EMISSIONS TEST REPORT

for

CARBON MONOXIDE (CO) EMISSIONS

Train A (Unit 7) & Train B (Unit 8)

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

February 4-5, 2013

Prepared By
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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 February 4-5, 2014 was conducted to satisfy requirements of the Michigan Renewable Operating Permit No. MI-ROP-B6478-2010. Emission tests were performed on the Refrigeration Plant Train A - Unit 7 & Train B - Unit 8 for carbon monoxide (CO) destruction efficiency (DE).

A summary of results from the emissions testing are highlighted below:

Emissions Testing Summary – CO Destruction Efficiency
Refrigeration Plant - Belle River Mills Compressor Station
DTE Gas
St. Clair, Michigan
February 4-5, 2014

Unit	Load (%)	Load (bhp)	CO (Destruction Efficiency)
Train A – Unit 7	48.8	634	98.7
Train B – Unit 8	61.6	827	97.4

Permit Limit:
CO-Destruction Efficiency = 93%

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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, located in St. Clair, Michigan. The fieldwork, performed on February 4-5, 2014 was conducted to satisfy requirements of the Michigan Renewable Operating Permit No. MI-ROP-B6478-2010. Emission tests were performed on the Refrigeration Plant Train A - Unit 7 & Train B - Unit 8 for carbon monoxide (CO) destruction efficiency (DE).

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

The fieldwork was performed in accordance with EPA Reference Methods and Intent to Test[1], Test Plan Submittal. The following EM&R personnel participated in the testing program: Mark Grigereit, Senior Specialist, Mr. Thomas Snyder and Mr. Fred Meinecke, Senior Environmental Technicians. Mr. Grigereit was the project leader. Ms. Phillis Rynne and Ms. Mollie Monaghan, Environmental Engineers with EM&R, provided process coordination for the testing program. Mr. Nathan Hude and Mr. Robert Elmouchi with the Air Quality Division of the Michigan Department of Environmental Quality (MDEQ) witnessed portions of the testing. Mr. Nathan Hude approved the Test Plan[2].

2.0 SOURCE DESCRIPTION

The Belle River Mills Compressor Station located at 5440 Puttygut Road, St. Clair, Michigan, employs the use of two natural gas-fired, lean burn, Waukesha 1,480-Hp, 4-cycle, spark ignition, reciprocating internal combustion engines. The engines generate line pressure assisting the refrigeration plant operation.

The emissions from the engines are exhausted through catalyst beds and to the atmosphere through individual exhaust stacks. The composition of the emissions from the engines depend both upon the speed of the engine and the torque delivered to the compressor. Ambient atmospheric conditions, as it affects the density of air, limit the speed and torque at which the engines can operate.

During the emissions testing the engines were scheduled to operate at full load conditions, but actually were operated at reduced load conditions due to limitations on the system. There was not sufficient flow through the Refrigeration Plant to operate at 100% load

[1] MDEQ, Test Plan, Submitted December 9, 2013. (Attached-Appendix A)
[2] MDEQ, Approval Letter, Received January 15, 2014. (Attached-Appendix A)

conditions. The average load on Train A – Unit 7 was 48.8%. The average load on Train B – Unit 8 was 61.6%. Mr. Nathan Hude, MDEQ, was notified of the reduced load restrictions at the time of testing.

A schematic representation of the engine exhaust and sampling locations are presented in Figure 1. Sampling was simultaneously performed in the duct prior to the catalyst bed and immediately following the catalyst bed for CO and O_2 to determine the CO destruction efficiency.

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 10	Carbon Monoxide	NDIR Instrumental Analyzer Method

3.1 Oxygen and Carbon Monoxide (USEPA Methods 3A and 10)

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.

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.

3.1.2 O_2 and CO Sampling Train

The EPA Methods 3A and 10 sampling system (Figure 2) consisted of the following components:

(1) Stainless steel sampling probe.

(2) Heated Teflon™ sampling line.
(3) MAK® gas conditioner with particulate filter.
(4) Flexible unheated Teflon™ sampling line.
(5) Servomax 1400 O2/CO2 gas analyzer and TECO 48i NDIR CO gas analyzer.
(6) USEPA Protocol 1 calibration gases.
(7) Data Acquisition System.

