

EMISSIONS TEST REPORT

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for

**OXIDES OF NITROGEN (NO_x) AND CARBON
MONOXIDE (CO)**

TURBINES 1 & 2

**RIVERVIEW ENERGY SYSTEMS, LLC
Riverview, Michigan**

April 27 & 28, 2015

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

DTE Energy®





MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
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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 Riverview Energy Systems County Wayne

Source Address 20000 Grange Road City Riverview

AQD Source ID (SRN) M4469 ROP No. MI-ROP-M4469-2015 ROP Section No. 1

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 4/27/2015 To 4/27/2015

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

NOx and CO emission testing 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

Gary Quantock	Vice President	734-913-5649
Name of Responsible Official (print or type)	Title	Phone Number
		6/16/15
Signature of Responsible Official		Date



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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Resources (EM&R), Field Services Group, performed emissions testing at Riverview Energy Systems, LLC, located in Riverview, Michigan. The fieldwork, performed on April 27 & 28, 2015 was conducted to satisfy requirements of the Michigan Renewable Operating Permit No. MI-ROP-M4469-2015. Emissions tests were performed on Turbines 1 & 2 for oxides of nitrogen (NO_x) and carbon monoxide (CO).

The results of the emissions testing are highlighted below:

**Emissions Testing Summary – Turbines 1 & 2
Riverview Energy Systems, LLC
Riverview, MI
April 27 & 28, 2015**

	Oxides of Nitrogen (% by volume @ 15% O₂)	Carbon Monoxide (lb/hr)
Turbine 1	0.0029	2.46
Turbine 2	0.0029	2.91
Permit Limit	0.0071	15.78



1.0 INTRODUCTION

DTE Energy's Environmental Management and Resources (EM&R), Field Services Group, performed emissions testing at Riverview Energy Systems, LLC, located in Riverview, Michigan. The fieldwork, performed on April 27 & 28, 2015, was conducted to satisfy requirements of the Michigan Renewable Operating Permit No. MI-ROP-M4469-2015.

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 3A, 7E, and 10.

The fieldwork was performed in accordance with EPA Reference Methods and EM&R's Intent to Test¹, which was approved by the Michigan Department of Environmental Quality (MDEQ)¹. The following EM&R personnel participated in the testing program: Mr. Mark Grigereit, Principal Engineer and Mr. Thomas Snyder, Senior Environmental Technician. Mr. Grigereit was the project leader.

Mr. Joe Davis, Facility Technician, DTE Biomass Energy, provided on-site operation of the Turbines. Mr. David Patterson and Mr. Jonathan Lamb, MDEQ, reviewed the test plan and observed the testing.

2.0 SOURCE DESCRIPTION

The Riverview Energy Systems, LLC power generating facility, located at 20000 Grange Road, Riverview, MI is a power generating facility. The facility consists of two (2) landfill gas-fired Solar T-4701 turbines with associated electrical generators.

The purpose of the source is to utilize land fill gas from the Riverview Energy Systems Landfill to produce energy to be sent to the electrical grid. Each Turbine was tested while operating at greater than 90% of full load conditions.

See Figure 1 for a diagram of the Turbine sampling locations.

3.0 SAMPLING AND ANALYTICAL PROCEDURES

¹ MDEQ, Test Plan, Submitted March 27, 2015. (Attached-Appendix A)

¹ MDEQ, Acceptance Letter, April 3, 2015. (Attached-Appendix A)



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 & CO ₂	Instrumental Analyzer Method
USEPA Method 7E	Oxides of Nitrogen	Chemiluminescent Instrumental Analyzer Method
USEPA Method 10	Carbon Monoxide	NDIR Instrumental Analyzer Method

3.1 OXYGEN AND CARBON DIOXIDE (USEPA METHOD 3A)

3.1.1 Sampling Method

Oxygen (O₂) and Carbon Dioxide (CO₂) 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. Testing was performed simultaneously with the gaseous emissions testing.

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

- (1) Single point sampling probe (located in the centroidal area of the exhaust stack)
- (2) Heated Teflon™ sampling line
- (3) MAK® gas conditioner with particulate filter
- (4) Flexible unheated Teflon™ sampling line
- (5) Servomex 1400 O₂/CO₂ gas analyzer
- (6) Appropriate USEPA Protocol 1 calibration gases
- (7) Data Acquisition System

3.1.2 Sampling Train Calibration

The O₂ and CO₂ analyzers were 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 for each diluent was then introduced through the entire sampling system to determine sampling system bias for each analyzer 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 located 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 O₂/CO₂ emissions were recorded in percent (%). The 1-minute readings collected during the testing can be found in Appendix B.

