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COMPLIANCE TEST REPORT

for

CARBON MONOXIDE EMISSIONS (CO)

UNITS 12-1 to 12-5

SRN: B2803

**Placid Substation
Clarkston, Michigan**

November 6-8, 2023

**Prepared By:
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EXECUTIVE SUMMARY

DTE Energy's Environmental Management & Safety (EM&S) Ecology, Monitoring, & Remediation Group, performed emissions testing on five (5) 3,600 Brake-HP diesel engines located at the Placid Substation in Clarkston, Michigan. The fieldwork performed November 6-8, 2023 was conducted to satisfy requirements of MI-ROP-B2803-2023, and 40CFR Part 63 Subpart ZZZZ. Emission tests were performed on Units 12-1 to 12-5 for carbon monoxide (CO) destruction efficiency.

The results of the emissions testing are highlighted below:

CO Emissions Test Results Placid Substation November 6-8, 2023

Date	Unit	Average CO Destruction Efficiency (%) or Outlet Emissions (ppm) ¹
11-6-23	12-1	79.8% DE
11-7-23	12-2	75.6% DE
11-7-23	12-3	72.8% DE
11-8-23	12-4	78.3% DE
11-8-23	12-5	75.1% DE

(1) ppm @ 15% O₂

Subpart ZZZZ Limit: Limit the concentration of CO in the stationary RICE exhaust to 23 ppmvd or less at 15% O₂; or Reduce CO emissions by 70% or more

1.0 INTRODUCTION

DTE Energy's Environmental Management & Safety (EM&S) Ecology, Monitoring, & Remediation Group, performed emissions testing on five (5) 3,600 Brake-HP diesel engines located at the Placid Substation in Clarkston, Michigan. The fieldwork performed November 6-8, 2023, was conducted to satisfy requirements of MI-ROP-B2803-2023, and 40CFR Part 63 Subpart ZZZZ. Emission tests were performed on Units 12-1 to 12-5 for carbon monoxide (CO) 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, the requirements outlined in MI-ROP-B2803-2023, 40CFR Part 63 Subpart ZZZZ, and EM&S's Intent to test¹, test plan submittal. The following EM&S personnel participated in the testing program: Mr. Mark Grigereit, Principal Engineer and Mr. Fred Meinecke, Environmental Specialist. Mr. Zach Josefiak, Associate Environmental Engineer with DTE, provided process coordination for the testing program.

2.0 SOURCE DESCRIPTION

The Placid Substation located at 4912 Edgar Rd, Clarkston, Michigan, employs the use of five General Motors EM&D, Model 20-645-E4, 20 cylinder, 3,600 Horse Power diesel engines (Units 12-1 to 12-5) purchased in 1970 and installed November 21, 1970. The engines generate supplemental electrical power during peak electrical demand periods or when required for load stability. On site diesel generators produce the electrical power supply which is sent to the electrical grid. Each unit can produce approximately 2.5 GMW at full load conditions.

The emissions from the engines are exhausted through individual catalyst beds and to the atmosphere through individual exhaust stacks.

During the emissions testing the engines were operated at 100% load conditions (2.5 MW).

A schematic representation of the engines exhausts and sampling locations are presented in Figure 1. Sampling was performed in the duct prior to and downstream of the catalyst bed.

¹ EGLE, Test Plan, Submitted October 3, 2023. (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 Instrumental Analyzer Method

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.

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 O₂ and CO Sampling Train

The EPA Methods 3A and 10 sampling systems at the inlet and outlet (Figure 2) consisted of the following components:

- (1) Single-point stainless steel sampling probe with a cintered filter.
- (2) Heated PTFE™ sampling line.
- (3) Universal® and MAK® gas conditioners with a 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 Train Calibration

The O₂ / CO sampling trains were calibrated per procedures outlined in USEPA Methods 3A & 10. Zero, span, and mid-range calibration gases were introduced directly into the CO and O₂ analyzers to determine the instruments linearity. A zero and mid-range span gas was then introduced through the entire sampling system to determine sampling system bias for each analyzer. Additional system calibrations were performed at the completion of each test.

