EMISSIONS TEST REPORT

for

OXIDES OF NITROGEN (NO_X), CARBON MONOXIDE (CO), AND NON-METHANE ORGANIC COMPOUNDS (NMOC)

Z-330 - COMPRESSOR ENGINE NO. 5

DTE GAS

BELLE RIVER MILLS COMPRESSOR STATION
East China, Michigan

August 25, 2016

Prepared By
Environmental Management & Resources
Environmental Field Services Group
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DEQ

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 County St. Clair

Source Address 5440 Puttygut Road City China Township

AQD Source ID (SRN) B6478 RO Permit No. MI-ROP-B6478-2016 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 8/25/16 To 8/25/17

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

ROP Emissions Test Report, EU018 (#5 Z-330) NOx, CO, and NMOC

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
Thomas Anderson		10/12/16
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 August 25, 2016, to satisfy requirements of the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. B6478-2016 (draft) and 40CFR Part 60 Subpart JJJJ. Emissions tests were performed on Z-330 Compressor Engine No. 5 for oxides of nitrogen (NO_x), carbon monoxide (CO), and non-methane organic compounds (NMOC).

The results of the emissions testing are highlighted below:

Emissions Testing Summary – Compressor Engine No. 5
Belle River Mills Compressor Station
East China, MI
August 25, 2016

	Oxides of Nitrogen (g/hp-hr)	Carbon Monoxide (g/hp-hr)	Non-Methane Organic Compounds (g/hp-hr)
Compressor Engine No. 5	2.1	1.6	0.4
Permit Limit	3.0	3.0	1.0

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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 August 25, 2016, to satisfy requirements of the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. B6478-2016(draft) and 40CFR Part 60 Subpart JJJJ. Emissions tests were performed on Z-330 Compressor Engine No. 5 for oxides of nitrogen (NO_x), carbon monoxide (CO), and non-methane organic compounds (NMOC).

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Method 320.

The fieldwork was performed in accordance with EPA Reference Methods,ASTM Methods and EM&R's Intent to Test[1], which was approved by the Michigan Department of Environmental Quality (MDEQ)[2]. The following EM&R personnel participated in the testing program: Mr. Mark Grigereit, Principal Engineer, Mr. Thom Snyder, Environmental Specialist and Mr. Fred Meinecke, Senior Environmental Technician. Mr. Grigereit was the project leader.

Ms. Susan King, DTE-Gas, provided on-site support of the testing. Mr. Tom Gasloli, MDEQ, reviewed the Test Plan. Mr. Robert Elmouchi, MDEQ, observed portions of the testing.

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 engines (derated to 9,000 Hp). The Z-330 compressor engines 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.

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[1] MDEQ, Test Plan, Submitted January 7, 2016. (Attached-Appendix A)

[2] MDEQ, Acceptance Letter, January 20, 2016. (Attached-Appendix A)

The emissions from both Z-330 engines exhaust directly to the atmosphere through individual exhaust stacks. Compressor Engine No. 5 was operated at greater than 90% of the 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.

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
ASTM Method D6348	NO_x, CO, VOC, CO_2, Moisture Content	FTIR

3.1 MOISTURE (ASTM METHOD D6348)

3.1.1 Sampling Method

Moisture content in the exhaust was evaluated using ASTM Method D6348, "Measurement of Vapor Phase Organic Emissions by Extractive Fourier Transform Infrared (FTIR)".

3.2 OXIDES of NITROGEN, CARBON MONOXIDE, VOLATILE ORGANIC COMPOUNDS, CARBON DIOXIDE (ASTM METHOD D6348)

3.2.1 Sampling Method

Oxides of Nitrogen, Carbon Monoxide, Volatile Organic Compounds, and Carbon Dioxide emissions were evaluated using ASTM Method D6348, "Measurement of Vapor Phase Organic Emissions by Extractive Fourier Transform Infrared (FTIR)". Single point sampling was performed. Triplicate 60-minute test runs were performed.

The EPA Method 320 sampling system (Figure 2) consisted of the following:

(1) Single-point sampling probe
(2) Flexible heated PTFE sampling line
(3) Air Dimensions Heated Head Diaphragm Pump
(4) MKS MultiGas 2030 FTIR spectrometer
(5) Appropriate calibration gases
(6) Data Acquisition System

The FTIR was equipped with a temperature controlled, 5.11 meter multipass gas cell maintained at 191°C. Gas flows and sampling system pressures were monitored using a rotometer and pressure transducer. All data was collected at 0.5 cm^{-1} resolution.

