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EMISSIONS TEST REPORT

for

CARBON MONOXIDE (CO) EMISSIONS

PART 63 SUBPART ZZZZ

UNIT 1

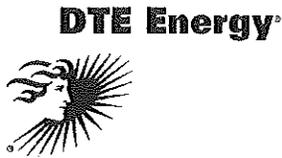
**DTE-Gas, Willow Compressor Station
Ypsilanti, Michigan**

May 14, 2015

Prepared By
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EXECUTIVE SUMMARY

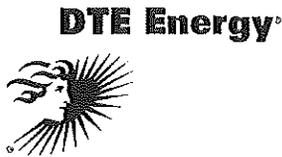
DTE Energy's Environmental Management and Resources (EM&R) Field Services Group performed emissions testing at the DTE-Gas, Willow Compressor Station, located in Ypsilanti, Michigan. The fieldwork, performed on May 15, 2015 was conducted according to the test method specified in 40CFR Part 63.6640(c). The emission test was performed on Unit 1 to demonstrate carbon monoxide (CO) destruction efficiency performance.

The results of the emissions testing are highlighted below:

**CO Emissions Test Results
Willow Compressor Station - Unit 1
May 15, 2015**

Unit 1 – Operating Load (Brake Horsepower)	Average CO Emission Rate (gram/BHp-Hr)	Average CO Destruction Efficiency (%)
4,709.5	1.6	98.8

Permit Limits: CO = 2.5 grams/BHp-Hr
CO-DE = 93%



1.0 INTRODUCTION

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group performed emissions testing at the DTE-Gas, Willow Compressor Station, located in Ypsilanti, Michigan. The fieldwork, performed on May 15, 2015 was conducted according to the test method specified in 40CFR Part 63.6640(c). The emission test was performed on Unit 1 to demonstrate carbon monoxide (CO) destruction efficiency performance.

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. The following DECS personnel participated in the testing program: Mark Grigereit, Principal Engineer and Thomas Snyder, Senior Engineering Technician-EM&R. Mr. Grigereit was the project leader.

2.0 SOURCE DESCRIPTION

The Willow Compressor Station located at 3020 East Michigan Avenue, Ypsilanti, Michigan, employs the use of a Caterpillar 3616 natural gas-fired 4,735 Horse Power reciprocating engine (Unit 1). The engine generates line pressure assisting the transmission of natural gas throughout the pipeline transmission system in SE Michigan.

The emissions from the engine are exhausted through a catalyst bed and to the atmosphere through an individual exhaust stack. The composition of the emissions from the engine depends 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 engine can effectively operate.

During the emissions testing the engine was operated at maximum load conditions

A schematic representation of the engine exhaust and sampling locations are presented in Figure 1. Sampling was performed in the duct prior to and immediately following the catalyst bed.

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 (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.

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 O₂ and CO Sampling Train

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

- (1) Single-point stainless steel sampling probe.
- (2) Heated Teflon™ sampling line.
- (3) Universal® gas conditioner with particulate filter.
- (4) Flexible unheated Teflon™ sampling line.
- (5) Servomex 1400 O₂/CO₂ gas analyzer and TECO 48i NDIR CO gas analyzer.
- (6) Data Acquisition System.

Refer to Figure 2 for a schematic of the O₂ and CO sampling train.

3.1.3 Sampling Train Calibration

The O₂ / 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 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 engine consisted of a single 15-minute sample at the inlet and exhaust of the catalyst. Testing was conducted at three points across the diameter of the duct. Sampling was performed simultaneously for O₂ and CO and data was recorded as 1-minute averages.

3.1.5 Quality Control and Assurance (O₂ 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 0-966.2 ppm and 0-49.3 ppm ranges. The O₂ analyzers spans were 0-17.8% and 0-17.6% ranges.

Calibration gas certification sheets are located in Appendix B.

3.1.6 Data Reduction

The O₂ 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 grams per Brake Horsepower Hour (g/BHp-Hr) and percent Destruction Efficiency (DE) as required by the Method. Emission calculations are based upon calculations found in USEPA Methods 3A, 7E, 10 and 19. Example calculations are located in Appendix C.

The 1-minute readings collected are located in Appendix A.

4.0 OPERATING PARAMETERS

The test program included the collection of engine speed (RPM), engine load (%), fuel flow (scfh), catalyst inlet and outlet temperature (°F), catalyst pressure drop ("H₂O), and generator operating hours (kW-hour) along with other engine data. Operational data collected during the testing is located in Appendix D.



5.0 RESULTS

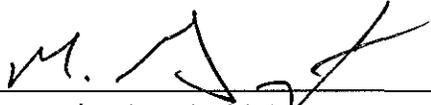
Table 1 presents the CO emission testing results from Unit 1. The CO emissions are presented in grams per brake horsepower hour (g/Bhp-Hr), prior to and after the catalyst, and the destruction efficiency in percent (%). Also presented are the Unit load in percent (%), speed (rpm), brake horsepower, and heat input (MMBtu/Hr). The Results of the testing indicate that Unit 1 is in compliance all applicable federal and state permit requirements for CO. Measured concentrations of CO are 1.6 g/BHp-Hr (limit - 2.5 g/BHp-Hr) and 98.8% destruction efficiency (limit – 93% DE).

