

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

Enbridge Energy contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the Natural Gas-Fired Turbine (EUTURBINE1) at the Vector Pipeline L.P. - Athens Compressor Station facility (State Registration No.:N8151) located in Athens, Michigan. Testing was performed on June 29, 2021, for the purpose of satisfying the emission testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit No. MI-ROP-N8151-2016 and Subpart KKKK.

The specific objectives were to:

- Verify the concentration of NO_x corrected to 15% oxygen (O₂) at the exhaust duct (SVTURBINE1) serving EUTURBINE1
- 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)
6/29/2021	EUTURBINE1	O ₂	EPA 3A	3	21-30
6/29/2021	EUTURBINE1	NO _x	EPA 7E	3	21-30

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 dated May 12, 2021 that was submitted to EGLE.

**TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EUTURBINE1
JUNE 29, 2021**

Parameter/Units	Average Results	Allowable Limits
Nitrogen Oxides (NO_x) ppmvd @ 15% O ₂	9.2	25

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location: Vector Pipeline L.P. - Athens Compressor Station
4981 Two Mile Road
Athens, MI 49011
Project Contact: Shane Yokom
Role: Supervisor Environment Safety and Reliability
Environment Operations US
Company: Enbridge Energy
Telephone: 517-851-6010
Email: shane.yokom@enbridge.com

Agency Information

Regulatory Agency: EGLE
Agency Contact: Karen Kajiya-Mills
Telephone: 517-335-3122
Email: kajiya-milk@michigan.gov

Testing Company Information

Testing Firm: Montrose Air Quality Services, LLC
Contact: Matthew Young
Title: District Manager
Telephone: 248-548-8070
Email: myoung@montrose-env.com

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

**TABLE 1-3
TEST PERSONNEL AND OBSERVERS**

Name	Affiliation	Role/Responsibility
Matthew Young	Montrose	District Manager, QI
Michael Nummer	Montrose	Field Technician
Shane Yokom	Enbridge Energy	Observer/Client Liaison/Test Coordinator

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

Vector Pipeline L.P. - Athens Compressor Station operates a natural gas-fired Solar Mars 100 turbine rated at 15,000 horsepower at a heat input rate of 120 MMBtu/hr. Emissions from the turbine are controlled by Dry Low-NOx (SoLoNOx) emissions controls.

The turbine is equipped with two separate shafts. The first shaft controls the speed of the compressor turbine (i.e., the natural gas producer or "NGP") and the second shaft controls the speed of power turbine and natural gas compressor. The turbine can be regulated in terms of turbine load as well as power turbine and NGP rotational speeds.

EUTURBINE1 was in operation during this test event.

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 Dimensions (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
EUTURBINE1 Exhaust Duct (Run 1)	91.0 x 91.0	360.0 / 4.0	120.0 / 1.3	Gaseous: 15 (5/port)
EUTURBINE1 Exhaust Duct (Runs 2-3)	91.0 x 91.0	360.0 / 4.0	120.0 / 1.3	Gaseous: 3

See Appendix A.1 for more information regarding the sampling location.

2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed while EUTURBINE1 was operating at 93.0% NGP.

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:

- NGP, %
- PT, rpm
- Horsepower
- SoLoNOx Mode
- Natural Gas usage, MSCF
- Natural Gas usage, MSCF/day
- Natural Gas heating value, Btu/ft³

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 TEST METHODS

The test methods for this test program were presented previously 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 O₂ and CO₂ in stack gas. Conditioned gas is sent to analyzer(s) that measure the concentrations of O₂ and CO₂. The performance requirements of the method must be met to validate data.

