



# **COMPLIANCE TEST REPORT**

for

## **CARBON MONOXIDE EMISSIONS (CO)**

**UNITS 11-1 to 11-5**

**SRN: B2804**

**Wilmot Substation  
Kingston Township, Michigan**

**June 8-9 and June 14-15, 2021**

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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 Wilmot Substation in Kingston Township, Michigan. The fieldwork, performed on June 8-9 and June 14-15, 2021 was conducted to satisfy requirements of MI-ROP-B2804-2018, and 40CFR Part 63 Subpart ZZZZ. Emission tests were performed on Units 11-1 to 11-5 for carbon monoxide (CO) destruction efficiency.

The results of the emissions testing are highlighted below:

### CO Emissions Test Results Wilmot Substation June 8-9 and June 14-15, 2021

Date	Unit	Average CO Destruction Efficiency (%)
6-8-21	11-5	89.5
6-15-21	11-4	88.2
6-8-21	11-3	90.0
6-9-21	11-2	88.5
6-14-21	11-1	86.6

**Subpart ZZZZ Limit:** Limit the concentration of CO in the stationary RICE exhaust to 23 ppmvd or less at 15% O<sub>2</sub>; 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 Wilmot Substation in Kingston Township, Michigan. The fieldwork, performed on June 8-9 and June 14-15, 2021 was conducted to satisfy requirements of MI-ROP-B2804-2018, and 40CFR Part 63 Subpart ZZZZ. Emission tests were performed on Units 11-1 to 11-5 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-B2804-2018, 40CFR Part 63 Subpart ZZZZ, and EM&S's intent to test<sup>1</sup>, test plan submittal, which was approved in a letter by Mr. Matt Karl from the Michigan Department of Environment, Great Lakes, and Energy (EGLE) dated November 17, 2020. The following EM&S personnel participated in the testing program: Mr. Thomas Snyder, Sr. Environmental, and Mr. Fred Meinecke, Senior Engineering Technician. Ms. Stefanie Ledesma, Environmental Engineer with DTE Electric, provided process coordination for the testing program.

## 2.0 SOURCE DESCRIPTION

The Wilmot Substation located at 5977 E. Bevans Rd, Kingston Township, Michigan, employs the use of five EM&D, MP45, 20 cylinder, 3,600 Horse Power diesel engines (Units 11-1 to 11-5). 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 MW 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.

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<sup>1</sup> EGLE, Test Plan, Submitted September 18, 2020. (Attached-Appendix A)

<sup>2</sup> EGLE, Approval Letter (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 (O<sub>2</sub>) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight (Instrumental Analyzer Method)". The O<sub>2</sub> 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<sub>2</sub> 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 O<sub>2</sub>/CO<sub>2</sub> 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 O<sub>2</sub> / 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 O<sub>2</sub> 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 O<sub>2</sub> and CO. Data was recorded as 1-minute averages.

### **3.1.5 Quality Control and Assurance (O<sub>2</sub> and CO)**

All sampling and analytical equipment was calibrated per the guidelines referenced in Methods 3A and 10. 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.

### **3.1.6 Data Reduction**

The O<sub>2</sub> and CO emission readings in percent (%) and parts per million (ppm) were recorded at 4-second intervals and averaged to 1-minute increments. The CO emissions were normalized to 15% O<sub>2</sub>, 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.

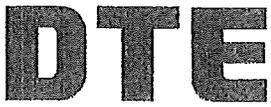
The 1-minute O<sub>2</sub> and CO readings collected can be found in Appendix B.

## **4.0 OPERATING PARAMETERS**

The test program included the collection of catalyst inlet temperature (°F), catalyst pressure drop ("H<sub>2</sub>O), and crank case vacuum ("H<sub>2</sub>O). Ambient temperature (°F), Relative Humidity (%), and Barometric Pressure (in) were also recorded during each test. Upon completion of the testing, and a thorough review, it was discovered and determined that the time stamp on Unit 11-4's operational data was offset by 24 days. The data collection system for this is being investigated, repaired, and/or replaced as corrective action. Operational and atmospheric data collected during the testing is in Appendix E.

## 5.0 RESULTS

Tables 1-5 present the CO emissions @ 15% O<sub>2</sub> results from Units 11-1 to 11-5. 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 ("H<sub>2</sub>O). The results of the testing indicate that Units 11-1 to 11-5 comply with MI-ROP-B2804-2018, and 40CFR Part 63 Subpart ZZZZ requirements of reducing CO emissions by 70% or more.