3.2.2 Sampling Train Calibration

The FTIR was calibrated according to procedures outlined in ASTM Method D6348. Direct measurements of nitrogen, oxides of nitrogen (NO_x), carbon monoxide (CO), propane (C_3H_8), and ethylene (C_2H_4) gas standards were made at the test location to confirm concentrations.

A calibration transfer standard (CTS) was analyzed before and after testing at each location. The concentration determined for all CTS runs were within ±5% of the certified value of the standard. Ethylene was passed through the entire system to determine the sampling system response time and to ensure that the entire sampling system was leak-free.

Nitrogen was purged through the sampling system at each test location to confirm the system was free of contaminants.

NO_x, CO, and C_3H_8 gas standards were passed through the sampling system at each test location to determine the response time and confirm recovery.

NO_x, CO, and C_3H_8 spiking was performed to verify the ability of the sampling system to quantitatively deliver a sample containing NO_x, CO, and C_3H_8 from the base of the probe to the FTIR. Analyte spiking assures the ability of the FTIR to quantify NO_x, CO, and C_3H_8 in the presence of effluent gas.

As part of the spiking procedure, samples from each engine were measured to determine NO_x, CO, and C_3H_8 concentrations to be used in the spike recovery calculations. The determined sulfur hexafluoride (SF_6) concentration in the spiked

and unspiked samples was used to calculate the dilution factor of the spike and thus used to calculate the concentration of the spiked NO_x, CO, and C_3H_8. The following equation illustrates the percent recovery calculation.

$$DF = \frac{SF_{6(spike)}}{SF_{6(direct)}} \qquad \text{(Sec. 9.2.3 (3) ASTM Method D6348)}$$

$$CS = DF * Spike_{dir} + Unspike(1 - DF) \qquad \text{(Sec. 9.2.3 (4) ASTM Method D6348)}$$

DF = Dilution factor of the spike gas
$SF_{6(direct)}$ = SF6 concentration measured directly in undiluted spike gas
$SF_{6(spike)}$ = Diluted SF_6 concentration measured in a spiked sample
$Spike_{dir}$ = Concentration of the analyte in the spike standard measured by the FTIR directly
CS = Expected concentration of the spiked samples
Unspike = Native concentration of analytes in unspiked samples

All analyte spikes were introduced using an instrument grade stainless steel rotometer. The spike target dilution ratio was 1:10 or less. All NO_x, CO, and C_3H_8 spike recoveries were within the EPA Method 320 allowance of ±30%.

3.2.3 Quality Control and Assurance

As part of the data validation procedure, reference spectra are manually fit to that of the sample spectra and a concentration is determined. The reference spectra are scaled to match the peak amplitude of the sample, thus providing a scale factor. The scale factor multiplied by the reference spectra concentration is used to determine the concentration value for the sample spectra. Sample pressure and temperature corrections are then applied to compute the final sample concentration. The manually calculated results are then compared with the software-generated results. The data is then validated if the two concentrations are within ± 5% agreement. If there is a difference greater than ± 5%, the spectra are reviewed for possible spectral interferences or any other possible causes that might lead to inaccurately quantified data. PRISM Analytical Technologies, Inc. validated the FTIR data. The data validation reports are located in Appendix D.

3.2.4 Data Reduction

Each spectrum was derived from the coaddition of 64 scans, with a new data point generated approximately every one minute. The NO_x, CO, and VOC emissions were recorded in parts per million (ppm) dry volume basis. The CO_2 emissions were recorded in percent (%) dry volume basis. The moisture content

was recorded in percent (%). The FTIR data was reprocessed by Prism Analytical to calculate an accurate VOC emission. The reprocessed data is located in the Prism Validation Report.

4.0 OPERATING PARAMETERS

The test program included the collection of generator load (kW), engine speed (RPM), inlet manifold air pressure (psi), fuel upper heating value (BTU), fuel flow (scfm) and generator operating hours (kW-hour).

Operational data 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 R. Grigereit, QSTI

This report prepared by:

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TABLE NO. 1
NOx, CO, and NMEOC EMISSION TESTING RESULTS
Compressor Engine No. 5 Z330 - Belle River Mills Compressor Station
August 25, 2016

Test	Test Date	Test Time	Load	Brake-Hp	Heat Input	NO_x Emissions		CO Emissions		VOC Emissions	
			(%)		(MMBtu/hr)	(ppm_{dry})	(gram/BHp-Hr)[1]	(ppm_{dry})	(gram/BHp-Hr)[1]	Total VOC as Propane (ppm_{dry})	VOC (gram/BHp-Hr)[1]
1	8/25/16	8:44-9:44	90	8,125	64.8	158.1	2.1	188.5	1.5	31.7	0.4
2		9:57-10:57	90	8,134	65.0	157.7	2.1	189.4	1.6	32.5	0.4
3		11:12-12:12	90	8,138	65.6	140.9	1.9	199.4	1.7	32.7	0.4
		Average:	*90*	*8,132*	*65.1*	*152.2*	*2.0*	*192.4*	*1.6*	*32.3*	*0.4*

