

**EMISSIONS TEST REPORT**

for

**FORMALDEHYDE**

**UNITS 1 & 2**

**BLUE WATER RENEWABLES, LLC  
Smiths Creek, Michigan**

**August 18-19, 2015**

**RECEIVED**

OCT 19 2015

**AIR QUALITY DIV.**

Prepared By  
Environmental Management & Resources  
Environmental Field Services Group  
DTE Corporate Services, LLC  
7940 Livernois H-136  
Detroit, MI 48210

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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY  
AIR QUALITY DIVISION

AIR QUALITY DIVISION

**RENEWABLE OPERATING PERMIT  
REPORT CERTIFICATION**

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 Blue Water Renewables County St Clair

Source Address 6797 Smiths Creek Road City Smiths Creek

AQD Source ID (SRN) P0262 ROP No. P0262-2012a ROP Section No. NA

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 Aug 18, 2015 To Aug 19, 2015

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

Formaldehyde Emissions Test Report

\_\_\_\_\_

\_\_\_\_\_

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>Gary S. Quantock</u>	<u>Vice President - Operations</u>	<u>734-913-5649</u>
Name of Responsible Official (print or type)	Title	Phone Number
		<u>10/16/15</u>
Signature of Responsible Official		Date

\* Photocopy this form as needed.



**EXECUTIVE SUMMARY**

DTE Energy's Environmental Management and Resources, Field Services Group (DTE), performed formaldehyde emissions testing at Blue Water Renewables, LLC, located in Smiths Creek, Michigan. The testing was conducted to satisfy requirements of Michigan Department of Environmental Quality (MDEQ) Consent Order: *AQD No. 25-2015*. The testing was originally scheduled to be completed on August 11, 2015. Problems with the exhaust system silencers on both of the engines prevented safe testing on that day. The silencers problem was corrected and successful testing was subsequently performed on August 18-19, 2015. This delayed testing was conducted with the approval of the MDEQ.

The results of the emissions testing are summarized below:

**Emissions Testing Summary  
Blue Water Renewables, LLC  
Smiths Creek, MI**

	Formaldehyde Emissions	
	Unit 1 (8-18-2015)	Unit 2 (8-19-2015)
<b>lb/hr*</b>	1.7	1.8
<b>Permit Limit</b>	<b>2.1</b>	<b>2.1</b>

\* pounds per hour



## **1.0 INTRODUCTION**

DTE Energy's Environmental Management and Resources, Field Services Group (DTE), performed formaldehyde emissions testing at Blue Water Renewables, LLC, located in Smiths Creek, Michigan. The fieldwork, performed on August 18-19, 2015 was conducted to satisfy requirements of Michigan Department of Environmental Quality (MDEQ) Consent Order: AQD No. 25-2015. The Consent Order required testing of both engines to demonstrate that formaldehyde emissions complied with the limits specified in MI-ROP-P0262-2012a. Formaldehyde emissions tests from both Units 1 and 2 were determined.

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 1-3A, and 320.

The fieldwork was performed in accordance with EPA Reference Methods and the DTE Intent to Test<sup>1</sup>, which was approved by the Michigan Department of Environmental Quality (MDEQ)<sup>2</sup>. The following DTE personnel participated in the testing program: Mr. Mark Grigereit, Principal Engineer, Mr. Thomas Snyder and Mr. Fred Meinecke, Environmental Technicians. Mr. Phil Kauppi and Ms. Lindsey Wells, Prism Analytical Technologies Incorporated (PATI) provided FTIR support. Mr. Snyder was the project leader. Mr. Nick Diedrich, DTE Energy Resources, provided coordination of the testing program.

Mr. Jason Galbraith, Facility Operator, DTE Biomass Energy, provided on-site operation of the units. Mr. Mark Dziadosz, MDEQ, reviewed the Test Plan. Mr. Mark Dziadosz and Ms. Rebecca Loftus, MDEQ, observed the testing.

## **2.0 SOURCE DESCRIPTION**

The Blue Water Renewables, LLC power generating facility, located at 6797 Smiths Creek Road, Smiths Creek, MI is an electricity generating facility. The facility consists of two (2) landfill gas-fired internal combustion engines with associated electrical generators.

The systems are Caterpillar G3520C – 1200 RPM 1600 kW Gas Generator Sets. The purpose of the source is to utilize landfill gas from the Smiths Creek Landfill to produce energy that is delivered to the electrical grid.

