ADVANCED INDUSTRIAL RESOURCES

BOILER MACT TEST REPORT
NO. 11 BOILER
(MERCURY)
AT
VERSO ESCANABA LLC
ESCANABA, MICHIGAN
PROJECT ID: KR- 9989

PREPARED FOR:

VERSO

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Test Date:

MAY 23, 2018

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

Verso Escanaba, LLC. (VE), is a pulp and paper mill in Escanaba, Michigan. Processes at the facility include the No. 11 Boiler. The facility is operated under the Michigan Department of Environmental Quality (MDEQ) issued Renewable Operating Permit (ROP) Number MI-ROP-A0884-2016. The No. 11 Boiler is also subject to the operational and emission limits established under 40 CFR 63 Subpart DDDDD – *NESHAP for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters*.

This document describes the test report for establishing compliance with the applicable emissions limits set-forth in the referenced NESHAP guidance as well as establishing source and control device operational limitations and ranges.

Testing was conducted on the No. 11 Boiler exhaust duct and stack to quantify the emissions of mercury.

The field sampling portion of the test program was conducted on May 23, 2018, in accordance with the site-specific Test Plan submitted to the MDEQ. All test methods and procedures were performed by Advanced Industrial Resources, Inc. (*AIR*) in accordance with approved USEPA Methods (i.e., 40 CFR 60 Appendix A Methods 1, 2, 3a, 4, 19, and 30B).

1.2 KEY PERSONNEL

The key personnel who coordinated the test program and their telephone numbers are:

Adam Becker, Environmental Engineer, Verso Escanaba LLC	906-233-2929
Derek Stephens, Advanced Industrial Resources	404-843-2100
Scott Wilson, Advanced Industrial Resources	800-224-5007

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS & CONTROL EQUIPMENT DESCRIPTION

Verso Escanaba LLC operates a pulp and paper mill in Escanaba, Michigan. Processes at the facility include the No. 11 Boiler.

The No. 11 Boiler (EU11B68), installed 1981, modified 1986, is an ABB Combustion Engineering combination fuel boiler rated for 750,000 pounds of steam per hour (approximately 1040 million BTU per hour heat input) that provides steam for mill processes and steam turbine-generators for producing electricity. The No. 11 Boiler is permitted to burn natural gas and solid fuels, which include pulverized coal, wood residue, wastewater treatment plant residuals, Tire-Derived Fuel (TDF), and non-hazardous secondary material (NHSM) engineered fuel pellets. Emissions from the No. 11 Boiler are controlled by an over-fired air system (OAF), multi-clone, and electrostatic precipitator. Opacity is monitored by a COMS which meets the design, installation, performance and certification requirements of Performance Specification 1 under Appendix B of 40 CFR 60 and the quality assurance requirements of Procedure 2 under Appendix F to 40 CFR 60. The COMS also meets the requirements of 63.7525. The boiler utilizes an oxygen trim system to maintain optimum air to fuel ratios. For purposes of Boiler MACT compliance, the No. 11 Boiler is in the *hybrid suspension/grate burners designed to burn wet biomass/bio-based solid* subcategory. The Table 2-1 summarizes the applicable Boiler MACT emissions limits and operating parameters associated with No. 11 Boiler.

Table 2-1
Boiler No. 11 Summary of Applicable Emissions Limits and Operating Parameter

Pollutant	Emissions Limit	Control Device	Operating Parameter
Hg	5.7E-06 lb/MMBtu heat input	Multi-Cyclone, Dry ESP	Hg input loading to boiler

The applicable operating limits and compliance methodology for each parameter are summarized below in Table 2-2. Operating limits have been set through Initial Performance Testing and may be modified based on subsequent testing. Operational data collected during the performance test runs is included in Appendix G.