3.1.4 Sampling Duration & Frequency

The emissions testing of each engine consisted of triplicate 60-minute samples at the inlet and exhaust of the catalyst. Testing was conducted at three points across the diameter of the exhaust duct during each run. Sampling was performed simultaneously for O₂ and CO. Data was recorded as 1-minute averages.

3.1.5 Quality Control and Assurance (O₂ and CO)

All sampling and analytical equipment was calibrated per the guidelines referenced in Methods 3A and 10. Calibration gases were EPA Protocol 1 certified, 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.

3.1.6 Data Reduction

The O₂ and CO emission readings in percent (%) and parts per million (ppm) were recorded at 10-second intervals and averaged to 1-minute increments. The CO emissions were normalized to 15% O₂, and that number was used to determine CO % Destruction Efficiency (DE) as required by 40CFR Part 63 Subpart ZZZZ. Emission calculations are based upon calculations found in USEPA Methods 3A, 7E, 10 and 19. Example calculations can be found in Appendix D.

The 1-minute O₂ and CO readings collected can be found in Appendix B.

4.0 OPERATING PARAMETERS

The test program included the collection of catalyst inlet temperature (°F), catalyst pressure drop ("H₂O), and crank case vacuum ("H₂O). Ambient temperature (°F), Relative Humidity (%), and Barometric Pressure (in) were also recorded during each test. Operational and atmospheric data collected during the testing is in Appendix E.

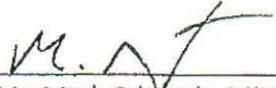
5.0 RESULTS

Tables 1-5 present the CO emissions @ 15% O₂ results from Units 12-1 to 12-5. The CO emissions are presented in parts per million (ppm) for the inlet and outlet and the destruction efficiency in percent (%). Also presented are the Oxygen inlet and outlet in percent (%), the catalyst inlet temperature in degrees Fahrenheit (°F), and pressure drop across the catalyst in inches of water ("H₂O). The results of the testing indicate that Units 12-1 to 12-5 comply with MI-ROP-B2803-2023, and 40CFR Part 63 Subpart ZZZZ requirements of reducing CO emissions by 70% or more.

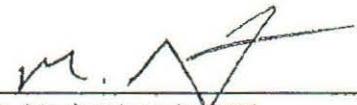


6.0 CERTIFICATION STATEMENT

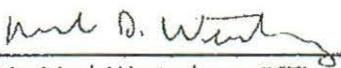
"I certify that I believe the information provided in this document is true, accurate, and complete. Results of testing are based on the good faith application of sound professional judgment, using techniques, factors, or standards approved by the Local, State, or Federal Governing body, or generally accepted in the trade."



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DTE

RESULTS TABLES

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Carbon Monoxide (CO) Emissions Testing Results
Diesel Peaker 12-1
DTE Energy, Placid Substation
Clarston, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	11/06/23	11/06/23	11/06/23	
Sampling Start Time	0755-0855	0907-1007	1020-1120	
Average Inlet O ₂ Content (% dry)	11.8	11.7	11.6	11.7
Average Inlet O ₂ Content (% dry, corrected) ¹	12.0	12.0	11.9	12.0
Average Inlet CO Concentration (ppmv, dry)	124.9	126.9	134.3	128.7
Average Inlet CO Concentration (ppmv, dry, corrected) ¹	130.6	132.8	140.7	134.7
Average Inlet CO Concentration (ppmv @ 15% O ₂) ²	86.7	87.9	92.3	
Average Outlet O ₂ Content (% dry)	12.0	11.9	11.8	11.9
Average Outlet O ₂ Content (% dry, corrected) ¹	12.1	12.1	12.0	12.1
Average Outlet CO Concentration (ppmv, dry)	26.6	26.8	27.3	26.9
Average Outlet CO Concentration (ppmv, dry, corrected) ¹	26.4	26.8	27.6	26.9
Average Outlet CO Concentration (ppmv @ 15% O ₂) ²	17.7	17.9	18.4	
CO Destruction Efficiency	79.5%	79.6%	80.1%	79.8%

