EMISSIONS TEST REPORT

for

CARBON MONOXIDE (CO)

EUENGINE1

DTE GAS

WILLOW RUN COMPRESSOR STATION
Ypsilanti, Michigan

June 9, 2022

Prepared By
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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Safety (EM&S), Ecology, Monitoring, and Remediation Group performed emissions testing at the DTE-Gas Willow Compressor Station located in Ypsilanti, Michigan. The fieldwork was performed on June 9, 2022, to satisfy requirements of the Michigan Department of Environment, Great Lakes and Energy (EGLE) Renewable Operating Permit, MI-ROP-N7421-2022 and 40 CFR 63, Subpart ZZZZ. Emissions tests were performed on the Engine 1100 (EUENGINE1) for carbon monoxide (CO).

The results of the emissions testing are highlighted below:

Emissions Testing Summary – Engine 1
Willow Run Compressor Station
Ypsilanti, MI
June 9, 2022

	Carbon Monoxide Inlet (ppmvd@15%O2)	Carbon Monoxide Outlet (ppmvd@15%O2)	Carbon Monoxide (DE)
EUENGINE1	267.2	2.2	99.2
Permit Limit			93

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Safety (EM&S), Ecology, Monitoring, and Remediation Group performed emissions testing at the DTE-Gas Willow Compressor Station located in Ypsilanti, Michigan. The fieldwork was performed on June 9, 2022, to satisfy requirements of the Michigan Department of Environment, Great Lakes and Energy (EGLE) Renewable Operating Permit, MI-ROP-N7421-2022 and 40 CFR 63, Subpart ZZZZ. Emissions tests were performed on the Engine 1100 (EUENGINE1) for 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, 10, and 19.

The fieldwork was performed in accordance with EPA Reference Methods and EM&S's Intent to Test[1], which was approved by EGLE[2]. The following EM&S personnel participated in the testing program: Mr. Mark D. Westerberg, Sr. Environmental Specialist, and Mr. Fred Meinecke, Environmental Specialist. Mr. Westerberg was the project leader. Mr. Andrew Riley, Environmental Quality Analyst with EGLE was onsite to observe the testing.

2.0 SOURCE DESCRIPTION

The Willow Run Compressor Station located at 3020 East Michigan Avenue, Ypsilanti, Michigan, employs the use of four (4) non-emergency natural gas-fired reciprocating internal combustion engines (RICE) and one (1) simple-cycle compressor turbine. The engines are identified as EURICE1-3 and EUENGINE1 (flexible group FGENGINES and FGENGMACT4Z) in Renewable Operating Permit, MI-ROP-N7421-2022. The compressor turbine is identified as EUTURBINE1. EURICE1 and EURICE2 are rated at 2,500 HP, EURICE3 is rated at 5,000 HP, EUENGINE1 is rated at 4,735 HP, and EUTURBINE1 is rated at 7,770 HP. The units 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.

The emissions from EUENGINE1 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.

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[1] DTE Test Plan, Submitted March 11, 2022. (Attached-Appendix A)

[2] EGLE, Acceptance Letter, May 19, 2022. (Attached-Appendix A)

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The unit operates on an as needed basis providing pipeline pressure. The engine was tested at 100% (+/- 10%) rated capacity to meet ROP and National Emissions Standards for Hazardous Air Pollutants (NESHAP) testing requirements.

A schematic representation of EUENGINE1 (Engine 1100) exhaust and sampling locations 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	Paramagnetic Analyzer
USEPA Method 10	Carbon Monoxide	NDIR Analyzer
USEPA Method 19	Mass Emissions Calculations	Heat Input

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 analyzers utilize paramagnetic sensors. Testing was performed simultaneously with the gaseous emissions testing.

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

(1) Single-point sampling probe (traversed across the exhaust stack)
(2) Heated PTFE sampling line
(3) MAK® gas conditioner with particulate filter
(4) Flexible unheated PTFE sampling line
(5) Servomex 1400 O_2/CO_2 gas analyzer
(6) Appropriate USEPA Protocol 1 calibration gases

(7) Data Acquisition System

3.1.2 Sampling Train Calibration

The O_2 analyzer was calibrated according to procedures outlined in USEPA Methods 3A and 7E. Zero, span, and mid-range calibration gases were introduced directly into the analyzer to verify the instruments linearity. A zero and mid-range gas was then introduced through the entire sampling system to determine sampling system bias at the completion of each test.

