20 mar - 20 g - 20 mar - 20 m - 20 mar - 20	
sample duration, minutes	24	24	24	-
O ₂ , % volume dry	16.98	17.00	17.00	16.99
Nitrogen Oxides (NO _x)	walata 2008 walata baka wakazi baka kukazi kutoka kutoka kutoka kutoka kutoka kutoka kutoka kutoka kutoka kutok			nd II Commission and an Address of the Grand Constant and Statistical States and Statistical Statistical States and Statistical Statistical Statistical States and Statistical Stat
ppmvd	45	44	44	44
ppmvd @ 15% O₂	67	66	67	67
lb/hr (as NO₂)	123	121	122	122
lb/MMBtu (as NO ₂)	0.25	0.24	0.25	0.25
Carbon Monoxide (CO)		den en e	de openen en	
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.

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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	
	15:05-15:45	15:59-16:38	16:57-17:34	ne en e
Process Data *	en en de la consta d'esta constante en la constante de la constante de la constante en la constante de la const	dien die neemen oor die en de Die Ansaac maan aan die volk Volk die Alder Herbourge aan die konstanse waard kam	An the should be a set of a set of a set of the set of	//
fuel flow, scfh	501,610	501,818	501,039	501,489
Sampling & Flue Gas Parame	ters			******
sample duration, minutes	24	24	24	
O2, % volume dry	16.88	16.88	16.89	16.88
Nitrogen Oxides (NO _x)	ner van 1616 of BLPL is een de de val 18 met 18 die 1900 die 1910 weerste en bewerkende dat in 1800 DE 1910 wee			fan oorden toen de de kerken wie de de kerken wij de de kerken weken de de kerken weken de sekerken weken de de
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)	anna an ann an 1966 agus a ann an	2. 	die Tale da wel de Versen ander de Versen	
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.

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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	2019
Process Data *	nan kan kan dan dari yang panakan kan kan kan kan kan kan kan kan k	gan an a		Bandan - Angere State (1997) - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 19
fuel flow, scfh	441,343	439,800	439,854	440,332
Sampling & Flue Gas Paramet	ers			
sample duration, minutes	24	24	24	
O2, % 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)	ammanaya.ganadiifatiifatiifatiifatiina dammanaanaanaadiihaiifatiifatiina ammanaanaa amiida	(departed and an an an and a second and a seco	-Bernarian and an and a second a	
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.

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Table 4-10 NO_x, CO Emissions Results -

MONTROSE AIR QUALITY SERVICES

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 Paramete	rs			
sample duration, minutes	24	24	24	
O2, % volume dry	17.06	17.05	17.01	17.04
Nitrogen Oxides (NO _x)				
ppmvd	42	44	45	44
ppmvd @ 15% O2	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)	anna gun 1999 a tha ann ann ann ann ann an 1990 a tha ann ann ann ann ann ann ann ann ann a		E	
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.

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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 *			New Construction of the second se	and a subminimum proving an angle of a subminimum and a subminimum and a subminimum and a subminimum and a subm
fuel flow, scfh	481,151	480,981	481,301	481,144
Sampling & Flue Gas Paramet	ters			
sample duration, minutes	24	24	24	
O ₂ , % volume dry	16.92	16.90	16.89	16.90
Nitrogen Oxides (NO _x)			Benering were service and an	-
ppmvd	49	49	49	49
ppmvd @ 15% O2	72	73	73	73
lb/hr (as NO₂)	133	135	134	134
lb/MMBtu (as NO ₂)	0.26	0.27	0.27	0.27
Carbon Monoxide (CO)		žeroveni – – – – – – – – – – – – – – – – – – –	5	
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.

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

MONTROSE AIR QUALITY SERVICES

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 *			бителен жана жана жана жана жана жана жана жа	ny yang ny yang ng pantan kan ti Dintan dalah di taman myapa yang nang nang banda na pang pang
fuel flow, scfh	504,018	504,924	505,553	504,832
Sampling & Flue Gas Paramet	ers		Euleriskin en in Französsen und sonn hann hann hann hann hann hann hann h	
sample duration, minutes	24	24	24	
O ₂ , % volume dry	16.80	16.76	16.76	16.78
Nitrogen Oxides (NO _x)			hay-aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa	
ppmvd	51	50	50	50
ppmvd @ 15% O ₂	73	72	71	72
lb/hr (as NO₂)	141	139	138	139
lb/MMBtu (as NO₂)	0.27	0.26	0.26	0.27
Carbon Monoxide (CO)		3	δ, γ,	
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.