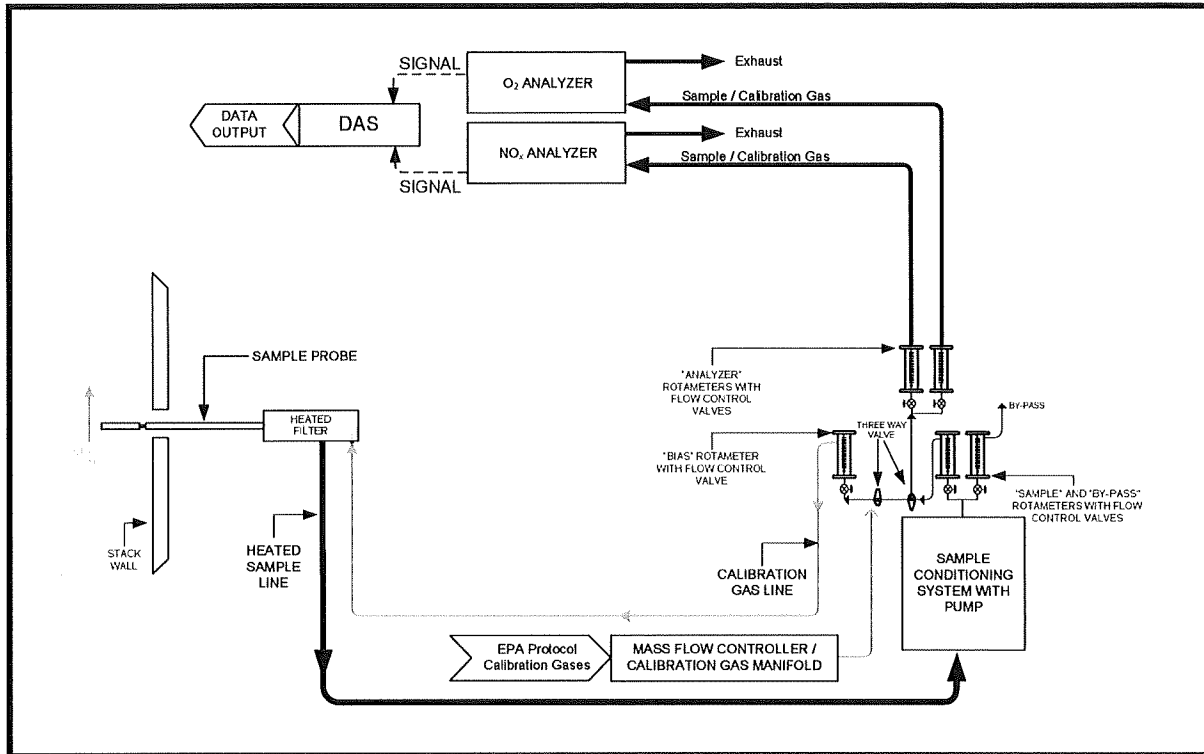
The sampling system is detailed in Figure 3-1.

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 NO₂. Conditioned gas is sent to a NO_x analyzer to measure the concentration of NO_x. NO and NO₂ can be measured separately or simultaneously together but, for the purposes of this method, NO_x is the sum of NO and NO₂. The performance requirements of the method must be met to validate the data.

The sampling system is detailed in Figure 3-1.

FIGURE 3-1
EPA METHOD 3A (O₂) AND 7E 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.

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 displayed in Table 1-2. The results of individual 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 -
 EUTURBINE1 EXHAUST DUCT**

Run Number	1	2	3	Average
Date	6/29/2021	6/29/2021	6/29/2021	--
Time	9:45-10:26	10:38-10:59	11:08-11:29	--
Process Data*				
Engine Load, %NGP	93.05	93.05	93.05	93.05
Flue Gas Parameters				
O ₂ , % volume dry	16.13	16.06	16.02	16.07
Nitrogen Oxides (NO_x)				
ppmvd	8.09	7.22	7.28	7.53
ppmvd @ 15% O ₂	9.99	8.80	8.80	9.20

* Process data was provided by Vector Pipeline, L.P. - Athens Compressor Station personnel.

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 NO₂ to NO converter efficiency check of the analyzer was conducted per the procedures in EPA Method 7E, Section 8.2.4. The conversion efficiency met the criteria.

