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BOILER MACT COMPLIANCE TEST REPORT
NO. 9 BOILER
(NORTH & SOUTH STACKS)
AT
ESCANABA PAPER COMPANY
ESCANABA, MICHIGAN
PROJECT ID: KR- 9340

PREPARED FOR:

VERSO

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Test Date:
SEPTEMBER 3-4, 2015

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

The Verso Corporation operates The Escanaba Paper Company (EPC) pulp and paper mill in Escanaba, Michigan. Processes at the facility include the No. 9 Boiler. The facility is operated under the Michigan Department of Environmental Quality (MDEQ) issued Renewable Operating Permit (ROP) Number MI-ROP-A0884-2008a. The No. 9 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. 9 Boiler exhaust stacks (North & South) to quantify the emissions of particulate matter (total filterable), carbon monoxide, hydrogen chloride, and mercury.

The field sampling portion of the test program was conducted on September 3-4, 2015, 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, 5, 10, 26A, and 30B).

1.2 KEY PERSONNEL

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

Paula LaFleur, Escanaba Paper Company	906-233-2603
Todd Schmidt, Escanaba Paper Company	906-233-2929
Derek Stephens, *QSTI I-IV*, 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

Escanaba Paper Company operates a pulp and paper mill in Escanaba, Michigan. Processes at the facility include the No. 9 Boiler.

The No. 9 Boiler (EU9B03) is a Babcock & Wilcox boiler rated for 250,000 pounds of steam per hour (approximately 360 million BTU per hour heat input) that provides steam for mill processes and steam turbine-generators for producing electricity. The No. 9 boiler burns primarily wood residue and natural gas, but is also permitted to burn paper cores. Emissions from the No. 9 Boiler are controlled by a multi-clone and two (2) wet scrubbers and are vented to the atmosphere from two (2) separate but identical stacks identified as the North and South stacks. The boiler utilizes an oxygen trim system to maintain optimum air to fuel ratios. For purposes of Boiler MACT compliance, the No. 9 Boiler is in the *hybrid suspension/grate burners designed to burn wet biomass/bio-based solid* subcategory. Table 2-1 summarizes the applicable Boiler MACT emissions limits and operating parameters associated with No. 9 Boiler.

Table 2-1
Boiler No. 9 Summary of Applicable Emissions Limits and Operating Parameters

Pollutant	Emissions Limit[a]	Control Device	Operating Parameter
Filterable PM	0.44 lb/MMBtu heat input	Multi-Cyclone, Wet Scrubbers	Scrubber liquid flow and differential pressure
Carbon Monoxide (CO)	2,800 ppmvd @ 3% O_2[b],[c]	N/A	Oxygen trim system set point
Mercury (Hg)	5.7E-06 lb/MMBtu heat input	Multi-Cyclone, Wet Scrubbers	Mercury (Hg) input loading to boiler
Hydrogen Chloride (HCl)	2.2E-02 lb/MMBtu heat input	N/A	Hydrogen chloride (HCl) input loading to boiler
All	N/A	N/A	Operating Load (as steam flow rate

(a) Emissions limits are for boilers under the subcategory of ***hybrid suspension/grate burners designed to burn wet biomass/bio-based solids.***
(b) Parts per million by volume, dry basis, corrected to 3% oxygen concentration on a three (3)-run average.
(c) Per U.S. EPA's proposed reconsideration of Boiler MACT for major sources (80 FR 3090), the CO emissions limit is 3,500 ppmvd @ 3% O_2. The SSMP will be modified as needed based on amendments to Subpart DDDDD, if any, due to the proposed rule.

The applicable operating limits and compliance methodology for each parameter are summarized in Table 2-2. Operating limits are set through Initial Performance Testing and can be modified based on subsequent testing.

Table 2-2
Boiler No. 9 Summary of Operating Limits

Parameter	Compliance Methodology[a][b]	Operating Limit[c]
Oxygen Content[d]	Conduct initial and annual performance testing for CO. Operate the oxygen trim system set no lower than the lowest hourly average oxygen concentration measured during the most recent CO performance test.	1.6%
Differential Pressure	Conduct initial and annual performance testing for filterable PM. Maintain the 30-day rolling differential pressure at or above the value corresponding to the lowest one (1)-hour average pressure drop measured during the most recent performance test.	North – 6" H_2O; South – 4" H_2O
Scrubber Flow	Conduct initial and annual performance testing for filterable PM. Maintain the 30-day rolling average liquid flow rate at or above the lowest one (1)-hour average liquid flow rate measured during the most recent performance test.	North – 1163 gpm; South – 1067 gpm
Operating Load	Conduct initial and annual performance testing for filterable PM, CO, Hg, and HCl. 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.	243 KPPH (max. avg. steam flow); 267 KPPH (110% of max. avg. steam flow)

