EMISSION TEST REPORT

Report Title RESULTS OF THE PARTICULATE MATTER TESTING OF BOILER NO. 11

Report Date March 28, 2016

Test Dates February 24, 2016

Facility Information	
Name	Detroit Renewable Power, L.L.C.
Street Address	5700 Russell St.
City, County	Detroit, Wayne County

Facility Permit Information			
State Registration No.	M4148	ROP No.	MI-ROP-M4148-2011a

Testing Contractor	
Company Mailing Address	Derenzo Environmental Services 39395 Schoolcraft Rd. Livonia, MI 48150
Phone	(517) 268-0043
Project No.	1509004

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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
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 Detroit Renewable Power County Wayne

Source Address 5700 Russell St. City Detroit

AQD Source ID (SRN) M4148 ROP No. MI-ROP-M4148-2011a ROP Section No. Section 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 _____ To _____

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

Particulate matter emission test report for the exhaust associated with EUBOILER011.

The testing was conducted in accordance with the approved test protocol and the facility was operated in compliance with

the permit conditions or at the maximum routine operating conditions for the facility.

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

Linwood Bubar	President	(313) 972-4641
Name of Responsible Official (print or type)	Title	Phone Number
Signature of Responsible Official		4-4-16 Date

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

RESULTS OF THE
PARTICULATE MATTER TESTING
OF BOILER NO. 11

DETROIT RENEWABLE POWER, L.L.C.
DETROIT, MICHIGAN

1.0 INTRODUCTION

Detroit Renewable Power, L.L.C. (DRP) operates municipal solid waste (MSW) processing lines, three (3) refuse derived fuel (RDF) fired boilers, and an ash handling system at its Detroit, Michigan facility that are identified as flexible group FGMSWPROC-LINE, FGBOILERS011-013 and emission unit EUASH-HANDLING, respectively, in the State of Michigan Renewable Operating Permit MI-ROP-M4148-2011a issued to the facility.

Conditions of the operating permit require DRP to perform particulate matter compliance testing on each boiler contained in FGBOILERS011-013. Particulate matter emissions testing was performed in December, 2015 on Boiler No. 11. Results of the particulate matter emissions testing exceeded the emission limits specified in the operating permit. DRP representatives corrected issues discovered on the control device associated with Boiler No. 11 and a retest was performed on the Boiler No. 11 exhaust. This test report presents the results of the particulate matter retest performed on Boiler No. 11.

The boiler emission testing was performed February 24, 2016 by Derenzo Environmental Services representatives Blake Beddow, Jeff Schlaff and Andrew Rusnak. The project was coordinated by DRP representatives Ms. Tabetha Peebles and Mr. Damian Doerfer.

Mr. Tom Maza and Ms. Joyce Zhu of the Michigan Department of Environmental Quality, Air Quality Division (MDEQ-AQD) were on-site to observe portions of the compliance demonstrations. The exhaust gas sampling and analysis was performed using procedures specified in the Test Plan submitted to MDEQ-AQD dated September 24, 2015 and approved by the regulatory agency. The MDEQ-AQD waved the requirement to submit a new test plan 30-days prior to the test event.

Appendix 1 provides a copy of the test plan approval letter issued by the MDEQ-AQD.

Questions regarding this emission test report should be directed to:

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Report Certification

This test report was prepared by Derenzo Environmental Services based on field sampling data collected by Derenzo Environmental Services. Facility process data were collected and provided by DRP employees or representatives. This test report has been reviewed by DRP representatives and approved for submittal to the Michigan Department of Environmental Quality (MDEQ).

I certify that the testing was conducted in accordance with the approved test plan unless otherwise specified in this report. I believe the information provided in this report and its attachments are true, accurate, and complete.

Report Prepared By:

Andy Rusnak, QSTI
Technical Manager
Derenzo Environmental Services

Based on information and belief formed after reasonable inquiry, I believe the statements and information in this report are true, accurate and complete. The testing was performed in accordance with the approved test plan and the facility was operated in compliance with the permit conditions, at or near maximum routine operating conditions, during the test periods.

Facility Certification By:

Linwood Bubar
President
Detroit Renewable Power, L.L.C.

2.0 SUMMARY OF RESULTS

The particulate matter sampling conducted on the EUBOILER011 exhaust verified that the unit operated in compliance with the emission limit specified in ROP No. MI-ROP-M4148-2011a.

The following table presents a summary of the particulate matter sampling performed on Boiler No. 11. Detailed results are presented in Tables 6.1 of this report.

