

COMPLIANCE TEST REPORT

for

CARBON MONOXIDE (CO) EMISSIONS TESTING

WHITE-SUPERIOR COMPRESSOR ENGINE

**ALPENA COMPRESSOR STATION
Harrison, Michigan**

October 5, 2022

**Prepared By
Environmental Management & Safety
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The logo for DTE Energy Services, consisting of the letters 'DTE' in a bold, blocky, sans-serif font. The letters are dark grey with a fine, grid-like texture.



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Results Table:Gaseous Emission Testing Results – White-Superior Compressor Engine

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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Safety (EMS) Ecology, Monitoring, and Remediation Group performed emissions testing at Alpena Compressor Station, located in Harrison, Michigan. The fieldwork, performed on October 5, 2022, was conducted to satisfy requirements of the Michigan Renewable Operating Permit No. MI-ROP-N5935-2019 and 40 CFR Part 63 Subpart ZZZZ. Emissions tests were performed on the White-Superior Compressor Engine for carbon monoxide (CO).

The results of the emissions testing are summarized below:

Emissions Testing Summary – Compressor Engine (EUWHITESUPERIOR) Alpena Compressor Station Harrison, MI

October 5, 2022	Carbon Monoxide ⁽¹⁾ (ppm _{dry})
White-Superior Compressor Engine	3.3
Subpart ZZZZ Permit Limit	<47

⁽¹⁾ ppm, corrected to 15% O_{2,dry}



1.0 INTRODUCTION

DTE Energy's Environmental Management and Safety (EMS) Ecology, Monitoring, and Remediation Group performed emissions testing at Alpena Compressor Station, located in Harrison, Michigan. The fieldwork, performed on October 5, 2022, was conducted to satisfy requirements of the Michigan Renewable Operating Permit No. MI-ROP-N5935-2019 and 40 CFR Part 63 Subpart ZZZZ. Emissions tests were performed on the White-Superior Compressor Engine 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 1-3A, and 10.

The fieldwork was performed in accordance with EPA Reference Methods and EMS's Intent to Test¹ which was approved by the Michigan Department of Environment, Great Lakes, and Energy (EGLE)². The following DTE personnel participated in the testing program: Mr. Mark Grigereit, Principal Engineer and Mr. Fred Meinecke, Environmental Specialist. Mr. Grigereit was the project leader.

Mr. Darin Cummings, DTE Gas, provided on-site support of the testing. Mr. Daniel Droste, EGLE, reviewed the test plan and Mr. Nathanael Gentle, EGLE, observed the testing.

2.0 SOURCE DESCRIPTION

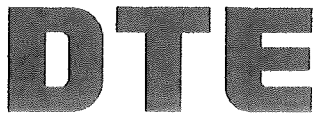
The Alpena Compressor Station, located at 8512 East Arnold Lake Road, Harrison, MI is a natural gas compressor station. The facility operates one White-Superior, 4-cycle, lean burn, natural gas-fired 2,000 Horse-Power reciprocating engine. The engine generates line pressure assisting in the transmission of natural gas throughout the pipeline transmission system in 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 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, may limit the speed and torque at which the engines can effectively operate each day.

Schematic representations of the engine's exhaust and sampling locations are presented in Figure 1.

¹ EGLE, Test Plan, Submitted March 11, 2022. (Attached-Appendix A)

² EGLE, Acceptance Letter, September 12, 2022. (Attached-Appendix A)



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

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.

3.1.2 O₂ and CO Sampling Train

The EPA Methods 3A and 10 sampling system (Figure 1) consisted of the following components:

- (1) Stainless steel sampling probe.
- (2) Heated PTFE sampling line.
- (3) Sampling gas conditioner with particulate filter.
- (4) Flexible unheated PTFE sampling line.
- (5) Servomex 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 Duration & Frequency

The emissions testing of the engine consisted of one 15-minute sample at the exhaust of the catalyst. Testing was conducted at three points across the diameter of the duct. Sampling was performed simultaneously for O₂ and CO. Data was recorded at 10-second intervals.

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3.1.4 Quality Control and Assurance (O₂ and CO)

All sampling and analytical equipment was calibrated per 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.

3.1.5 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 Methods 7E, 10, and 19 and can be found in Appendix D. The CO emissions data collected during the testing was calculated as parts per million, corrected to 15% oxygen (ppm @ 15% O₂).

4.0 OPERATING PARAMETERS

The test program included the collection of compressor data collected included engine speed (RPM) and torque (Hp), fuel flow, inlet & exhaust manifold air pressure (psi) and temperature (F), and differential pressure across the catalyst (in. H₂O).

Operational data is in Appendix E.

5.0 DISCUSSION OF RESULTS

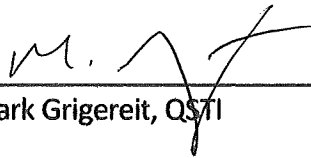
The Results Table presents the emission testing results from Compressor Engine while operating at greater than 90% of full load conditions. The CO emissions are presented in parts per million, corrected to 15% oxygen (ppm @ 15% O₂). Additional test data presented for each test includes the collected operating data.

The results from the testing demonstrate that the Compressor Engine is in compliance with Michigan Renewable Operating Permit No. MI-ROP-N5935-2019 and 40 CFR Part 63 Subpart ZZZZ.