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<sup>1</sup> MDEQ, Test Plan, Submitted July 1, 2015. (Attached-Appendix A)

<sup>2</sup> MDEQ, Acceptance Letter, July 13, 2015. (Attached-Appendix A)



See Figure 1 for a diagram of the unit sampling locations and stack dimensions.

### 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 Methods 1-2	Exhaust Gas Flow Rates	Field data analysis and reduction
USEPA Method 3A	Oxygen	Instrumental Analyzer Method
USEPA Method 320	Formaldehyde, Moisture Content, Carbon Dioxide	FTIR

### 3.1 **STACK GAS VELOCITY AND FLOWRATES (USEPA METHODS 1-2)**

#### 3.1.1 *Sampling Method*

Stack gas velocity traverses were conducted in accordance with the procedures outlined in USEPA Method 1, "Sample and Velocity Traverses for Stationary Sources," and Method 2, "Determination of Stack Gas Velocity and Volumetric Flowrate." Two (2) sampling ports were utilized on the unit's exhaust duct, sampling at six (6) points per port for a total of twelve (12) points. A flow traverse was conducted prior to each gas test.

A cyclonic flow check was performed during the compliance emissions testing. Testing in the stack demonstrated that no cyclonic flow was present according to procedures in USEPA Method 2.

The EPA Method 2 sampling equipment consisted of a 0-10" incline manometer, S-type Pitot tube ( $C_p = 0.84$ ) and a Type-K calibrated thermocouple.



## **3.2 OXYGEN (USEPA METHOD 3A)**

### **3.2.1 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 analyzers utilize paramagnetic sensors. Continuous oxygen sampling was performed simultaneously with the Method 320 sampling.

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

- (1) Single-point sampling probe (located in the centroid of the exhaust stack)
- (2) Flexible unheated Teflon™ sampling line
- (3) Servomax 1400 O<sub>2</sub>/CO<sub>2</sub> gas analyzer
- (4) Appropriate USEPA Protocol 1 calibration gases
- (5) Data Acquisition System

### **3.2.2 Sampling Train Calibration**

The O<sub>2</sub> analyzer was calibrated according to procedures outlined in USEPA Methods 3A. 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.

### **3.2.3 Quality Control and Assurance**

All sampling and analytical equipment was calibrated according to the guidelines referenced in Methods 3A. 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 located in Appendix C.

### **3.2.4 Data Reduction**

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The O<sub>2</sub> emissions were recorded in percent (%).

## **3.3 MOISTURE (USEPA METHOD 320)**

### **3.3.1 Sampling Method**

Moisture content in the exhaust was evaluated using USEPA Method 320, "Measurement of Vapor Phase Organic Emissions By Extractive Fourier Transform Infrared (FTIR)".



### 3.4 FORMALDEHYDE (USEPA METHOD 320)

#### 3.4.1 *Sampling Method*

Formaldehyde emissions were evaluated using USEPA Method 320, "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 EPA Method 320 sampling system (Figure 2) consisted of the following:

- (1) Single-point sampling probe (located in the centroid of the exhaust stack)
- (2) Flexible heated Teflon™ 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 rotometer and pressure transducer. All data was collected at 0.5 cm<sup>-1</sup> resolution.

#### 3.4.2 *Sampling Train Calibration*

The FTIR was calibrated according to procedures outlined in USEPA Methods 320. Direct measurements of nitrogen, acetaldehyde, and ethylene gas standards were made at the test location to confirm concentrations. Acetaldehyde was used as a surrogate for formaldehyde per Method 320.

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. The ethylene was passed through the entire system to determine the sampling system response time and to ensure that the sampling system was leak-free at the stack location.

Nitrogen was purged through the sampling system at each test location to confirm the system was free of contaminants.

An acetaldehyde gas standard was passed through the sampling system at each test location to determine the response time and confirm recovery.



Acetaldehyde spiking was performed to verify the ability of the sampling system to quantitatively deliver a sample containing acetaldehyde from the base of the probe to the FTIR. Analyte spiking assures the ability of the FTIR to quantify acetaldehyde in the presence of effluent gas.

