EMISSIONS TEST REPORT

for

OXIDES OF NITROGEN (NO_X) AND CARBON MONOXIDE (CO)

Z330 Engine 4

DTE-Gas
Belle River Mills Compressor Station (SRN:B6478)
East China, Michigan

September 11, 2015

Prepared By
Environmental Management & Resources
Environmental Field Services Group
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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

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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 (RO) Permit 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 described in General Condition No. 22 in the RO Permit and be made available to the Department of Environmental Quality, Air Quality Division upon request.

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

Source Address: 5440 Puttygut Road City: China Township

AQD Source ID (SRN): B6478 RO Permit No.: MI-ROP-B6478-2010 RO Permit Section No.:

Please check the appropriate box(es):

☐ **Annual Compliance Certification (General Condition No. 28 and No. 29 of the RO Permit)**

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 RO Permit, 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 RO Permit.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, 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 RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (General Condition No. 23 of the RO Permit)**

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

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the RO Permit 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 RO Permit 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 9/11/2015 To 9/12/2016

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:

Emissions Compliance Testing Report, Z-330 Unit 4

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.

Larry Maiorana	Manager - Reliability	(586)405-7389
Name of Responsible Official (print or type)	Title	Phone Number
Lawrence A. Maiorana		11/9/15
Signature of Responsible Official		Date

* Photocopy this form as needed.

EQP 5736 (Rev 9/01)

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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 (SRN:B6478), located in East China, Michigan. The fieldwork was performed on September 11, 2015, to satisfy requirements of the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. B6478-2010 and 40CFR Part 60 Subpart JJJJ. Emissions tests were performed on Z-330 Engine 4 for oxides of nitrogen (NO_x), and carbon monoxide (CO).

The results of the emissions testing are highlighted below:

Emissions Testing Summary
Belle River Mills Compressor Station
Engine 4 Z-330
September 11, 2015

	4 Z-330 Emission Rate[1]	ROP Permit Limit[1]	40 cfr Part 60 JJJJ Permit Limit[1]
Average Oxides of Nitrogen Concentration	1.24	3.0	2.0
Average Carbon Monoxide Concentration	1.94	3.0	4.0

(1) Emissions in grams per brake horsepower-hour (g/BHp-hr)

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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 (SRN:B6478), located in East China, Michigan. The fieldwork was performed on September 11, 2015, to satisfy requirements of the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. B6478-2010 and 40CFR Part 60 Subpart JJJJ. Emissions tests were performed on Z-330 Engine 4 for oxides of nitrogen (NO_x), and carbon monoxide (CO).

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 3A, 7E, 10, and 19.

The fieldwork was performed in accordance with EPA Reference Methods and EM&R's Intent to Test[1], Test Plan Submittal, which was approved by the Michigan Department of Environmental Quality (MDEQ) on August 3, 2015[2]. The following EM&R personnel participated in the testing program and 40CFR Part 60 Subpart JJJJ: Mr. Mark Grigereit, Principal Engineer, and Mr. Fred Meinecke, Senior Environmental Technician. Mr. Grigereit was the project leader. Mr. Tom Gasloli with the Air Quality Division of the Michigan Department of Environmental Quality (MDEQ) reviewed the test plan and observed the testing activities.

2.0 SOURCE DESCRIPTION

The Belle River Mills Compressor Station located at 5440 Puttygut Road, East China, Michigan, employs the use of two (4 and #5) natural gas-fired Cooper Z-330 2-stroke lean burn 10,000 Horse Power reciprocating Engine. The Z-330 compressor Engine generate line pressure assisting the transmission of natural gas into and out of the gas storage field as well as to and from the pipeline transmission system in south east Michigan.

The emissions from both Z-330 Engine exhaust directly into the atmosphere through individual exhaust stacks. Engine 4 was operated at their maximum load during the testing. The composition of the emissions from the engine depends on both the speed of the engine and the torque delivered to the compressor. Ambient atmospheric conditions, as it affects the density of air, may limit the speed and torque at which the engine can effectively operate.

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[1] MDEQ, Test Plan, sent August 3, 2015. (Attached-Appendix A)

[2] MDEQ, Approval Letter. (Attached-Appendix A)

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

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	Chemilumenecent Instrumental Analyzer Method
USEPA Method 10	Carbon Monoxide	NDIR Instrumental Analyzer Method
USEPA Method 19	Emission Rate Calculations	Stoichiometric Calculations

3.1 OXYGEN (USEPA METHOD 3A)

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 analyzer utilizes a paramagnetic sensor. Triplicate 60-minute tests were performed on the engine exhaust.