(a) Per Boiler MACT, if performance tests for a given pollutant for at least two (2) consecutive years show that your emissions are at or below 75% of the emissions limit for the pollutant, and if there are no changes in the operation of the individual boiler or air pollution control equipment that could increase emissions, performance test frequency for the pollutant may be decreased to once every three (3) years.
(b) As described in the Alternative Monitoring Approval located at Appendix C, operating limits do not apply when Boiler No. 9 is combusting natural gas only.
(c) The most recent performance tests can be found at the location referenced in Appendix A.
(d) Boiler MACT does not specifically address oxygen trim system range requirements. EPC will assign the set point based on performance testing.

2.2 SAMPLING LOCATION

The sampling locations on the No. 9 Bark Boiler North and South exhaust stacks are located at least 4.3 equivalent diameters downstream from the nearest flow disturbance and at least 5.7 equivalent diameters upstream from the stack exhaust. The exhaust stacks from the No. 9 Boiler each have circular cross-sections with internal diameters of 84.0 inches. Each stack has two sampling ports oriented 90 degrees to one another in a plane perpendicular to the exhaust flow direction. A schematic diagram of the sampling

locations is presented in Appendix D. Twenty-four (24) sampling points (twelve points per port) were used for USEPA Methods 2, 3A, 4, 5, 10, 26A, 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 establish compliance with the applicable emissions limits set-forth in the referenced NESHAP guidance as well as to establish source and control device operational limitations and ranges. Testing was conducted under two (2) separate operating conditions including firing various ratios of bark and gas.

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.

Items of note include the following:

1) Run 2 of Method 30B on both the North and South stacks were invalidated due to the % Relative Deviation between the paired sorbent traps exceeding the applicable agreement requirement. Therefore, the average emissions reported for Condition 1 are based on Runs 1 and 2.

3.3 PRESENTATION OF TEST RESULTS

Concentrations and mass rates are presented in Appendix A. 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: Measured and Allowable Emissions - No. 9 Boiler

Source	Operating Condition	Measured and Allowable Emissions				% of Allowable
		Pollutant	Average Measured	Allowable	Units	
No. 9 Boiler	Condition 1	PM	0.13	0.44	lb / MMBtu	**30%**
		CO	608	2800	ppm @ 3% O2	**22%**
		HCl	< 1.4E-04	2.2E-02	lb / MMBtu	**< 1%**
		Hg	7.0E-07	5.7E-06	lb / MMBtu	**12%**
	Condition 2	PM	0.15	0.44	lb / MMBtu	**35%**
		CO	1652	2800	ppm @ 3% O2	**59%**
		HCl	< 1.1E-04	2.2E-02	lb / MMBtu	**< 0.5%**
		Hg	8.8E-07	5.7E-06	lb / MMBtu	**15%**

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, control device operating parameters and steam production rates.

3.5 CMS PERFORMANCE EVALUATIONS

3.5.1 Monitoring Equipment

The Escanaba Paper Company is required by 40 CFR 63.7525 and 40 CFR 63.8(e) to conduct performance evaluations on the continuous monitoring system (CMS) equipment used to demonstrate compliance with the operating limits in Table 2-2.

The CMS equipment, including performance and equipment specifications and data collection, is detailed in Tables 3-1.