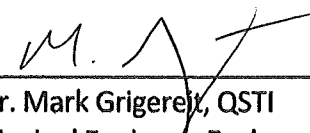


6.0 CERTIFICATION STATEMENT


"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 TABLE



**White-Superior Compressor Engine
DTE Energy Gas, Alpena Compressor Station
Harrison, MI**

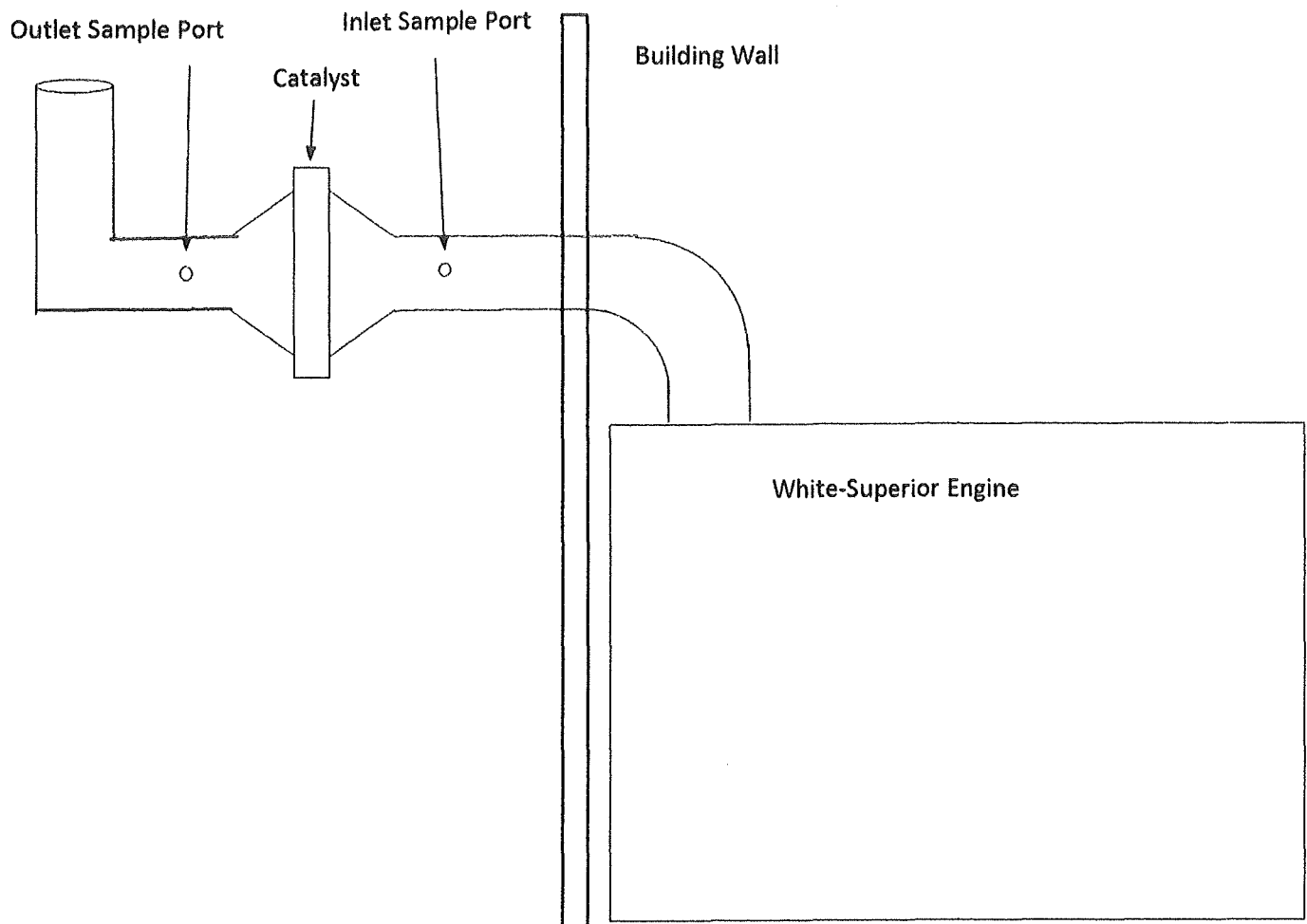
Parameter	Run 1
Sampling Date	10/05/22
Sampling Start Time	10:46-11:01
Gross BTU	1040
Torque (%)	96
Speed (RPM)	900
Brake-HP	1911
Brake-HP (%)	96
Fuel Flow (100 scf/hr)	154.9
Heat Input Rate (MMBtu/Hr)	16.11
Catalyst Diff Pressure ("H2O)	-0.6
Catalyst Pre Temp (F)	849
Catalyst Post Temp (F)	920
Average Outlet O ₂ Concentration (% dry)	8.1
Average Outlet O ₂ Concentration (% dry, corrected) ¹	8.2
Average Outlet CO Concentration (ppmv, dry)	7.3
Average Outlet CO Concentration (ppmv, dry, corrected) ¹	7.2
Average Outlet CO Concentration (ppmv, dry, @15% O ₂) ¹	3.3
Average Outlet CO Concentration (lb/MMBtu)	0.008
Average Outlet CO Emission Rate (lb/hr, dry)	0.12
Average Outlet CO Emission Rate (lb/MMscf fuel)	7.81

¹corrected for analyzer drift as per USEPA Method 7E

O₂ : oxygen

CO : carbon monoxide

Figure 1 – Sampling Location
Compressor Engine
Alpena Compressor Station
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Figure 2 – EPA Methods 3A/10
Alpena Compressor Station
October 2022

