



## EXECUTIVE SUMMARY

Chase Young Environmental Testing Inc (CYET) was retained by Central Michigan University (CMU) [SRN: K2460] to conduct emission testing at the EUGASTURBINE at their facility located at 1720 East Campus Drive in Mount Pleasant, Michigan 48859 in Isabella County. The emissions test program was conducted on October 19, 2022 and was performed in accordance with CYET project number 221643 Emission Test Plan as well as the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Air Quality Division (AQD) acceptance letter.

The emissions test program was conducted to determine compliance with MI-ROP-K2460-2021 issued by the Michigan department of Environment, Great Lakes, and Energy (EGLE). EUGASTURBINE is part of the Flexible Group FGPOWERPLANT and is subject to the emission limits of the MI-ROP-K2460-2021 and 40 CFR Part 60, Subpart GG. The emission limit for EUGASTURBINE is 167 ppmv NOx @15% O<sub>2</sub> corrected to ISO standard day conditions.

**Table 1**  
**EUGASTURBINE Overall Emission Summary**  
**Test Date: October 19, 2022**

| Condition | kW       | NOx ppmv @15% O <sub>2</sub><br>Corrected to ISO Standard<br>Day Conditions |
|-----------|----------|---|
| 100% Load | 3,200 kW | 102   |
| 75% Load  | 2,400 kW | 108   |
| 50% Load  | 1,600 kW | 90  |
| 30% Load  | 960 kW   | 70  |



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| Appendix G | EGLE AQD Test Plan Acceptance Letter                  |

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**1. Introduction**

Chase Young Environmental Testing Inc (CYET) was retained by Central Michigan University (CMU) [SRN: K2460] to conduct emission testing at the EUGASTURBINE at their facility located at 1720 East Campus Drive in Mount Pleasant, Michigan 48859 in Isabella County. The emissions test program was conducted on October 19, 2022 and was performed in accordance with CYET project number 221643 Emission Test Plan as well as the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Air Quality Division (AQD) acceptance letter. The purpose of this report is to document the results of the test program.

The test program was conducted to determine compliance with MI-ROP-K2460-2021 issued by the Michigan department of Environment, Great Lakes, and Energy (EGLE). EUGASTURBINE is part of the Flexible Group FGPOWERPLANT and is subject to the emission limits of the MI-ROP-K2460-2021 and 40 CFR Part 60, Subpart GG.

**1.a Identification, Location, and Dates of Test**

Sampling and analysis for the emission test program was conducted on October 19, 2022 at the CMU Plant located in Mount Pleasant, MI.

Testing on the EUGASTURBINE consisted of a single 36-minute test run and eleven 21-minute test runs. Three test runs were performed at each of four different load settings (30% peak load, 50% peak load, 75% peak load, and 90-100% peak load).

**1.b Purpose of Testing**

AQD issued Renewable Operating Permit No. MI-ROP-K2460-2021 to CMU on March 3, 2021. This permit limits emissions as summarized by Table 2.

**Table 2  
Reporting Units and Emission Limits**

| Unit ID/<br>Source Name | Parameter       | Reporting Units   | Emission Limit | Emission Limit Reference                           |
|-------------------------|-----------------|---|----------------|--|
| EUGASTURBINE            | NO <sub>x</sub> | ppmvd @15% O <sub>2</sub><br>and ISO standard<br>Day Conditions | 167            | MI-ROP-K2460-2021<br>40 CFR Part 60, Subpart<br>GG |



### **1.c Source Description**

EUGASTURBINE is a natural gas or fuel oil fired turbine, 3,130 KW output (40 MMBTU/hr input) for campus electric generation. This emission unit is subject to 40 CFR Part 60, Subparts A and GG. (PTI 32-05). It is part of the flexible group ID FGPOWERPLANT in PTI 32-05.

Figure 1 present the test ports and traverse/sampling point locations used.

### **1.d Test Program Contacts**

The contact for the source and test report is:

Mr. John Fernandez  
Supervisor Utilities/Operations  
Central Michigan University  
Ferna1j@cmich.edu  
(989) 774-4437

Names and affiliations for personnel who were present during the testing program are summarized by Table 3.