Table 2.1 Summary of air pollutant sampling performed on Boiler No. 11

Parameter	Reference Method Average Result	Allowable Limit
PM (gr/dscf @ 7% O_2)	0.004	0.010

3.0 SOURCE DESCRIPTION

3.1 Sources Tested

DRP receives MSW at its Detroit facility and processes the waste to generate RDF. MSW is handled on one (1) of three (3) processing lines. The processed RDF is combusted in three (3) identical Combustion Engineering Model VU40 dual-fuel boilers which generate superheated steam. A portion of the steam is provided to a turbine which produces electricity for sale to the local utility. Steam is also provided to Detroit Thermal L.L.C. for central heating purposes. Ash produced by the combustion of RDF is collected, wetted and transported to a storage area prior to removal from the facility for disposal.

3.2 Type of Raw Materials Used

The primary raw material is MSW. The facility is permitted to process 20,000 tons of MSW per week and 1,043,000 tons annually. Each boiler is rated to produce 362,800 lb of steam per hour at a pressure of 900 psig and temperature of 825 °F. The steam turbine can produce up to 68 megawatts (MW) of electricity.

3.3 Emission Control System Description

Each individual MSW processing line is equipped with a fabric filter baghouse associated with the primary shredder and a cyclone and fabric filter baghouse associated with the secondary shredder. The RDF storage area is equipped with fabric roof vent filters to prevent fugitive emissions.

Emissions from the combustion of RDF in the boilers are controlled by a lime-injection dry flue gas scrubber and a fabric filter baghouse, installed in series to control emissions of acid gases, metals, organics and particulate matter. CO, NO_x and VOC emissions are minimized through good combustion practices.

Fugitive particulate matter emissions from the ash handling storage facility are controlled by the installation of dust filters on the exhaust fans, properly wetting the ash material and washing and covering the ash hauling vehicles.

3.4 Process Operating Conditions During the Compliance Testing

During the Boiler No. 11 particulate matter compliance test program, DRP was running greater than 50% of maximum capacity. The boiler produced an average of 311,333 lb steam/hr (86% of maximum steam output).

DRP representatives provided operating data (boiler steam production) for each test period.

Table 3.1 presents a summary of the recorded operating data for the boiler.

Appendix 2 provides boiler steam production records.

Table 3.1 Summary of Operating Conditions during Compliance Testing

Unit	Parameter	Compliance Test Average	Units
Boiler No. 11 (PM Test)	Steam Production	311,333	lb/hr

4.0 SAMPLING AND ANALYTICAL PROCEDURES

A test plan for the compliance testing prepared by DRP and Derenzo Environmental Services and was reviewed by the MDEQ-AQD. This section provides a summary of the sampling and analytical procedures that were used during the test and presented in the test plan.

4.1 Summary of USEPA Test Methods

Derenzo Environmental Services performed the exhaust gas and pollutant measurements in accordance with the following USEPA reference test methods:

Parameter / Analyte	Sampling Methodology	Analytical Methodology
Velocity traverses	USEPA Method 1	Selection of sample and velocity traverse locations by physical stack measurements
Volumetric flow rate	USEPA Method 2	Measurement of velocity head using a Type-S Pitot tube and inclined manometer
Oxygen and Carbon dioxide	USEPA Method 3A	IR & Paramagnetic instrumental analyzers
Moisture	USEPA Method 4	Water weight gain in chilled impingers.
Particulate matter	USEPA Method 5	Gravimetrical analysis

In addition to the measurement methods specified in the previous table:

- USEPA Method 205; *Verification of Dilution Systems for Field Instrument Calibrations,* was used to verify linearity of the calibration gas dilution system.

4.2 Boiler Particulate Matter Testing

4.2.1 Sampling Location and Velocity Measurements (USEPA Methods 1 and 2)

The locations of the exhaust gas measurement ports meet the USEPA Method 1 criteria for a representative measurement location. The inner diameter of the stack is 91 inches. The stack is equipped with two (2) 9.0-inch sample ports, opposed 90°, that provided a sampling location 11.9 duct diameters downstream and greater than 26.4 duct diameters upstream from any flow disturbance.

The representative sample locations were determined in accordance with USEPA Method 1 based on the measured distance to upstream and downstream disturbances. The absence of significant cyclonic flow was determined at each sampling location.

Exhaust gas velocity was measured throughout each isokinetic sampling run using USEPA Method 2. Exhaust gas velocity pressure and temperature were measured at each sampling location in accordance with USEPA Method 2 using an S-type Pitot tube connected to a red-oil manometer. A K-type thermocouple mounted to the Pitot tube was used for temperature measurements. The pitot tube and connective tubing were leak-checked prior to each set of velocity measurements to verify the integrity of the measurement system.

