EMISSIONS TEST REPORT

for

CARBON MONOXIDE (CO) EMISSIONS

ENGINES 1 & 2

DTE-Gas Columbus Compressor Station
Columbus Township, Michigan

August 15, 2019

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 Columbus Compressor Station, located in Columbus, Michigan. The fieldwork, performed on August 15, 2019, was conducted to satisfy requirements of the Michigan Air Renewable Operating Permit No. B6480-2019 and 40 CFR Part 63 NESHAP Subpart ZZZZ. Emission testing was performed on Engines 1 & 2 at the inlet and outlet of each engine's catalyst.

The results of the emissions testing are highlighted below:

Emissions Testing Summary
Columbus Compressor Station
Engines 1 & 2
August 15, 2019

Parameter	Engine 1	Engine 2
Average Inlet Carbon Monoxide Emissions (gram/BHP-Hr, dry)	0.87	1.00
Average Outlet Carbon Monoxide Emissions (gram/BHP-Hr, dry)	0.015	0.009
Average Carbon Monoxide Reduction Efficiency (93%)[1]	98.3	99.1

[1] (Permit Limit)

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Resources (EM&R), Field Services Group, performed emissions testing at the DTE-Gas Columbus Compressor Station, located in Columbus, Michigan. The fieldwork, performed on August 15, 2019, was conducted to satisfy requirements of the Michigan Air Renewable Operating Permit No. B6480-2018 and 40 CFR Part 63 NESHAP Subpart ZZZZ. Emission testing was performed on Engines 1 & 2 at the inlet and outlet of each engine's catalyst.

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. The following DTE personnel participated in the testing program: Mark Grigereit, Principal Engineer and Mr. Thomas Snyder, Environmental Specialist. Mr. Grigereit was the project leader. The Michigan Department of Environment, Great Lakes, and Energy (EGLE) and USEPA, Region V was notified of the emissions 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.

The emissions from Engines 1 & 2 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

[1] EGLE, Test Plan, Submitted August 8, 2019. (Attached-Appendix A)

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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 (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 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". 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 the engine consisted of one 15-minute test at the inlet and exhaust of each catalyst. Sampling was conducted in a centroid position at each sampling location and was performed simultaneously for O_2 and CO. 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 (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 E. The CO emissions data collected during the testing was calculated as 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 Engines 1 & 2 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 Engines 1 & 2 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."

Mark Grigereit, QSTI

This report prepared by:

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Environmental Management and Resources
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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	Engine 1	Engine 2
Sampling Date	08/15/19	08/15/19
Sampling Start Time	08:35-08:50	08:06-08:21
Gross Dry BTU	1068	1068
Load (%)	91.0	91.2
Speed (RPM)	546.5	547.6
Brake-HP	1,870	1,860
Brake-HP (%) (Fuel Based)	94%	93%
Fuel Flow (100 scf/hr)	118.1	122.4
Heat Input Rate (MMBtu/Hr)	12.62	13.08
Average Inlet O_2 Content (%, dry)	10.7	11.0
Average Intlet O_2 Content (%, dry, corrected)[1]	10.7	11.0
Average Inlet CO Concentration (ppmv, dry)	221.9	237.8
Average Inlet CO Concentration (ppmv, dry, corrected)[1]	219.2	234.4
Average Inlet CO Concentration (lb/MMBtu)	0.284	0.313
Average Inlet CO Emission Rate (lb/hr, dry)	3.59	4.09
CO Emission Rate (gram/BHP-Hr, dry)	**0.87**	**1.00**
Average Outlet O_2 Content (%, dry)	10.6	10.9
Average Outlet O_2 Content (%, dry, corrected)[1]	10.7	11.0
Average Outlet CO Concentration (ppmv, dry)	4.0	2.4
Average Outlet CO Concentration (ppmv, dry, corrected)[1]	3.8	2.1
Average Outlet CO Concentration (ppmv, dry, corrected)[2]	2.1	1.1
Average Outlet CO Concentration (lb/MMBtu)	0.0049	0.003
Average Outlet CO Emission Rate (lb/hr, dry)	0.062	0.037
CO Emission Rate (gram/BHP-Hr, dry)	**0.015**	**0.009**
CO Destruction Efficiency	**98.3%**	**99.1%**

