



**40 CFR 63 Subpart ZZZZ  
Annual Compliance Demonstration**

**Consumers Energy St. Clair  
Compressor Station EUENGINE 2-4**

**RECEIVED**  
JUL 21 2016  
AIR QUALITY DIV.

*Prepared for:*  
**Consumers Energy**

Consumers Energy  
1945 West Parnall Road  
Jackson, Michigan

Project No. 16-4883.00  
July 7, 2016

BT Environmental Consulting, Inc.  
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Royal Oak, Michigan 48073  
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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY  
AIR QUALITY DIVISION

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JUL 21 2016

RENEWABLE OPERATING PERMIT  
REPORT CERTIFICATION

AIR QUALITY DIV.

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name Consumers Energy Company - St. Clair Compressor Station County St. Clair

Source Address 10021 Marine City Highway City Ira Township

AQD Source ID (SRN) B6637 ROP No. MI-ROP-B6637-2015 ROP Section No. \_\_\_\_\_

Please check the appropriate box(es):

Annual Compliance Certification (Pursuant to Rule 213(4)(c))

Reporting period (provide inclusive dates): From \_\_\_\_\_ To \_\_\_\_\_

- 1. During the entire reporting period, this source was in compliance with ALL terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.
- 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, EXCEPT for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))

Reporting period (provide inclusive dates): From \_\_\_\_\_ To \_\_\_\_\_

- 1. During the entire reporting period, ALL monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.
- 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, EXCEPT for the deviations identified on the enclosed deviation report(s).

Other Report Certification

Reporting period (provide inclusive dates): From \_\_\_\_\_ To \_\_\_\_\_

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

40 CFR 63 Subpart ZZZZ Annual Compliance Demonstration for EUENGINE2-4

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

<u>Gregory Baustian</u>	<u>Ex. Manager, Gas Compression &amp; Storage</u>	<u>(616) 237-4009</u>
Name of Responsible Official (print or type)	Title	Phone Number

Signature of Responsible Official

7/15/2016  
Date

**Executive Summary**

**AIR QUALITY DIV.**

BT Environmental Consulting, Inc. (BTEC) was retained by Consumers Energy to conduct a compliance emissions test program at the inlet and outlet of a single spark ignition reciprocating internal combustion engine (EUENGINE2-4) catalytic converter at the Consumers Energy St. Clair Compressor Station facility in Ira Township, Michigan. The test program consisted of measurement of exhaust gas carbon monoxide (CO) and oxygen (O<sub>2</sub>) concentrations at the inlet and outlet of a single catalytic converter controlling emissions from an internal combustion engine.

Testing of the source consisted of triplicate 21-minute test runs for each pollutant at the inlet and outlet of the catalytic converter. Sampling was performed utilizing United States Environmental Protection Agency (USEPA) reference test methods. Testing occurred on May 27, 2016. The results of the emissions test program will be used to demonstrate compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) for RICE, 40 CFR Part 63, Subpart ZZZZ. and are summarized by Table 1.

**Table I  
Overall Emission Summary**

<b>Source</b>	<b>Pollutant</b>	<b>Average CO (Corrected to 15% O<sub>2</sub>)</b>	<b>CO Limit</b>
EUENGINE2-4	CO	89% reduction	93% Reduction or 47 ppmvd@15% O <sub>2</sub>
		11 ppmvd@15%O <sub>2</sub>	



## **1.0 Introduction**

BT Environmental Consulting, Inc. (BTEC) was retained by Consumers Energy to conduct a compliance emissions test program at the inlet and outlet of a single spark ignition reciprocating internal combustion engine (EUENGINE2-4) catalytic converter at the Consumers Energy St. Clair Compressor Station facility in Ira Township, Michigan. The test program consisted of measurement of exhaust gas carbon monoxide (CO) and oxygen (O<sub>2</sub>) concentrations at the inlet and outlet of a single catalytic converter controlling emissions from an internal combustion engine. The CO concentrations were then corrected to 15% O<sub>2</sub> and the CO control efficiency calculated on a concentration-to-concentration basis.

Testing of the source consisted of triplicate 21-minute test runs for each pollutant at the inlet and outlet of the catalytic converter conducted simultaneously. Sampling was performed utilizing United States Environmental Protection Agency (USEPA) reference test methods. Testing occurred on May 27, 2016. The results of the emissions test program will be used to demonstrate compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) for RICE, 40 CFR Part 63, Subpart ZZZZ.

The following BTEC professionals participated in conducting this study: Matthew Young, Project Manager; and Jake Zott, Environmental Technician. Mr. Brian Mauzy with Consumers Energy provided the on-site coordination for this project.

