BOILER NUMBER ONE
PELLET TRIALS TEST PROGRAM
EMISSIONS TEST REPORT

L'ANSE WARDEN ELECTRIC COMPANY, LLC.
157 South Main Street
L'Anse, Michigan 49946

February 2018

W.O. No. 14464.007.007

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 (RO) Permit 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 described in General Condition No. 22 in the RO Permit and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name L'Anse Warden Electric Company LLC County Baraga

Source Address 157 S. Main Street City L'Anse

AQD Source ID (SRN) B4260 RO Permit No. MI-ROP-B4260-2011 RO Permit Section No. _____

Please check the appropriate box(es):

☐ **Annual Compliance Certification (General Condition No. 28 and No. 29 of the RO Permit)**

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 RO Permit, 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 RO Permit.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, 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 RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (General Condition No. 23 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the RO Permit 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 RO Permit 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 12/18/17 To 12/19/17

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

Emission 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.

James R. Richardson	Technical Manager	906-885-7187
Name of Responsible Official (print or type)	Title	Phone Number
		16/February/2018
Signature of Responsible Official		Date

1. INTRODUCTION

Weston Solutions, Inc. (WESTON) was retained by L'Anse Warden Electric Company, LLC (LWEC) to perform an emissions testing program on the Boiler No. 1 exhaust duct at the LWEC facility located in L'Anse, Baraga County, Michigan. Boiler No. 1 was previously a coal, oil, and gas-fired steam generating station and has been converted to burn biomass. The facility currently operates under the State of Michigan Renewable Operating Permit (ROP) No. MI-ROP-B4260-2011 and the Michigan Department of Environmental Quality (MDEQ) Air Quality Division (AQD) Permit to Install (PTI) 53-17, issued 18 August 2017, which allows for a temporary (180 calendar days) trial use of engineered fuel pellets as part of LWEC's fuel stream.

The objective of this test program was to determine concentrations and emission rates of particulate matter (PM), particulate matter ≤ 10 microns (PM10), metals (As, Pb, Mn, Ni), hydrogen chloride (HCl), nitrogen oxides (NOx), and sulfur dioxide (SO_2) during three separate engineered pellet fuel test trials as required by the PTI. Testing was used to determine the maximum percentage of pellets in the fuel mix, and the minimum required rate of reagent injection.

WESTON's Integrated Air Services (IAS) group completed all required testing during 18-20 December 2017. A representative of the MDEQ was present throughout the testing.

1.1 PLANT INFORMATION

L'Anse Warden Electric Company, LLC
157 South Main Street
L'Anse, Michigan 49946
Mr. JR Richardson, Technical Manager
Phone: 906-885-7187

1.2 TESTING FIRM INFORMATION

Weston Solutions, Inc.
1400 Weston Way
West Chester, PA 19380
Mr. Ken Hill, Senior Project Manager
Phone: 610-701-3043

1.3 ANALYTICAL LABORATORIES

Maxxam Analytics
6740 Campobello Road
Mississauga, Ontario, Canada
Mr. Clayton Johnson, Project Manager – Air Toxics
Phone: 905-817-5769

ALS Group USA, Corp.
ALS Environmental
3860 S. Palo Verde Road, Suite 302
Tucson, AZ 85714
Ms. Wendy Hyatt, Client Services Manager
Phone: 520-573-1061

1.4 SUMMARY OF TEST PARAMETERS

All testing was performed pursuant to WESTON's Emissions Test Protocol submitted in September 2017 (Revision 1, submitted November 2017). Table 1-1 provides the test parameters, associated test methods, and reporting units for this test program.

Following this introduction, Section 2 provides a summary of the test results. Section 3 provides a description of the process and sampling locations. Section 4 provides a description of the sampling and analytical procedures. Section 5 outlines the fuel processing, fuel sampling and analytical procedures to be used during the test program. Section 6 provides quality assurance and quality control procedures (QA/QC). Appendix A provides detailed test results. Raw test data, boiler operating data, laboratory reports, fuel sample results, quality control records, example calculations, and listing of project participants are provided in Appendices B through H, respectively.