[1]corrected for analyzer drift as per USEPA Method 6C

2corrected 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 15, 2019

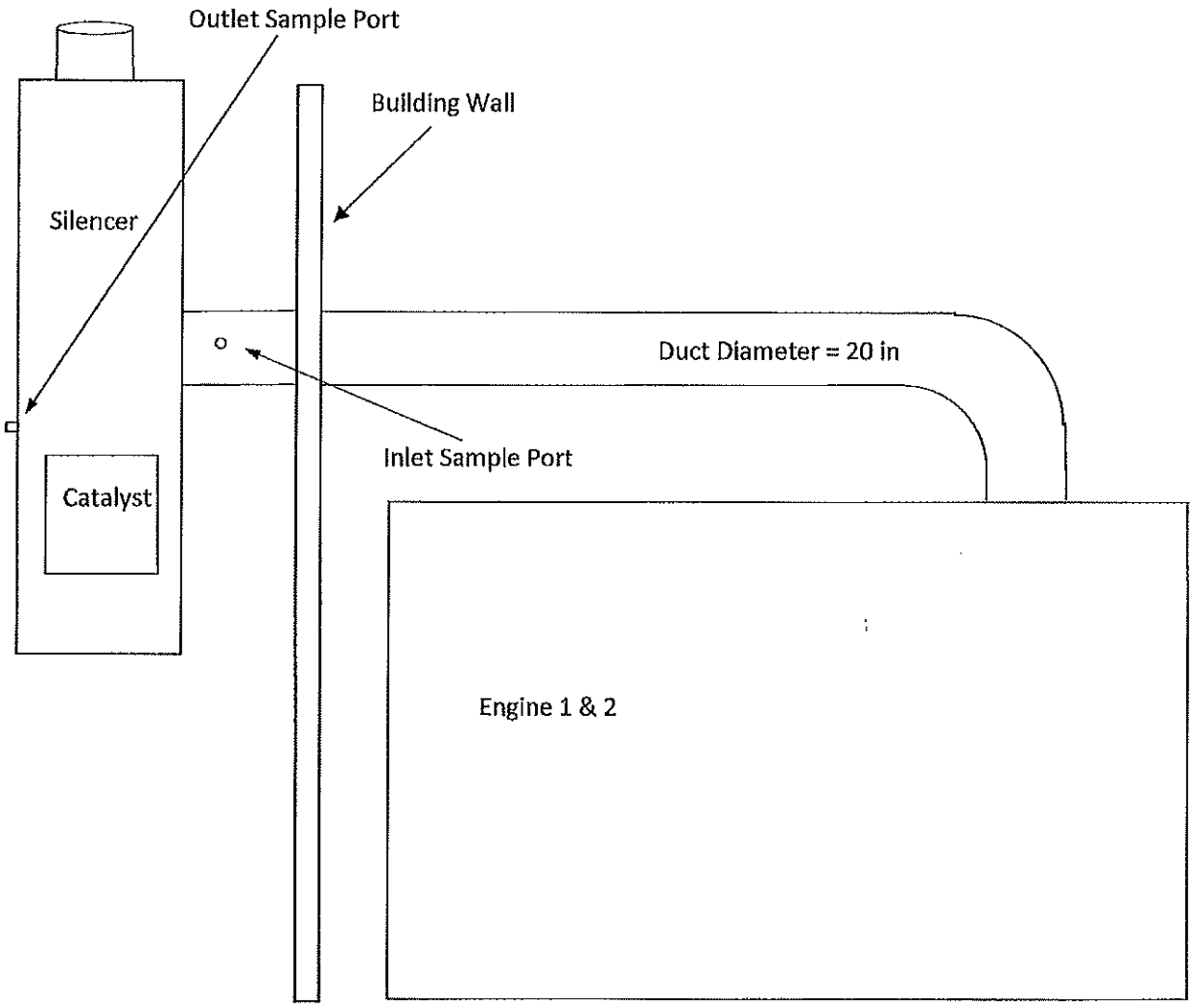

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