## **2.0 Process Description**

Natural gas-fired, 4 Stroke, Lean Burn, 4000 HP (27 MMBTU/HR), natural gas fired, Reciprocating Internal Combustion Engine used for natural gas compression. The engine is equipped with oxidation catalyst for control.

## **3.0 Sampling and Analytical Methodologies**

Sampling and analytical methodologies for the emissions test program can be separated into two categories as follows:

- (1) Measurement of O<sub>2</sub> using Method 3A
- (2) Measurement of CO using Method 10

Descriptions of sampling and analytical methodologies by category are summarized by Sections 3.1 through 3.2, respectively.

### **3.1 Oxygen Content (USEPA 3A)**

The O<sub>2</sub> content of the gas stream was measured using a Teledyne 300E CO/O<sub>2</sub> gas analyzer at the inlet and a Servomex 4100 O<sub>2</sub>/CO<sub>2</sub> gas analyzer at the outlet. The gas stream was drawn through a stainless-steel probe with a heated in-line filter to remove any particulate, a heated Teflon<sup>®</sup> sample line, through a refrigerated Teflon<sup>®</sup> sample conditioner to remove the moisture from the sample before it entered the O<sub>2</sub> analyzer. Data was recorded on a PC equipped with

data acquisition software. Recorded O<sub>2</sub> concentrations were averaged and reported for the duration of each 21-minute test run (as drift corrected per Method 7E). A drawing of the sampling train used for the testing program is presented as Figure 1.

In accordance with Method 7E, a 3-point (zero, mid, and high) bias check and calibration check was performed on the O<sub>2</sub> analyzer prior to initiating the test program. Following each test run, a 2-point (zero and high) calibration drift check was performed. The O<sub>2</sub> analyzer was operated at the 0-25% range.

### **3.2 Carbon Monoxide Content (USEPA 10)**

The CO content of the exhaust gas was evaluated according to procedures outlined in 40 CFR 60, Appendix A, Method 10. The CO content of the gas stream was measured using a Teledyne 300E CO/O<sub>2</sub> gas analyzer at the inlet and a Teledyne T300M CO gas analyzer at the outlet (see Figure 1 for a schematic of the sampling train). The gas stream was drawn through a stainless-steel probe with a heated in-line filter to remove any particulate, a heated Teflon<sup>®</sup> sample line, through a refrigerated sample conditioner with a peristaltic pump to remove the moisture from the sample before it entered the analyzer. Data was recorded on a PC equipped with Labview<sup>®</sup> II data acquisition software. Recorded CO concentrations were averaged and reported for the duration of each 21-minute test run (as drift corrected per Method 7E). The analyzer at the inlet was calibrated for a range of 0 to 1000 ppm, and the analyzer at the outlet was calibrated for a range of 0 to 100 ppm.

In accordance with Method 10, a 3-point (zero, mid, and high) calibration check was performed on the CO analyzer. Calibration drift checks were performed at the completion of each run. For analyzer calibrations, calibration gases were mixed to desired concentrations using an EnviroNics Series 4040 Computerized Gas Dilution System. The Series 4040 consists of a single chassis with four mass flow controllers. The mass flow controllers are factory-calibrated using a primary flow standard traceable to the United States National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11-point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity. A field quality assurance check of the system was performed pursuant to Method 205 by setting the diluted concentration to a value identical to a Protocol 1 calibration gas and then verifying that the analyzer response is the same with the diluted gas as with the Protocol 1 gas.

**4.0 Test Results**

The results of the emissions test program are summarized by Table 1.


**Table 1  
Overall Emission Summary**

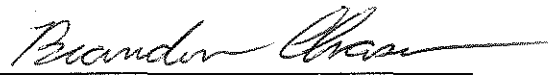
Source	Pollutant	Average CO (Corrected to 15% O <sub>2</sub> )	CO Limit
EUENGINE2-4	CO	89% reduction	93% Reduction or 47 ppmvd@15% O <sub>2</sub>
		11 ppmvd@15%O <sub>2</sub>	

Field and computer generated data for each test run are available in Appendix A, as well as all other applicable field data. Equipment calibration and span gas documentation is presented in Appendix B. Example calculations for equations used to determine emission rates are presented in Appendix C. Raw CEM data is included as Appendix D.

**Limitations**

The information and opinions rendered in this report are exclusively for use by Consumers Energy. BTEC will not distribute or publish this report without Consumers Energy's consent except as required by law or court order. BTEC accepts responsibility for the competent performance of its duties in executing the assignment and preparing reports in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages.

