# EMISSIONS TEST REPORT

for

# CARBON MONOXIDE (CO) EMISSIONS

EU007-008

DTE - Gas Columbus Compressor Station
Columbus Township, Michigan

August 11, 2021

Prepared By
Environmental Management & Safety
Ecology, Monitoring, and Remediation
DTE Corporate Services, LLC
7940 Livernois G4-S
Detroit, MI 48210

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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 Columbus Compressor Station, located in Columbus, Michigan. The fieldwork, performed on August 11, 2021, was conducted to satisfy requirements of Michigan Air Renewable Operating Permit No. B6480-2018 and 40 CFR Part 63 Subpart ZZZZ. Emission testing was performed on EU007-008 at the inlet and outlet of each engine's catalyst to determine carbon monoxide destruction efficiency.

The results of the emissions testing are highlighted below:

**Emissions Testing Summary**
**Columbus Compressor Station**
**EU007-008**
**August 11, 2021**

| Parameter | EU007 | EU008 |
|---|---|---|
| Average Inlet Carbon Monoxide Emissions (gram/BHP-Hr, dry) | 0.90 | 1.03 |
| Average Outlet Carbon Monoxide Emissions (gram/BHP-Hr, dry) | 0.010 | 0.017 |
| Average Carbon Monoxide Reduction Efficiency (93%)[1] | 98.9 | 98.3 |

[1] (Permit Limit)

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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 Columbus Compressor Station, located in Columbus, Michigan. The fieldwork, performed on August 11, 2021, was conducted to satisfy requirements of Michigan Air Renewable Operating Permit No. B6480-2018 and 40 CFR Part 63 Subpart ZZZZ. Emission testing was performed on EU007-008 at the inlet and outlet of each engine's catalyst to determine carbon monoxide destruction efficiency.

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 DTE's Intent to Test[1], test plan submittal, which was approved in a letter by Mr. Mark Dziadosz from the Michigan Department of Environment, Great Lakes, and Energy (EGLE) dated July 22, 2021. The following DTE personnel participated in the testing program: Mr. Thomas Snyder, Sr. Environmental Specialist and Mr. Fred Meinecke, Environmental Specialist. Mr. Snyder was the project leader. Mr. Shamim Ahammod, EGLE, witnessed the testing.

## 2.0 SOURCE DESCRIPTION

The Columbus Compressor Station located at 1647 Caughill Road, Columbus, Michigan, employs the use of two (2) DeLaval, 4-cycle, lean burn, natural gas-fired 2,000 Horse Power reciprocating engines. The engines generate line pressure assisting in the transmission of natural gas throughout the pipeline transmission system in SE Michigan.

Emissions from EU007-008 are exhausted through a catalyst bed 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, may limit the speed and torque at which the engines can effectively operate.

Schematic representations of each engine's exhaust and sampling locations are 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

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[1] EGLE, Test Plan, Submitted March 1, 2021. (Attached-Appendix A)

[2] EGLE, Approval Letter, July 22, 2021 (Attached-Appendix A)

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| Sampling Method | Parameter | Analysis |
|---|---|---|
| USEPA Method 3A | Oxygen | Paramagnetic |
| USEPA Method 10 | Carbon Monoxide | NDIR |

## 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, "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)". 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 (Instrumental Analyzer Procedure)". 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 PTFE sampling line.
(3) Sampling gas conditioner with particulate filter.
(4) Flexible unheated PTFE 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 Duration & Frequency

The emissions testing of each engine consisted of one 15-minute test run. Sampling was conducted in the centroid position at each sampling location and was performed simultaneously for $O_2$ and CO at the inlet and outlet of the catalyst. Data was recorded at 10-second intervals.

### 3.1.4 Quality Control and Assurance ($O_2$ 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

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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, by volume, dry basis (ppmvd). The 1-minute readings collected can be found in Appendix B.

USEPA Method 19 was used to calculate CO emission rates using a proxy GC to determine fuel heating value. CO emissions data collected during testing was calculated as pounds per hour (lb/hr), ppmvd adjusted to 15% oxygen, and grams per brake horsepower-hour (g/BHp-Hr).