¹corrected for analyzer drift as per USEPA Method 7E

MW : megawatts

O₂ : oxygen

CO : carbon monoxide

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

lb/hr : pounds per hour

Carbon Monoxide (CO) Emissions Testing Results
Diesel Peaker 12-2
DTE Energy, Placid Substation
Clarston, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	11/07/23	11/07/23	11/07/23	
Sampling Start Time	0811-0911	0921-1021	1032-1132	
Average Inlet O ₂ Content (% dry)	12.1	12.1	12.1	12.1
Average Inlet O ₂ Content (% dry, corrected) ¹	12.1	12.1	12.1	12.1
Average Inlet CO Concentration (ppmv, dry)	179.5	171.1	167.4	172.7
Average Inlet CO Concentration (ppmv, dry, corrected) ¹	184.4	174.8	171.1	176.8
Average Inlet CO Concentration (ppmv @ 15% O ₂) ²	124.0	117.4	115.0	
Average Outlet O ₂ Content (% dry)	11.8	11.8	11.8	11.8
Average Outlet O ₂ Content (% dry, corrected) ¹	11.8	11.8	11.8	11.8
Average Outlet CO Concentration (ppmv, dry)	46.4	44.2	43.3	44.6
Average Outlet CO Concentration (ppmv, dry, corrected) ¹	46.4	44.0	43.1	44.5
Average Outlet CO Concentration (ppmv @ 15% O ₂) ²	30.3	28.7	28.0	
CO Destruction Efficiency	75.6%	75.6%	75.6%	75.6%

¹corrected for analyzer drift as per USEPA Method 7E

MW : megawatts

O₂ : oxygen

CO : carbon monoxide

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

lb/hr : pounds per hour

Carbon Monoxide (CO) Emissions Testing Results
 Diesel Peaker 12-3
 DTE Energy, Placid Substation
 Clarston, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	11/07/23	11/07/23	11/07/23	
Sampling Start Time	1147-1247	1258-1358	1409-1509	
Average Inlet O ₂ Content (% dry)	12.0	12.0	12.0	12.0
Average Inlet O ₂ Content (% dry, corrected) ¹	12.1	12.1	12.1	12.1
Average Inlet CO Concentration (ppmv, dry)	159.0	152.6	148.1	153.2
Average Inlet CO Concentration (ppmv, dry, corrected) ¹	163.2	156.9	152.4	157.5
Average Inlet CO Concentration (ppmv @ 15% O ₂) ²	109.0	104.8	101.7	
Average Outlet O ₂ Content (% dry)	11.7	11.8	11.8	11.8
Average Outlet O ₂ Content (% dry, corrected) ¹	11.8	11.8	11.8	11.8
Average Outlet CO Concentration (ppmv, dry)	45.8	43.7	42.5	44.0
Average Outlet CO Concentration (ppmv, dry, corrected) ¹	45.9	43.9	42.9	44.2
Average Outlet CO Concentration (ppmv @ 15% O ₂) ²	29.7	28.5	27.8	
CO Destruction Efficiency	72.8%	72.9%	72.6%	72.8%

¹corrected for analyzer drift as per USEPA Method 7E

MW : megawatts

O₂ : oxygen

CO : carbon monoxide

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

lb/hr : pounds per hour

Carbon Monoxide (CO) Emissions Testing Results
Diesel Peaker 12-4
DTE Energy, Placid Substation
Clarston, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	11/08/23	11/08/23	11/08/23	
Sampling Start Time	0805-0905	0915-1015	1025-1125	
Average Inlet O ₂ Content (% dry)	12.4	12.4	12.3	12.4
Average Inlet O ₂ Content (% dry, corrected) ¹	12.2	12.2	12.1	12.2
Average Inlet CO Concentration (ppmv, dry)	179.4	177.3	190.0	182.2
Average Inlet CO Concentration (ppmv, dry, corrected) ¹	181.0	179.2	190.8	183.7
Average Inlet CO Concentration (ppmv @ 15% O ₂) ²	122.7	121.6	128.6	
Average Outlet O ₂ Content (% dry)	11.9	11.8	11.8	11.8
Average Outlet O ₂ Content (% dry, corrected) ¹	11.9	11.9	11.9	11.9
Average Outlet CO Concentration (ppmv, dry)	41.9	41.3	43.1	42.1
Average Outlet CO Concentration (ppmv, dry, corrected) ¹	41.0	40.2	42.1	41.1
Average Outlet CO Concentration (ppmv @ 15% O ₂) ²	27.0	26.5	27.5	
CO Destruction Efficiency	78.0%	78.2%	78.6%	78.3%

