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EMISSIONS TEST REPORT

for

OXIDES OF NITROGEN (NO_X) EMISSIONS

EUTURBINE1

DTE-Gas, Willow Compressor Station
Ypsilanti, Michigan

June 7, 2022

Prepared By
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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Safety (EM&S), Ecology, Monitoring, and Remediation Group performed emissions testing at the DTE-Gas Willow Compressor Station located in Ypsilanti, Michigan. The fieldwork, performed on June 7, 2022, was conducted to satisfy requirements of the Michigan Department of Environment, Great Lakes and Energy (EGLE) Renewable Operating Permit, MI-ROP-N7421-2022 and 40 CFR 60, Subpart KKKK.

Emissions tests were performed on the Solar Compressor EUTurbine 1. Testing was performed for Oxides of Nitrogen (NOx) while operating the Turbine at the highest achievable operating load.

The results of the emissions testing are highlighted below:

NO_X Emissions Test Results
Willow Compressor Station
Solar Compressor Turbine (EUTurbine 1)
June 7, 2022

Turbine Load (Gas Producer Speed)	Turbine Load (Hp)	NO_X Concentration (ppm @ 15% O_2)	Permit Limit[1]
95%	5,027	7.5	15.0

[1] Average Oxides of Nitrogen Emissions Concentration (ppm) corrected to 15% O_2

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Safety (EM&S), Ecology, Monitoring, and Remediation Group performed emissions testing at the DTE-Gas Willow Compressor Station located in Ypsilanti, Michigan. The fieldwork, performed on June 7, 2022, was conducted to satisfy requirements of the Michigan Department of Environment, Great Lakes and Energy (EGLE) Renewable Operating Permit, MI-ROP-N7421-2022 and 40 CFR 60, Subpart KKKK.

Emissions tests were performed on the Solar Compressor EUTurbine 1. Testing was performed for Oxides of Nitrogen (NOx) while operating the Turbine at the highest achievable operating load.

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 3A & 7E. The fieldwork was performed in accordance with EPA Reference Methods and EM&S's Intent to Test[1], Test Plan Submittal. The following DTE personnel participated in the testing program: Mark D. Westerberg, Sr. Environmental Specialist and Fred Meinecke, Environmental Specialist. Mr. Westerberg was the project leader. Ms. Regina Angellotti (EGLE) approved the Test Plan.

2.0 SOURCE DESCRIPTION

The Willow Compressor Station located at 3020 East Michigan Avenue, Ypsilanti, Michigan, employs the use of one Solar natural gas-fired 7,700 Horse-Power combustion turbine (EUTurbine 1) with a low NO_x combustor for NO_x control. The turbine generates line pressure assisting with the transmission of natural gas through the pipeline transmission system in SE Michigan. Testing for NO_x emissions was performed while the turbine operated in the $LoNO_x$ mode at 95% gas producer speeds.

The turbine exhausts directly to the atmosphere through a rectangular exhaust duct. Sampling was performed in the round horizontal section of the ductwork located inside the building.

A schematic representation of the turbine exhaust and sampling location is presented in Figure 1.

[1] EGLE, Test Plan, Submitted February 3, 2022. (Attached-Appendix A)

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3.0 SAMPLING AND ANALYTICAL PROCEDURES

DTE Energy obtained emissions measurements in accordance with procedures specified in the USEPA *Standards of Performance for New Stationary Sources*. The sampling and analytical methods used in the testing program are indicated in the table below

Sampling Method	Parameter	Analysis
USEPA Method 3A	Oxygen	Instrumental Analyzer Method
USEPA Method 7E	Oxides of Nitrogen	Instrumental Analyzer Method

3.1 OXYGEN AND OXIDES OF NITROGEN (USEPA METHODS 3A AND 7E)

3.1.1 Sampling Method

Oxygen (O_2) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight (Instrumental Analyzer Method)". The O_2 analyzer utilizes a paramagnetic sensor.

Oxides of Nitrogen (NO_x) emissions were evaluated using USEPA Method 7E, "Determination of Oxides of Nitrogen Emissions from Stationary Sources". The NO_x analyzer utilizes a chemiluminescent detector.

