EMISSIONS TEST REPORT

for

CARBON MONOXIDE (CO) DESTRUCTION EFFICIENCY
40 CFR Part 63 Subpart ZZZZ

EURICE3

DTE-Gas Willow Compressor Station
Ypsilanti, Michigan

July 25, 2024

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 performed July 25, 2024, was conducted to satisfy requirements of the Michigan Renewable Operating Permit MI-ROP-N7421-2022 and 40 CFR Part 63 Subpart ZZZZ. Emission tests were performed on Engine 2100 (EURICE3) for carbon monoxide (CO). Carbon monoxide (CO-DE) destruction efficiency testing was performed on each engine.

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

CO DE Emissions Test Results
Willow Run Compressor Station – EURICE3
Ypsilanti, Michigan
July 25, 2024

EURICE 3	Load (BHp)	BHp (%)	Carbon Monoxide (gram/B-Hp)	Carbon Monoxide (DE)
EURICE3	4,500	90%	0.003	99.8%
Permit Limit			**2.0**	**>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 performed July 25, 2024, was conducted to satisfy requirements of the Michigan Renewable Operating Permit MI-ROP-N7421-2022 and 40 CFR Part 63 Subpart ZZZZ. Emission tests were performed on EURICE3 for carbon monoxide (CO). Carbon monoxide (CO-DE) destruction efficiency testing was performed on each engine.

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 EMR's Intent to Test[1], Test Plan Submittal. The following EM&S Field Services personnel participated in the testing program: Mr. Mark Grigereit, Principal Engineer, Mr. Mark Westerberg, Senior Environmental Specialist and Mr. Steven Grigereit, Student Co-Op. Mr. Grigereit was the project leader. The Air Quality Division of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) received the Test Plan on and witnessed portions or the testing.

2.0 SOURCE DESCRIPTION

The Willow Compressor Station located at 3020 East Michigan Avenue, Ypsilanti, Michigan, employs the use of four natural gas fired reciprocating internal combustion engines, denoted as EUENGINE1 and EURICE 3 in ROP-N7421-2022. EUENGINE1 is nominally rated at 4,735 HP EURICE3-2 are nominally rated at 2,500 HP. EURICE3 is nominally rated at 5,000 HP. The engines generate line pressure assisting the transmission of natural gas throughout the pipeline transmission system in SE Michigan.

The emissions from each engine are exhausted through a catalyst bed and to the atmosphere through individual exhaust stacks. The composition of the emissions 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 engines can effectively operate.

During the emissions testing each engine was operated within 10% of its highest achievable load.

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[1] EGLE, Test Plan, Submitted January 16, 2024. (Attached-Appendix A)

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A schematic representation of the engine exhaust and sampling locations are presented in Figures 1 and 2.

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 (CO)	NDIR

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. 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, Sampling 3-pts per Subpart ZZZZ
(2) Heated Teflon™ sampling line
(3) MAK® gas conditioner with particulate filter
(4) Flexible unheated Teflon™ sampling line
(5) Servomax 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 span 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 can be found in Appendix B.

3.2 CARBON MONOXIDE (USEPA METHOD 10)

3.2.1 Sampling Method

Carbon monoxide (CO) emissions at the catalyst inlet and exhaust were evaluated using USEPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources". The CO analyzer utilizes an NDIR detector. Triplicate 60-minute tests were performed.

The EPA Method 10 sampling system (Figure 3) consisted of the following:

(1) Stainless-steel sample probe Sampling 3-pts per Subpart ZZZZ,
(2) Heated Teflon™ sampling line
(3) MAK® gas conditioner with particulate filter
(4) Flexible unheated Teflon™ sampling line
(5) TECO 48i NDIR CO gas analyzer
(6) Appropriate USEPA Protocol 1 calibration gases
(7) Data Acquisition System.

3.2.2 Sampling Train Calibration

The CO sampling trains were calibrated per procedures outlined in USEPA Method 10. 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.

3.2.3 Quality Control and Assurance

All sampling and analytical equipment was calibrated per the guidelines referenced in Method 10. Calibration gases were EPA Protocol 1 gases, and the concentrations were

within the acceptable ranges (40-60% mid-range and span). 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 (ppm). The 1-minute readings collected can be found in Appendix B.

Emissions calculations are based on calculations located in USEPA Method 10, and 19 and can be found in Appendix E. The CO emissions data collected during the testing was calculated as grams per brake horsepower-hour (g/BHp-Hr).

4.0 OPERATING PARAMETERS

Process data includes fuel flow (100scf/hr), catalyst pre and post temperature (°F), pressure drop across the catalyst ("H_2O), Brake-HP, speed and torque.

Operational data is in Appendix D.