3.1.2 O_2 Sampling Train

The EPA Method 3A sampling system (Figure 2) consisted of the following:

(1) Single-point sampling probe (moved throughout the test according to Method 7E)
(2) Heated PTFE sampling line
(3) MAK® gas conditioner with particulate filter
(4) Flexible unheated PTFE sampling line

(5) Servomex 1400 O_2 gas analyzer
(6) Appropriate USEPA Protocol 1 calibration gases
(7) pDaqview® Data Acquisition System.

3.1.3 Sampling Train Calibration

The O_2 analyzer was calibrated according to procedures outlined in USEPA Method 7E. Zero, span, and mid range calibration gases were introduced directly into the analyzer to verify the instruments linearity. A zero and mid range span gas was then introduced through the entire sampling system to determine sampling system bias for the analyzer at the completion of each test.

3.1.4 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 and the concentrations were within the acceptable ranges (40-60% mid range and span) specified in Method 7E. Calibration gas certification sheets are located in Appendix C.

3.1.5 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The O2 emissions were recorded in percent (%). The 1-minute readings collected can be found in Appendix B.

3.2 OXIDES OF NITROGEN AND CARBON MONOXIDE (USEPA METHODS 7E AND 10)

3.2.1 Sampling Method

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 Chemilumenecent detector. Carbon monoxide (CO) emissions were evaluated using USEPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources". The CO analyzer utilizes a NDIR detector. Triplicate 60-minute tests were performed on the engine exhaust.

3.2.2 NO_x and CO Sampling Train

The EPA Methods 7E and 10 sampling system (Figure 2) consisted of the following:

(1) Single-point sampling probe (moved throughout the test according to Method 7E)
(2) Heated PTFE sampling line
(3) MAK® gas conditioner with particulate filter

(4) Flexible unheated PTFE sampling line
(5) TECO 42i Chemilumenecent NO/NO_x gas analyzer, and TECO 48i NDIR CO gas analyzer
(6) Appropriate USEPA Protocol 1 calibration gases
(7) pDaqview® Data Acquisition System.

3.2.3 Sampling Train Calibration

The NOx / CO sampling train was calibrated according to procedures outlined in USEPA Method 7E. Zero, span, and mid range calibration gases were introduced directly into each analyzer to verify the instruments linearity. A zero and mid range span gas for each pollutant was then introduced through the entire sampling system to determine sampling system bias for each analyzer at the completion of each test.

3.1.4 Quality Control and Assurance

All sampling and analytical equipment was calibrated according to the guidelines referenced in Methods 7E and 10. Calibration gases were EPA Protocol 1 gases and the concentrations were within the acceptable ranges (40-60% mid range and span) specified in Method 7E. Calibration gas certification sheets are located in Appendix C.

DTE performed NO_x converter efficiency testing by directly challenging the NO_x analyzer with a nitrogen dioxide (NO_2) calibration gas of 50.9 ppm. Results from the converter efficiency test demonstrated that the analyzer met the requirements of Method 7E (Eq-1).

Eq. 1

$$Eff_{NO2} = \frac{C_{Dir}}{C_v} = \frac{46.6}{50.9} = 91.6\%$$

3.1.5 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The NOx and CO emissions were recorded in parts per million (ppm). The 1-minute readings collected can be found in Appendix B.

Emissions calculations are based on calculations located in USEPA Methods 7E, 10, and 19 (Appendix D).

4.0 OPERATING PARAMETERS

The test program included the collection of engine operating data during each test run. Parameters recorded included Brake horsepower, gross dry BTU, fuel feed rate, spark timing, fuel pressure, air manifold pressure & temperature, and suction and discharge pressure.

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

5.0 DISCUSSION OF RESULTS

The results of the NO_x and CO emission testing on Engine 4 are presented in Tables No. 1. The NOx and CO emissions are presented in parts per million, dry (ppm_{dry}), pounds per hour (lbs/hr), pounds per million British Thermal Unit (lbs/MMBtu), and grams per brake horsepower – hour (grams/BHp-hr). Process data presented includes engine load in percent (%), engine brake-horsepower (Brake-Hp), and heat input in million British Thermal unit per hour (MMBtu/Hr).

For Engine 4, the average NO_x emissions of 1.24 grams/BHp-Hr and CO emissions of 1.94 grams/BHp-Hr are in compliance with permit MI-ROP-B6478-2010 and 40CFR Part 60 Subpart JJJJ.