¹corrected for analyzer drift as per USEPA Method 7E

MW : megawatts

O₂ : oxygen

CO : carbon monoxide

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

lb/hr : pounds per hour

Carbon Monoxide (CO) Emissions Testing Results
Diesel Peaker 12-5
DTE Energy, Placid Substation
Clarston, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	11/08/23	11/08/23	11/08/23	
Sampling Start Time	1138-1238	1249-1349	1400-1500	
Average Inlet O ₂ Content (% dry)	12.1	12.0	12.0	12.0
Average Inlet O ₂ Content (% dry, corrected) ¹	11.9	11.9	11.9	11.9
Average Inlet CO Concentration (ppmv, dry)	194.7	187.6	196.3	192.9
Average Inlet CO Concentration (ppmv, dry, corrected) ¹	195.6	190.1	199.7	195.1
Average Inlet CO Concentration (ppmv @ 15% O ₂) ²	128.7	124.9	130.4	
Average Outlet O ₂ Content (% dry)	11.5	11.4	11.4	11.4
Average Outlet O ₂ Content (% dry, corrected) ¹	11.6	11.6	11.5	11.6
Average Outlet CO Concentration (ppmv, dry)	51.7	50.0	50.9	50.9
Average Outlet CO Concentration (ppmv, dry, corrected) ¹	51.1	49.6	50.5	50.4
Average Outlet CO Concentration (ppmv @ 15% O ₂) ²	32.4	31.5	31.8	
CO Destruction Efficiency	74.9%	74.8%	75.6%	75.1%

¹corrected for analyzer drift as per USEPA Method 7E

MW : megawatts

O₂ : oxygen

CO : carbon monoxide

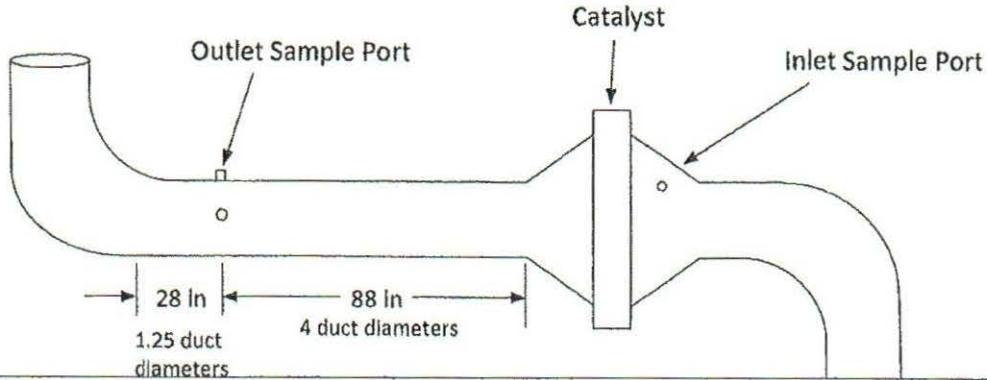
ppmv : parts per million on a volume-to-volume basis

lb/hr : pounds per hour

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FIGURES

Figure 1 - Stack Drawing & Sampling Location
Placid Substation Diesel Generators
November 2023