5.0 DISCUSSION OF RESULTS

The Results of the CO testing for EURICE3 are presented in Table 1. The CO emissions are presented in parts per million (ppm) and grams per brake horsepower-hour (g/Bhp-Hr). Process data presented includes the Unit load in percent (%), as brake horsepower-hour (Brake-Hp), and Heat Input in Million British Thermal Unit per hour (MMBtu/hr) for each test.

The results of the testing indicate that EURICE3 meets the emissions limits established in Michigan Renewable Operating Permit MI-ROP-N7421-2022 and 40 CFR Part 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."

Mr. Mark Grigereit, QSTI

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RESULTS TABLES

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TABLE NO. 1
CO EMISSIONS TEST RESULTS
DTE Gas - Willow Run Compressor Station
EURICE3 (Engine 2100)
July 25, 2024

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	8:55-9:55	90%	986	4,504	310.6	33.4	11.0	10.9	168.1	0.6	99.7%
2	10:02-11:02	90%	985	4,500	309.2	33.3	11.0	11.0	170.9	0.5	99.7%
3	11:10-12:10	90%	992	4,496	309.2	33.3	11.0	11.0	171.1	0.1	99.9%
	Three Test Average:	90%	*988*	*4,500*	*309.7*	*33.3*	11.0	11.0	170.0	0.4	99.8%
								Permit Limit :			***>93%***

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

[2] calculated as actual average horse power divided by 2,500 (nominal rated horsepower)