5.2 QA/QC DISCUSSION

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

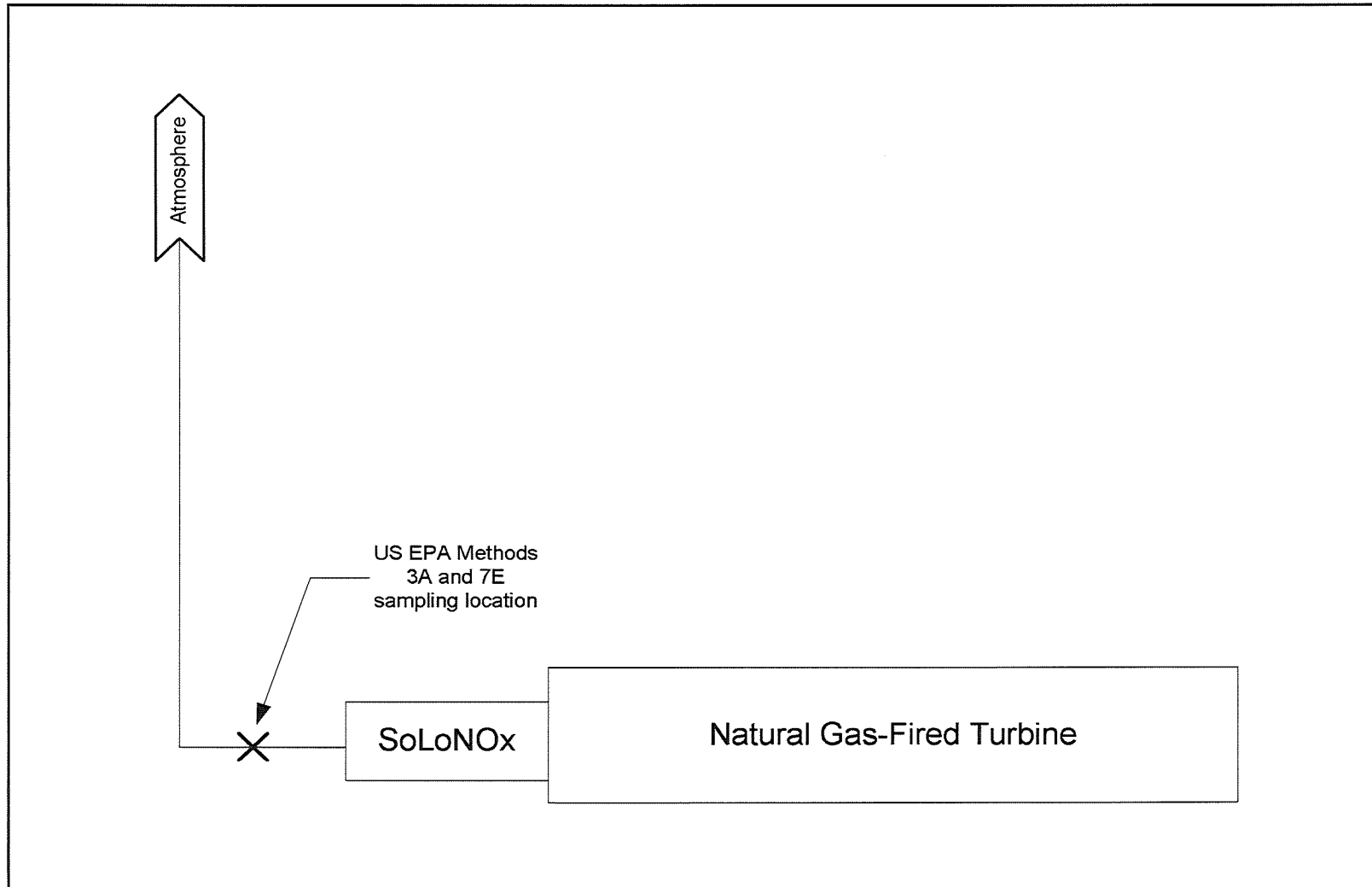
5.3 QUALITY STATEMENT

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).

