EMISSIONS TEST REPORT

for

OXIDES OF NITROGEN (NO_X), CARBON MONOXIDE (CO), AND VOLATILE ORGANIC COMPOUNDS (VOC)

EUNEMEGEN

MI-ROP-B7221-2020 & 40 CFR Part 60 Subpart JJJJ

DTE GAS-MILFORD COMPRESSOR STATION
Milford, Michigan

October 2, 2024

Prepared By
Environmental Management & Safety
Environmental Field Services Group
DTE Corporate Services, LLC
7940 Livernois Ave., G4-S
Detroit, MI 48210

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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Safety (EM&S) Environmental Field Services Group performed emissions testing at the DTE Gas Milford Compressor Station located in Milford, Michigan. The fieldwork was performed on October 2, 2024, to satisfy requirements of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit (ROP) No. MI-ROP-B7221-2020 and 40CFR Part 60 Subpart JJJJ. Emissions testing was performed on the emergency generator (EUNEMGEN) for oxides of nitrogen (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC).

The results of the emissions testing are highlighted below:

Emissions Testing Summary – Emergency Generator
Milford Compressor Station
Milford, MI
October 2, 2024

	Oxides of Nitrogen (ppmvd @ 15% O_2)	Oxides of Nitrogen (lb/hr)	Carbon Monoxide (ppmvd @ 15% O_2)	Carbon Monoxide (lb/hr)	Volatile Organic Compounds (ppmvd @ 15% O_2)
EUNEMGEN	102.3	1.44	300.7	2.68	18.3
Permit Limit	160	4.0	540	11.0	86

1.0 INTRODUCTION

DTE Energy's Environmental Management and Safety (EM&S) Environmental Field Services Group performed emissions testing at the DTE Gas Milford Compressor Station located in Milford, Michigan. The fieldwork was performed on October 2, 2024, to satisfy requirements of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit (ROP) No. MI-ROP-B7221-2020 and 40CFR Part 60 Subpart JJJJ. Emissions testing was performed on the emergency generator (EUNEMGEN) for oxides of nitrogen (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC).

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 3A, 4, 7E, 19, and ASTM D6348.

The fieldwork was performed in accordance with EPA Reference Methods, ASTM 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. Thomas Snyder, Principal Environmental Specialist and Mr. Mark Grigereit, Principal Engineer. Mr. Snyder was the project leader.

Mr. Chris Conley, DTE Gas, provided on-site support of the testing. Mr. Jeremy Howe, EGLE-TPU, reviewed and approved the Test Plan.

2.0 SOURCE DESCRIPTION

The Milford Compressor Station located at 3515 Childs Lake Road, Milford, Michigan, employs the use of one natural gas-fired 1,818 horsepower (hp) emergency generator (EUNEMGEN) nominally rated at 1,300 electrical kilowatts (ekW). The emergency generator is used to provide electrical power to the facility in the case of a power outage.

The emissions from the emergency generator exhaust directly to the atmosphere through a vertical exhaust stack. The engine was operated at greater than 90% of the maximum load during the testing.

A schematic representation of the engine exhaust and sampling location is presented in Figure 1.

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[1] EGLE, Test Plan, Submitted July 15, 2024. (Attached-Appendix A)

[2] EGLE, Acceptance Letter, September 20, 2024. (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
ASTM Method D6348	NO_x, CO, and VOC	FTIR

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.

Three-point testing was performed for each of the three runs. The exhausts were not stratified as the diluent gas (O_2) did not vary more than 0.1% at any point. Data was recorded at 10-second intervals.

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

(1) Single-point sampling probe (located in centroid of the exhaust stack)
(2) Heated Teflon™ sampling line
(3) MAK® gas conditioner with particulate filter
(4) Flexible unheated Teflon™ sampling line
(5) Servomax 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.

3.3 MOISTURE (ASTM METHOD D6348)

3.3.1 Sampling Method

Moisture content in the exhaust was evaluated using ASTM Method D6348, "Measurement of Vapor Phase Organic Emissions by Extractive Fourier Transform Infrared (FTIR)".