3.1.2 O_2 and NO_x Sampling Train

The EPA Methods 3A and 7E sampling system (Figure 2) consisted of the following components:

(1) Stainless steel sampling probe with cintered filter.
(2) Heated Teflon™ sampling line.
(3) MAK® gas conditioner with particulate filter.
(4) Flexible unheated Teflon™ sampling line.
(5) Servomex 1400 O_2/CO_2 gas analyzer and TECO 42i NO_x gas analyzer.
(6) Appropriate USEPA Protocol 1 Calibration Gases
(7) Data Acquisition System.

Refer to Figure 2 for a schematic of the O_2 and NO_x sampling train.

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3.1.3 Sampling Train Calibration

The O_2 / NO_X sampling trains were calibrated according to procedures outlined in USEPA Methods 3A & 7E. Zero, span, and mid-range calibration gases were introduced directly into the NO_X and O_2 analyzers to determine the instruments linearity. A zero and mid-range span gas was then introduced through the entire sampling system to determine sampling system bias for each analyzer. Additional system calibrations were performed at the completion of each test.

3.1.4 Sampling Duration & Frequency

The emissions testing of the Turbine consisted of triplicate 20-minute samples performed at one load. Sampling was performed simultaneously for O_2 & NO_X. Previous testing performed on the source demonstrated that the source is not stratified; therefore, a single sampling point (Port C, point 2) was utilized. Data was recorded at 10-second intervals.

3.1.5 Quality Control and Assurance (O_2 and NOX)

All sampling and analytical equipment was calibrated according to the guidelines referenced in Methods 3A and 7E. Calibration gases were EPA Protocol 1 gases. Calibration gas concentrations were within the acceptable ranges (analyzer span >30% of the pollutant gas measured with mid-range calibration gas values 40-60% of the analyzer span) specified in Method 7E. Methods 3A references Method 7E for calibration standards. Calibration gas certification sheets are in Appendix B.

Prior to testing, DTE performed converter efficiency testing by directly challenging the NO_X analyzer with a nitrogen dioxide (NO_2) calibration gas of 14.57 ppm. Results from the converter efficiency test demonstrated that the analyzer met the requirements of Method 7E[Eq. 1] (Greater than 90%).

Eq. 1 $$Eff_{NO2} = \frac{13.33}{14.57} = 91.5\%$$

3.1.6 Data Reduction

The O_2 and NO_X emission readings in parts per million (ppm) were recorded at 10-second intervals and averaged to 1-minute increments. The NOx emissions were reported in parts per million corrected to 15% O_2 (ppm @ 15% O_2) as required by the permit requirements.

The emissions data collected can be found in Appendix B.

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4.0 OPERATING PARAMETERS

The test program included the collection of turbine operating data during each test run. Parameters recorded included compressor exhaust temperature and pressure, % Load (reported as Hp), gross dry BTU, fuel feed rate, and stack exhaust temperature.

Operational data and results of the fuel analysis can be found in Appendix E.

5.0 RESULTS

The results of the NOx emission testing conducted on EUTurbine 1 are presented in Table No 1. The NOx emissions are presented in parts per million (ppm) and parts per million at 15% oxygen (ppm @ 15% O_2) and process data presented in unit load (%).

Testing of EUTurbine 1 demonstrated compliance with EGLE ROP emission limits. Testing was performed while the turbine was operated in $LoNO_x$ mode at 95% gas producer speed/ and 5,027 HP. (maximum achievable load on the day of testing).

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6.0 CERTIFICATION STATEMENT

"I certify that I believe the information provided in this document is true, accurate, and complete. Results of testing are based on the good faith application of sound professional judgment, using techniques, factors, or standards approved by the Local, State, or Federal Governing body, or generally accepted in the trade."

Mark D. Westerberg, QSTI

This report prepared by: _____

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Environmental Management and Safety
DTE Energy Corporate Services, LLC

This report reviewed by: _____

for Mr. Mark Grigereit, QSTI
Principal Engineer, Ecology, Monitoring, and Remediation
Environmental Management and Safety
DTE Energy Corporate Services, LLC

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RESULTS TABLE

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TABLE NO. 1
NOX EMISSIONS TEST RESULTS
DTE Gas - Willow Run Compressor Station
EUTURBINE1
June 7, 2022