## 4.0 OPERATING PARAMETERS

The test program included the collection of engine torque (%), engine speed (RPM), Horsepower (BHp), inlet and exhaust manifold air temperature (°F) suction and discharge pressure (psig), fuel upper heating value (BTU), and fuel flow (SCFH). Operational data is in Appendix D.

## 5.0 DISCUSSION OF RESULTS

The results of the CO emission testing on EU007-008 are presented in the Results Table. 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 (%). Process data presented includes the Unit load in percent (%), Engine Speed in revolutions per minute (RPM), Engine Torque in brake horsepower (Brake-hp), and Heat Input in million British Thermal Unit per hour (MMBtu/hr) for each test. The results of the testing indicate that EU007-008 are in compliance with permit requirements for CO of 93% Destruction Efficiency.

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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."

Thomas Snyder, QSTI

This report prepared by:

Mr. Thomas Snyder, QSTI
Sr. Environmental Specialist, Ecology, Monitoring, & Remediation
Environmental Management & Safety
DTE Energy Corporate Services, LLC

This report reviewed by:

Mr. Jason Logan, QSTI
Environmental Specialist, Field Services Group
Environmental Management and Safety
DTE Energy Corporate Services, LLC

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# RESULTS TABLE

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Carbon Monoxide (CO) Emissions Testing Results
EU007 & EU008
DTE Gas, Columbus Compressor Station
Columbus, Michigan

| Parameter | EU007 | EU008 |
|---|---|---|
| Sampling Date | 08/11/21 | 08/11/21 |
| Sampling Start Time | 9:35-9:50 | 8:57-9:12 |
| Gross Dry BTU | 1050 | 1050 |
| Load (%) | 90% | 90% |
| Speed (RPM) | 529.0 | 530.0 |
| Brake-HP | 1,679 | 1,631 |
| Brake-HP (%) | 84% | 82% |
| Fuel Flow (100 scf/hr) | 110.5 | 118.9 |
| Heat Input Rate (MMBtu/Hr) | 11.60 | 12.48 |
| Average Inlet $O_2$ Content (%, dry) | 10.7 | 11.5 |
| Average Inlet $O_2$ Content (%, dry, corrected)[1] | 10.5 | 11.3 |
| Average Inlet CO Concentration (ppmv, dry) | 225.5 | 217.2 |
| Average Inlet CO Concentration (ppmv, dry, corrected)[1] | 225.5 | 216.8 |
| Average Inlet CO Concentration (ppmv, dry, corrected)[2] | 126.8 | 113.7 |
| Average Inlet CO Concentration (lb/MMBtu) | 0.287 | 0.297 |
| Average Inlet CO Emission Rate (lb/hr, dry) | 3.33 | 3.71 |
| **CO Emission Rate (g/BHP-Hr, dry)** | **0.90** | **1.03** |
| Average Outlet $O_2$ Content (%, dry) | 10.3 | 11.1 |
| Average Outlet $O_2$ Content (%, dry, corrected)[1] | 10.4 | 11.1 |
| Average Outlet CO Concentration (ppmv, dry) | 2.8 | 3.9 |
| Average Outlet CO Concentration (ppmv, dry, corrected)[1] | 2.4 | 3.7 |
| Average Outlet CO Concentration (ppmv, dry, corrected)[2] | 1.4 | 1.9 |
| Average Outlet CO Concentration (lb/MMBtu) | 0.003 | 0.005 |
| Average Outlet CO Emission Rate (lb/MMScf) | 3.22 | 5.19 |
| Average Outlet CO Emission Rate (lb/hr, dry) | 0.036 | 0.062 |
| **CO Emission Rate (g/BHP-Hr, dry)** | **0.010** | **0.017** |
| **CO Destruction Efficiency (g/BHP-Hr, dry)** | **98.9%** | **98.3%** |
| **CO Destruction Efficiency (ppmvd @ 15% O2)** | **98.9%** | **98.3%** |

