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Detroit Renewable Power
Detroit, Michigan

Final Report

Shredder Stacks & Ash Handling Building
2016 Source Testing Program
RWDI # 1600272
December 15, 2016

[redacted]

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI AIR Inc. (RWDI) was retained by Detroit Renewable Power to conduct emission sampling on the Primary and Secondary Shredder (300 Line) exhaust stacks and the Ash Handling Building at their facility located at 5700 Russell Street, Detroit, Michigan. The test program was conducted in order to fulfill the requirements of the Michigan Department of Environmental Quality (MDEQ) Title V Renewable Operating Permit (ROP) # MI-ROP-M4148-2011a dated August 19, 2011.

The Sampling Plan for this testing program was submitted August 25, 2016 to the Michigan Department of Environmental Quality (MDEQ). Approval for the testing program was granted by the MDEQ on September 23, 2016. Testing was conducted on the 300L Primary and Secondary Shredder exhaust stacks October 3, 2016 and on the Ash Handling Building October 4, 2016. A copy of the MDEQ approval letter can be found in Appendix B.

The following table represents a summary of the stack testing results and compares the testing results to the limits set out in Detroit Renewable Power's Renewable Operating Permit.

Parameter	Stack Testing Results			ROP Limit [1]
Limits from ROP: MI-ROP-M4148-2011a	**Primary**	**Secondary**	**Ash Handling Building**	
Particulate Matter (PM)	0.0020	0.0015	-	0.0028 lb/ 1000 lb flue gas
Visible Emissions	-	-	0	0

Notes:

[1] Refer to Appendix A for Renewable Operating Permit: MI-ROP-M4148-2011a

The results of the testing indicate that all parameters are in compliance with respect to the ROP limits. A summary of all testing results can be found in the Tables section of the report with detailed sampling results in the Appendices.

1. INTRODUCTION

RWDI AIR Inc. (RWDI) was retained by Detroit Renewable Power to conduct emission sampling on the 300L Primary and Secondary Shredder (EUMSWPPROC-LINE300) exhaust stacks and the Ash Handling Building (EUASH-HANDLING) at their facility located at 5700 Russell Street, Detroit, Michigan. The test program was conducted in order to fulfill the requirements of the Michigan Department of Environmental Quality (MDEQ) Title V Renewable Operating Permit (ROP) # MI-ROP-M4148-2011a dated August 19, 2011.

The Sampling Plan for this testing program was submitted August 25, 2016 to the Michigan Department of Environmental Quality (MDEQ). Approval for the testing program was granted by the MDEQ on September 23, 2016. The 2016 sampling program was completed from October 3 to October 18, 2016. Testing was conducted on the 300L Primary and Secondary Shredder exhaust stacks October 3, 2016 and on the Ash Handling Building October 4, 2016. A copy of the MDEQ approval letter can be found in Appendix B.

This stack testing study consisted of the following parameters:

- Total particulate matter (TPM);
- Velocity, flow rate and temperature;
- Visible Emission

2. SOURCE DESCRIPTION

2.1 Facility Description

Detroit Renewable Power is a refuse-derived fuel (RDF) plant that began commercial operation in October 1991. The facility is permitted to receive up to 20,000 tons of municipal solid waste (MSW) per week. The MSW is processed into RDF, which is then combusted in the furnaces, producing a maximum 362,800 pounds of steam per hour per unit. The steam is used to generate up to 68 megawatts of electricity and supply export steam at a rate of up to 550,000 pounds per hour. The energy products are sold to DTE Corporation and Detroit Thermal.

2.2 Process Description – Shredder Building

The Waste processing lines (FGMSWPROC-Lines) have identical sampling ports located in 17-inch diameter stacks for the Primary Shredder baghouse and 45-inch diameter stacks for the Secondary Shredder baghouse. There are three (3) separate lines associated with this process equipment (EUMSWPROC-LINE1, EUMSWPROC-LINE2, and EUMSWPROC-LINE3). 300 Line (EUMSWPROC-LINE3) was tested for the primary and secondary exhaust system.

