1.0 Introduction

1.1 Summary of Test Program

CMS Generation Michigan Power LLC-Kalamazoo River Generating Station (KRGS) (State Registration No.: N6731) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the GE Frame 7E Combustion Turbine (EUCOMBTURB01) at the KRGS facility located in Comstock, Michigan. Testing was performed on September 27, 2022, for the purpose of satisfying the emission testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operation Permit No. MI-ROP-N6731-2021 and 40 CFR Part 60, Subpart KKKK.

The specific objectives were to:

- Verify the nitrogen oxides (NO_x) emissions at the SVCOMBTURB01 exhaust serving EUCOMBTURB01
- 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)
9/27/2022	EUCOMBTURB01	O_2	EPA 3A	3	21
9/27/2022	EUCOMBTURB01	NO_x	EPA 7E	3	21

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 Table 1-2. 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 1-3. The tests were conducted according to the test plan (protocol) dated August 26, 2022, that was submitted to the EGLE.

Table 1-2
Summary of Average Compliance Results – EUCOMBTURB01

September 27, 2022

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxides (NO_x)		
ppmvd @ 15% O_2	8.7	15
lb/hr, as NO_2	28.3	72.9

1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location: CMS Generation Michigan Power LLC
Kalamazoo River Generating Station
6900 East Michigan Avenue
Comstock, MI 49093

Project Contact:	Timothy Morrison	Theon Heisserer IV
Role:	Plant Manager	EHS Coordinator
Company:	KRGS	CMS Energy Enterprises
Telephone:	269-385-8950	313-336-7189 Ext. 250
Email:	timothy.morrison@CMS.com	Theon.HeissererIV@CMSenergy.com

Agency Information

Regulatory Agency: EGLE
Agency Contact: Monica Brothers
Telephone: 269-567-3552
Email: brothersm@michigan.gov

Testing Company Information

Testing Firm: Montrose Air Quality Services, LLC

Contact:	John Nestor	Robert J. Lisy, Jr.
Title:	District Manager	Reporting Hub Manager
Telephone:	248-548-8070	440-262-3760
Email:	jonestor@montrose-env.com	rlisy@montrose-env.com

Test personnel and observers are summarized in Table 1-3.

Table 1-3
Test Personnel and Observers

Name	Affiliation	Role/Responsibility
John Nestor	Montrose	District Manager, QI
Roy Zimmer	Montrose	Field Technician
Timothy Morrison	CMS-KRGS	Test Coordinator
Theon Heisserer IV	CMS Energy Enterprises	Client Liaison
Monica Brothers	EGLE	Observer

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

The KRGS facility located in Comstock, Michigan operates one simple-cycle combustion turbine that fires natural gas (NG). The turbine has a nominal output capacity of approximately 86 Megawatts (MW). The turbine exclusively uses natural gas as the fuel. 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.

2.2 Flue Gas Sampling Location

Information regarding the sampling location is presented in Table 2-1.

Table 2-1
Sampling Location

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
EUCOMBTURB01 Exhaust Stack	138.0 X 174.0	600.0 / 3.9	300.0 / 1.9	Stratification Check: 16 Gaseous: 3

A 16-Point Stratification Test was performed at the EUCOMBTURB01 Exhaust Stack during Runs 1 and 2. The sampling location was found to be minimally stratified per the Stratification Acceptance Criteria as specified in EPA Method 7E, Section 8.1.2, because several points exceeded the mean pollutant concentration by greater than 5%. Therefore, for Run 3, the sampling train utilized three traverse points 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

The compliance test was performed while EUCOMBTURB01 was operating at greater than 75% of peak load (86 MW).