3.2 OXIDES OF NITROGEN AND CARBON MONOXIDE (USEPA METHODS 7E AND 10)

3.2.1 Sampling Method

Oxides of nitrogen (NO_x) emissions were evaluated using USEPA Method 7E, "Determination of Oxides of Nitrogen Emissions from Stationary Sources". The NO_x analyzer utilizes a Chemiluminescent detector. Carbon monoxide (CO) emissions were evaluated using USEPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources". The CO analyzer utilizes an NDIR detector. Previous emissions testing of the sources demonstrated an absence of stratification (<1%), therefore a single centroid sampling point was selected. Triplicate 60-minute tests were performed on each engine exhaust.

The EPA Methods 7E and 10 sampling system (Figure 2) consisted of the following:

- (1) Stainless-steel sample 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) TECO 42i Chemiluminescent NO/NO_x gas analyzer, and TECO 48i NDIR CO gas analyzer
- (6) Appropriate USEPA Protocol 1 calibration gases
- (7) Data Acquisition System.

3.2.2 Sampling Train Calibration

The NO_x / CO sampling trains were calibrated according to procedures outlined in USEPA Method 7E and 10. Zero, span, and mid range calibration gases were introduced directly into each analyzer to verify the instruments linearity. A zero and



5.0 DISCUSSION OF RESULTS

Table Nos. 1 and 2 present the emissions testing results from Turbines 1 & 2 while operating at greater than 90% of full load conditions. The NO_x emissions are presented as ppm @ 15% O₂, and % by volume @ 15% O₂, and the CO emissions are presented in pounds per hour (lb/hr).

Turbine 1 had a temperature override sensor malfunction during run 1. Although emissions sampling was continued during the unit's down time, the NO_x and CO emissions were not included in the run 1 average. The average emissions from run 1 include 20 minutes of sampling before the malfunction and 40 minutes of sampling after the malfunction.

The Turbine 1 NO_x emissions averaged 29 ppmv @ 15% O₂, and 0.0029 % by volume @ 15% O₂. The average NO_x emissions are less than the permit limit of 0.0071% by volume @ 15% O₂. The Turbine 1 CO emissions averaged 2.46 lb/hr. The average CO emissions are less than the permit limit of 15.78 lb/hr.

The Turbine 2 NO_x emissions averaged 28.5 ppmv @ 15% O₂, and 0.0029 % by volume @ 15% O₂. The average NO_x emissions are less than the permit limit of 0.0071% by volume @ 15% O₂. The Turbine 2 CO emissions averaged 2.91 lb/hr. The average CO emissions are less than the permit limit of 15.78 lb/hr.

Additional test data presented in the results tables for each test includes the kilowatts generated (kW), and the fuel flow (scfm).

Turbines 1 & 2 are in compliance with NO_x and CO emissions limits stated in Michigan Renewable Operating Permit No. MI-ROP-M4469-2015.



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', written above a horizontal line.

Thomas Snyder, QSTI

This report prepared by:

A handwritten signature in cursive script, appearing to read 'Thomas Snyder', written above a horizontal line.

Mr. Thomas Snyder, QSTI
Sr. Environmental 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 'M. Grigereit', written above a horizontal line.

Mr. Mark R. Grigereit, QSTI
Principal Engineer, Environmental Field Services
Environmental Management and Resources
DTE Energy Corporate Services, LLC

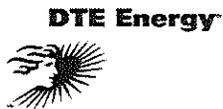


TABLE NO. 1
NOx & CO EMISSIONS TESTING RESULTS - UNIT 1
 Riverview Energy Systems, LLC
 Riverview, Michigan
 April 27, 2015

Test	Test Date	Test Time	Engine Load (Kw)	Fuel Flow (scf/min)	Heat Input Rate (MMBtu/Hr)	Oxygen ⁽¹⁾ (%) _{dry}	NO _x Emissions ⁽¹⁾		CO Emissions ⁽²⁾ (lb/hr) _{dry}
							(ppmv @ 15 % O ₂) _{dry}	(% by volume @ 15 % O ₂) _{dry}	
Test 1	April 27, 2015	9:10-9:30, 10:00-10:40 ⁽²⁾	3,650	1,745	50.6	15.8	28.4	0.0028	2.49
Test 2		11:01-12:01	3,615	1,721	49.9	15.9	29.1	0.0029	2.48
Test 3		12:15-13:15	<u>3,612</u>	<u>1,725</u>	<u>50.0</u>	<u>15.9</u>	<u>29.6</u>	<u>0.0030</u>	<u>2.41</u>
<i>Average:</i>			3,626	1,730	50.2	15.9	29.0	0.0029	2.46

NOTES:

- (1): Corrected for analyzer drift per USEPA method 7E.
 (2): Break in test time due to Turbine operational issues.