Table 2-2
Boiler No. 11 Summary of Operating Limits

Parameter	Compliance Methodology	Operating Limit
Operating Load	Conduct initial and annual performance testing for Hg. Maintain the operating load such that the 30-day rolling average steam flow rate does not exceed 110% of the highest hourly average operating load recorded during the most recent performance test.	698 KPPH (max. avg. steam flow); 767 KPPH (110% of max. avg. steam flow-2017)
Hg Input Loading	Monitor Hg monthly pollutant loading to the boiler by monitoring each fuel type's heat input to the boiler and multiplying that by the pollutant concentration and maintain Hg loading at or below the level established during the performance test with maximum HCl loading.	2.69E-06 lbs Hg/mmBTU heat input

2.2 SAMPLING LOCATION

The sampling location for mercury emissions testing on the No. 11 Boiler exhaust is located at greater than 8.0 equivalent diameters downstream from the nearest upstream flow disturbance and at least 2.0 equivalent diameters upstream from the stack exhaust. The exhaust stack has a circular cross-section with an internal diameter of 168.0 inches. The stack has four sampling ports oriented on a 90 degree horizontal plane perpendicular to the exhaust flow direction. A schematic diagram of the sampling location is presented in Appendix D. Twelve (12) sampling points (three points per port) were used for USEPA Methods 2, 3A, 4, and 30B sampling, in accordance with USEPA Method 1 requirements.

3.0 SUMMARY AND DISCUSSION OF TEST RESULTS

3.1 OBJECTIVES

The purpose of the testing was to conducted on the No. 11 Boiler exhaust duct and stack to quantify the emissions of mercury

3.2 FIELD TEST CHANGES, PROBLEMS, OR ITEMS OF NOTE

The testing was conducted in accordance with the Site-Specific Test Protocol submitted to the MDEQ. No problems were encountered during testing that required deviation from the planned test protocol.

3.3 PRESENTATION OF TEST RESULTS

Emission rates and concentrations are summarized and compared to NESHAP BMACT limits in Table 3-1. Complete emissions data are presented in Appendix A and Reduced and tabulated data from the field-testing is included in Appendix B. The calculations and nomenclature used to reduce the data are presented in Appendix C. Actual raw field data sheets are presented in Appendix D. Laboratory reports and custody records are presented in Appendix E.

TABLE 3-1: Results Summary - BMACT (63 DDDDD) Emission Standards

Source	Pollutant	Average Measured	Allowable	Units	% of Allowable
No. 11 Power Boiler	Hg	5.8E-07	5.7E-06	lb / MMBtu	**10%**

3.4 PROCESS OPERATION DATA

All essential process and control device monitoring equipment was operating and data was being recorded throughout the test periods. Data collected is presented in Appendix G and includes heat input rates per fuel type, applicable CEMS and COMS data, control device operating parameters and steam production rates.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Emission rate testing was performed on the No. 11 Power Boiler exhaust in accordance with 40 *CFR* 60 Appendix A. Specifically:

- EPA Method 1 was used for the qualification of the location of sampling ports and for the determination of the number and positions of stack traverse points, as applicable to sample traverses for Method 2.

- EPA Method 2 was employed for the determination of the stack gas velocity and volumetric flow rate during stack sampling using the Type "S" Pitot tube.

- EPA Method 3A was used for the calculation of the density and dry molecular weight of the effluent stack gas as well as to determine the oxygen and carbon dioxide concentrations using a calibrated instrumental analyzer.

- EPA Method 4 was used for the determination of moisture content.

- EPA Method 19 was to determine the heat input of the boiler and was used to report the applicable emissions in the units of lbs/MMBtu.

- EPA Method 30B was used for the determination of total vapor phase mercury emissions.

All samples were stored upright in a closed sample box until final laboratory analysis. In order to limit the chain of custody, only essential *AIR* personnel are permitted access to these samples.

5.0 QUALITY ASSURANCE ACTIVITIES

The quality assurance/quality control (QA/QC) measures associated with the sampling and analysis procedures given in the noted EPA reference methodologies, in Subparts A of 40 *CFR* 60 and 40 *CFR 63*, and in the *EPA QA/QC Handbook*, Volume III (EPA 600/R-94/038c) were employed, as applicable. Such measures included, but were not limited to, the procedures detailed below.

5.1 PROBE NOZZLE DIAMETER CHECKS

Probe nozzles were calibrated before field testing by measuring the internal diameter of the nozzle entrance orifice along three different diameters. Each diameter was measured to the nearest 0.001 inch, and all measurements were averaged. The diameters were within the limit of acceptable variation of 0.004".