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 TABLES

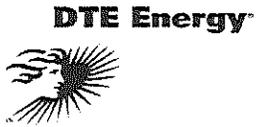


TABLE NO. 1
CARBON MONOXIDE (CO) EMISSION TESTING RESULTS
 Unit 1 - Willow Run Compressor Station
 May 14, 2015

Test	Time	Load (%)	Speed (RPM)	Brake-HP	Heat Input (MMBtu/Hr)	Oxygen ⁽¹⁾		CO Emissions ⁽¹⁾		Destruction Efficiency (%)
						Inlet (%)	Outlet (%)	Inlet (g/BHp-Hr)	Outlet (g/BHp-Hr)	
Average	13:29-13:44	87.0	996.5	4,710	31.38	12.1	12.0	1.6	0.02	98.8

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

CO Permit Limits:

2.5 g/BHp-Hr
 93% DE

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FIGURES



Figure 1 – Sampling Location
Willow Compressor Station
May 14, 2015

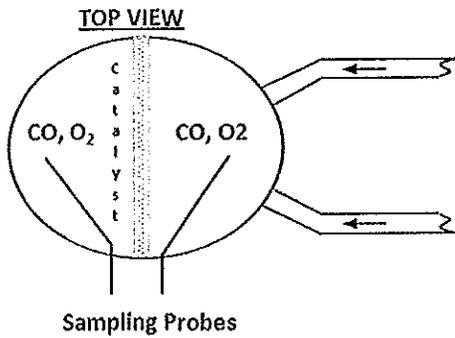
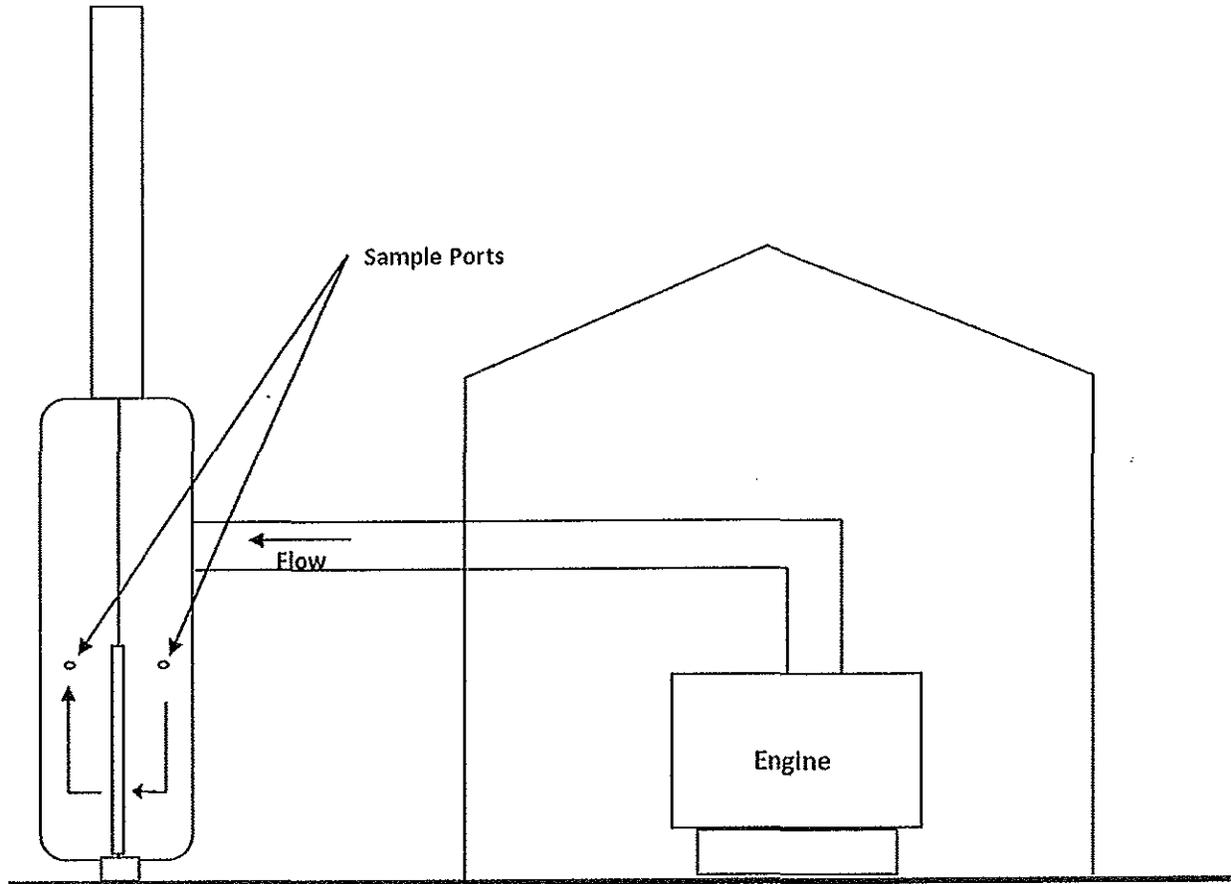




Figure 2 – EPA Methods 3A/10
Willow Compressor Station
May 14, 2015