FGMSWPROC-LINES includes all activities from receipt of MSW in the facility, weighing, delivery of MSW into the MSW Process Building, unloading in the tipping floor area, MSW loading into RDF process conveyor lines, RDF processing, storage, loading into 2 boiler feed conveyor lines, and conveying RDF into the Power Block Building. Refuse Derived Fuel (RDF) processing starts from the loaders feeding MSW into 3 lines each consisting of a feed conveyor, magnetic separator, primary shredder (controlled by a baghouse fabric filter system), screens, secondary shredder (controlled by a cyclone and a baghouse fabric filter system) and conveyor feed into RDF storage room. Fugitive particulate in MSW Process Building are controlled by ventilation exhaust fans with vent filters.

2.3 Process Description – Ash Handling Building

EU-ASHSYSTEM refers to the ash handling system including removal grate siftings, bottom ash and fly ash from the boilers and air pollution control systems. Grate siftings and bottom ash from each boiler are discharged to a quench trough and then removed by submerged scrap conveyors (SSC). Fly ash from the tubular air heater hoppers, economizer hoppers and fabric filter hoppers, is discharged to drag-flight conveyors (DFC). The flyash is transported via the DFCs to a surge bin and from there to a flyash conditioning system (i.e., pugmill where only water is added to wet dry material). Wetted flyash from this system is discharged onto the bottom ash conveyors and transported to the ash/loadout storage building prior to off-site disposal. Fugitive particulate emissions from the ash/loadout building are controlled by a ventilation exhaust filter system.

3. SAMPLING LOCATION

3.1 Source Sample Location Description

The primary stack is 17 inch in diameter and has two sampling ports, 90 degrees apart and 6 inches in diameter. The sampling ports were located 14 duct diameters downstream from the ID fan and 42 duct diameters upstream before the stack outlet. The secondary stack is 45 inch in diameter and has two sampling ports, 90 degrees apart and 6 inches in diameter. The sampling ports were located 11 duct diameters downstream from the ID fan and 16 duct diameters upstream before the stack outlet.

Figure 3.1a: Diagram of Flow Disturbance Distance and Stack Diameters for EUMSWPROC-LINE3 (Primary Shredder Baghouse)

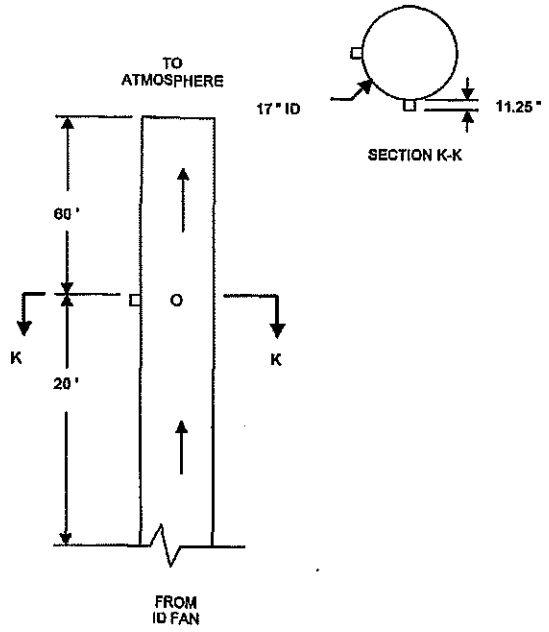
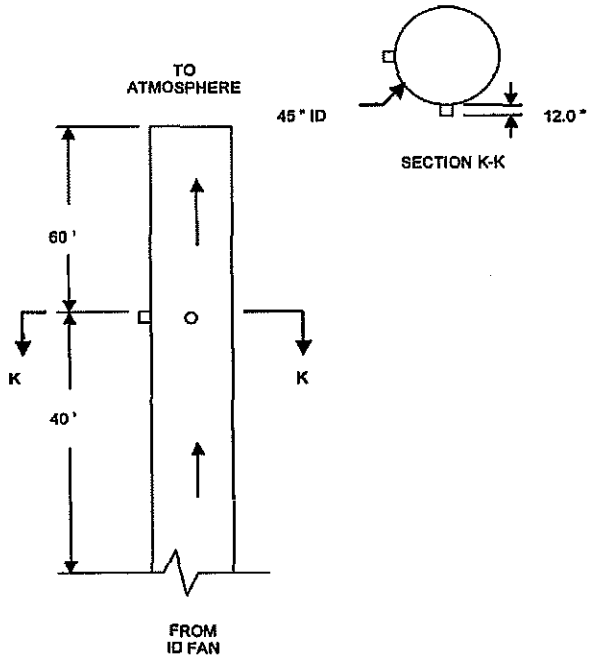