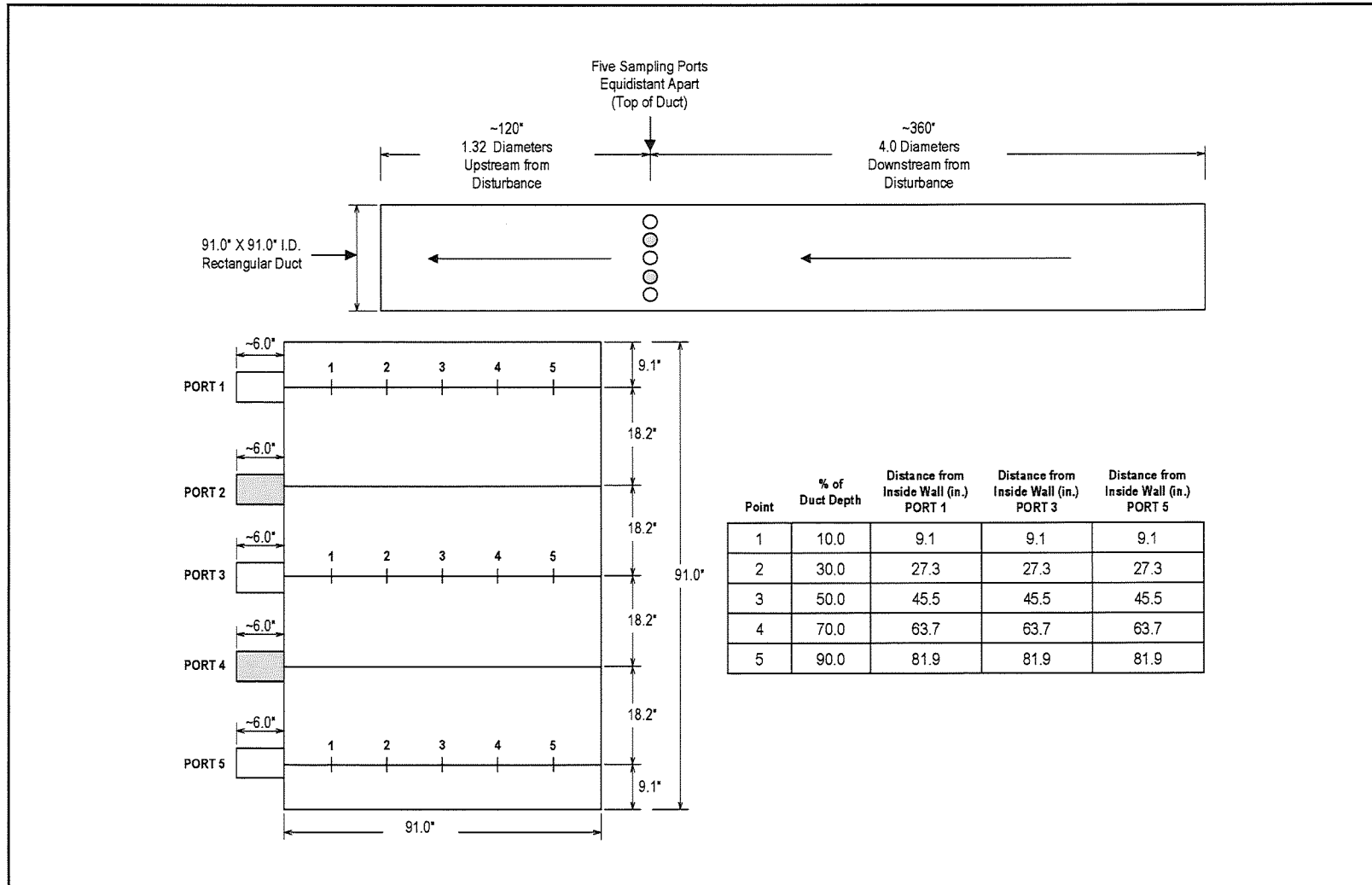
APPENDIX A FIELD DATA AND CALCULATIONS

Appendix A.1 Sampling Locations

EUTURBINE1 SAMPLING LOCATION SCHEMATIC



EURURBINE1 EXHAUST DUCT CEMS (RUN 1) TRAVERSE POINT LOCATION DRAWING



EURURBINE1 EXHAUST DUCT CEMS (RUNS 2 AND 3) TRAVERSE POINT LOCATION DRAWING