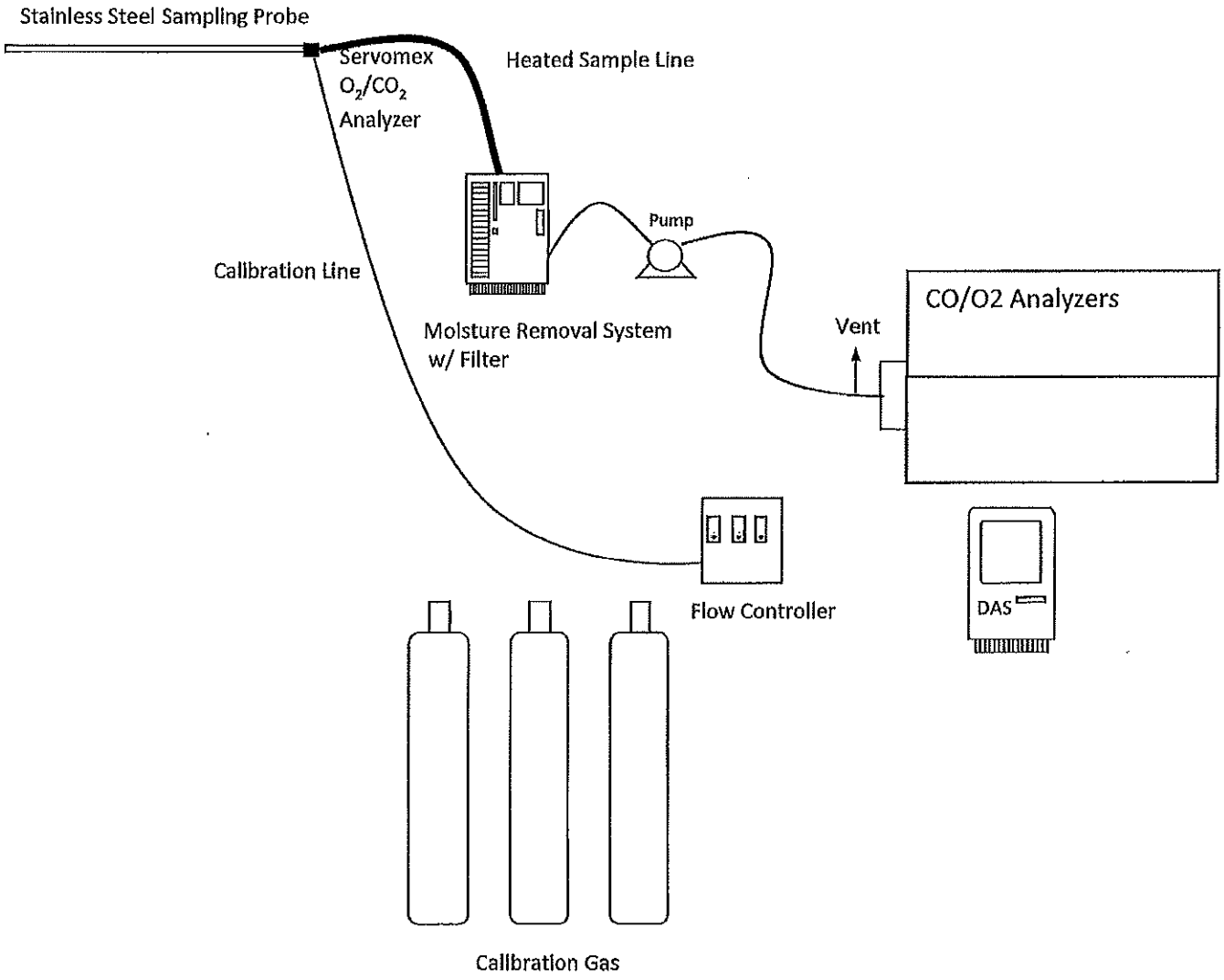
Figure 2 – EPA Methods 3A/10
Columbus Compressor Station
August 15, 2019



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APPENDIX A

EGLE TEST PLAN