3.4 OXIDES of NITROGEN, CARBON MONOXIDE, and VOC (ASTM METHOD D6348)

3.4.1 Sampling Method

Oxides of Nitrogen, Carbon Monoxide, and VOC emissions were evaluated using ASTM Method D6348, "Measurement of Vapor Phase Organic Emissions by Extractive Fourier Transform Infrared (FTIR)". Single point sampling was performed. Triplicate 60-minute test runs were performed.

The ASTM D6348 sampling system (Figure 2) consisted of the following:

(1) Single-point sampling probe
(2) Flexible heated PTFE sampling line
(3) Air Dimensions Heated Head Diaphragm Pump
(4) MKS MultiGas 2030 FTIR spectrometer
(5) Appropriate calibration gases
(6) Data Acquisition System

The FTIR was equipped with a temperature controlled, 5.11-meter multipass gas cell maintained at 191°C. Gas flows and sampling system pressures were monitored using a rotameter and pressure transducer. All data was collected at 0.5 cm^{-1} resolution.

3.4.2 Sampling Train Calibration

The FTIR was calibrated per procedures outlined in ASTM Method D6348. Direct measurements propane (C_3H_8), oxides of nitrogen (NO_x), carbon monoxide (CO), and ethylene (C_2H_4) gas standards were made at the test location to confirm concentrations.

A calibration transfer standard (CTS) was analyzed before and after testing at each location. The concentration determined for all CTS runs were within ±5% of the certified value of the standard. Ethylene was passed through the entire system to determine the sampling system response time and to ensure that the entire sampling system was leak-free.

Nitrogen was purged through the sampling system to confirm the system was free of contaminants.

NO_x, CO, and C_3H_8 gas standards were passed through the sampling system to determine the response time and confirm recovery.

NO_x, CO, and C_3H_8 spiking was performed to verify the ability of the sampling system to quantitatively deliver a sample containing NO_x, CO, and C_3H_8 from the base of the probe to the FTIR. Analyte spiking assures the ability of the FTIR to quantify NO_x, CO, and C_3H_8 in the presence of effluent gas.

As part of the spiking procedure, samples from EUNEMGEN were measured to determine NO_x, CO, and C_3H_8 concentrations to be used in the spike recovery calculations. The determined sulfur hexafluoride (SF_6) concentration in the spiked and unspiked samples was used to calculate the dilution factor of the spike and thus used to calculate the concentration of the spiked NO_x, CO, and C_3H_8. The following equation illustrates the percent recovery calculation.

$$DF = \frac{SF_{6(spike)}}{SF_{6(direct)}}$$

(Sec. 9.2.3 (3) ASTM Method D6348)

$$CS = DF * Spike_{dir} + Unspike(1 - DF)$$

(Sec. 9.2.3 (4) ASTM Method D6348)

DF = Dilution factor of the spike gas
$SF_{6(direct)}$ = SF6 concentration measured directly in undiluted spike gas

$SF_{6(spike)}$ = Diluted SF_6 concentration measured in a spiked sample
$Spike_{dir}$ = Concentration of the analyte in the spike standard measured by the FTIR directly
CS = Expected concentration of the spiked samples
Unspike = Native concentration of analytes in unspiked samples

All analyte spikes were introduced using an instrument grade stainless steel rotometer. The spike target dilution ratio was 1:10 or less. All NO_x, CO, and C_3H_8 spike recoveries were within the ASTM Method D6348 allowance of ±30%.

3.4.3 Quality Control and Assurance

As part of the data validation procedure, reference spectra are manually fit to that of the sample spectra and a concentration is determined. The reference spectra are scaled to match the peak amplitude of the sample, thus providing a scale factor. The scale factor multiplied by the reference spectra concentration is used to determine the concentration value for the sample spectra. Sample pressure and temperature corrections are then applied to compute the final sample concentration. The manually calculated results are then compared with the software-generated results. The data is then validated if the two concentrations are within ± 5% agreement. If there is a difference greater than ± 5%, the spectra are reviewed for possible spectral interferences or any other possible causes that might lead to inaccurately quantified data. PRISM Analytical Technologies, Inc. validated FTIR data from all three of the sources. The data validation reports are in Appendix F.