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

[2]corrected to 15% $O_2$

$O_2$ : oxygen

CO : carbon monoxide

ppmv : parts per million on a volume-to-volume basis

lb/hr : pounds per hour

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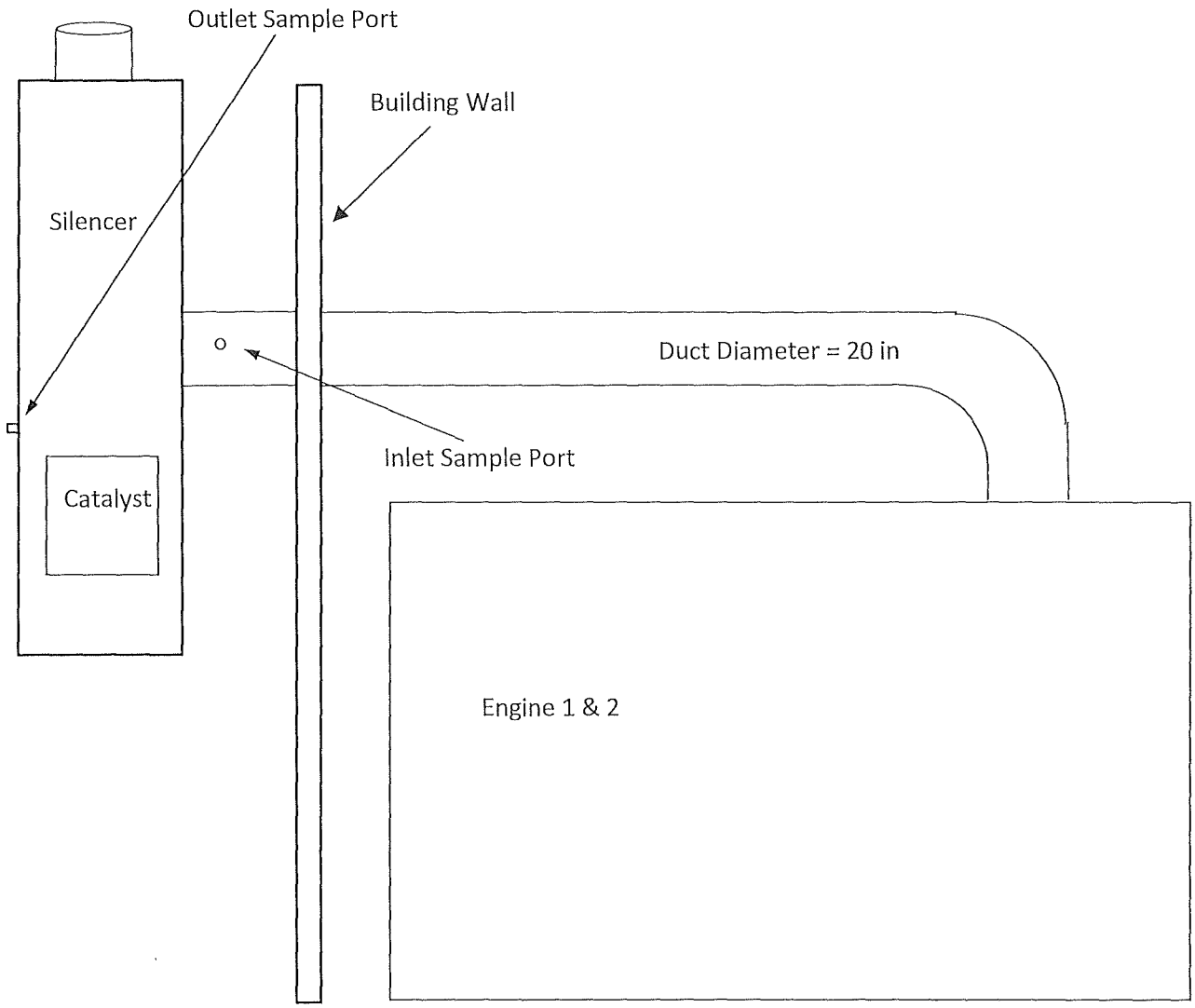
# FIGURES