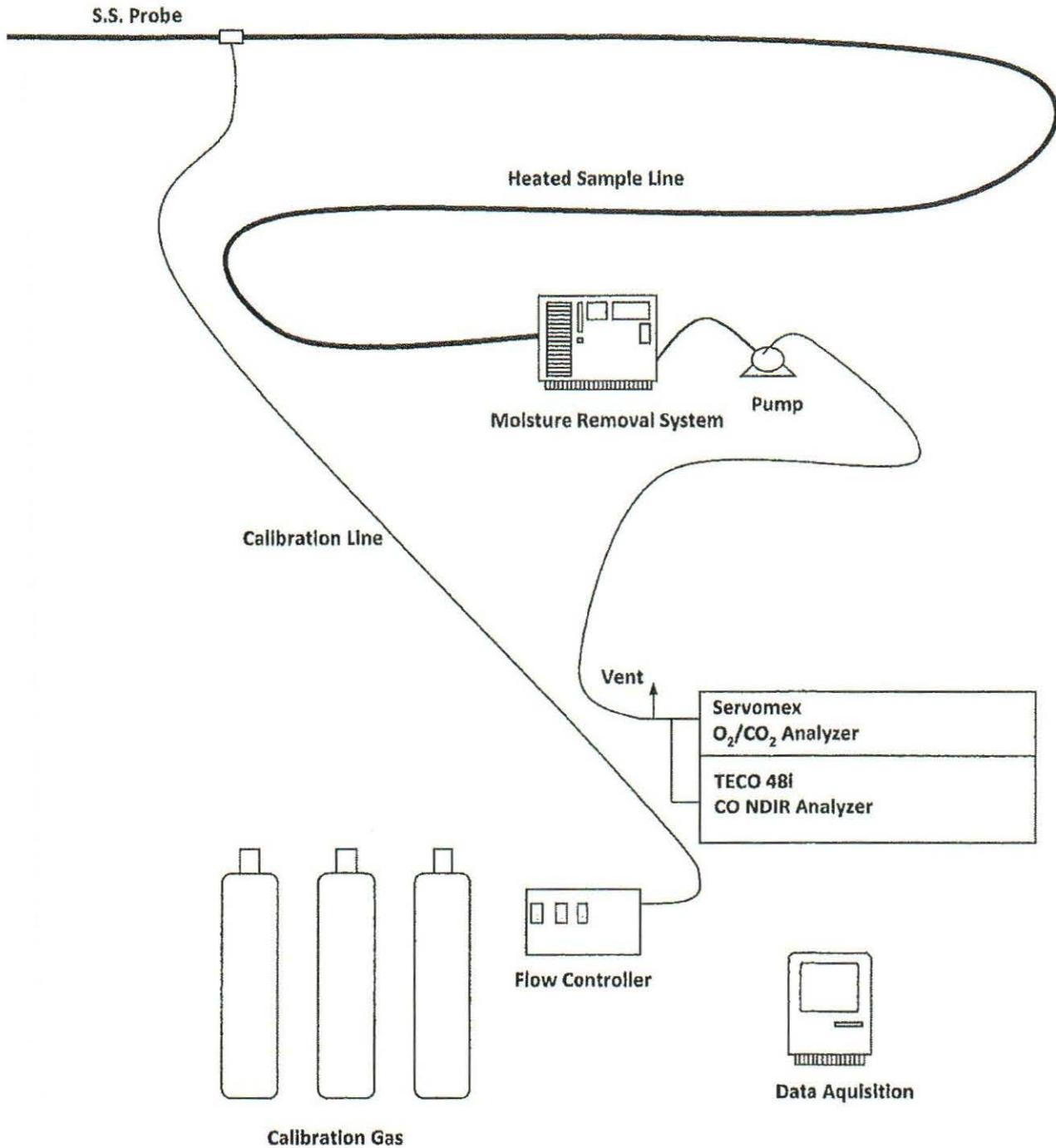


Outlet	Distance
Point 1	3.67 in
Point 2	11.00 in
Point 3	18.33 in

Duct Diameter = 22 in

Diesel Generator

Figure 2 – EPA Methods 3A/10
Placid Substation Diesel Generators
November 2023



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APPENDIX A
EGLE TEST PLAN