Figure 3.1b: Diagram of Flow Disturbance Distance and Stack Diameters for EUMSWPROC-LINE3 (Secondary Shredder Baghouse)



4. SAMPLING METHODOLOGY

The following section provides an overview of the sampling methodologies used in this program. Table 1, located in the **Tables** section, summarizes the testing parameters and corresponding methodologies.

4.1 Stack Velocity, Temperature, and Volumetric Flow Rate Determination

The exhaust velocities and flow rates were determined following the US EPA Method 2, "Determination of Stack Gas Velocity and Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer. Volumetric flow rates were determined following the equal area method as outlined in US EPA Method 2. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a digital temperature indicator.

The dry molecular weight of the stack gas was determined following calculations outlined in US EPA Method 3, "Determination of Molecular Weight of Dry Stack Gas". Stack moisture content was determined through direct condensation and according to US EPA Method 4, "Determination of Moisture Content of Stack Gas".

4.2 Sampling for Total Particulate Matter (TPM)- Shredder Stacks

Particulate concentrations and emission rates were determined utilizing EPA Method 5. The EPA Method 5 sampling train consists of a nozzle, a heated glass probe, a heated, tared quartz filter, and two chilled impingers each with 100 mL of DI water, an empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 5 with the following exceptions:

- Due to the potential safety hazards involved in testing an RDF processing shredder stack (potentially explosive area); it is not possible to conduct testing isokinetically at all sampling points as per EPA Method 1.
- As completed in previous years, isokinetic sampling will be conducted at one (1) sampling point which represents the average stack velocity (based on previous data from this source).

In order to complete this, the process line was turned off to allow testing personnel to enter the stack area; the sampling train was assembled (the sampling console (meterbox) and testing personnel were kept a safe distance from the sampling location; an umbilical was utilized to connect the console to the sampling train); a pre-selected nozzle (based on data collected from a previous test on this process line) was attached to the sampling probe; a pre-test leak check was performed; the sampling probe as inserted into the center of the stack. Testing personnel then evacuated the stack area. Then the process line was turned back on. The stack velocity (ft/sec) at this selected single point, was checked to ensure it was within 20% of the average of the previous test, then sampling commenced (confirming that isokinetic sampling can be maintained). If the stack velocity was not within 20% of the average of the previous test, the process line would have been turned off and another sampling point selected.

At the conclusion of the test, the process line was turned off and a final leak check performed. Three (3) sampling runs were conducted in this manner. Collected sample volumes were approximately 45 cubic feet. The temperature of the filter and probe were monitored and controlled to 248 $\pm$ 25^{0}F.

At the end of each test run, the nozzle, probe, and filter front half were rinsed with acetone into a sample jar. The filter was recovered dry into a sample jar. The moisture catch was then determined gravimetrically. The moisture catch in the silica gel was also determined gravimetrically. The samples were analyzed in accordance with EPA Method 5.