Prior to performing the initial velocity traverse the S-type Pitot tube and manometer lines were leak-checked at the test site. These checks were made by blowing into the impact opening of the Pitot tube until 3 or more inches of water were recorded on the manometer, then capping the impact opening and holding it closed for 15 seconds to ensure that it was leak free. The static pressure side of the Pitot tube was leak-checked using the same procedure.

Appendix 3 provides drawings for the exhaust stack sampling location.

4.2.2 CO_2 and O_2 Determination (USEPA Method 3A)

CO_2 and O_2 content in the exhaust gas streams were measured continuously throughout each test period in accordance with USEPA Method 3A. The CO_2 content of the gas stream was monitored using a Servomex Model 1440D infrared (IR) gas analyzer. The O_2 content of the gas stream was monitored using a Servomex Model 1440D paramagnetic gas analyzer.

Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document). Sampling times were recorded on field data sheets.

Appendix 4 provides O_2 and CO_2 calculation sheets. Raw instrument response data are provided in Appendix 5.

4.2.3 Moisture Determination (USEPA Method 4)

Moisture content was measured concurrently with the isokinetic sampling trains and determined in accordance with USEPA Method 4. Moisture from the gas sample was removed by the chilled impingers of the isokinetic sampling train. The net moisture gain from the gas sample was determined by gravimetric analytical techniques in the field. Percent moisture was calculated based on the measured net gain from the impingers and the metered gas sample volume of dry air.

4.2.4 Determination of Particulate Matter (PM) (USEPA Method 5)

PM determinations in the boiler exhaust gas streams were made using a USEPA Method 5 train. Each sampling run was 60 minutes in duration.

A "goose-neck" nozzle constructed of stainless steel was connected via Teflon® fitting to a borosilicate glass probe liner within a heated stainless steel probe. The probe liner was attached to a heated glass filter holder containing a pre-weighed (tarred) glass fiber filter. The back half of the filter holder was connected directly to the impinger train. The impinger train consisted of a set of impingers, charged as follows:

1st impinger: 100 ml of H_2O
2nd impinger: 100 ml of H_2O
3rd impinger: empty (knock-out)
4th impinger: approximately 300 grams of pre-dried silica gel and glass fiber.

At the conclusion of the sample period the sample recovery procedures in Method 5 were followed to recover the filter. Polypropylene sample bottles were used to recover the probe and front half of the filter housing acetone rinses. Particulate matter analysis was performed by Bureau Veritas, NA, Inc. in Novi, MI.

Appendix 6 provides PM calculation sheets. The laboratory report is provided in Appendix 7.

5.0 INTERNAL QA/QC ACTIVITIES

5.1 Sampling System Response Time Determination

The response time of the sampling system was determined prior to the compliance test program by introducing upscale gas and zero gas, in series, into the sampling system using a tee connection at the base of the sample probe. The elapsed time for the analyzer to display a reading of 95% of the expected concentration was determined using a stopwatch.

The Servomex 1440D O_2 analyzer exhibited the longest system response time at 1 minutes 50 seconds. Results of the response time determinations were recorded on field data sheets. For each test period, test data were collected once the sample probe was in position for at least twice the maximum system response time.

5.2 Gas Divider Certification (USEPA Method 205)

STEC Model SGD-710C 10-step gas dividers were used to obtain appropriate calibration span gases. The ten-step STEC gas dividers were NIST certified (within the previous 12 months) with a primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivered calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas that was introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas dividers. The field evaluations yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

5.3 Instrumental Analyzer Interference Check

The instrumental analyzers used to measure O_2, and CO_2 have had an interference response test preformed prior to their use in the field (June 12, 2014), pursuant to the interference response test procedures specified in USEPA Method 7E. The appropriate interference test gases (i.e., gases that would be encountered in the exhaust gas stream) were introduced into each analyzer, separately and as a mixture with the analyte that each analyzer is designed to measure. All of analyzers exhibited a composite deviation of less than 3.0% of the span for all measured interferent gases. No major analytical components of the analyzers have been replaced since performing the original interference tests.

5.4 Determination of Exhaust Gas Stratification

A stratification test for the exhaust stack configuration was performed prior to the test periods. The stainless steel sample probe was positioned at sample points correlating to 16.7%, 50% and 83.3% across the stack diameter. Pollutant concentration data were recorded at each sample point for a minimum of twice the maximum system response time.