This report was prepared by:   
 Paul Diven  
 Environmental Technician

This report was reviewed by:   
 Brandon V. Chase  
 Staff Environmental Engineer

**Table 2**  
**CO Reduction**  
**Consumers Energy**  
**St Clair Michigan**  
**BTEC Project No. 16-4883.00**  
**Sampling Dates: May 27, 2016**

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	5/27/2016	5/27/2016	5/27/2016	
Test Run Time	10:15-10:36	10:52-11:13	11:27-11:48	
Inlet Oxygen Concentration (%)	9.00	9.06	9.05	<b>9.04</b>
Inlet Oxygen Concentration (% , drift corrected as per USEPA 7E)	8.96	9.04	9.04	<b>9.01</b>
Outlet Oxygen Concentration (%)	8.94	8.97	8.96	<b>8.96</b>
Outlet Oxygen Concentration (% , drift corrected as per USEPA 7E)	8.95	8.99	8.99	<b>8.98</b>
Inlet Carbon Monoxide Concentration (ppmv)	211.98	207.67	210.93	<b>210.19</b>
Inlet CO Concentration (ppmv, corrected as per USEPA 7E)	218.12	213.72	217.61	<b>216.48</b>
Inlet CO Concentration (ppmv, corrected to 15% O <sub>2</sub> )	<b>105.10</b>	<b>103.48</b>	<b>105.02</b>	<b>104.53</b>
Inlet CO Concentration (ppmv, corrected to 15% O <sub>2</sub> ) (Corrected as per USEPA 7E)	<b>107.74</b>	<b>106.32</b>	<b>108.24</b>	<b>107.43</b>
Outlet Carbon Monoxide Concentration (ppmv)	21.94	22.24	22.60	<b>22.26</b>
Outlet CO Concentration (ppmv, corrected as per USEPA 7E)	22.52	23.10	23.57	<b>23.07</b>
Outlet CO Concentration (ppmv, corrected to 15% O <sub>2</sub> )	<b>10.82</b>	<b>11.00</b>	<b>11.17</b>	<b>11.00</b>
Outlet CO Concentration (ppmv, corrected to 15% O <sub>2</sub> ) (Corrected as per USEPA 7E)	<b>11.12</b>	<b>11.45</b>	<b>11.68</b>	<b>11.41</b>
CO Reduction	89.7%	89.4%	89.4%	89.5%
<b>CO Reduction (corrected as per USEPA 7E)</b>	<b>89.7%</b>	<b>89.2%</b>	<b>89.2%</b>	<b>89.4%</b>

Inlet O <sub>2</sub> Correction			
Co	0.13	0.13	0.13
Cma	9.95	9.95	9.95
Cm	9.99	9.96	9.95

Outlet O <sub>2</sub> Correction			
Co	0.08	0.06	0.05
Cma	9.95	9.95	9.95
Cm	9.94	9.92	9.91

Inlet CO Correction			
Co	-1.26	-0.91	-0.93
Cma	398	398	398
Cm	387.84	387.51	386.56

Outlet CO Correction			
Co	-0.20	-0.39	-0.43
Cma	49.8	49.8	49.8
Cm	48.75	48.39	48.23