As part of the spiking procedure, samples from each engine were measured to determine acetaldehyde concentrations to be used in the spike recovery calculations. The determined SF<sub>6</sub> 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 acetaldehyde. The following equation illustrates the percent recovery calculation.

$$DF = \frac{SF_{6(spiked)}}{SF_{6(direct)}} \quad (\text{Sec. 9.2.3 (3) USEPA Method 320})$$

$$CS = DF * Spike_{dir} + Unspike(1 - DF) \quad (\text{Sec. 9.2.3 (4) USEPA Method 320})$$

DF = Dilution factor of the spike gas

SF<sub>6(direct)</sub> = SF<sub>6</sub> concentration measured directly in undiluted spike gas

SF<sub>6(spiked)</sub> = Diluted SF<sub>6</sub> concentration measured in a spiked sample

Spike<sub>dir</sub> = 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 acetaldehyde spike recoveries were within the EPA Method 320 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



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Technologies, Inc. validated the FTIR data. The data validation reports are located in Appendix D.

#### **3.4.4 Data Reduction**

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

### **4.0 OPERATING PARAMETERS**

The test program included the collection of generator load (kW), engine speed (RPM), inlet manifold air pressure (psi), inlet air temperature (F), gas fuel correction factor (%), fuel flow (scfm) and throttle actuator position (%).

Operational data is located in Appendix F.

### **5.0 DISCUSSION OF RESULTS**

Table No. 1 presents the formaldehyde emission testing results from Unit 1 while operating at greater than 90% of full load conditions. The formaldehyde emissions are presented in parts per million (ppm) and pounds per hour (lb/hr). The measured 1.7 lbs/hr for Unit 1 is in compliance with the permit limit of 2.1 lbs/hr. Additional test data presented for each test includes the kilowatts generated (kW), Oxygen (%), and the exhaust gas flowrate (scfm and dscfm).

Table No. 2 presents the formaldehyde emission testing results from Unit 2 while operating at greater than 90% of full load conditions. The formaldehyde emissions are presented in parts per million (ppm) and pounds per hour (lb/hr). The measured 1.8 lbs/hr for Unit 2 is in compliance with the permit limit of 2.1 lbs/hr. Additional test data presented for each test includes the kilowatts generated (kW), Oxygen (%), and the exhaust gas flowrate (scfm and dscfm).



**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."

A handwritten signature in cursive script, appearing to read "Thomas Snyder".

Thomas Snyder, QSTI

This report prepared by:

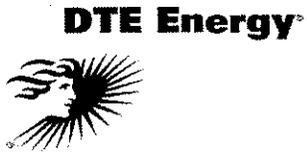
A handwritten signature in cursive script, appearing to read "Thomas Snyder".

Mr. Thomas Snyder, QSTI  
Senior Engineering Technician, Environmental Field Services  
Environmental Management and Resources  
DTE Energy Corporate Services, LLC

This report reviewed by:

A handwritten signature in cursive script, appearing to read "Thomas Durham".

Mr. Tom Durham  
Manager, Environmental Field Services  
Environmental Management and Resources  
DTE Energy Corporate Services, LLC

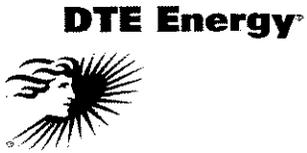


**TABLE NO. 1**  
**FORMALDEHYDE EMISSION TESTING RESULTS - UNIT 1**  
**Blue Water Renewables, LLC**  
**Smiths Creek, MI**  
**August 18, 2015**

Test	Test Date	Test Time	Generator		Exhaust Gas Flowrate		Formaldehyde Emissions	
			Power (kW)	Oxygen (%)	(SCFM)	(DSCFM)	(ppm)	(lb/hr)
Test 1	<b>18-Aug-15</b>	7:25-8:25	1,599	8.2	5,179	4,481	66.4	1.6
Test 2		8:44-9:44	1,550	8.2	5,076	4,389	73.4	1.7
Test 3		9:53-10:53	<u>1,528</u>	<u>8.2</u>	<u>5,087</u>	<u>4,399</u>	<u>78.3</u>	<u>1.9</u>
		<i>Average:</i>	<i>1,559</i>	<i>8.2</i>	<i>5,114</i>	<i>4,423</i>	<i>72.7</i>	<i>1.7</i>