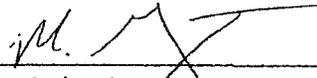


6.0 CERTIFICATION STATEMENT

"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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Thomas Snyder, QSTI

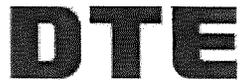
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## RESULTS TABLES





**TABLE NO. 1**  
**CARBON MONOXIDE (CO) EMISSION TESTING RESULTS**  
Unit 11-5 Wilmot Substation  
June 8, 2021

Test	Time	Load (MW)	Catalyst		Oxygen <sup>(1)</sup>		CO Emissions @ 15% O <sub>2</sub> <sup>(1)</sup>		Destruction Efficiency (%)
			Inlet Temperature (°F)	Catalyst Pressure Drop (H <sub>2</sub> O)	Inlet (%)	Outlet (%)	Inlet (ppm)	Outlet (ppm)	
Run - 1	8:28-9:28	2.5	725	0.0002	11.8	11.8	147.4	15.7	89.4
Run - 2	9:37-10:37	2.5	726	-0.0004	11.8	11.8	149.0	15.7	89.4
Run - 3	10:50-11:50	<u>2.5</u>	<u>729</u>	<u>0.0003</u>	<u>11.7</u>	<u>11.7</u>	<u>160.5</u>	<u>16.5</u>	<u>89.7</u>
	<i>Avg:</i>	2.5	727	0.000	11.8	11.8	152.3	16.0	89.5

<sup>(1)</sup> Corrected for analyzer drift per USEPA method 7E  
40CFR Part 63 Subpart ZZZZ Limit: 70% DE



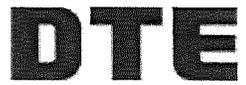


**TABLE NO. 2**  
**CARBON MONOXIDE (CO) EMISSION TESTING RESULTS**  
**Unit 11-4 Wilmot Substation**  
**June 15, 2021**

Test	Time	Load (MW)	Catalyst Inlet Temperature (°F)	Catalyst Pressure Drop ( $"\text{H}_2\text{O}$ )	Oxygen <sup>(1)</sup>		CO Emissions @ 15% O <sub>2</sub> <sup>(1)</sup>		Destruction Efficiency (%)
					Inlet (%)	Outlet (%)	Inlet (ppm)	Outlet (ppm)	
Run - 1	7:34-8:34	2.5	675	0.003	12.3	12.3	97.2	12.4	87.2
Run - 2	8:42-9:42	2.5	681	0.003	12.3	12.3	97.7	11.3	88.5
Run - 3	9:54-10:54	<u>2.5</u>	<u>687</u>	<u>0.002</u>	<u>12.3</u>	<u>12.2</u>	<u>99.2</u>	<u>10.9</u>	<u>89.0</u>
	<i>Avg:</i>	<i>2.5</i>	<i>681</i>	<i>0.003</i>	<i>12.3</i>	<i>12.3</i>	<i>98.0</i>	<i>11.5</i>	<i>88.2</i>

<sup>(1)</sup> Corrected for analyzer drift per USEPA method 7E  
40CFR Part 63 Subpart ZZZZ Limit: 70% DE





**TABLE NO. 3**  
**CARBON MONOXIDE (CO) EMISSION TESTING RESULTS**  
 Unit 11-3 Wilmot Substation  
 June 8, 2021

Test	Time	Load (MW)	Catalyst		Oxygen <sup>(1)</sup>		CO Emissions @ 15% O <sub>2</sub> <sup>(1)</sup>		Destruction Efficiency (%)
			Inlet Temperature (°F)	Pressure Drop ("H <sub>2</sub> O)	Inlet (%)	Outlet (%)	Inlet (ppm)	Outlet (ppm)	
Run - 1	12:10-13:10	2.5	793	-0.010	10.9	10.8	384.1	39.8	89.6
Run - 2	13:21-14:21	2.5	797	-0.011	10.9	10.9	365.8	35.9	90.2
Run - 3	14:35-15:35	<u>2.5</u>	<u>792</u>	<u>-0.120</u>	<u>11.0</u>	<u>11.0</u>	<u>343.9</u>	<u>34.3</u>	<u>90.0</u>
	<i>Avg:</i>	2.5	794	-0.047	10.9	10.9	364.6	36.7	89.9

<sup>(1)</sup> Corrected for analyzer drift per USEPA method 7E  
 40CFR Part 63 Subpart ZZZZ Limit: 70% DE