Test	Test Time	Unit Load (%)[2]	Fuel Flow (100SCFH)	Heat Input (MMBtu/Hr)	O_2 Content (%, dry)[1]	NOx Emissions (ppmvd)[1]	NOx Emissions (lb/MMBtu)	NOx Emissions (ppmvd @ 15% O_2)[3]
Test-1	8:24-8:44	63.0%	237.0	25.0	15.5	7.2	0.029	7.9
Test-2	8:54-9:14	65.0%	236.0	24.8	15.6	6.6	0.027	7.3
Test-3	9:25-9:45	66.0%	236.0	24.8	15.6	6.6	0.027	7.3
	Ave:	*64.7%*	*236.3*	*24.9*	*15.6*	*6.8*	*0.027*	*7.5*

[1] corrected for analyzer drift as per USEPA Method 7E

[2] calculated as actual average horse power divided by 7,770 (nominal rated horsepower)

[3] NO_x Permit Limit 15.0 ppm corrected to 15%O_2

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FIGURES

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Figure 1 – Sampling Location
EUTURBINE1
Willow Run Compressor Station

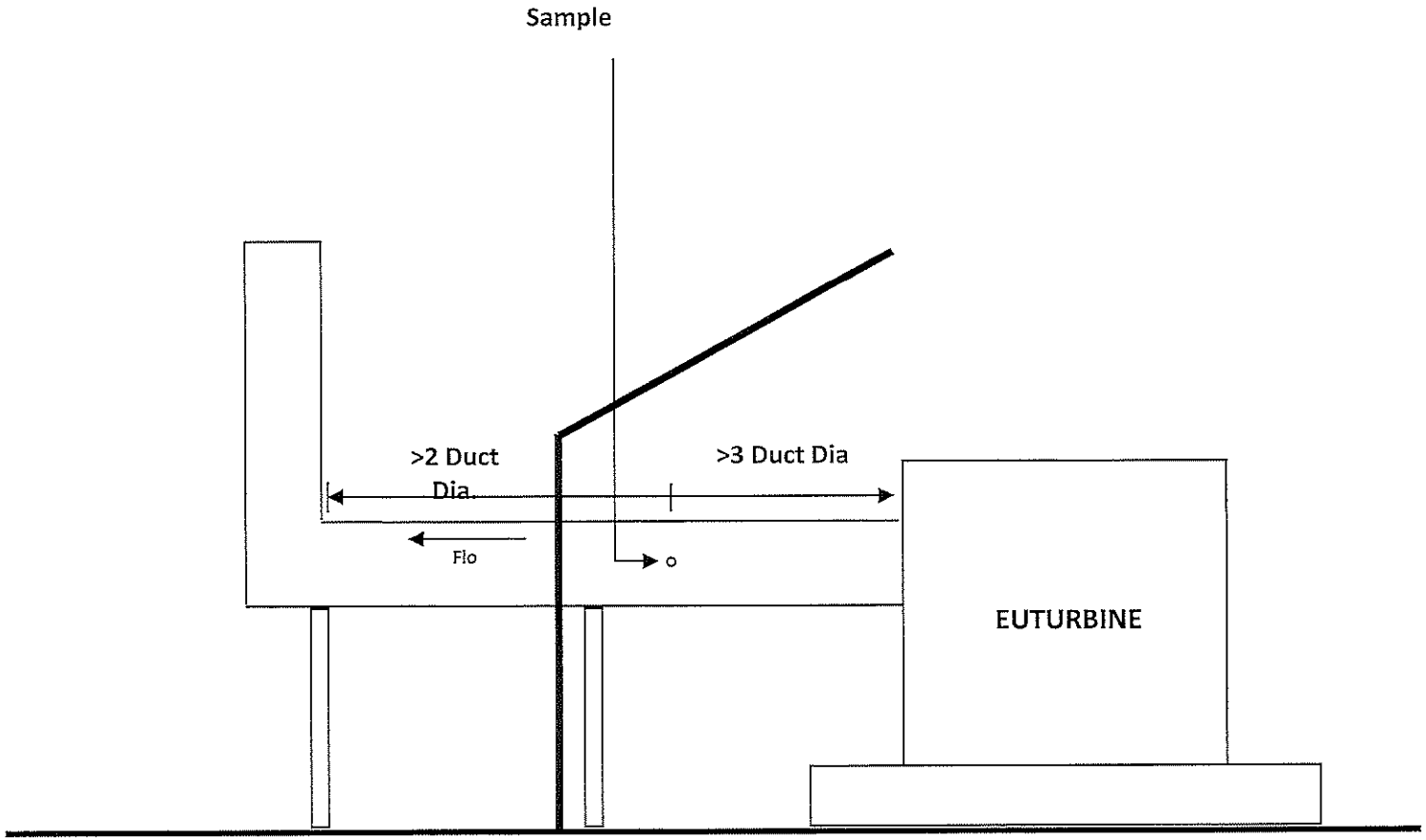

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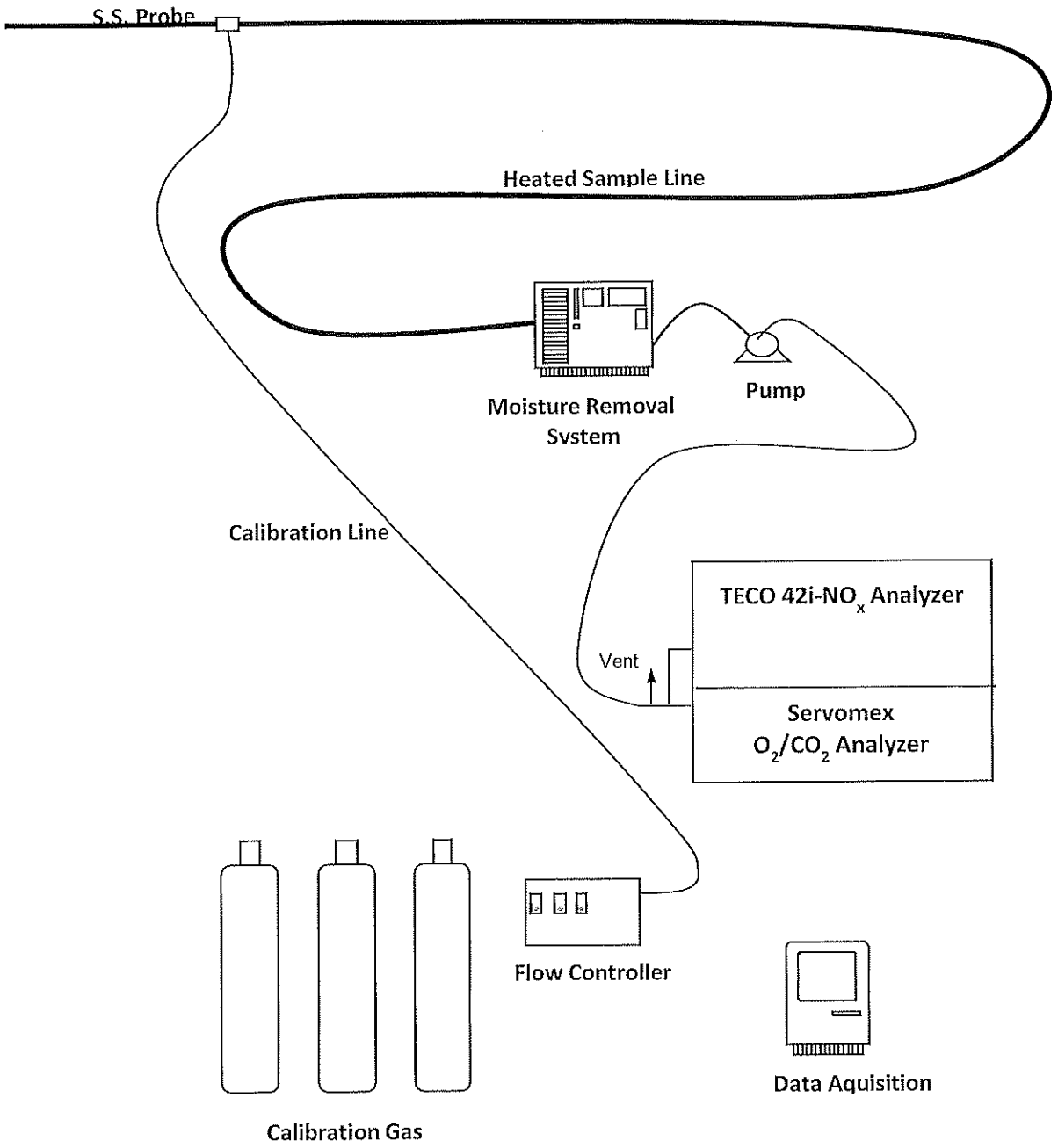
Figure 2 – USEPA Methods 3A & 7E
EUTURBINE1
Willow Compressor Station
June 2022



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APPENDIX A

EGLE TEST PLAN