3.1.3 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 in Appendix C.

3.1.4 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The O_2 emissions were recorded in percent (%). The 1-minute readings collected during the testing are in Appendix B.

3.2 CARBON MONOXIDE (USEPA METHOD 10)

3.2.1 Sampling Method

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

The EPA Method 10 sampling system (Figure 2) consisted of the following:

(1) Stainless-steel sample probe (traversed across the exhaust stack)
(2) Heated PTFE sampling line
(3) MAK® gas conditioner with particulate filter
(4) Flexible unheated PTFE sampling line
(5) TECO 48i NDIR CO gas analyzer
(6) Appropriate USEPA Protocol 1 calibration gases
(7) Data Acquisition System.

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3.2.2 Sampling Train Calibration

The CO sampling train was calibrated according to procedures outlined in USEPA Method 10. Zero, span, and mid-range calibration gases were introduced directly into each analyzer to verify the instruments linearity. A zero and mid-range 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.

3.2.3 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 in Appendix C.

3.2.4 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The CO emissions were recorded in parts per million, dry (ppmvd). The 1-minute readings collected are in Appendix B.

Emissions calculations, based on calculations located in USEPA Methods 7E, 10, and 19, are in Appendix E. The CO emissions data collected during the testing was reduced to parts per million corrected to 15% oxygen on a dry basis (ppmvd @ 15% O_2).

3.4 MASS EMISSIONS (USEPA METHOD 19)

3.4.1 Sampling Method

Pollutant mass emissions were calculated using procedures used in USEPA Method 19. The CO analyzer utilizes non-dispersive infrared (NDIR) technology. Fuel flow (scf) was recorded during each test period and reduced to scf/hr. The facility provided fuel heat content (btu/scf) at the start of the test day.

Sample emissions calculations are presented in Appendix D.

4.0 OPERATING PARAMETERS

The test program included the collection of engine torque (Hp), engine speed (RPM), inlet and exhaust catalyst temperature (°F) catalyst differential pressure (psi), fuel upper heating value (BTU), and fuel flow (100 scfh).

Operational data is in Appendix E.

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5.0 DISCUSSION OF RESULTS

Table No. 1 presents the emission testing results from EUENGINE1 while operating at greater than 90% of full load conditions. Additional test data presented for each test includes the engine load in percentage (%), heat input (MMBtu/hr), and emissions (ppm). EUENGINE1 demonstrated compliance with CO emission limits as stated in Renewable Operating Permit, MI-ROP-N7421-2022 and 40 CFR 63, Subpart ZZZZ.

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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 D. Westerberg, QSTI

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RESULTS TABLE

CO EMISSIONS TEST RESULTS

DTE Gas - Willow Run Compressor Station

EUEngine1 (Engine 1)

June 9, 2022

Test	Test Time	Unit Load (% of rated HP)[2]	Engine Speed (RPM)	Engine Torque (Brake-hp)	Fuel Flow (100 SCFH)	Heat Input (MMBtu/hr)	O_2 Inlet (%, dry)[1]	O_2 Outlet (%, dry)[1]	CO Inlet (ppmvd @ 15% O_2)	CO Outlet (ppmvd @ 15% O_2)	CO Destruction
1	8:56-9:56	94.0	961	4,262	267.9	28.7	11.7	11.8	267.1	2.0	99.3%
2	9:12-10:12	92.3	951	4,183	261.9	28.1	11.8	11.8	266.7	3.0	98.9%
3	10:30-11:30	91.7	974	4,268	268.8	28.8	11.7	11.7	267.6	1.5	99.4%
	Three Test Average:	92.7	*962*	*4,238*	*266.2*	*28.5*	11.7	11.7	267.2	2.2	99.2%
								Permit Limit :			*>93%*

[1] corrected for analyzer drift as per USEPA Method 7E

[2] calculated as actual average horse power divided by 4,735(nominal rated horsepower)