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

- Heat Input Rate, MMBtu/hr
- Gas Fuel Flow, scf/hr
- Turbine Load, MW

3.0 Sampling and Analytical Procedures

3.1 Test Methods

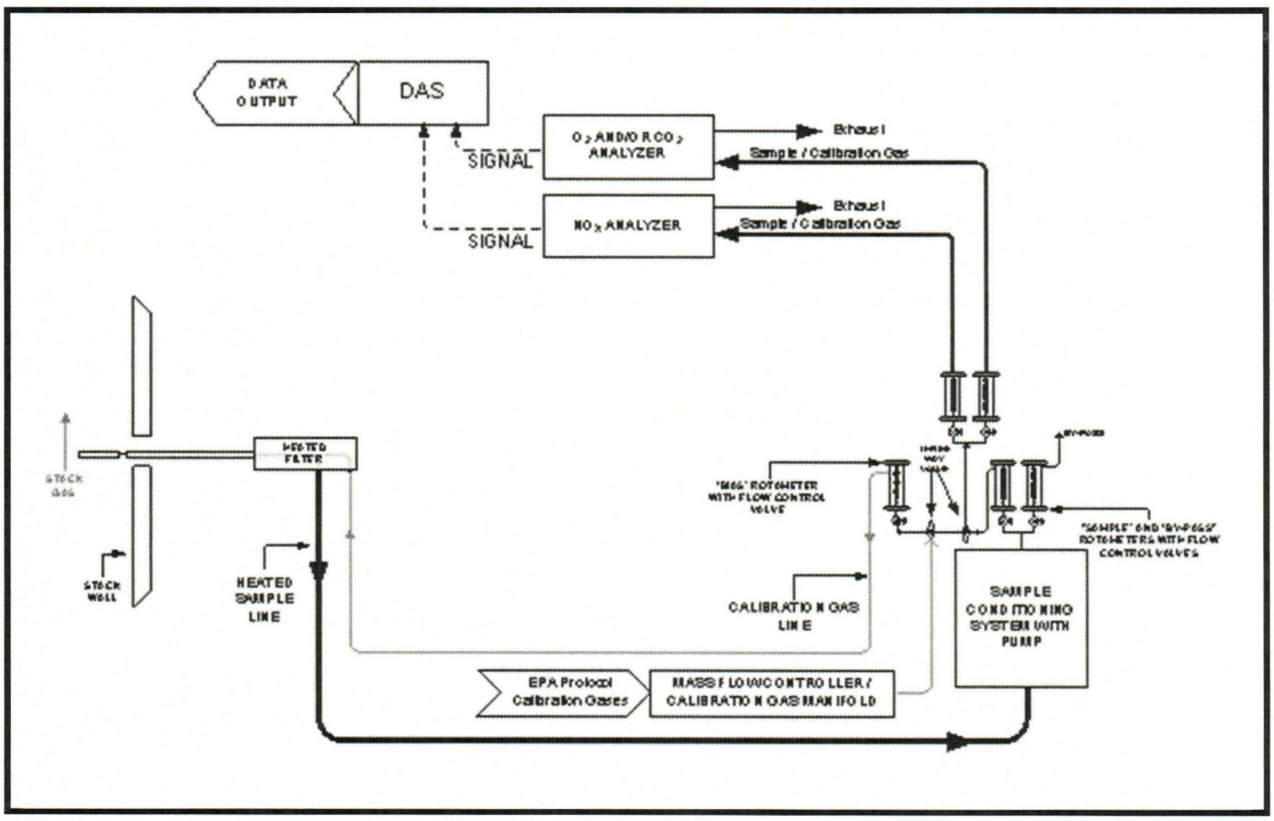
The test methods for this test program have been presented in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

3.1.1 EPA Method 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.

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



3.1.2 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.

3.1.3 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 Table 1-2. The results of individual compliance test runs performed are presented in Table 4-1. 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 Emissions Results -
EUCOMBTURB01

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	9/27/2022	9/27/2022	9/27/2022	--
Time	7:27-7:48	8:03-8:24	8:38-8:59	--
Process Data				
Heat input rate, MMBtu/hr	883.96	884.10	884.20	884.05
Turbine load, MW	76.8	77.0	77.0	76.9
Percent of peak load, %	89.3	89.5	89.5	89.4
Sampling & Flue Gas Parameters				
sample duration, minutes	21	21	21	--
O_2, % volume dry	14.99	15.00	14.95	14.98
Nitrogen Oxides (NO_x)				
ppmvd	8.94	8.64	8.59	8.72
ppmvd @ 15% O_2	8.92	8.64	8.51	8.69
lb/MMBtu, as NO_2	0.033	0.032	0.031	0.032
lb/hr, as NO_2	29.1	28.1	27.7	28.3

5.0 Internal QA/QC Activities

5.1 QA/QC Audits

EPA Method 3A and 7E 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 check of the analyzer was conducted per the procedures in EPA Method 7E, Section 16.2.2. The conversion efficiency 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).