**PERMIT LIMIT:**

Formaldehyde                      2.1 lbs/hr



**TABLE NO. 2**  
**FORMALDEHYDE EMISSION TESTING RESULTS - UNIT 2**  
 Blue Water Renewables, LLC  
 Smiths Creek, MI  
 August 19, 2015

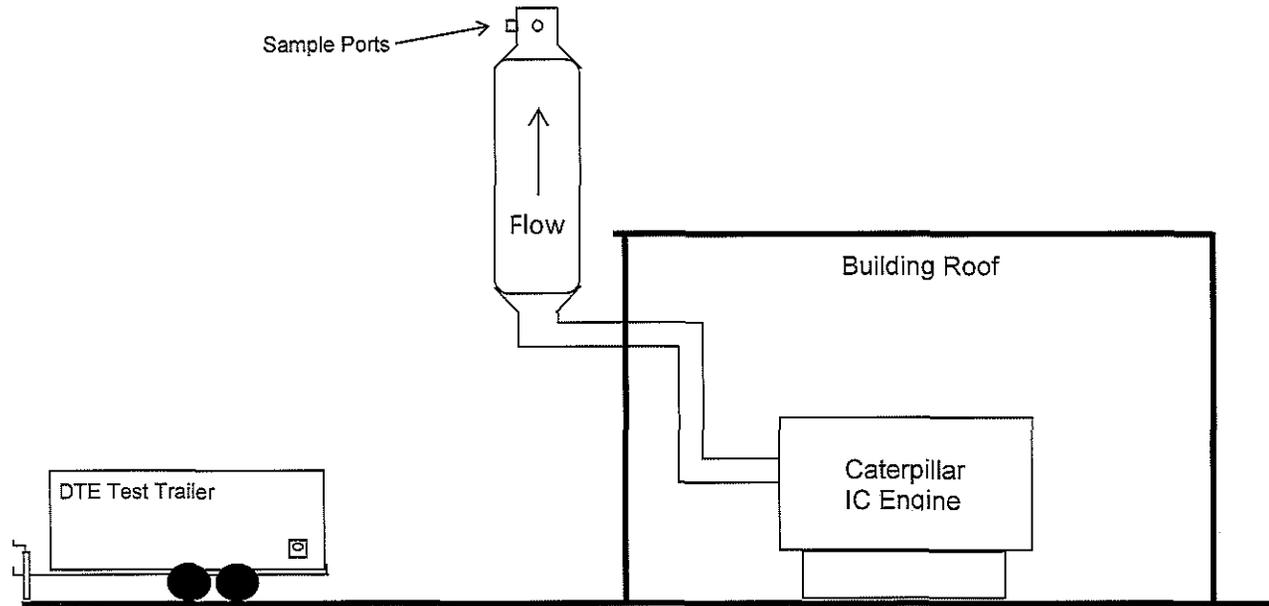
Test	Test Date	Test Time	Generator	Oxygen	Exhaust Gas Flowrate		Formaldehyde Emissions	
			Power (kW)	(%)	(SCFM)	(DSCFM)	(ppm)	(lb/hr)
Test 1	19-Aug-15	7:58-8:58	1,605	7.7	5,182	4,440	71.7	1.7
Test 2		9:06-10:06	1,594	7.7	5,100	4,369	74.5	1.8
Test 3		10:20-11:20	<u>1,609</u>	<u>7.7</u>	<u>5,101</u>	<u>4,378</u>	<u>77.1</u>	<u>1.9</u>
		<i>Average:</i>	<i>1,603</i>	<i>7.7</i>	<i>5,128</i>	<i>4,396</i>	<i>74.4</i>	<i>1.8</i>

**PERMIT LIMIT:**

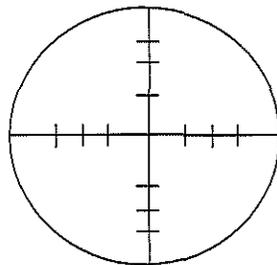
Formaldehyde 2.1 lbs/hr



**Figure 1 – Stack Drawing and Exhaust Sampling Point Location**  
**Blue Water Renewables – Units 1&2**  
**August 18-19, 2015**



Stack Diameter = 15.5"



Velocity Measurement  
Points

Points	Distance From Inner Wall
1	0.68
2	2.26
3	4.59
4	10.91
5	13.24
6	14.82



Figure 2 – USEPA Method 3A/320 Sampling Train  
Blue Water Renewables  
August 18-19, 2015