4.3 Visible Emission Monitoring – Ash Handling Building

The accumulated emissions time of fugitive emissions was determined by observing the process area(s) during normal operations for three, 1-hour time periods. The times included periods when ash is being transferred from the MWC unit to the storage area, and when ash is being loaded for disposal. This method does not require that the opacity of emissions be determined, but rather the length of time that any fugitive emissions are visible. Fugitive emissions include emissions that escape capture by exhaust hoods; that are emitted during material transfer; that are emitted from building housing material processing or handling equipment; or that are emitted directly from process equipment. If any fugitive emissions are observed during the observation period, the length of time that the emissions are visible is quantified using a stopwatch. This total accumulated time of fugitive emissions is then used to determine compliance with the permit and Subpart Cb.

4.4 Quality Assurance/ Quality Control Activities

Applicable quality assurance measures were implemented during the sampling program to ensure the integrity of the results. These measures included detailed documentation of field data, equipment calibrations for all measured parameters, completion of Chain of Custody forms when submitting laboratory samples, and submission of field blank samples to the laboratories. Table 2 presents a sample log and summarizes the sampling times, sample ID's and filter ID's.

Leak checks were performed on the Method 5 sampling train by plugging the sample inlet and pulling a representative vacuum. This check was done before and after each test. Similar leak check procedures for pitot tube and pressure lines were also conducted. Daily temperature sensor audits were completed by noting the ambient temperature, as measured by a reference thermometer, and comparing these values to those obtained from the stack sensor. Leak checks for each test were documented on the field data sheets presented in the applicable appendices for each sample parameter.

5. RESULTS

The average emission results for this study are presented in the **Tables** section of this report. Table 2 presents a summary of test dates and times. A minimum of three (3) tests on the stack was performed for all of the parameters tested in the study. Detailed information regarding each test run can be found in the corresponding Appendix. Below is a summary of the applicable Table and Appendix ID with corresponding test parameter.

Parameter	Table	Appendix
Stack Gas Characteristics	3	C
Total Particulate Matter and Selected Metals	4	C
Visible Emissions	5	G
ROP Limit Comparison	6	-

All calibration information for the equipment used for this study is included in Appendix E. All laboratory results are included in Appendix F.

6.1 Discussion of Results

Particulate measurement results for both the 300L Primary and Secondary (EUMSWPPROC-LINE300) indicate that the sources are in compliance with respect to the ROP limits.

There was no visible emission observed during the test time for the Ash Handling Building (EUASH-HANDLING) and therefore it is also in compliance with respect to the ROP limits.

When the laboratory reported values less than their method detection limit for a specific component, the respective concentration and emission rates were calculated using this reportable detection limit (RDL). This method is a conservative approach when calculating the emissions.

6. OPERATING CONDITIONS

Operating conditions during the sampling were monitored by Detroit Renewable Power personnel. All equipment was operated under normal maximum operating conditions.

Radio contact was kept between the process operators and the sampling team. A member of the RWDI sampling team contacted the operator before each test, to ensure that the process was at normal operating conditions.

7. CONCLUSIONS

Testing was conducted on the 300L Primary and Secondary Shredder exhaust stacks (EUMSWPPROC-LINE300) October 3, 2016 and on the Ash Handling Building (EUASH-HANDLING) October 4, 2016. All sources were tested in accordance with referenced methodologies following the MDEQ approved Sampling Plan submitted August 25, 2016.

Table 1: Summary of Sampling Parameters and Methodology

Source Location	No. of Tests per Stack	Sampling Parameter	Sampling Method
Primary Shredder	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1-4
	3	Total Particulate Matter	U.S. EPA [2] Method 5
Secondary Shredder	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1-4
	3	Total Particulate Matter	U.S. EPA [2] Method 5
Ash Handling Building	3 - 1 hour periods	Visbile Emissions	U.S. EPA [2] Method 22

Notes:

