DTE

EMISSIONS TEST REPORT

for

OXIDES OF NITROGEN (NO_X)
SUBPART KKKK TESTING

EUTURBINE1, EUTURBINE2, EUTURBINE3
MI ROP B7221-2020

DTE Gas Company – Milford Compressor Station
Milford, Michigan

October 25-26, 2022

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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 Company – Milford Compressor Station, located in Milford, Michigan. The fieldwork, performed October 25-26, 2022, was conducted to satisfy requirements of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit MI ROP B7221-2020 and 40 CFR Part 60 Subpart KKKK. Emissions tests were performed on the Solar Turbines 2100 (EUTURBINE1), 2200 (EUTURBINE2), and 3100 (EUTURBINE3) for oxides of nitrogen (NO_X).

The results of the emissions testing are highlighted below:

Emissions Test Results
Milford Compressor Station
EUTURBINE1-3
October 25-26, 2022

Emission Unit	O2 (%)	NOx (ppmvd)	NOx (ppmvd @ 15% O2)
EUTURBINE1	15.2	8.3	8.6
EUTURBINE2	15.3	5.7	6.1
EUTURBINE3	15.2	5.0	5.1
Permit Limit			***15***

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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 Company – Milford Compressor Station, located in Milford, Michigan. The fieldwork, performed between October 25-26, 2022, was conducted to satisfy requirements of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit MI ROP B7221-2020 and 40 CFR Part 60 Subpart KKKK. Emissions tests were performed on the Solar Turbines 2100 (EUTURBINE1), 2200 (EUTURBINE2), and 3100 (EUTURBINE3) for oxides of nitrogen (NO_X).

The following DTE personnel participated in the testing program: Thomas Snyder, Senior Environmental Specialist, and Fred Meinecke, Environmental Specialist.

2.0 SOURCE DESCRIPTION

The DTE Gas Company – Milford Compressor Station operates three (3) identical Model Taurus 70 turbines, manufactured by Solar Turbines, at the facility. The purpose of the turbines is to generate the compression needed to distribute natural gas through the pipeline delivery system. The turbines are all simple cycle design, natural gas fired turbines nominally rated at 10,504 horsepower (ISO).

While MI ROP B7221-2020 allows for the installation of a total of five (5) gas compression turbines, only the three addressed in this report have been installed to date.

Figure 1 presents a schematic of the sampling location for each turbine. The exhaust on each turbine is identical.

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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

Exhaust Oxygen (O_2) content was measured using USEPA Method 3A, "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)". The O_2 analyzer utilizes a paramagnetic sensor.

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

All gas samples were measured on a dry basis (i.e. sample was conditioned prior to introduction into the pollutant analyzers).

3.1.2 Sampling Train

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

(1) Stainless steel sampling probe with sintered filter.
(2) Heated Teflon™ sampling line.
(3) MAK® gas conditioner with particulate filter.
(4) Flexible unheated Teflon™ sampling line.
(5) Instrumental gas analyzer bank.
(6) Data Acquisition System.

Refer to Figure 2 for a schematic of the gaseous sampling train.

3.1.3 *Sampling Train Calibration*

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

3.1.4 *Sampling Duration & Frequency*

NO_X emissions testing consisted of triplicate, 20-minute test runs. Sampling was performed at three points located at 16.7, 50.0, and 83.3% across the stack duct. Concentration averages were logged at 10-second intervals.

3.1.5 *Quality Control and Assurance*

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 specified in Method 7E.

Prior to testing, DTE performed converter efficiency testing by directly challenging the NO_X analyzer with a nitrogen dioxide (NO_2) calibration gas of 15.42 ppm. Results from the converter efficiency test demonstrated that the analyzer met the requirements of Method 7E[Eq. 1] (Greater than 90%).

Eq. 1 $$Eff_{NO2} = \frac{C_{Dir}}{C_v} = \frac{13.94}{15.42} = 90.4\%$$

Field calibration data sheets and gas certification sheets are in Appendix C.

3.1.6 *Data Reduction*

The O_2 (%) and NO_X (ppmvd) readings were logged at 10-second intervals and recorded in 1-minute increments. NO_X emissions are reported in parts per million, dry, corrected to 15% O_2 (ppm @ 15% O_2) for comparison to the emission limit.

Raw CEM data is presented in Appendix B.

4.0 OPERATING PARAMETERS

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

Operational data can be found in Appendix E.

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5.0 RESULTS

The results of the NOx emissions testing conducted on EUTURBINE1-3 are presented in Table Nos. 1-3.

EUTURBINE1-3 demonstrated compliance with permitted NOx emission rates. Testing was performed while the turbine was operated in $LoNO_x$ mode at full load. Test results are less than 75% of the emission limit, therefore, in accordance with Subpart KKKK, NOx emission testing will be performed within 26 calendar quarters of this test event.

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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."