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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 *	tananan di kana ang pang pang pang pang pang pang pa		&0000000000000000000000000000000000000	A to 2010 10 000000 00000000000000000000000
fuel flow, scfh	450,955	451,414	452,773	451,714
Sampling & Flue Gas Paramet	ers			
sample duration, minutes	24	24	24	
O ₂ , % volume dry	17.30	17.24	17.23	17.25
Nitrogen Oxides (NO _x)		dia amin'ny fisiana amin'ny fisiana amin'ny fisiana dia 2004-000-000-000-000-000-000-000-000-000		Kunnen ander ander ander ander ander ander ander ander and
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 NO₂)	0.24	0.24	0.25	0.24
Carbon Monoxide (CO)	ann 2009 til 2007 til 2007 som annan annan sinn sin annan a far sin annan an sin an sin sin annan sin a sin an		*	######################################
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.

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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	allan 1000 talan 1000 talan 1000 talah 1000
Process Data *			k	
fuel flow, scfh	469,387	469,196	471,114	469,899
Sampling & Flue Gas Paramet	ers	8	ด้างการการการการการการการการการการการการการก	
sample duration, minutes	24	24	24	
O2, % volume dry	17.15	17.12	17.11	17.13
Nitrogen Oxides (NO _x)	na na kali kalen Poroko Coppo popo popo popo popo popo popo		konsessonen on ander en ander	***************************************
ppmvd	46	46	46	46
ppmvd @ 15% O2	72	72	72	72
lb/hr (as NO₂)	129	129	131	129
lb/MMBtu (as NO ₂)	0.26	0.26	0.27	0.26
Carbon Monoxide (CO)			Samuer, an e transcenation, and the solition of the	
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.

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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 *	an ya ana ya ana ana ana ana ana ana ana			
fuel flow, scfh	492,249	492,238	493,260	492,582
Sampling & Flue Gas Parame	ters		line commentation and a second sec	
sample duration, minutes	24	24	24	
O ₂ , % volume dry	17.02	16.98	16.97	16.99
Nitrogen Oxides (NO _x)		8	Andrewsen (2019) - 2019	
ppmvd	44	44	45	44
ppmvd @ 15% O ₂	67	66	68	67
lb/hr (as NO₂)	126	124	128	126
lb/MMBtu (as NO ₂)	0.25	0.24	0.25	0.25
Carbon Monoxide (CO)	สระกระสมบัตรที่มาริเรากระกระกระกระกระกระกระการการการกระกระระจะจะจะจะจะจะจะจะจะจะจะจะจะจะจะจ	£,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
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.

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

Dee Number	5		-	A
Kun 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 *			Energy and a first free down a second of a first second free 2 first of a second second second second second se	
fuel flow, scfh	514,837	516,277	515,757	515,624
Sampling & Flue Gas Paramete	ers			
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% O2	70	70	71	70
lb/hr (as NO2)	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.

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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	ten an de la constant de la constant La constant de la cons		han da anna da annar a faa maranna da a da faa ah haan ah da anna da anna da anna da anna da anna da anna da an	nin kana kana kana kana kana kana kana k
lb/hr (as NO2)	106.2	113.3	122.1	135.1
EUCOMBTURB03		Summer of the second	5=====================================	
lb/hr (as NO ₂)	101.6	117.3	133.7	139.3
EUCOMBTURB04	de CENTE THE CENTER OF	A an a constant and a	Buna dammad avarbanna faraðu skild skondar við skonda skild skonda skild skild skild skild skild skild skild sk	
lb/hr (as NO2)	114.1	129.5	125.9	138.9
Combined Turbines				
lb/hr (as NO₂)	430.8	475.6	508.6	552.5

CMS Generation Michigan Power LLC-Livingston Generation Station 2022 Compliance Emissions Test Report

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 NO₂ 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).

CMS Generation Michigan Power LLC-Livingston Generation Station 2022 Compliance Emissions Test Report