# Figure 1 – Sampling Location
# Columbus Compressor Station - Engines 1 & 2
# August 11, 2021

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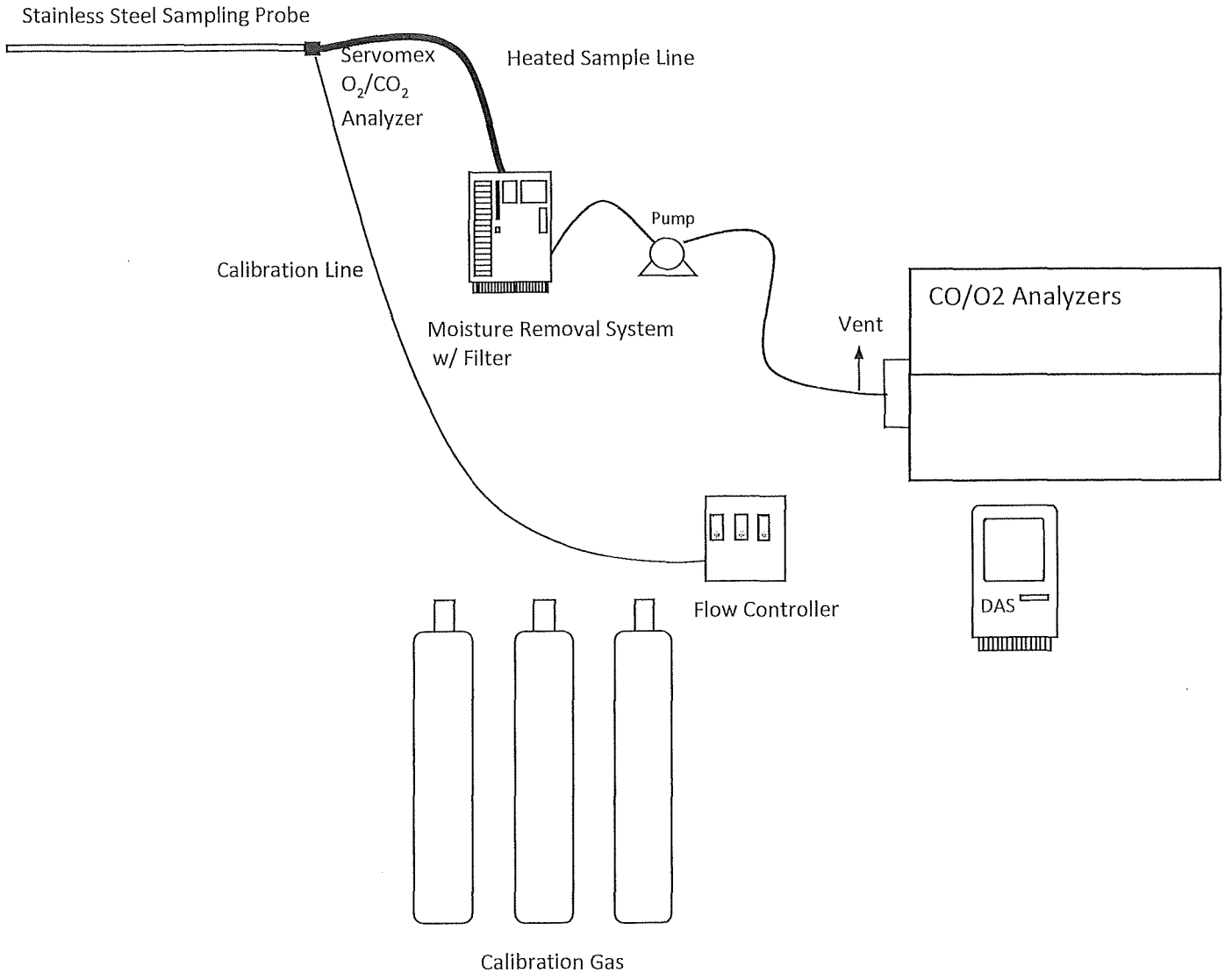
# Figure 2 – EPA Methods 3A/10
# Columbus Compressor Station
# August 11, 2021

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# APPENDIX A

# EGLE TEST PLAN