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Appendix A
Field Data and Calculations

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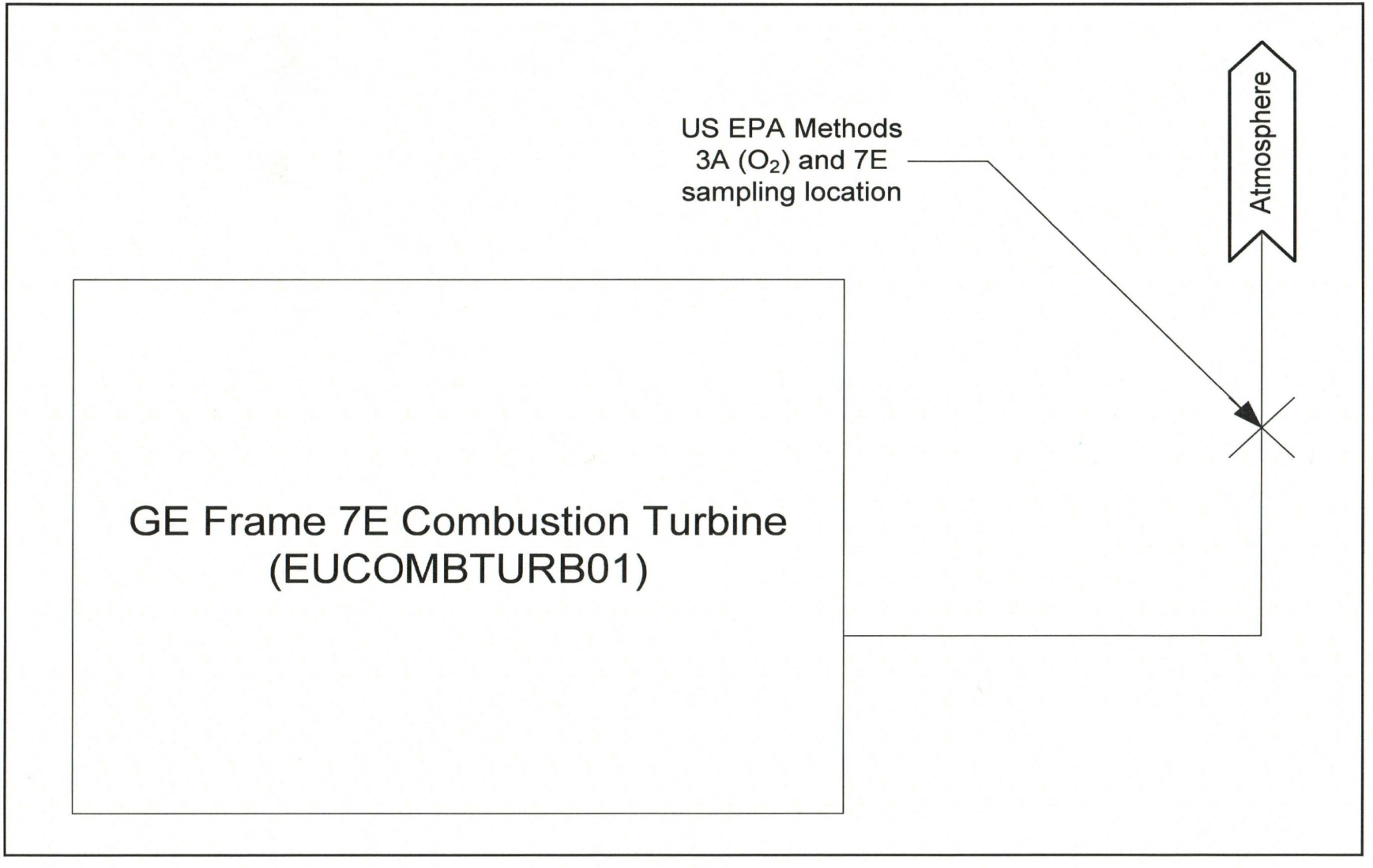
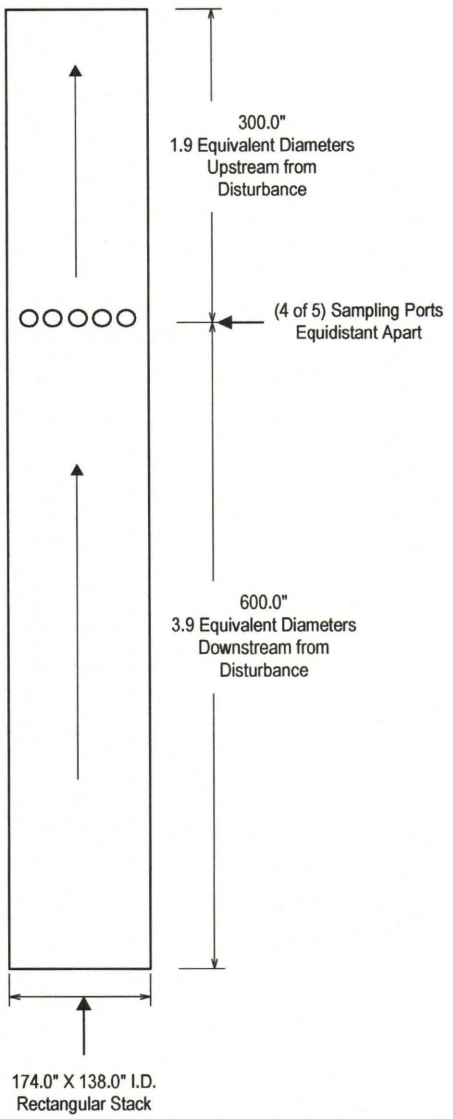
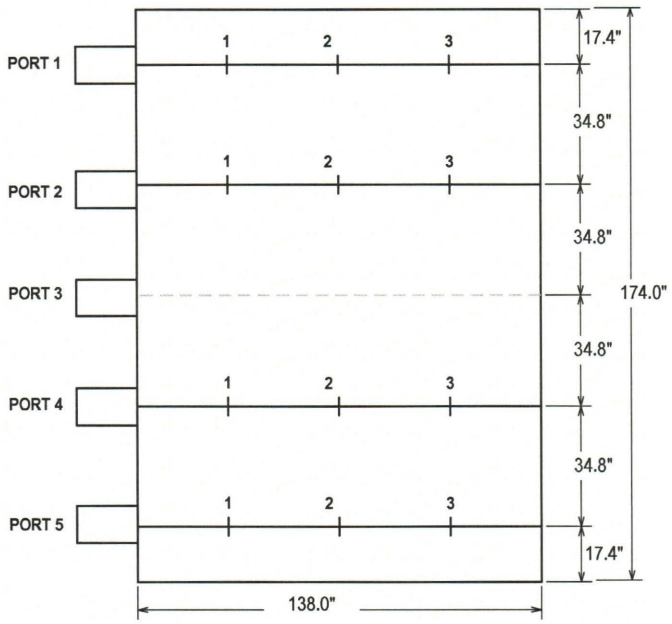
Appendix A.1
Sampling Locations

EUCOMBTURB01 SAMPLING LOCATION SCHEMATIC



EUCOMBTURB01 EXHAUST STACK TRAVERSE POINT LOCATION DRAWING





Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2	Distance from Inside Wall (in.) PORT 3
1	16.7	23.0	23.0	--
2	50.0	69.0	69.0	--
3	83.3	115.0	115.0	--

Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 4	Distance from Inside Wall (in.) PORT 5
1	16.7	23.0	23.0
2	50.0	69.0	69.0
3	83.3	115.0	115.0

* Port 3 was not accessible during this test event.