3.4.4 Data Reduction

Each spectrum was derived from the coaddition of 64 scans, with a new data point generated approximately every minute. The NO_x, CO, and VOC emissions were recorded in parts per million (ppm) dry volume basis. The moisture content was recorded in percent (%).

FTIR Manufacture software calculated total non-methane- non-ethane VOC by summing the hydrocarbons measured, multiplied by each compounds' molar ratio to propane. VOCs measured consist of Propane, Butane, Ethylene, Acetylene, Propylene, Acetaldehyde, and Methanol.

Emissions readings on the outlet of the EUNEMEGEN were reduced to parts by million by volume, dry, adjusted to 15% O_2 in accordance with 40 CFR Part 60 Subpart JJJJ.

4.0 OPERATING PARAMETERS

The test program included the collection of generator load (kW), fuel flow (scf) and generator percent load (%).

Operational data is presented in Appendix E.

5.0 DISCUSSION OF RESULTS

Table No. 1 presents the emission testing results from EUNEMGEN while operating at greater than 90% of full load conditions. The NO_X and CO emissions are reduced to lb/hr and ppmvd at 15% O_2. VOC emissions are reduced to ppmvd, as propane, at 15% O_2. Additional test data presented for each test includes the engine load in percentage (%), heat input (MMBtu/hr), and emissions (ppm). EUNEMGEN demonstrated compliance with NO_X, CO, and VOC emission limits as stated in MI-ROP-B7221-2020 and the NSPS (40 CFR Part 60 Subpart JJJJ).

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."

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Mark Grigereit, QSTI

This report prepared by: ________________________________
Mr. Mark Grigereit, QSTI
Principal Engineer, Environmental Field Services
Ecology, Monitoring, and Remediation
DTE Energy Corporate Services, LLC

This report reviewed by: ________________________________
Mr. Thom Snyder, QSTI
Principal Specialist, Environmental Field Services
Ecology, Monitoring, and Remediation
DTE Energy Corporate Services, LLC

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RESULTS TABLE

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Emissions Testing Results
EUN EM GEN
DTE Gas, Milford Compressor Station
Milford, MI

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	10/02/24	10/02/24	10/02/24	
Sampling Start Time	8:53-9:53	10:03-11:03	11:14-12:14	
Gross Dry BTU	1061	1061	1061	1,061
Electrical Output (kW)	1315	1315	1314	1,315
Load (%)	101%	101%	101%	101%
Fuel Flow (100 scf/hr)	37.7	37.5	37.6	37.6
Heat Input Rate (MMBtu/Hr)	4.0	4.0	4.0	4.0
Average O_2 Content (%, dry)	9.2	9.3	9.3	9.3
Average O_2 Content (%, dry, corrected)[1]	9.2	9.2	9.3	9.2
Average CO Concentration (ppmvd)	591.0	594.3	597.2	594.2
Average CO Concentration (ppmvd, at 15% O2)	**298.2**	**300.9**	**303.0**	**300.7**
Permit Limit (ppmvd, at 15% O2)				**540**
Average CO Concentration (lb/MMBtu)	0.67	0.67	0.68	0.67
Average CO Emission Rate (lb/hr)	**2.67**	**2.68**	**2.70**	**2.68**
Permit Limit (lb/hr)				**11.0**
Average NO$_x$ Concentration (ppmvd)	198.2	202.2	206.0	202.1
Average NO$_x$ Concentration (ppmvd, @ 15% O2)	**100.0**	**102.4**	**104.5**	**102.3**
Permit Limit (ppmvd, at 15% O2)				**160**
Average NO$_x$ Concentration (lb/MMBtu)	0.35	0.36	0.37	0.36
Average NO$_x$ Emission Rate (lb/hr)	**1.41**	**1.44**	**1.47**	**1.44**
Permit Limit (lb/hr)				**4.0**
THC Concentration (ppmv, as propane) (dry)	36.2	36.2	36.2	36.2
THC Concentration (ppmvd, as propane, @ 15% O2)	18.2	18.3	18.4	18.3
VOC (ppmvd, as propane, @ 15% O2)[2]	**18.2**	**18.3**	**18.4**	**18.3**
Permit Limit (ppmvd, as propane, @ 15% O2)				**86**