**Table 3  
Test Personnel**

| Name, Title, and Email   | Affiliation   | Telephone      |
|--|---|----------------|
| Mr. John Fernandez<br>Supervisor Utilities/Operations<br>Fernalj@cmich.edu     | Central Michigan University<br>1720 East Campus Drive<br>Mount Pleasant, Michigan<br>48859  | (989) 774-4437 |
| Mr. Michael Walton<br>Director of Energy and Utilities<br>Walto1mj@cmich.edu   | Central Michigan University<br>1720 East Campus Drive<br>Mount Pleasant, Michigan<br>48859  | (989) 774-1566 |
| Mr. Tharen Foster<br>Utilities/Operations                                      | Central Michigan University<br>1720 East Campus Drive<br>Mount Pleasant, Michigan<br>48859  | (989) 774-4437 |
| Mr. Brandon Chase<br>Senior Environmental Engineer<br>bchase@cyetinc.com       | CYET<br>28744 Groveland Street<br>Madison Heights, MI 48071   | (248) 506-0107 |
| Mr. Matthew Young<br>Senior Project Manager<br>myoung@cyetinc.com              | CYET<br>28744 Groveland Street<br>Madison Heights, MI 48071   | (586) 744-9133 |
| Mr. Benjamin Witkopp<br>Environmental Quality Analyst<br>WitkoppB@michigan.gov | Technical Programs Unit<br>Air Quality Division<br>– Field Operations<br>Michigan Dept of<br>Environment, Great Lakes &<br>Energy | (989) 295-1612 |

**2. Summary of Results**

Sections 2.a through 2.d summarize the results of the emissions compliance test program.

**2.a Operating Data**

Process data monitored during the emissions test program include:

- KW output unit set point,
- natural gas usage, ccf

Process operating data is included in Appendix F.

## **2.b Applicable Permit**

The applicable permit for this emissions test program is Renewable Operating Permit (ROP) No. MI-ROP-K2460-2021.

## **2.c Results**

The overall results of the emission test program are summarized by Table 1 (see Section 5.a, and Appendix A). Emission limits are presented in Table 2 (see section 1.b, and Appendix A). Detailed emission rates are presented in Tables 4-7 in Appendix A.

## **3. Source Description**

Sections 3.a through 3.e provide a detailed description of the process.

### **3.a Process Description**

Natural gas or fuel oil fired turbine, 3,130 KW output (40 MMBTU/hr input) for campus electric generation. This emission unit is subject to 40 CFR Part 60, Subparts A and GG. (PTI 32-05).

### **3.b Process Flow Diagram**

Due to the simplicity of the process, a process flow diagram is not necessary.

### **3.c Raw and Finished Materials**

Raw material used is natural gas. The finished product is electricity.

### **3.d Process Capacity**

The natural gas or fuel oil fired turbine is rated at 3,130 KW output (40 MMBTU/hr input) for campus electric generation. This emission unit is subject to 40 CFR Part 60, Subparts A and GG. (PTI 32-05).

### **3.e Process Instrumentation**

Process data monitored during the emissions test program include:

- KW output unit set point,
- natural gas usage, ccf

Process operating data is included in Appendix F.

## **4. Sampling and Analytical Procedures**

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used.

#### 4.a Sampling Train and Field Procedures

Sampling and analysis procedures followed the methods codified at 40 CFR 60, Appendix A:

- Method 1 - “*Sample and Velocity Traverses for Stationary Sources*” was used to determine the sampling locations and the stack traverse points.
- Method 3A – “*Determination of Oxygen and Carbon Dioxide Concentrations in emissions from stationary sources*” (*Instrumental Analyzer Procedure*) was used to determine the oxygen concentration of the exhaust gas.
- Method 7E – “*Determination of Nitrogen Oxides Emissions from Stationary Sources*” (*Instrumental Analyzer Procedure*) was used to determine the nitrogen oxide concentration of the exhaust gas.

USEPA Method 1 was utilized to determine the necessary sampling points in which to collect the air pollutants. Twelve sampling points were used for the stratification test which was performed during Run 1.

The NO<sub>x</sub> and O<sub>2</sub> content of the gas stream was measured using a Teledyne API 200EH NO<sub>x</sub> and O<sub>2</sub> gas analyzer. The gas stream was drawn through a stainless-steel probe with a heated in-line filter to remove any particulate, a heated Teflon<sup>®</sup> sample line, through a refrigerated Teflon<sup>®</sup> sample conditioner to remove the moisture from the sample before it entered the analyzer. Data was recorded on a PC equipped with data acquisition software. Recorded NO<sub>x</sub> and O<sub>2</sub> concentrations were averaged and reported for the duration of each test (as drift corrected per Method 7E). A drawing of the sampling train used for the testing program is presented as Figure 2.

In accordance with Method 7E, a 3-point (zero, mid, and high) bias check and calibration check was performed on the analyzer prior to initiating the test program. Following each test run, a 2-point (zero and high) calibration drift check was performed. The analyzer was operated at the 0-25% range for O<sub>2</sub> and 0-500 ppm range for NO<sub>x</sub>.

A stratification test was performed on Run 1 as specified in Method 7E. The probe was marked for 12 sampling points using Method 1. Each point was sampled for 3 minutes (twice the sample response time of 90 seconds), for a total of 36 minutes. The NO<sub>x</sub> and O<sub>2</sub> concentrations were averaged for each sample point. NO<sub>x</sub> concentrations were then corrected to 15% O<sub>2</sub>. The oxygen corrected NO<sub>x</sub> concentrations for each sampling point were compared with the overall average oxygen corrected NO<sub>x</sub> concentration for Run 1. None of the sampling points differed by greater than 5% from the overall average, therefore a single sampling point located at the centroid of the stack was used for Runs 2 through 12 as specified in Method 7E and 40 CFR Part 60, § 60.335 (a)(5)(ii)(B).