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

**Equations**

$$\text{Conc}_{@15\%O_2} = \text{Conc} * (20.9 - 15) / (20.9 - \%O_2)$$

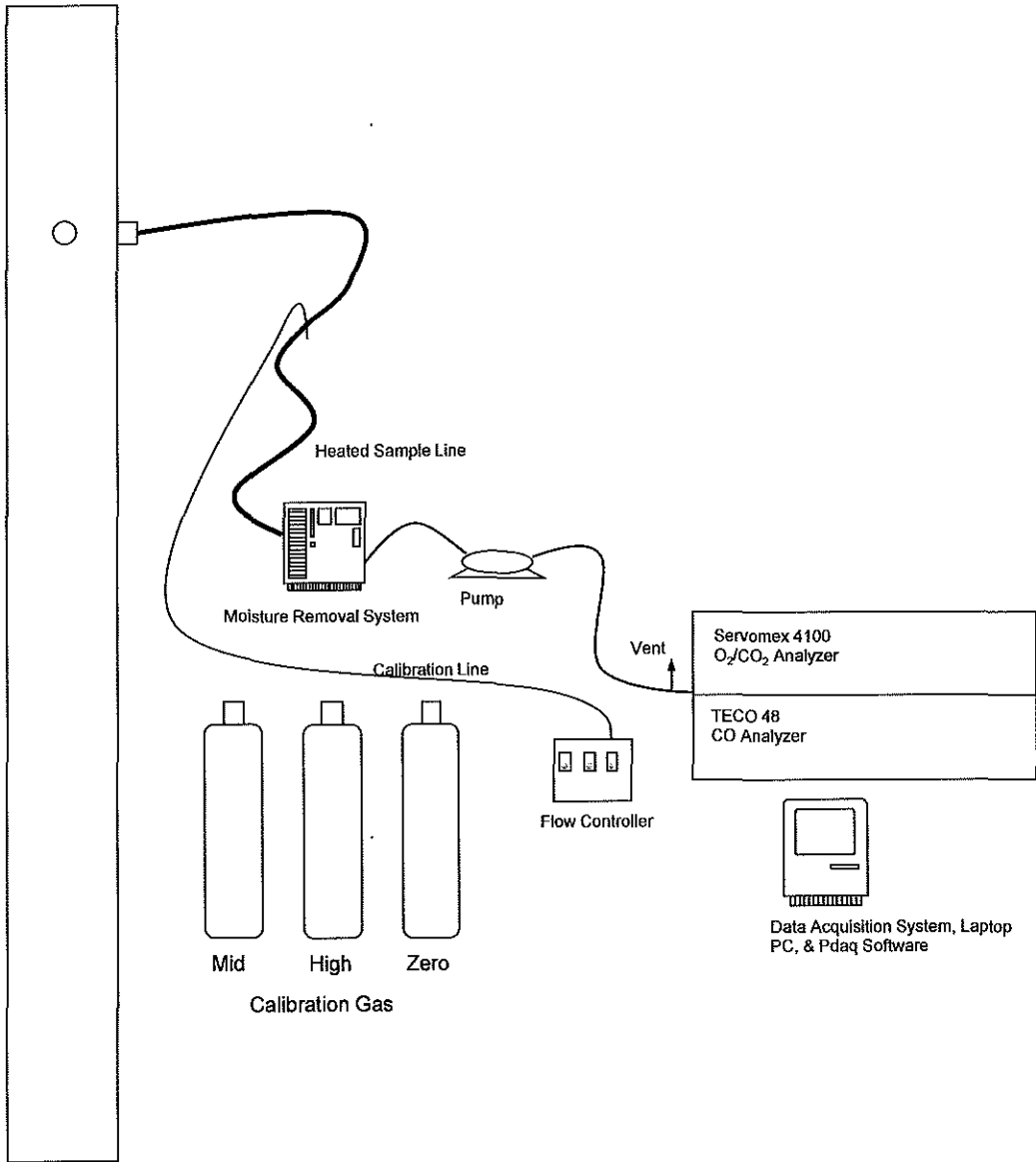


Figure No. 1

Site:  
USEPA Method 3A, and 10  
Consumers Energy  
Ira Township, Michigan

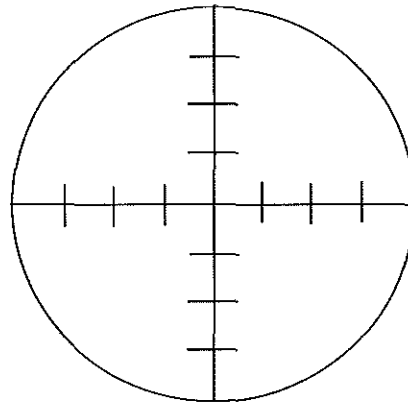
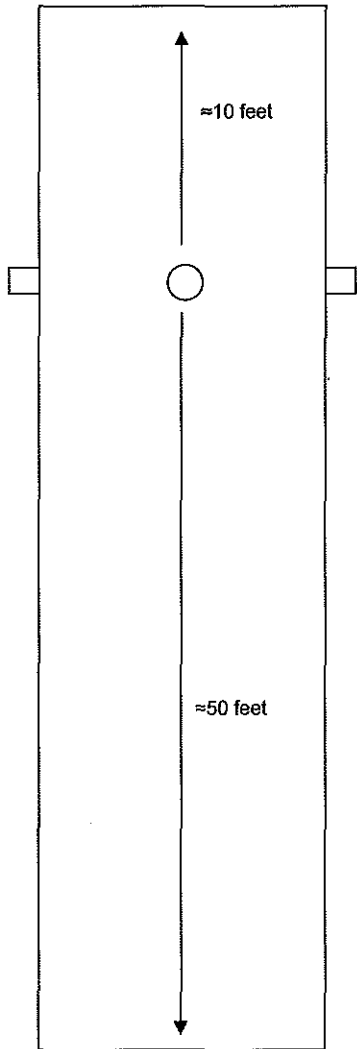
Sampling Date:  
May 27, 2016

BT Environmental Consulting Inc.  
4949 Fernlee Avenue  
Royal Oak, MI 48073





diameter = 32 inches



Not to Scale

Points	Distance "
1	5.3
2	16.0
3	26.7

Figure No. 2

Site:  
EUENGINE 2-4  
Consumers Energy  
Ira Township, Michigan

Sampling Date:  
May 27, 2016

**BT Environmental Consulting,  
Inc.**  
4949 Fernlee Avenue  
Royal Oak, Michigan 48073