ND = Non Detect

(1) ROP Permit Limit:

NOx - 3.0 gram/BHp-Hr

CO - 3.0 gram/BHp-Hr

VOC - 1.0 gram/BHp-Hr

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Figure 1 – Sampling Locations
Z330 Unit 5
Belle River Mills Compressor Station
August 25, 2016

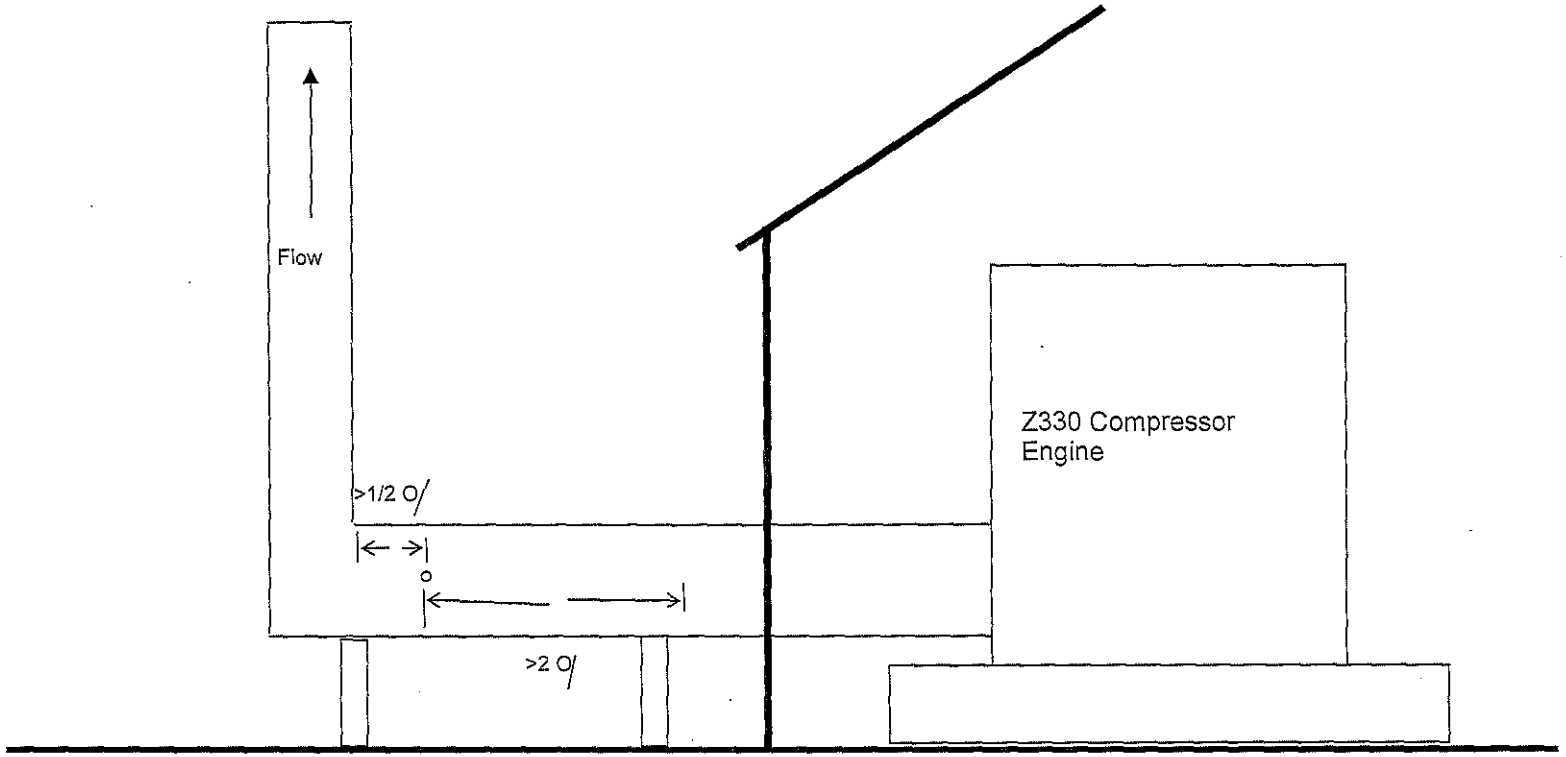

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Figure 2 – ~~EPA Method 320~~ ASTM D6348
Z330 Unit 5
Belle River Mills Compressor Station
August 25, 2016