NO<sub>x</sub> Concentrations were normalized to ISO Standard Day conditions using the equation from §60.335(b)(1)) below:

$$NO_{xISO} = (NO_{x0}) (Pr/Po)^{0.5} (e)^{19*(Ho-0.633)} (288 \text{ }^\circ\text{K}/Ta)^{1.53}$$

Where:

NO<sub>x0</sub> = Mean observed NO<sub>x</sub> concentration, ppmvd @15%O<sub>2</sub>

Pr = Reference Pressure (29.92 in Hg)

Po = Observed Pressure (barometric pressure for date of test, in. Hg)

Ho = Observed humidity of ambient air, g H<sub>2</sub>O/g air

e = Transcendental constant (2.718)

Ta = ambient temperature, °K

#### **4.b Recovery and Analytical Procedures**

This test program did not include laboratory samples, consequently, sample recovery and analysis are not applicable to this test program.

#### **4.c Sampling Ports**

A diagram of the stack indicating traverse point and sampling locations and stack dimensions is included as Figure 1.

#### **4.d Traverse Points**

A diagram of the stack indicating traverse point and sampling locations and stack dimensions is included as Figure 1.

### **5. Test Results and Discussion**

Sections 5.a through 5.k provide a summary of the test results.

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**5.a Results Tabulation**

The overall results of the emissions test program are summarized by Table 1. Detailed results for the emissions test program are summarized by Tables 4-7 in Appendix A.

**Table 1  
EUGASTURBINE Overall Emission Summary  
Test Date: October 19, 2022**

| Condition | kW       | NOx ppmv @15% O <sub>2</sub><br>Corrected to ISO Standard<br>Day Conditions |
|-----------|----------|---|
| 100% Load | 3,200 kW | 102   |
| 75% Load  | 2,400 kW | 108   |
| 50% Load  | 1,600 kW | 90  |
| 30% Load  | 960 kW   | 70  |

**5.b Discussion of Results**

EUGASTURBINE emission rates for NOx ppmv @15%O<sub>2</sub> corrected to ISO standard day conditions are in compliance with permit limits at all conditions tested. The emission limit for EUGASTURBINE is 167 ppmv NOx @15% O<sub>2</sub> corrected to ISO standard day conditions.

**5.c Sampling Procedure Variations**

Ambient air was used as upscale gas to calibrate the oxygen analyzer, as specified in the USEPA Method 3A FAQ.

[https://www.epa.gov/sites/default/files/2016-08/documents/method03a\\_faq.pdf](https://www.epa.gov/sites/default/files/2016-08/documents/method03a_faq.pdf)

**5.d Process or Control Device Upsets**

No upset conditions occurred during testing.

**5.e Control Device Maintenance**

There was no control equipment maintenance performed during the emissions test program.

**5.f Re-Test**

The emissions test program was not a re-test.

**5.g Audit Sample Analyses**

No audit samples were collected as part of the test program.



**5.h Calibration Sheets**

Relevant equipment calibration documents are provided in Appendix D.

**5.i Sample Calculations**

Sample calculations are provided in Appendix E.

**5.j Field Data Sheets**

Field documents relevant to the emissions test program are presented in Appendix C.

**5.k Laboratory Data**

There are no laboratory results for this test program.

**MEASUREMENT UNCERTAINTY STATEMENT**

Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, CYET personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, CYET personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of our Quality Manual and ASTM D 7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

**REPORT SIGNATURES**

CYET operated in conformance with the requirements of ASTM D7036-04 during this emissions test project and this emissions test report:

This report was prepared by: Brandon Chase

Brandon Chase  
Senior Environmental Engineer

This report was reviewed by: Matthew Young

Matthew Young  
Senior Project Manager

## Appendix A – Emission Results Tables

**Table 1**  
**EUGASTURBINE Overall Emission Summary**  
**Test Date: October 19, 2022**

| Condition | kW       | NOx ppmv @15% O <sub>2</sub><br>Corrected to ISO Standard<br>Day Conditions |
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| 75% Load  | 2,400 kW | 108   |
| 50% Load  | 1,600 kW | 90  |
| 30% Load  | 960 kW   | 70  |

**Table 2**  
**Reporting Units and Emission Limits**

| <b>Unit ID/<br/>Source Name</b> | <b>Parameter</b> | <b>Reporting Units</b>  | <b>Emission Limit</b> | <b>Emission Limit Reference</b>                    |
|---------------------------------|------------------|---|-----------------------|--|
| EUGASTURBINE                    | NO <sub>x</sub>  | ppmvd @15% O <sub>2</sub><br>and ISO standard<br>Day Conditions | 167                   | MI-ROP-K2460-2021<br>40 CFR Part 60, Subpart<br>GG |

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