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RESULTS TABLES

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TABLE NO. 1
NO_X EMISSIONS TEST RESULTS
DTE Gas - Milford Compressor Station
EUTURBINE1
October 25, 2022

Test	Test Time	Unit Load (%)[2]	O_2 Concentration (%, dry)[1]	NOx Concentration (ppmvd)[1]	NOx Concentration (ppmvd @ 15% O_2)
1-1	11:14-11:34	97%	15.2	8.4	8.7
1-2	11:46-12:06	96%	15.2	8.2	8.5
1-3	12:15-12:35	95%	15.2	8.3	8.6
				Ave:	***8.6***
				Permit Limit :	***15***

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

[2] calculated as actual average horse power divided by 10,504 (nominal rated horsepower)

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TABLE NO. 2
NO_X EMISSIONS TEST RESULTS
DTE Gas - Milford Compressor Station
EUTURBINE2
October 25, 2022

Test	Test Time	Unit Load (%)[2]	O_2 Concentration (%, dry)[1]	NOx Concentration (ppmvd)[1]	NOx Concentration (ppmvd @ 15% O_2)
2-1	12:49-13:09	83%	15.4	5.5	5.9
2-2	13:19-13:39	83%	15.4	5.9	6.3
2-3	13:52-14:12	83%	15.3	5.8	6.0
				Ave:	***6.1***
				Permit Limit:	***15***

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

[2] calculated as actual average horse power divided by 10,504 (nominal rated horsepower)

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TABLE NO. 3
NO_X EMISSIONS TEST RESULTS
DTE Gas - Milford Compressor Station
EUTURBINE3
October 26, 2022

Test	Test Time	Unit Load (%)[2]	O_2 Concentration (%, dry)[1]	NOx Concentration (ppmvd)[1]	NOx Concentration (ppmvd @ 15% O_2)
3-1	7:56-8:16	88%	15.2	5.0	5.1
3-2	8:27-8:47	91%	15.2	4.9	5.1
3-3	8:57-9:17	92%	15.2	5.0	5.2
				Ave:	***5.1***
				Permit Limit :	***15***

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

[2] calculated as actual average horse power divided by 10,504 (nominal rated horsepower)

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FIGURES

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Figure 1. Sampling Location
Milford Compressor Station
EUTURBINE1-3

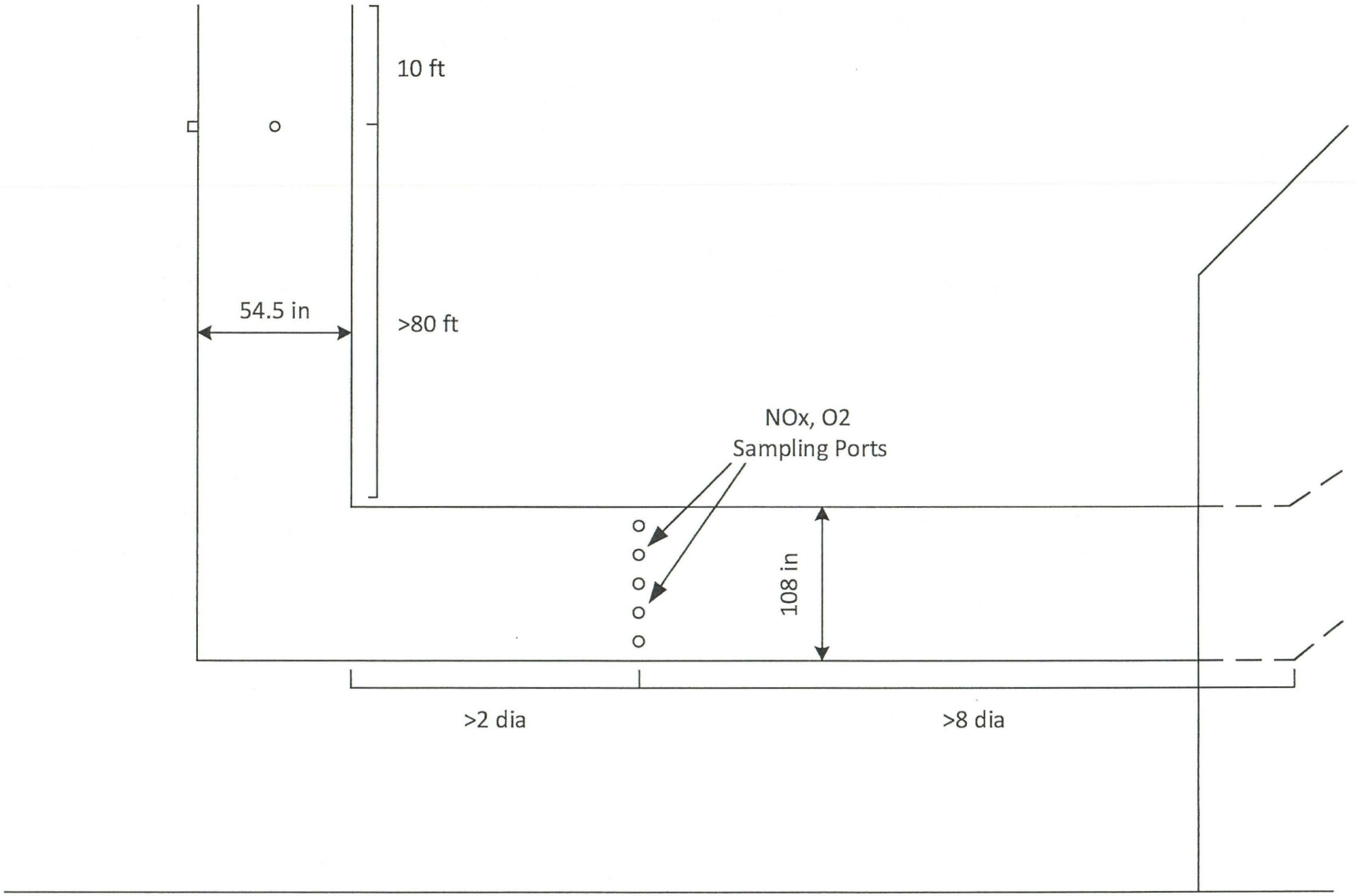

Figure 2 – EPA Methods 3A, 7E
Milford Compressor Station