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EMISSIONS TEST REPORT

for

OXIDES OF NITROGEN (NO_x) EMISSIONS

UNIT 1

**DTE-Gas, Belle River Mills Compressor Station
St. Clair, Michigan**

June 1, 2015

Prepared By
Environmental Management & Resources
Environmental Field Services Group
DTE Corporate Services, LLC
7940 Livernois H-136
Detroit, MI 48210

DTE Energy[®]



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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

**RENEWABLE OPERATING PERMIT
REPORT CERTIFICATION**

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name DTE Gas Company - Belle River Mills Compressor Station County St. Clair

Source Address 5440 Puttygut Road City China Township

AQD Source ID (SRN) B6478 ROP No. MI-ROP-B6478-2010 ROP Section No. _____

Please check the appropriate box(es):

Annual Compliance Certification (Pursuant to Rule 213(4)(c))

Reporting period (provide inclusive dates): From _____ To _____

1. During the entire reporting period, this source was in compliance with ALL terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, EXCEPT for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))

Reporting period (provide inclusive dates): From _____ To _____

1. During the entire reporting period, ALL monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, EXCEPT for the deviations identified on the enclosed deviation report(s).

Other Report Certification

Reporting period (provide inclusive dates): From 6/1/2015 To 6/1/2015

Additional monitoring reports or other applicable documents required by the ROP are attached as described:
Emissions Testing Report for Belle River Mills Turbine.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

| | | |
|--|----------------|--------------|
| Thomas Anderson | Manager - T&SO | 313-256-6476 |
| Name of Responsible Official (print or type) | Title | Phone Number |

| | |
|-----------------------------------|----------------|
| <u>Thomas Anderson</u> | <u>6/30/15</u> |
| Signature of Responsible Official | Date |

* Photocopy this form as needed.



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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group performed emissions testing at the DTE-Gas, Belle River Mills Compressor Station, located in St. Clair, Michigan. The fieldwork, performed on June 1, 2015 was conducted to satisfy requirements of the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP-B6478-2010. Emissions tests were performed on the Solar Compressor Turbine #1. Testing was performed for oxides of nitrogen (NO_x) while operating the Turbine at three (3) gas producer speeds.

The results of the emissions testing are highlighted below:

**NO_x Emissions Test Results
Belle River Mills Compressor Station
Solar Compressor Turbine #1
June 1, 2015**

| Turbine Load (Gas Producer Speed) | NO_x Concentration (ppm @ 15% O₂) | Permit Limit⁽¹⁾ |
|--|---|-----------------------------------|
| (102%) 13,139 B-Hp | 6.8 | 25.0 |
| (98%) 10,171 B-Hp | 10.8 | 25.0 |
| (96%) 8,701 B-Hp | 12.2 | 25.0 |

⁽¹⁾ Average Oxides of Nitrogen Emissions Concentration (ppm) corrected to 15% O₂



1.0 INTRODUCTION

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group performed emissions testing at the DTE-Gas, Belle River Mills Compressor Station, located in St. Clair, Michigan. The fieldwork, performed on June 1, 2015, was conducted to satisfy requirements of the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP-B6478-2010. Testing was performed for oxides of nitrogen (NO_x) to determine the emissions from the Solar Compressor Turbine #1 while operating at three (3) different gas producer speeds.

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&R's Intent to Test¹, Test Plan Submittal. The following DTE personnel participated in the testing program: Mark Grigereit, Principal Engineer and Thomas Snyder, Senior Technician. Mr. Grigereit was the project leader. Mr. Mark Dziadosz (MDEQ) observed the testing and approved the Test Plan².

2.0 SOURCE DESCRIPTION

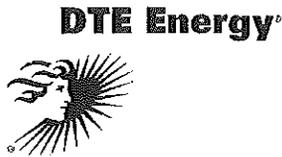
The Belle River Mills Compressor Station located at 5440 Puttygut Road, St. Clair, Michigan, employs the use of one Solar natural gas-fired 15,000 Horse Power combustion turbine (Turbine #1) with a low NO_x combustor for NO_x control. The turbine generates line pressure assisting with the transmission of natural gas into and out of the gas storage field as well as to and from the pipeline transmission system in SE Michigan. Testing for NO_x emissions was performed while the turbine operated in the LoNO_x mode at three gas producer speeds.

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

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

¹ MDEQ, Test Plan, Submitted May 1, 2015. (Attached-Appendix A)

² MDEQ, Approval Letter, Received May 13, 2015. (Attached-Appendix A)



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 (O₂) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight (Instrumental Analyzer Method)". The O₂ 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 O₂ 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 cindered filter.
- (2) Heated Teflon™ sampling line.
- (3) MAK® gas conditioner with particulate filter.
- (4) Flexible unheated Teflon™ sampling line.
- (5) Servomex 1400 O₂/CO₂ 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 O₂ and NO_x sampling train.



3.1.3 Sampling Train Calibration

The O₂ / 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 O₂ 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 each of three loads. Sampling was performed simultaneously for O₂ & 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. This approach was agreed upon in advance of testing with the MDEQ representative on-site. Data was recorded at 10-second intervals.

