

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: John Nestor **Date:** 07 / 19 / 2023

Name: John Nestor **Title:** District 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:** 07 / 18 / 2023

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

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1.0 Introduction

1.1 Summary of Test Program

NTH Consultants, Ltd. contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the Fairbanks Morse Model 31 AD 18-8 2,000 kW Dual Fuel Generator (EUENGINE5) at the City of Portland Light and Power (State Registration No.: N5352) facility located in Portland, Michigan. Testing was performed on June 5, 2023, for the purpose of satisfying the emission testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permit-to-Install (PTI) No. 353-94A and Table 6, 40 CFR Part 63, Subpart ZZZZ.

The emissions testing is required by the National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines codified at Title 40, Part 60, Subpart ZZZZ of the Code of Federal Regulations (40 CFR 63, Subpart ZZZZ). This standard requires either (1) a CO control efficiency across the catalyst bed of at least 70% or (2) a maximum CO emission rate of less than or equal to 23 ppmvd at 15% O₂.

The specific objectives were to:

- Verify the carbon monoxide (CO) concentration corrected to 15% oxygen (O₂) from the exhaust stack of the oxidation catalyst (CAT-OX) serving EUENGINE5
- Verify the CO reduction efficiency (RE) of the CAT-OX controlling emissions from EUENGINE5
- 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)
6/5/2023	EUENGINE5 CAT-OX Inlet	O ₂	EPA 3A	3	60
6/5/2023	EUENGINE5 CAT-OX Inlet	CO	EPA 10	3	60
6/5/2023	EUENGINE5 CAT-OX Exhaust	O ₂	EPA 3A	3	60
6/5/2023	EUENGINE5 CAT-OX Exhaust	CO	EPA 10	3	60

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 1-4. The tests were conducted according to the test plan (protocol) dated February 20, 2023, that was submitted to and approved by EGLE on March 28, 2023.

Table 1-2
Summary of Average Compliance Results – EUENGINE5
June 5, 2023

Parameter/Units	Average Results	Emission Limits
Carbon Monoxide (CO) – CAT-OX Inlet		
ppmvd @ 15% O ₂	327.2	--
Carbon Monoxide (CO) – CAT-OX Exhaust		
ppmvd @ 15% O ₂	60.3	23
CO Reduction Efficiency (RE)		
%	81.6	70*

* Table 6, 40 CFR Part 63, Subpart ZZZZ requires either a CO control efficiency across the catalyst bed of at least 70% or an outlet CO concentration of 23 ppmvd @ 15 % O₂ or less.

1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location: City of Portland Light and Power
 723 East Grand River Avenue
 Portland, MI 48875

Project Contact: Todd Davlin
 Role: Superintendent Electric Department
 Company: City of Portland
 Telephone: 517-647-6912
 Email: tdavlin@portland-michigan.org

Agency Information

Regulatory Agency:	EGLE	
Agency Contact:	Jeremy Howe	Michael Cox
Telephone:	231-878-6687	616-240-3607
Email:	HoweJ1@michigan.gov	CoxM9@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

Consultant Information

Company:	NTH Consultants, Ltd.
Contact:	Chloe Palajac
Telephone:	313-600-1191
Email:	cpalajac@nthconsultants.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
Shane Rabideau	Montrose	Field Technician
Todd Davlin	City of Portland	Client Liaison
Chloe Palajac	NTH Consultants	Test Coordinator

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

The City of Portland Light and Power operates the Fairbanks engine to provide electricity to the city, the engine is equipped with oxidation catalyst.

- Fairbanks Morse Model 31 AD 18-8 2,000 kW dual fuel generator (EUENGINE5)

Each engine is equipped with an oxidation catalyst for controlling exhaust gas CO and hydrocarbon emission rates. The oxidation catalyst system is passive in nature, and its efficiency is dependent on exhaust gas temperature and oxygen content as well as catalyst bed condition. The catalyst beds are rated for exhaust gas flow rates for the engines and to meet the emission standard for CO stipulated in 40 CFR Part 63, Subpart ZZZZ. EUENGINE5 was in operation for this test event.

2.2 Flue Gas Sampling Locations

O₂ (%) and CO (ppm) concentrations were measured at the inlet duct and exhaust duct of the CAT-OX associated with EUENGINE5 during the test event.

See Appendix A.1 for more information.

2.3 Operating Conditions and Process Data

The emissions test was performed while EUENGINE5 was operating at the conditions required by the permit. EUENGINE5 was tested during an average load of 1,928 kW.