5.2 PITOT TUBE FACE PLANE ALIGNMENT CHECK

Before field testing, each Type S Pitot tube was examined in order to verify that the face planes of the tube were properly aligned, per Method 2 of 40 *CFR* 60, Appendix A. The external tubing diameter and base-to-face plane distances were measured in order to verify the use of 0.84 as the baseline (isolated) Pitot coefficient. At that time the entire probe assembly (i.e., the sampling probe, nozzle, thermocouple, and Pitot tube) was inspected in order to verify that its components met the interference-free alignment specifications given in EPA Method 2. Because the specifications were met, then the baseline Pitot coefficient was used for the entire probe assembly.

After field testing, the face plane alignment of each Pitot tube was checked. No damage to the tube orifices was noted.

5.3 METERING SYSTEM CALIBRATION

Every three months each dry gas meter (DGM) console is calibrated at five orifice settings according to Method 5 of 40 *CFR* 60, Appendix A. From the calibration data, calculations of the values of Y_m and $\Delta H_@$ are made, and an average of each set of values is obtained. The limit of total variation of Y_m values is ± 0.02, and the limit for $\Delta H_@$ values is ± 0.20.

After field testing, the calibration of the DGM console was checked by performing three calibration runs at a single intermediate orifice setting that is representative of the range used during field-testing. Each DGM was within the limit of acceptable relative variation from Y_m of 5.0%.

5.4 TEMPERATURE GAUGE CALIBRATION

After field testing, the temperature measuring instruments on each sampling train was calibrated against standardized mercury-in-glass reference thermometers. Each indicated temperature was within the limit of acceptable variation between the absolute reference temperature and the absolute indicated temperature of 1.5%.

5.5 INSTRUMENT INTERFENCE RESPONSE

AIR obtained instrument vendor data that demonstrates the interference performance specification is not exceeded as defined in EPA Method 7E Section 13.4. Documentation is provided in Appendix D.

5.6 DATA REDUCTION CHECKS

AIR ran an independent check (using a validated computer program) of the calculations with predetermined data before the field test, and the *AIR* Team Leader conducted spot checks on-site to assure that data was being recorded accurately. After the test, *AIR* checked the data input to assure that the raw data had been transferred to the computer accurately.

5.7 EXTERNAL QUALITY ASSURANCE

5.7.1 TEST PROTOCOL EVALUATION

A Site-Specific Test Protocol (SSTP) was submitted to MDEQ in advance of testing, which provided regulatory personnel the opportunity to review and comment upon the test and quality assurance procedures used in conducting this testing.

5.7.2 ON-SITE TEST EVALUATION

A test schedule was submitted with the Site-Specific Test Protocol and MDEQ personnel were notified of all changes in the schedule. No tests were performed earlier than stated in the original schedule. Therefore, regulatory personnel were afforded the opportunity for on-site evaluation of all test procedures.

6.0 DATA QUALITY OBJECTIVES

The data quality objectives (DQOs) process is generally a seven-step iterative planning approach to ensure development of sampling designs for data collection activities that support decision making. The seven steps are as follows: (1) defining the problem; (2) stating decisions and alternative actions; (3) identifying inputs into the decision; (4) defining the study boundaries; (5) defining statistical parameters, specifying action levels, and developing action logic; (6) specifying acceptable error limits; and (7) selecting resource-effective sampling and analysis plan to meet the performance criteria. The first five steps are primarily focused on identifying qualitative criteria such as the type of data needed and defining how the data will be used. The sixth step defines quantitative criteria and the seventh step is used to develop a data collection design. In regards to emissions sampling, these steps have already been identified for typical monitoring parameters.

Monitoring methods presented in 40 *CFR* 60 Appendix A indicate the following regarding DQOs: Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods. At a minimum, each method provides the following types of information: summary of method; equipment and supplies; reagents and standards; sample collection, preservation, storage, and transportation; quality control; calibration and standardization; analytical procedures, data analysis and calculations; and alternative procedures. These test methods have been designed and tested according to DQOs for emissions testing and analysis. These test methods have been specified and were followed in accordance with the Site-Specific Test Protocol submitted to MDNRE to ensure that DQOs were met for this project.