3.1.5 Quality Control and Assurance (O₂ and NO_x)

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 located in Appendix B.

Prior to testing, DTE performed converter efficiency testing by directly challenging the NO_x analyzer with a nitrogen dioxide (NO₂) calibration gas of 25.49ppm. Results from the converter efficiency test demonstrated that the analyzer met the requirements of Method 7E^(Eq. 1) (Greater than 90%).

$$\text{Eq. 1} \quad \text{Eff}_{NO_2} = \frac{C_{Dir}}{C_v} = \frac{23.0}{25.49} = 90.2\%$$

Calibration gas certification sheets are located in Appendix C.



3.1.6 Data Reduction

The O₂ and NO_x emission readings in parts per million (ppm) were recorded at 10-second intervals and averaged to 1-minute increments. The NO_x emissions were reported in parts per million corrected to 15% O₂ (ppm @ 15% O₂) as required by the MDEQ ROP.

The emissions data collected can be found 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 gas producer speed), horsepower, gross dry BTU, fuel feed rate, air inlet pressure, and air inlet temperature.

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

5.0 RESULTS

The results of the NO_x emission testing conducted on Turbine #1 are presented in Table No 1. The NO_x emissions are presented in parts per million (ppm) and parts per million at 15% oxygen (ppm @ 15% O₂). Process data presented includes the unit load in percent (%) and brake-horse power (Brake-Hp).

Testing of Turbine #1 demonstrated compliance with Permit emission rates throughout the normal operating range of the turbine. Testing was performed while the turbine was operated in LoNO_x mode at three gas producer speeds/loads (102%, 98%, and 96%). On the day of testing, the lowest gas producer speed achievable was 96.0%. Historical testing on this unit has shown that when lower speeds were attempted the turbine operation became unstable and the turbine shut-down. The MDEQ has previously agreed that testing at 96% gas producer speed sufficiently demonstrated compliance.

The MDEQ Permit and Test Plan acceptance letter requires that testing be performed while operating the turbine outside of the LoNO_x mode to demonstrate compliance with permit requirement 1.1c (150 ppmv @ 15% O₂ while operating at ambient temperatures less than 0°F or less than 75% of peak load). Controls on the turbine will not allow operating at less than 75% of peak load (operating outside of LoNO_x mode), otherwise the turbine goes into "shut-down".



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 Grigereit, QSTI

This report prepared by: 

Mr. Mark Grigereit, QSTI
Principal Engineer, Field Services Group
Environmental Management and Resources
DTE Energy Corporate Services, LLC

This report reviewed by: 

Mr. Thomas Snyder
Senior Engineering technician, Field Services Group
Environmental Management and Resources
DTE Energy Corporate Services, LLC



**TABLE NO. 1
NITROGEN OXIDE (NO_x) EMISSION TESTING RESULTS
Turbine #1 - Belle River Mills Compressor Station
June 1, 2015**

| Test | Time | Gas Producer | | Oxygen ⁽¹⁾ (%) | NO _x Emissions ⁽¹⁾ | |
|---------|-------------|--------------|--------------------|------------------------------|--|-----------------------------|
| | | Speed (%) | Load (Brake-Hp) | | (ppm) | (ppm @ 15% O ₂) |
| Run - 1 | 10:15-10:35 | 102 | 13,153 | 15.8 | 5.7 | 6.6 |
| Run - 2 | 10:43-11:03 | 102 | 13,143 | 15.8 | 5.8 | 6.8 |
| Run - 3 | 11:10-11:30 | <u>102</u> | <u>13,121</u> | <u>15.8</u> | <u>6.0</u> | <u>7.0</u> |
| | <i>Avg:</i> | 102 | 13,139 | 15.8 | 5.8 | 6.8 |
| Run - 1 | 11:39-11:59 | 98 | 10,194 | 15.9 | 9.1 | 10.7 |
| Run - 2 | 12:07-12:27 | 98 | 10,153 | 15.9 | 9.1 | 10.7 |
| Run - 3 | 12:34-12:54 | <u>98</u> | <u>10,166</u> | <u>16.1</u> | <u>9.0</u> | <u>11.0</u> |
| | <i>Avg:</i> | 98 | 10,171 | 16.0 | 9.1 | 10.8 |
| Run - 1 | 13:01-13:21 | 96 | 8,706 | 16.2 | 9.9 | 12.3 |
| Run - 2 | 13:28-13:48 | 96 | 8,705 | 16.1 | 9.8 | 12.2 |
| Run - 3 | 13:54-14:14 | <u>96</u> | <u>8,692</u> | <u>16.1</u> | <u>9.9</u> | <u>12.2</u> |
| | <i>Avg:</i> | 96 | 8,701 | 16.1 | 9.9 | 12.2 |

(1) Corrected for analyzer drift per USEPA method 7E

NO_x Permit Limits:

25.0 ppm corrected to 15% O₂



Figure 2 – EPA Methods 3A & 7E
Belle River Compressor Station – Turbine 1
June 1, 2015