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

[2] three-test average based on assuming negative value is zero

FIGURES

Figure 1 – Sampling Location
EUNEMGEN
Milford Compressor Station
October 2, 2024

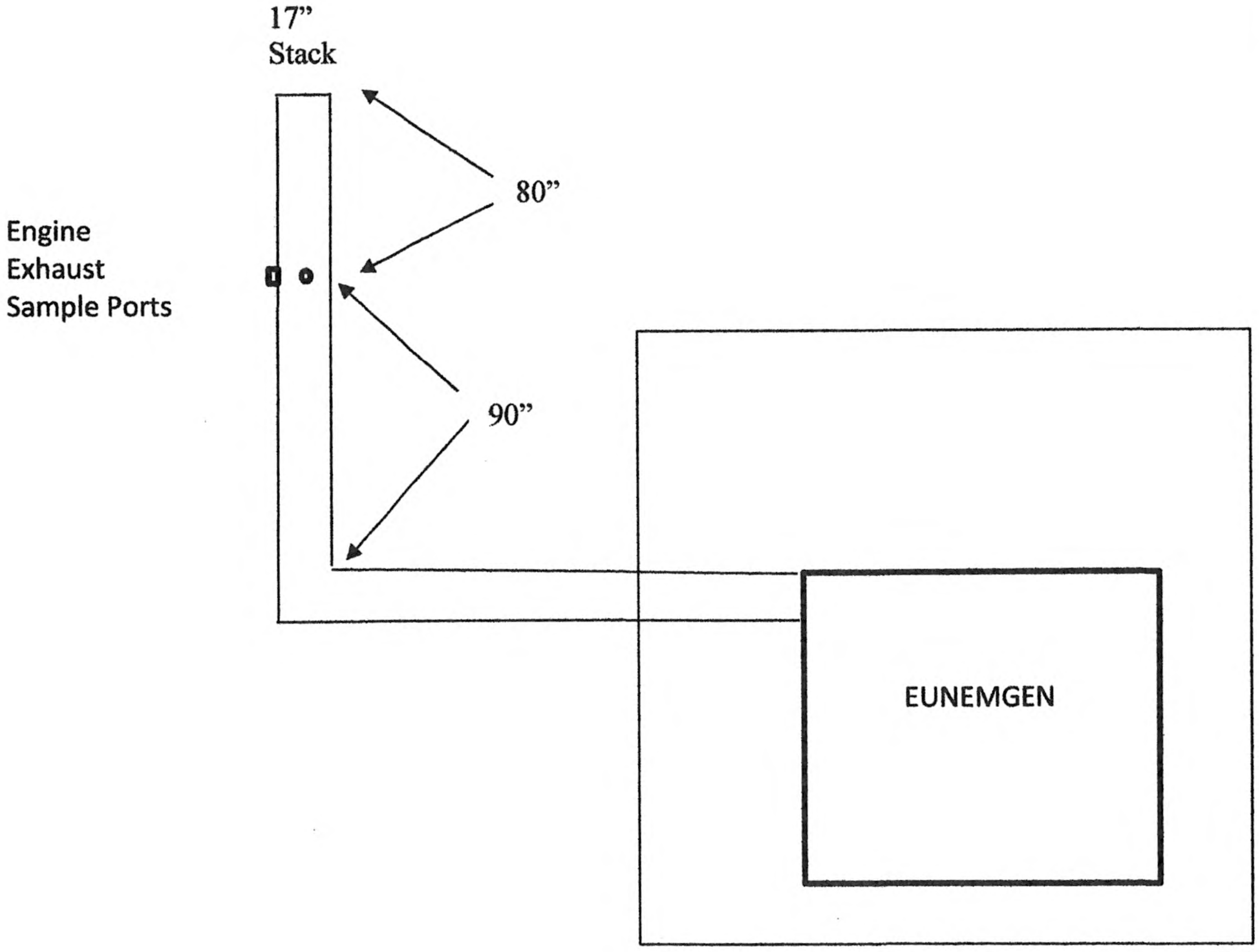

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Figure 2 – ASTM D6348/3A
EUNEMGEN
Milford Compressor Station
October 2, 2024