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FIGURES

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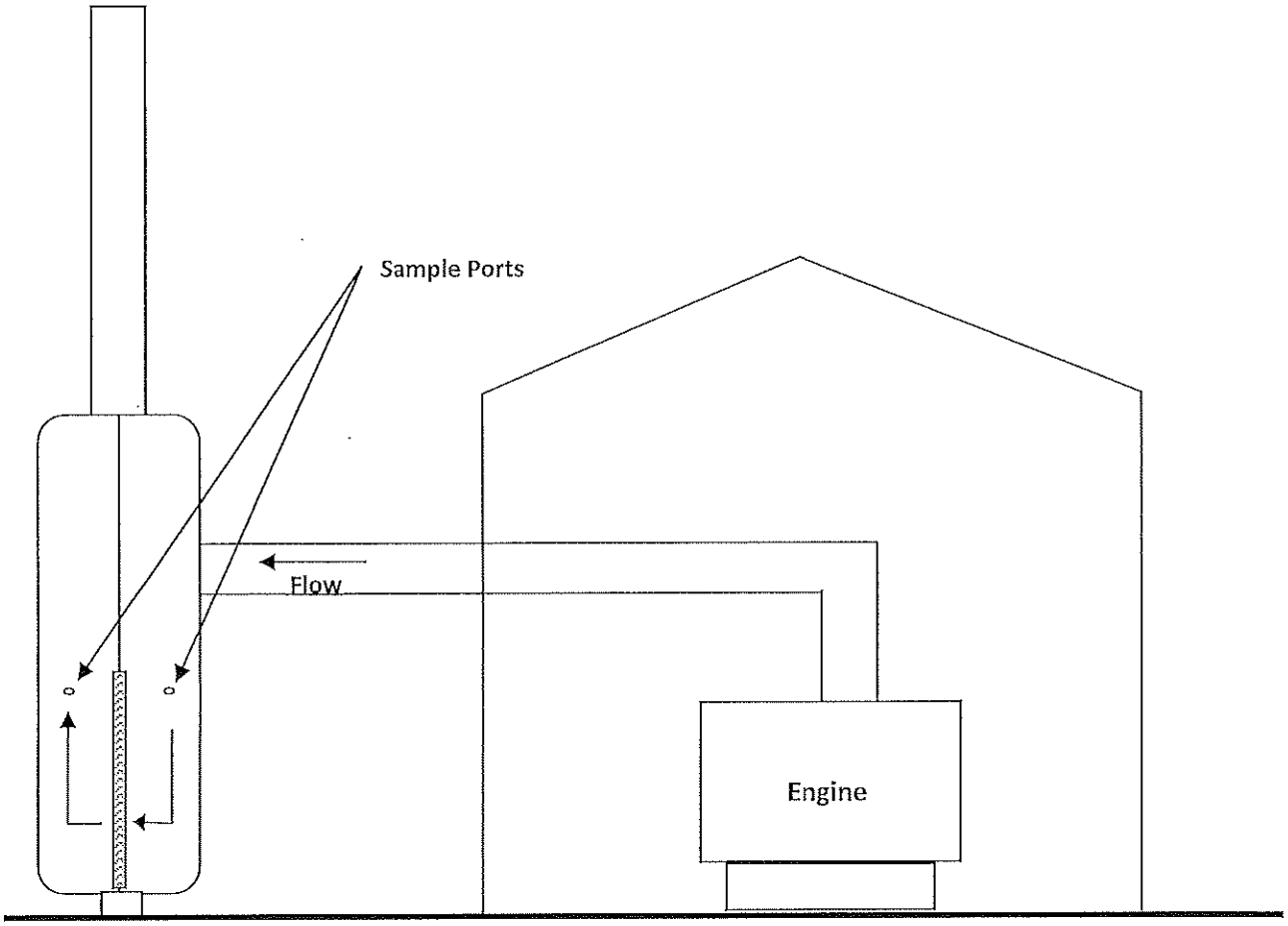
Figure 1 – Sampling Location
Willow Compressor Station
June 2022