[1] CARB- California Environmental Protection Agency

[2] U.S. EPA - United States Environmental Protection Agency

Table 2: Sampling Summary and Sample Log

Source and Test #	Sampling Date	Start Time	End Time	Filter ID / Trap ID	Lab Sample ID
Primary Shredder	**Velocity / Total Particulate**				
Blank	3-Oct-16	-	-	-	DFW992
Test #1	3-Oct-16	10:27 AM	1:40 PM	16092016	DFW995
Test #2	3-Oct-16	3:23 PM	4:23 PM	16092018	DFW996
Test #3	3-Oct-16	5:17 PM	6:17 PM	16092014	DFW997
Secondary Shredder	**Velocity / Total Particulate**				
Blank	3-Oct-16	-	-	-	DFW992
Test #1	3-Oct-16	10:27 AM	1:40 PM	16092015	DFW998
Test #2	3-Oct-16	3:23 PM	4:23 PM	16092017	DFW999
Test #3	3-Oct-16	5:17 PM	6:17 PM	16092013	DFX000
Ash Handling Building	**Opacity**				
Test #1	4-Oct-16	10:50 AM	12:00 PM	-	-
Test #2	4-Oct-16	12:05 PM	1:15 PM	-	-
Test #3	4-Oct-16	1:20 PM	2:30 PM	-	-

Table 3: Sampling Summary - Flow Characteristics

Stack Gas Parameter		Primary Shredder			Secondary Shredder		
		Test No. 1 TPM [1]	Test No. 2 TPM [1]	Test No. 3 TPM [1]	Test No. 1 TPM [1]	Test No. 2 TPM [1]	Test No. 3 TPM [1]
Testing Date		**3-Oct-16**	**3-Oct-16**	**3-Oct-16**	**3-Oct-16**	**3-Oct-16**	**3-Oct-16**
Stack Temperature	°F	70	71	72	80	84	86
	°C	21	22	22	27	29	30
Moisture	%	1.7%	2.9%	2.1%	2.4%	2.1%	1.8%
Velocity	ft/s	35.90	35.36	35.53	34.30	34.23	35.53
	m/s	10.94	10.78	10.83	10.45	10.43	10.22
Actual Flow Rate	CFM	3,395	3,344	3,360	22,730	22,686	22,217
Referenced Flow Rate[2]	CFM	3,344	3,249	3,287	21,835	21,708	21,226
Sampling Isokinetic Rate	%	100	102	101	101	102	101

Notes:

[1] TPM = Sampling for total particulate matter and metals

[2] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Detailed sampling results including individual test results can be found in Appendix C and D

Table 4: Total Particulate Matter – Averaged Results

	Primary Shredder			Secondary Shredder		
	Concentration @ Actual O_2	Concentraion	Emission Rate	Concentration @ Actual O_2	Concentraion	Emission Rate
Particulate	**(gr/dscf)**	**(lbs/^{1000}lbs$_{flue\ gas}$)**	**(lbs/hr)**	**(gr/dscf)**	**(lbs/^{1000}lbs$_{flue\ gas}$)**	**(lbs/hr)**
Total Particulate Matter	< 0.001	< 0.00202	< 0.03	< 0.0008	< 0.00153	< 0.15

Notes:

[1] Sampling followed U.S. EPA Method 5 (TPM)

[2] When laboratory analysis was below the reportable detection limit, this detection limit was used to calculate the concentration and emission rate

Detailed sampling results including individual test results can be found in Appendix C

Table 5: Ash Handling Building – Visible Emissions Results

	Ash Handling Building		
	Test 1 10:50 to 12:00	Test 2 12:05 to 13:15	Test 3 13:20 to 14:30
Parameter	# of Observations	# of Observations	# of Observations
Observations of Visible Emisions	0	0	0

Detailed sampling results including individual test results can be found in Appendix G

Table 6: Permit Limit Comparisons

Parameter	Stack Testing Results [1]	Stack Testing Results [1]	Stack Testing Results [1]	ROP Limit [1]
Limits from ROP: MI-ROP-M4148-2011a	**Primary Shredder**	**Secondary Shredder**	**Ash Handling**	
Particulate Matter (PM)	0.0020	0.0015	-	0.0028 $lbs/^{1000}lbs_{flue\ gas}$
Observations of Visible Emissions			0	0

Notes:

[1] Refer to Appendix A for Renewable Operating Permit: MI-ROP-M4148-2011a