3.1.3 Sampling Train Calibration

The O_2 / CO sampling trains were calibrated according to procedures outlined in USEPA Methods 3A & 10. Zero, span, and mid range calibration gases were introduced directly into the CO 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 each engine consisted of triplicate 60-minute samples at the inlet and exhaust of the catalyst on each engine. Sampling was performed simultaneously for O_2 and CO. Data was recorded as 1-minute averages.

3.1.5 Quality Control and Assurance (O_2 and CO)

All sampling and analytical equipment was calibrated according to the guidelines referenced in Methods 3A and 10. Calibration gases were EPA Protocol 1 gases. The CO analyzers spans were 0-24.58 ppm (24.58, 13.37, and zero) and 0-966.1 ppm (966.1, 489.5, and zero).

Calibration data for each analyzer and gas certification sheets are located in Appendix C.

3.1.6 Data Reduction

The O_2 and CO emission readings in percent (%) and parts per million (ppm) respectively were recorded at 10-second intervals and averaged to 1-minute increments. The CO emissions were reported in parts per million corrected to 15% O_2 and percent Destruction Efficiency (% DE) as required by the permit requirements. Emission calculations are based upon calculations found in USEPA Methods 3A, 10 and 19. Example calculations can be found in Appendix D.

The 1-minute analyzer readings collected can be found in Appendix B.

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4.0 OPERATING PARAMETERS

The test program included the collection of engine speed (RPM), discharge pressure (psig) load (%), fuel flow (SCFH), catalyst inlet and outlet temperature (°F), engine operating hours (hrs), and fuel heating value (BTU). Operational data is located in Appendix E.

A fuel gas sample was collected during the emission testing and the laboratory analysis is located in Appendix E.

5.0 DISCUSSION OF RESULTS

Tables No. 1 and 2 present the CO emission testing results from Train A – Unit 7 on February 4, 2013 and Train B – Unit 8 on February 5, 2013.

The CO emissions (inlet and outlet) are presented in parts per million (ppm), and parts per million at fifteen percent oxygen (ppm @ 15% O_2). The CO Destruction Efficiency is presented in percent (%). Additional test data presented for each Unit includes the Unit Load in percentage (%) and Brake Horsepower (bhp). The Unit heat input rate for each test is presented million British Thermal Unit per hour (MMBtu/Hr). The oxygen measured at the inlet and outlet is presented in percent (%)

The results of the testing indicate that Train A - Unit 7 & Train B - Unit 8 are in compliance, at the reduced loads tested, with the Michigan Renewable Operating Permit (MI-ROP-B6478-2010) limit for CO Destruction Efficiency of greater than 93%.

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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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Table No 1
Carbon Monoxide Destruction Efficiency Test Results
Train A - Unit 7
Belle River Mills Compressor Station
February 4, 2014

Test No	Test Time	Load (%)	BHp	Heat Input Rate (MMBtu/Hr)	Inlet Emissions			Outlet Emissions		CO Destruction Efficiency [2] (%)
					O_2 (%)[1]	CO (ppm)[1]	CO (ppm@15% O_2)	CO (ppm)[1]	CO (ppm@15% O_2)	
1	10:55-11:55	45.0	583	6.91	10.4	518.4	291.5	5.2	2.9	99.0
2	12:06-13:06	45.7	593	7.02	10.6	515.8	294.5	6.6	3.8	98.7
3	13:31-14:31	55.7	725	8.38	10.6	520.7	299.1	7.7	4.4	98.5
	Avg:	*48.8*	*634*	*7.44*	*10.5*	*518.3*	*295.0*	*6.5*	*3.7*	*98.7*

(1) Corrected for Analyzer drift as per USEPA Method 7E

(2) CO Reduction Efficiency based on ppm @ 15% O2

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Table No 2
Carbon Monoxide Destruction Efficiency Test Results
Train B - Unit 8
Belle River Mills Compressor Station
February 5, 2014