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FIGURES

Figure 1 – Sampling Locations
EURICE3
Willow Compressor Station
July 2024

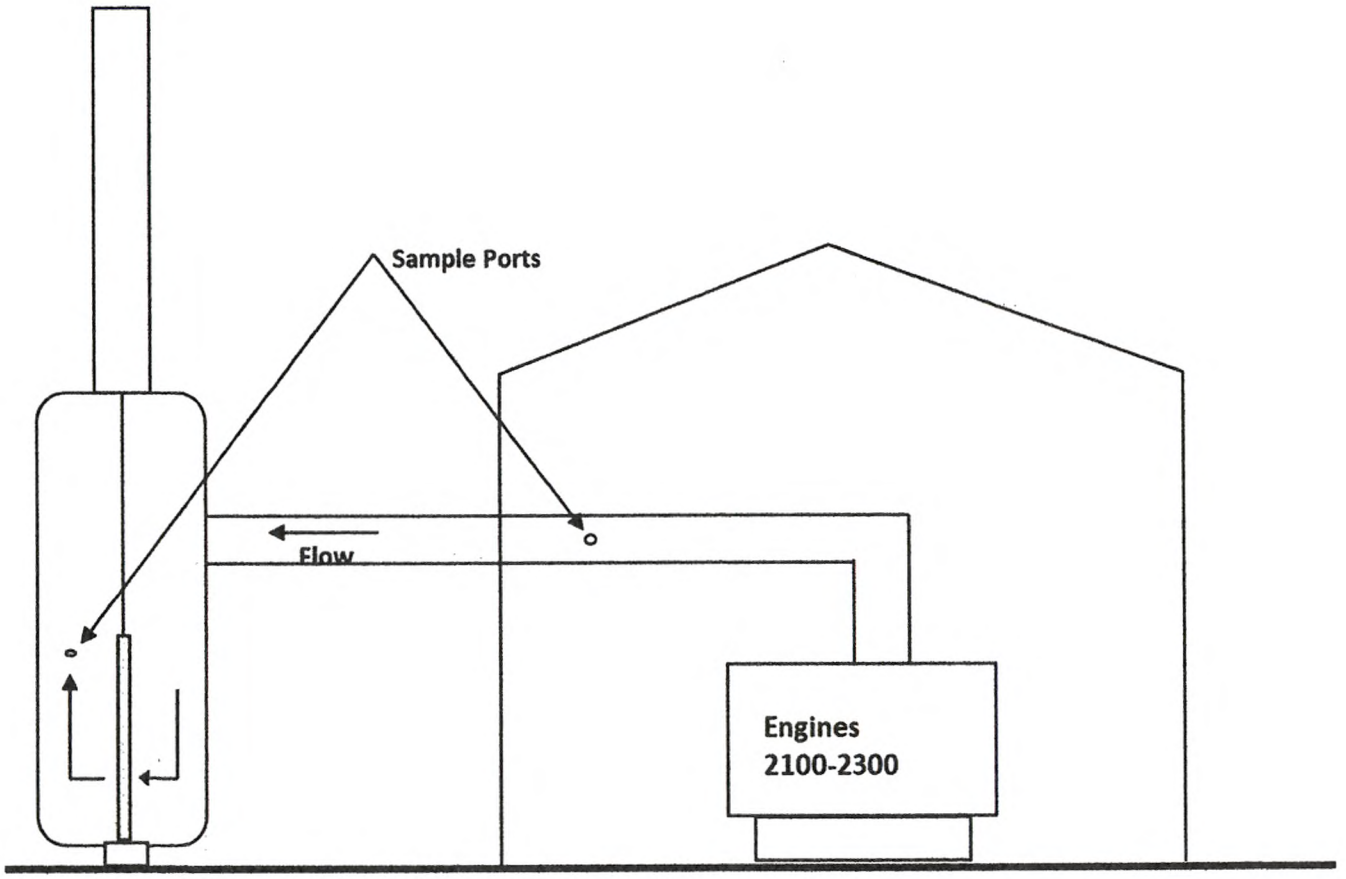

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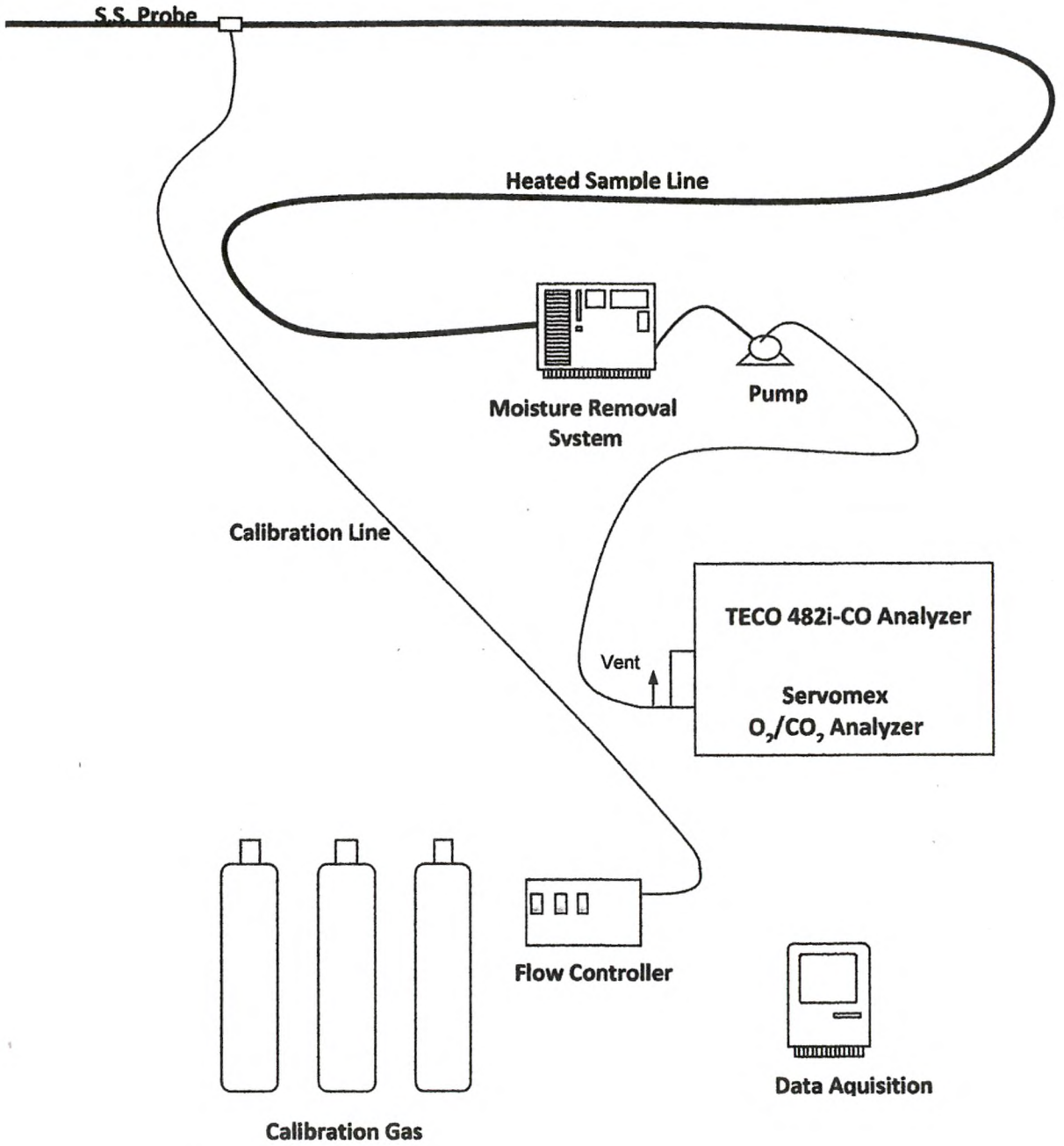
Figure 2 – EPA Methods 3A & 10
EURICE3
Willow Run Compressor Station
July 2024



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