TABLE NO. 4  
CARBON MONOXIDE (CO) EMISSION TESTING RESULTS  
Unit 11-2 Wilmot Substation  
June 9, 2021

Test	Time	Load (MW)	Catalyst		Oxygen <sup>(1)</sup>		CO Emissions @ 15% O <sub>2</sub> <sup>(1)</sup>		Destruction Efficiency (%)
			Inlet Temperature (°F)	Pressure Drop ("H <sub>2</sub> O)	Inlet (%)	Outlet (%)	Inlet (ppm)	Outlet (ppm)	
Run - 1	7:58-8:58	2.5	714	0.006	11.9	11.9	158.9	19.8	87.6
Run - 2	9:11-10:11	2.5	727	0.007	11.8	11.8	176.3	19.3	89.0
Run - 3	10:22-11:22	<u>2.5</u>	<u>735</u>	<u>0.008</u>	<u>11.8</u>	<u>11.8</u>	<u>180.5</u>	<u>20.1</u>	<u>88.9</u>
	<i>Avg:</i>	2.5	725	0.007	11.8	11.8	171.9	19.7	88.5

<sup>(1)</sup> Corrected for analyzer drift per USEPA method 7E  
40CFR Part 63 Subpart ZZZZ Limit: 70% DE



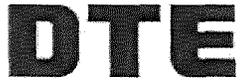


TABLE NO. 5  
CARBON MONOXIDE (CO) EMISSION TESTING RESULTS  
Unit 11-1 Wilmot Substation  
June 14, 2021

Test	Time	Load (MW)	Catalyst Inlet Temperature (°F)	Catalyst Pressure Drop ( $"H_2O$ )	Oxygen <sup>(1)</sup>		CO Emissions @ 15% O <sub>2</sub> <sup>(1)</sup>		Destruction Efficiency (%)
					Inlet (%)	Outlet (%)	Inlet (ppm)	Outlet (ppm)	
Run - 1	10:02-11:02	2.5	701	0.004	12.0	11.9	117.6	16.1	86.3
Run - 2	11:11-12:11	2.5	713	0.004	11.9	11.9	124.4	16.4	86.8
Run - 3	12:21-13:21	<u>2.5</u>	<u>711</u>	0.004	<u>11.9</u>	<u>11.9</u>	<u>120.3</u>	<u>15.9</u>	<u>86.8</u>
	<i>Avg:</i>	2.5	708	0.004	11.9	11.9	120.8	16.1	86.6

<sup>(1)</sup> Corrected for analyzer drift per USEPA method 7E  
40CFR Part 63 Subpart ZZZZ Limit: 70% DE

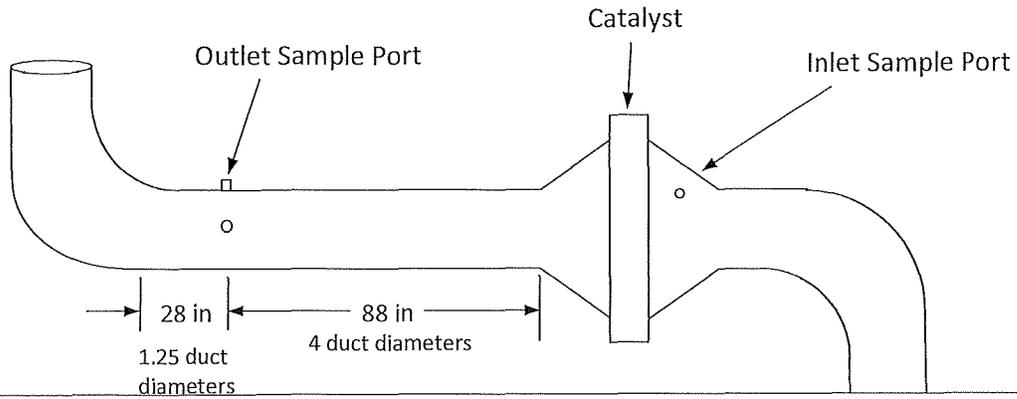


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FIGURES



Figure 1 - Stack Drawing & Sampling Location  
Wilmot Substation Diesel Generators  
June 8-9 & June 14-15, 2021



Outlet	Distance	Duct Diameter = 22 in
Point 1	3.67 in	
Point 2	11.00 in	
Point 3	18.33 in	

Diesel Generator

Figure 2 – EPA Methods 3A/10  
Wilmot Substation Diesel Generators  
June 8-9 & June 14-15, 2021