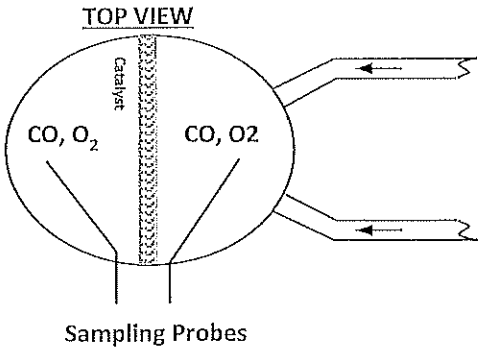


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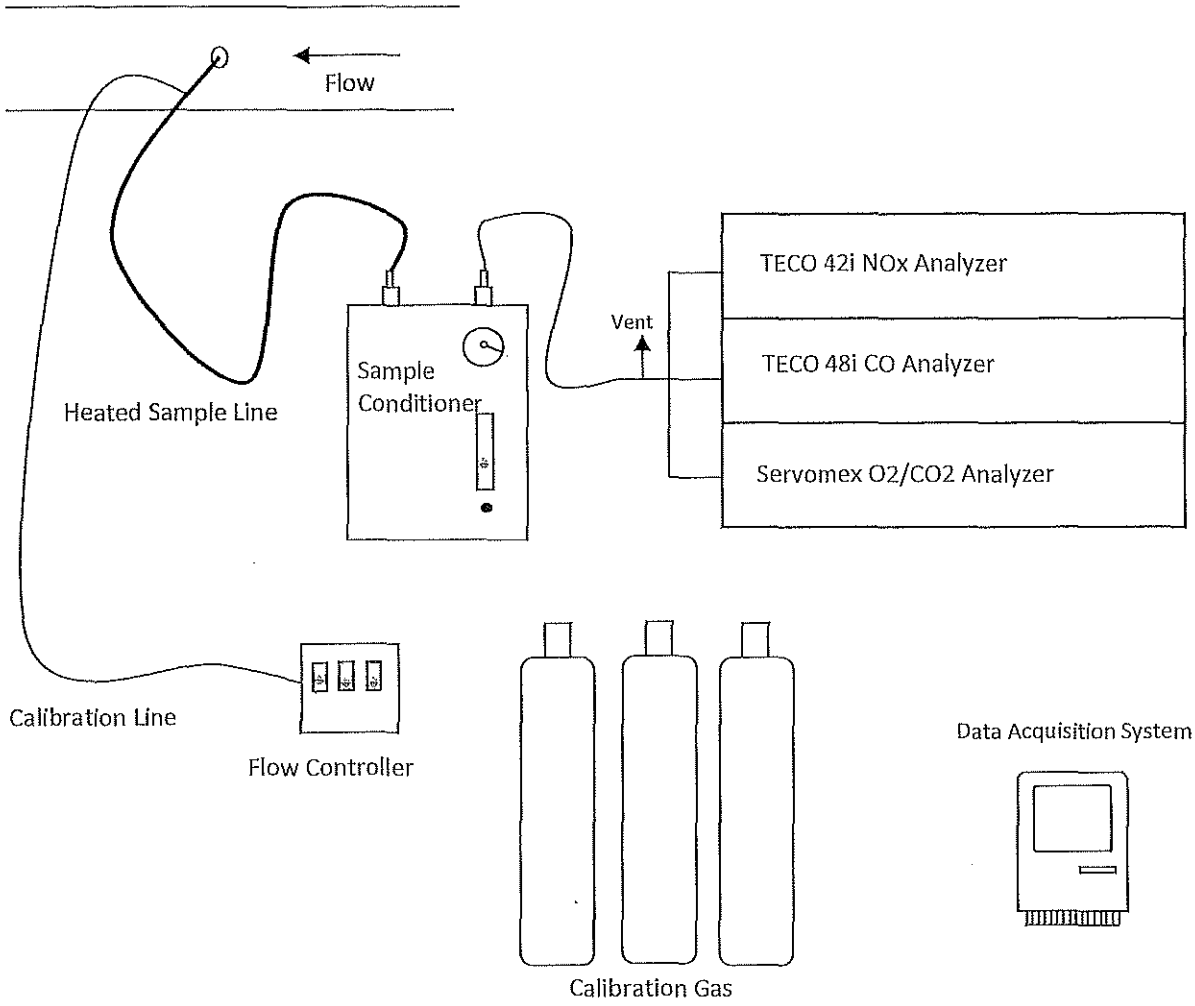
Figure 2 – EPA Methods 3A/7E/10
Willow Compressor Station
June 2022



APPENDIX A

EGLE TEST PLAN