The recorded data for each exhaust stack gas indicate that the measured O_2 and CO_2 concentrations did not vary by more than 5% of the mean across the stack diameter. Therefore, the stack gas was considered to be unstratified and the sampling was performed at one (1) sampling locations within the exhaust stack.

5.5 Instrument Calibration and System Bias Checks

At the beginning of the test day, initial three-point instrument calibrations were performed for the CO_2 and O_2 analyzers by injecting calibration gas directly into the inlet sample port for each instrument. System bias checks were performed prior to and at the conclusion of each sampling period by introducing the upscale calibration gas and zero gas into the sampling system (at the base of the stainless steel sampling probe prior to the particulate filter and Teflon® heated sample line) and determining the instrument response against the initial instrument calibration readings.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of CO_2 and O_2 in nitrogen and zeroed using hydrocarbon free nitrogen. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

5.6 Isokinetic Sampling QA/QC

The Nutech® Model 2010 sampling consoles and dry gas meters, which were used to extract a metered amount of exhaust gas from the stacks were calibrated prior to and after the test event. The calibration procedure uses the critical orifice calibration technique presented in USEPA Method 5. The digital pyrometer in the Nutech metering console was calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator. The isokinetic variation was calculated for each one hour sampling period and determined to be within +/-10% of 100% as required by USEPA Method 5.

The Pitot tube used for velocity pressure measurements was inspected for mechanical integrity and physical design prior to the field measurements. The gas velocity measurement train (Pitot tube, connecting tubing and incline manometer) was leak-checked prior to the field measurements and periodically throughout the testing period.

All recovered samples were stored at the required temperatures and shipped in the method specified sample bottles. The liquid level on each bottle was marked with permanent marker and the caps were secured closed with tape. Samples of the reagents used in the test project were sent to the laboratory for analysis to verify that the reagents used to recover the samples did not bias the results.

The laboratory analyses were conducted by a qualified third-party laboratories according to the

appropriate QA/QC procedures of the associated USEPA methodologies and are included on the final laboratory report.

Appendix 8 provides information and quality assurance data for the equipment and instrumental analyzers used for the test periods (calibration data, copies of calibration gas certificates, gas divider certification, Pitot tube integrity inspection sheets, meter box critical orifice calibration records, and interference study records).

6.0 TEST RESULTS AND DISCUSSION

6.1 Test Results and Allowable Emission Limits

Air pollutant emission measurement results for the isokinetic sampling runs are presented in Tables 6.1.

ROP No. MI-ROP-M4148-2011a requires DRP to perform PM testing of the Boiler No. 11 exhaust in accordance with the requirements in the ROP. The compliance demonstration performed on February 24, 2016 demonstrated that Boiler No. 11 is operated in compliance with the allowable emission limits specified in the ROP.

6.2 Variations from Normal Sampling Procedures or Operating Conditions

The testing was performed in accordance with the Test Plan dated September 24, 2015 and specified USEPA test methods. All instrument calibrations and sampling period results satisfied the quality assurance verifications required by USEPA with the following exception.

The pretest meter calibration (dated 2/19/16) failed the No. 3 calibration orifice. The No. 3 calibration orifice had a calculated Y variation of 2.55% (exceeds the allowable 2.0% standard). The use of the meter was discussed with Mr. Tom Maza of the MDEQ and its use was approved. Immediately following the compliance demonstration (dated 2/25/16) the meter was recalibrated (without making any adjustments to the dry gas meter) and all three (3) calibration orifices were below the allowable 2.0% Y variation standard (Calibration orifice No. 3 had a Y variation of 0.92%).

Table 6.1. Boiler No. 11 Particulate Matter Sampling Results

Test No.	1	2	3	Three-test Average
Test Date	2/24/16	2/24/16	2/24/16	-
Test Time	904 - 1014	1058 - 1202	1248 - 1352	-
Boiler Steam Production (lb/hr)	319,000	299,000	316,000	311,333
Measured O_2 Content (%)	12.1	12.7	12.8	12.5
Measured CO_2 Content (%)	8.01	7.48	7.52	7.67
Measured flowrate (dscfm)	188,151	186,097	200,757	191,668
USEPA Method 5 PM Test Results				
Measured Catch (gr)	0.16	0.10	0.09	0.12
Sampled Volume (dscf)	44.4	43.7	46.5	44.9
PM Emissions (gr/dscf)	0.004	0.002	0.002	0.003
PM Emissions (gr/dscf@7% O_2)	***0.006***	***0.004***	***0.003***	***0.004***
Emission Limit (gr/dscf @7% O_2)	-	-	-	0.010