On September 10, DTE attempted to complete the emissions testing. Although the first test run demonstrated compliance with ROP and Subpart JJJJ emission limits, it was determined that Engine 4 required adjustments to the controls. Specifically, an adjustment of the fuel equivalency ratio was made. Testing was postponed until September 11 to allow time for the tuning to occur. Test data from September 10 is located in Appendix F.

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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 Grigereit, QSTI

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RESULTS TABLE

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TABLE NO. 1
NOx and CO EMISSION TESTING RESULTS
Engine 4 Z330 - Belle River Mills Compressor Station
September 11, 2015

Test	Test Date	Test Time	Load (%)	Brake-Hp	Heat Input (MMBtu/hr)	NO_x Emissions[1] (ppm_{dry})	NO_x Emissions[1] (lb/hr)	NO_x Emissions[1] (lb/MMBtu)	NO_x Emissions[1] (gram/BHp-Hr)[2]	CO Emissions[1] (ppm_{dry})	CO Emissions[1] (lb/hr)	CO Emissions[1] (lb/MMBtu)	CO Emissions[1] (gram/BHp-Hr)[2]
1	9/11/15	7:06-8:06	93	8,145	64.7	78.7	21.67	0.34	1.2	215.1	36.06	0.56	2.0
2		8:22-9:22	93	8,154	64.7	79.9	21.74	0.34	1.2	213.1	35.30	0.55	2.0
3		9:35-10:35	93	8,141	64.4	87.2	23.17	0.36	1.3	206.6	33.41	0.52	1.9
		Average:	*93*	*8,147*	*64.6*	*81.9*	*22.19*	*0.34*	*1.2*	*211.6*	*34.92*	*0.54*	*1.9*

ND = Non Detect

(1) Emissions were corrected for analyzer drift per USEPA Method 7E

(2) ROP Permit Limit:
NOx - 3.0 gram/BHp-Hr
CO - 3.0 gram/BHp-Hr

(3) 40 CFR, Part 60, Subpart JJJJ Limit:
NOx - 2.0 gram/BHp-Hr
CO - 4.0 gram/BHp-Hr

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FIGURES

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Figure 1 – Sampling Locations
Z330 Engines 4
Belle River Mills Compressor Station
September 11, 2015

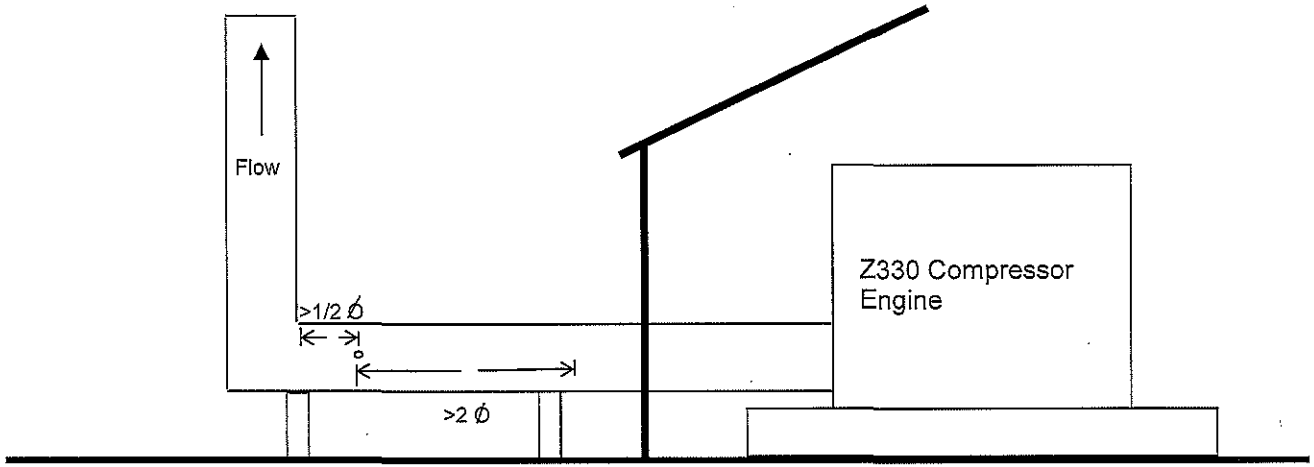

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Figure 2 – EPA Method 3A, 7E and 10
Z330 Engine 4
Belle River Mills Compressor Station
September 11, 2015