Table 1-1
Summary of Test Parameters

No of Test Conditions[1]	No of Test Runs and Duration	Analytical Parameters and Test Method	Reporting Units[2]	PTI 53-17 Emissions Limits
3	9 runs on pellets, 84 min.	PM-Metals/EPA 5 & 29	gr/dscf, lb/MMBtu, lb/hr	19.2 lb/hr (PM) 0.06 lb/MMBtu (PM) 0.02 lb/hr (Pb)
	9 runs on pellets, 95-105 min.	PM_{10}/EPA 201A-202	gr/dscf, lb/hr	15.4 lb/hr
	9 runs on pellets, 60 min.	HCl/Modified EPA 26A	ppmvd, lb/hr	2.17 lb/hr
	9 runs on pellets, ~120 min.	NOx, EPA 7E	ppmvd, lb/hr	145 lb/hr
	9 runs on pellets, ~120 min.	SO_2, EPA 6C	ppmvd, lb/hr	290 lb/hr
	9 runs on pellets, ~120 min.	O_2/CO_2, EPA 3A	%	---

1 Three separate pellet firing conditions: Condition 1 - 9.1%, Condition 2 - 12.4%, and Condition 3 - 16% of the total fuel mix.

2 lb/MMBtu emission factors calculated by EPA 19 and LWEC provided F_d-factor from the CO CEMS.

2. SUMMARY OF TEST RESULTS

2.1 TEST RESULTS DISCUSSION

Tables 2-1 through 2-3 of this section provide summaries of the compliance test results for each pollutant parameter. Any differences in the test results summary tables and detailed test results shown in the appendices are due to rounding the results for presentation purposes.

It should be noted the Condition 3 (16% pellets and 150 lb/hr of reagent) test conducted on 20 December 2017 was considered invalid as explained in the letter (dated 2 February 2018) submitted to MDEQ. As such, all Condition 3 test data and results have been omitted from this test report.

There were no other sampling or operational issues that impacted the field testing, and the results presented are believed to be representative of the emissions encountered during the test periods.

Table 2-1
Boiler No.1
Summary of Test Results
Condition One – 9.1% Pellets, 100 lb/hr Reagent

Pollutant	Test Run Number				PTI 53-17 Emissions Limit
	1	2	3	Average	
Particulate Matter (PM) (lb/hr)	1.19	2.02	0.94	1.38	19.2 lb/hr
Particulate Matter (PM) (lb/MMBtu)	0.004	0.007	0.003	0.005	0.06 lb/MMBtu
Particulate Matter $\leq$ 10 microns (PM_{10}) (lb/hr)	4.52	4.20	4.80	4.51	15.4 lb/hr
Particulate Matter $\leq$ 10 microns (PM_{10}) (lb/MMBtu)	0.016	0.017	0.018	0.017	---
Lead (Pb) (lb/hr)	1.22E-03	1.76E-03	1.10E-03	1.36E-03	0.02 lb/hr
Arsenic (As) (lb/hr)	1.96E-04	2.82E-04	2.41E-04	2.40E-04	---
Manganese (Mn) (lb/hr)	1.78E-02	6.38E-03	4.09E-03	9.44E-03	---
Nickel (Ni) (lb/hr)	1.17E-04	3.21E-04	5.01E.05	1.63E-04	---
Hydrogen Chloride (HCl) (lb/hr)	1.41	1.01	0.77	1.07	2.17 lb/hr
Nitrogen Oxides (NOx) (lb/hr)	72.5	67.4	71.5	70.5	145 lb/hr
Sulfur Dioxide (SO_2) (lb/hr)	5.9	6.1	7.0	6.3	290 lb/hr

Table 2-2
Boiler No.1
Summary of Test Results
Condition Two – 12.4% Pellets, 125 lb/hr Reagent

Pollutant	Test Run Number				PTI 53-17 Emissions Limit
	1	2	3	Average	
Particulate Matter (PM) (lb/hr)	3.66	2.59	2.09	2.78	19.2 lb/hr
Particulate Matter (PM) (lb/MMBtu)	0.012	0.009	0.007	0.010	0.06 lb/MMBtu
Particulate Matter $\leq$ 10 microns (PM_{10}) (lb/hr)	4.99	4.64	2.75	4.13	15.4 lb/hr
Particulate Matter $\leq$ 10 microns (PM_{10}) (lb/MMBtu)	0.017	0.016	0.010	0.014	---
Lead (Pb) (lb/hr)	1.12E-03	1.12E-03	1.09E-03	1.11E-03	0.02 lb/hr
Arsenic (As) (lb/hr)	2.80E-04	2.18E-04	1.97E-04	2.32E-04	---
Manganese (Mn) (lb/hr)	4.65E-03	4.47E-03	4.16E-03	4.43E-03	---
Nickel (Ni) (lb/hr)	2.22E-04	1.16E-04	3.34E-04	2.24E-04	---
Hydrogen Chloride (HCl) (lb/hr)	1.11	0.74	2.13	1.33	2.17 lb/hr
Nitrogen Oxides (NOx) (lb/hr)	72.3	69.1	73.8	71.7	145 lb/hr
Sulfur Dioxide (SO_2) (lb/hr)	11.9	9.3	8.9	10.0	290 lb/hr