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:

- Engine output, kW
- Catalyst inlet temperature, °F

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 in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 3A is an instrumental test method used to measure the concentration of O₂ and CO₂ in stack gas. The effluent gas is continuously or intermittently sampled and conveyed to analyzers that measure the concentrations of O₂ and CO₂. The performance requirements of the method must be met to validate data.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
 - The calibration span values are 20.00% O₂
- Method Exceptions:
 - None
- Target and/or Minimum Required Sample Duration: 60 minutes

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

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

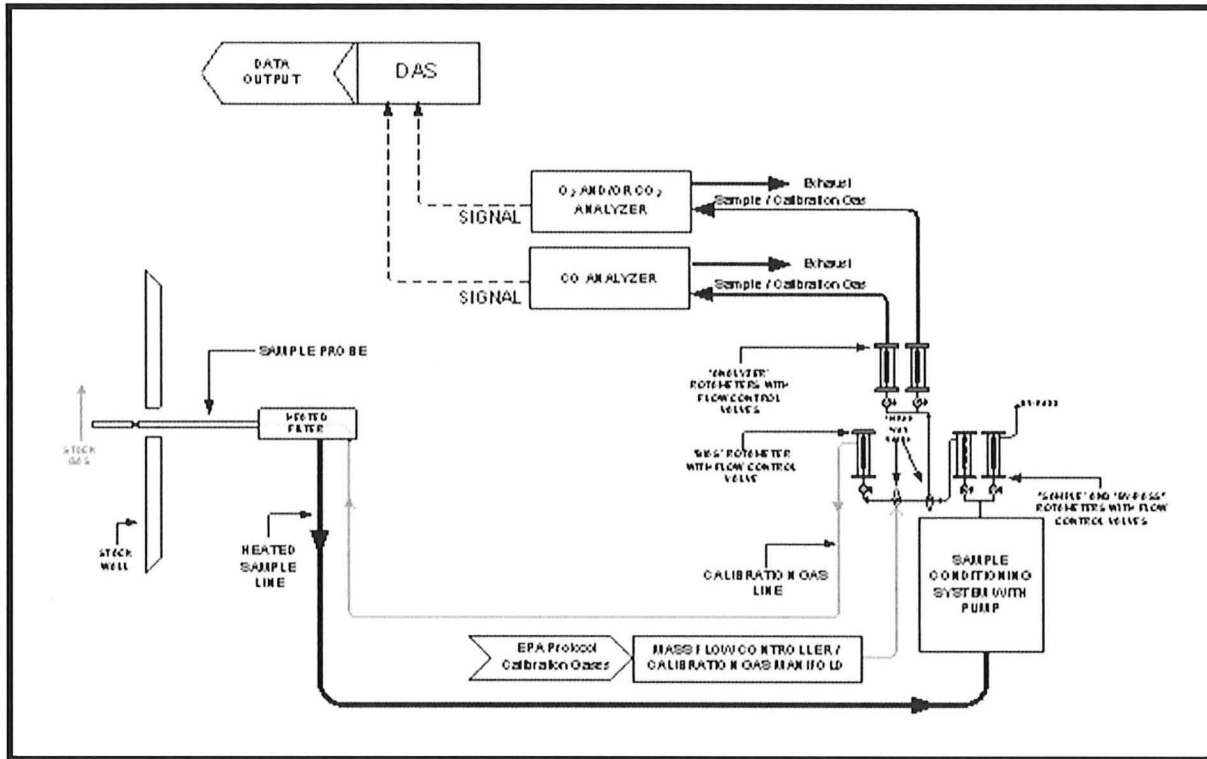
EPA Method 10 is an instrumental test method used to continuously measure emissions of CO. Conditioned gas is sent to an analyzer to measure the concentration of CO. The performance requirements of the method must be met to validate the data.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
 - A dry extractive sampling system is used to report emissions on a dry basis
 - Calibration span values are 998.4 ppmvd CO for the CAT-OX Inlet and 89.33 ppmvd CO for the CAT-OX Exhaust
- Method Exceptions:
 - None
- Target and/or Minimum Required Sample Duration: 60 minutes

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

Figure 3-1
EPA Methods 3A and 10 Sampling Train



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

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 Tables 4-1 and 4-2. 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
CO Emissions Results -
EUENGINE5 CAT-OX Inlet Duct

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	6/5/2023	6/5/2023	6/5/2023	--
Time	12:55-13:55	14:10-15:10	15:25-16:25	--
Sampling & Flue Gas Parameters				
sample duration, minutes	60	60	60	--
O ₂ , % volume dry	16.37	16.95	16.78	16.70
Carbon Monoxide (CO)				
ppmvd	242.1	232.3	223.5	232.6
ppmvd @ 15% O ₂	315.0	346.6	320.1	327.2

Table 4-2
CO Emissions and RE Results -
EUENGINE5 CAT-OX Exhaust Stack

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	6/5/2023	6/5/2023	6/5/2023	--
Time	12:55-13:55	14:10-15:10	15:25-16:25	--
Process Data*				
Catalyst outlet temperature, °F	515	520	528	521
Engine output, kW	1,909	1,924	1,951	1,928
Sampling & Flue Gas Parameters				
sample duration, minutes	60	60	60	--
O ₂ , % volume dry	16.53	16.86	16.70	16.70
Carbon Monoxide (CO)				
ppmvd	44.3	43.2	41.3	43.0
ppmvd @ 15% O ₂	59.8	63.1	58.0	60.3
CO Reduction Efficiency (RE)				
%	81.0	81.8	81.9	81.6

* Process data was provided by City of Portland personnel.

5.0 Internal QA/QC Activities

5.1 QA/QC Audits

EPA Method 3A 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.

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).

Appendix A

Field Data and Calculations

Appendix A.1

Sampling Locations

EUENGINE5 SAMPLING LOCATION SCHEMATIC