Table 3-1
Boiler No. 9 Performance and Equipment Specifications

Equipment	Type	Sample Interface	Parametric Signal Analyzer	Manufacturer Specified Accuracy	Monitor Range/ Output	Data Collection and Reduction Systems
Oxygen Meter	Rosemount 3000/3008 Probe	Zirconia electrochemical cell positioned in the boiler	0 - 10%, 4-20 mA signal	0.1% of oxygen or 3% of reading (whichever is greater)	Calibrated range: 0 - 10% O_2 4-20 mA (max range 25% O_2)	Data is collected in a DCS system. PI software is used to reduce and manage the data from the DCS system.
#2 Scrubber dP Transducer	Rosemount 1151HP4S2 2	Pressure taps on scrubber inlet and outlet	0–20" H_2O, 4-20 mA signal	±0.25% of calibrated range	Calibrated range: 0-20" H_2O 4-20 mA (max range 150" H_20)	Data is collected in a DCS system. PI software is used to reduce and manage the data from the DCS system.
#3 Scrubber dP Transducer	Rosemount 1151HP4S2 2	Pressure taps on scrubber inlet and outlet	0–20" H_2O, 4-20 mA signal	±0.25% of calibrated range	Calibrated range: 0-20 "H_2O/ 4-20 mA (max range 150" H_20)	Data is collected in a DCS system. PI software is used to reduce and manage the data from the DCS system.
North Scrubber Flow Meter	Yokogawa AA1-PSA-AIDH/BR/HAL	Magnetic flow meter on water recirc line from scrubber	4-20 mA signal, 0-2500 GPM	±0.5% of rate	Calibrated Range: 0-2500 GPM/4-20 mA (max range 2891.3 GPM)	Data is collected in a DCS system. PI software is used to reduce and manage the data from the DCS system.

Equipment	Type	Sample Interface	Parametric Signal Analyzer	Manufacturer Specified Accuracy	Monitor Range/ Output	Data Collection and Reduction Systems
South Scrubber Flow Meter	Yokogawa AXF150CE 1AL1LCA1 121BFF1	Magnetic flow meter on water recirc line from scrubber	4-20 mA signal, 0-2500 GPM	±0.35% of rate	Calibrated range: 0-2500 GPM/4-20 mA (Max range 2800 GPM)	Data is collected in a DCS system. PI software is used to reduce and manage the data from the DCS system.
Steam Flow Meter	Rosemount MDL3051S 1CD3A3F12 A1AB3D2E 5L4M5	Coplanar differential pressure in steam line to distribution header	0-250" H_2O, 4-20 mA signal, 0-360 KPPH	0.025% of span	0-250" H_2O, 4-20 mA, 0-350 KPPH	Data is collected in a DCS system. PI software is used to reduce and manage the data from the DCS system.

3.5.2 Evaluation Program Objective

The purpose of the CMS performance evaluation is to validate the continuous monitoring system data as required by 40 CFR 63.8(e)(3)(i) and 40 CFR 63.7525. Performance specifications typically include all the procedures for determining whether a particular CMS is capable of providing reliable measurements. In the absence of performance specifications, the monitors specified in 40 CFR 63.7525 are required to be installed, calibrated, certified, operated and maintained in accordance with the manufacturer's specifications. Consequently, the CMS performance evaluations consisted of the following the manufacturer calibration procedures and any other procedure(s) to document that the monitors meet the performance audit calibration acceptance criteria as specified in Table 3-2.

Table 3-2
Boiler No. 9 CMS Calibration Frequency and Calibration Acceptance Criteria

Measurement Type	Instrument Type	Calibration Frequency	Calibration Acceptance Criteria
Oxygen Meter	Rosemount 3000/3008 Probe	Annual (Performance Evaluation)	Minimum tolerance of +/- 0.2% O_2
#2 Scrubber dP Transducer	Rosemount 1151HP4S22	Annual (Performance Evaluation)	Minimum tolerance of ½-inch of water or 1% of pressure monitoring system operating range (whichever is less)
#3 Scrubber dP Transducer	Rosemount 1151HP4S22	Annual (Performance Evaluation)	Minimum gauge tolerance of ½-inch of water or 1% of pressure monitoring system operating range (whichever is less)
North Scrubber Flow Meter	Yokogawa AA1-PSA-AIDH/BR/HAL	Annual (Performance Evaluation)	Flow sensor with minimum tolerance of 2% of design flow rate
South Scrubber Flow Meter	Yokogawa AXF150CE1AL1LCA11 21BFF1	Annual (Performance Evaluation)	Flow sensor with minimum tolerance of 2% of design flow rate
Steam Flow Meter	Rosemount MDL3051S1CD3A3F12 A1AB3D2E5L4M5	Performance Evaluation During Scheduled Boiler Outage	Flow sensor with minimum tolerance of 2% of design flow rate

3.5.3 Performance Evaluation Schedule

The CMS performance evaluations consisted of equipment calibration checks in the weeks prior to the performance testing. Because steam flow and scrubber differential pressure transmitters require removal from the process for calibration, these calibration checks are scheduled to coincide with the most recent scheduled annual boiler outage.

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 5 was used for the determination of total filterable particulate matter.

- EPA Method 10 was used for the determination of carbon monoxide emission concentrations.

- 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 26A was used for the determination of hydrogen chloride emissions.

- 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.