PERMIT LIMITS:

NOx 0.0071% by volume at 15% O₂
 CO 15.78 lb/hr

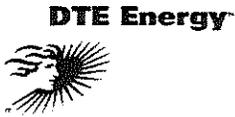


TABLE NO. 2
NOx & CO EMISSIONS TESTING RESULTS - UNIT 2
 Riverview Energy Systems, LLC
 Riverview, Michigan
 April 28, 2015

Test	Test Date	Test Time	Engine Load (Kw)	Fuel Flow (scf/min)	Heat Input Rate (MMBtu/Hr)	Oxygen ⁽¹⁾ (%) _{dry}	NO _x Emissions ⁽¹⁾		CO Emissions ⁽¹⁾ (lb/hr) _{dry}
							(ppmv @ 15% O ₂)	(% by volume @ 15% O ₂)	
Test 1	April 28, 2015	8:30-9:30	3,390	1,788	50.6	15.7	27.6	0.0028	3.11
Test 2		11:40-12:40	3,295	1,723	48.8	16.0	28.6	0.0029	2.91
Test 3		12:50-13:50	<u>3,303</u>	<u>1,703</u>	<u>48.2</u>	<u>16.0</u>	<u>29.3</u>	<u>0.0029</u>	<u>2.72</u>
		<i>Average:</i>	3,329	1,738	49.2	15.9	28.5	0.0029	2.91

NOTES:

(1): Corrected for analyzer drift per USEPA method 7E.

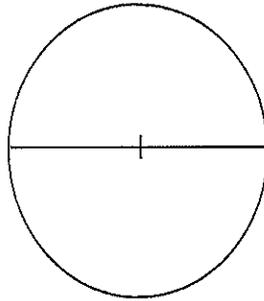
PERMIT LIMITS:

NOx 0.0071% by volume at 15% O₂
 CO 15.78 lb/hr



Figure 1 – Stack Drawing and Exhaust Sampling Point Location
Riverview Energy Systems – Units 1 & 2
April 27 & 28, 2015

Stack Diameter 30"



Measurement Points	
<u>Points</u>	<u>Distance From Inner Wall</u>
1	15"

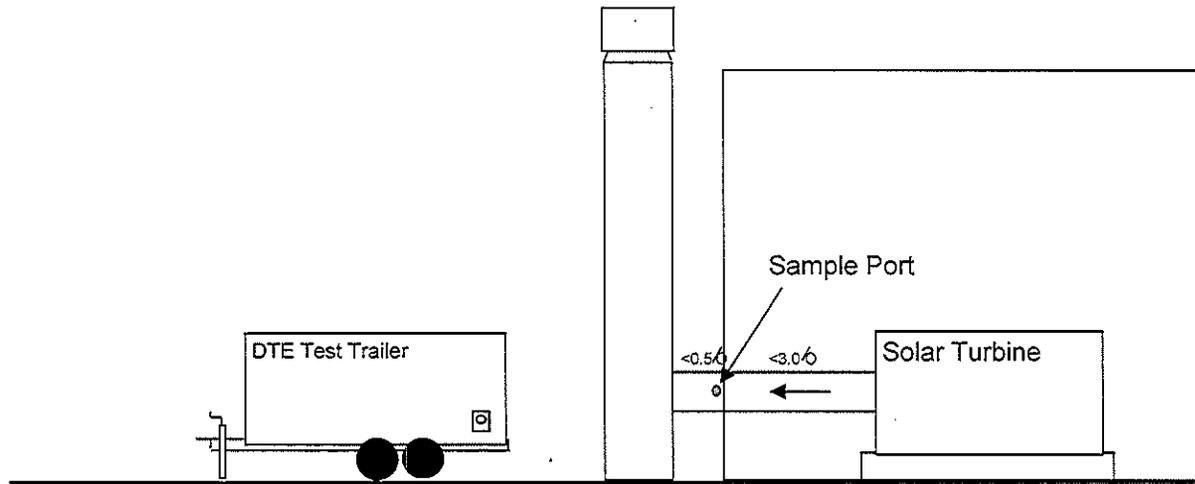




Figure 2 – USEPA Method 3A/7E/10 Sampling Train
Riverview Energy Systems
April 27 & 28, 2015