Test No	Test Time	Load (%)	BHp	Heat Input Rate (MMBtu/Hr)	Inlet Emissions			Outlet Emissions		CO Destruction Efficiency [2] (%)
					O_2 (%)[1]	CO (ppm)[1]	CO (ppm@15% O_2)	CO (ppm)[1]	CO (ppm@15% O_2)	
1	10:07-11:07	62.3	836	8.38	10.5	513.8	292.8	12.3	7.0	97.6
2	11:34-12:34	62.3	835	8.46	10.6	509.3	291.9	14.1	8.1	97.2
3	12:44-13:44	60.3	811	8.30	10.6	505.8	289.9	13.8	7.9	97.3
	Avg:	*61.6*	*827*	*8.38*	*10.6*	*509.6*	*291.5*	*13.4*	*7.7*	*97.4*

(1) Corrected for Analyzer drift as per USEPA Method 7E

(2) CO Reduction Efficiency based on ppm @ 15% O2

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Figure 1 – Sampling Location
Refrigeration Plant (Unit 7 & 8)
Belle River Mills Compressor Station
February 4-5, 2014

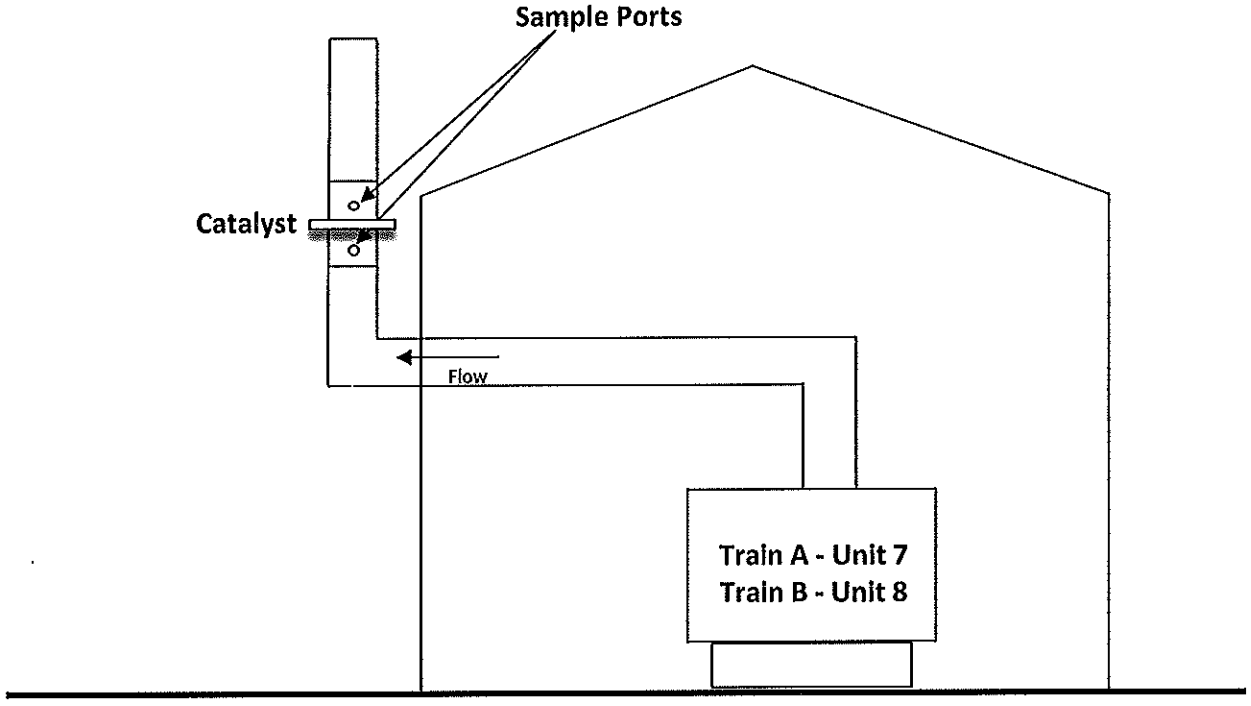

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Figure 2 – USEPA Methods 3A and 10
Refrigeration Plant (Unit 7 & 8)
Belle River Mills Compressor Station
February 4-5, 2014