ADVANCED INDUSTRIAL RESOURCES, INC.

BOILER MACT COMPLIANCE TEST REPORT
NO. 11 BOILER
AT
ESCANABA PAPER COMPANY
ESCANABA, MICHIGAN
PROJECT ID: KR- 9340

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Test Date:
SEPTEMBER 1-2, 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. 11 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. 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 particulate matter (total filterable), carbon monoxide, hydrogen chloride, and mercury.

The field sampling portion of the test program was conducted on September 1-2, 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. 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 burns 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
Filterable PM	0.44 lb/MMBtu heat input	Multi-Cyclone, Dry ESP	Opacity
CO	2,800 ppmvd @ 3% O_2 [a],[b]	N/A	Oxygen Trim System Set Point

Pollutant	Emissions Limit	Control Device	Operating Parameter
Hg	5.7E-06 lb/MMBtu heat input	Multi-Cyclone, Dry ESP	Hg input loading to boiler
HCl	2.2E-02 lb/MMBtu heat input	N/A	HCl input loading to boiler
All	N/A	N/A	Operating Load (as steam flow)

(a) Emissions limits for filterable PM and CO 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.
(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 below in Table 2-2. Operating limits have been set through Initial Performance Testing and may be modified based on subsequent testing.

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

Parameter	Compliance Methodology[(a)]	Operating Limit[(b)]
Opacity	Conduct initial and annual performance testing for filterable PM. Maintain opacity to less than or equal to 10% (daily block average)	≤10%
Oxygen Content[(b)]	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.	1.9%
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.	703 KPPH (max. avg. steam flow); 773 KPPH (110% of max. avg. steam flow)

(a) Per Boiler MACT, if your 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) 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 location for PM, HCl, and 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 (x4)) were used for USEPA Methods 2, 3A, 4, 5, 10, 26A, and 30B sampling, in accordance with USEPA Method 1 requirements.

The sampling location for CO emissions testing on the No. 11 Boiler exhaust is located within the duct prior to the breach of the No. 11 Boiler stack which is within the vicinity of the facility's CEMS probes and is where annual RATA certification tests are conducted. This sample location is rectangular and is equipped with a single sample port. Previous testing and certification of the facility's CEMS has indicated an absence of stratification at this sample location. Therefore, sampling was conducted within the centroidal region of the duct for Methods 3A and 10.

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 three (3) separate operating conditions including firing various ratios of coal, 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) HCl emissions testing shall be repeated on the No. 11 Boiler and therefore HCl emissions reported in this test report are not provided for BMACT compliance demonstration purposes. The additional HCl emissions testing is scheduled to be conducted during the week of November 9th, 2015.
2) Runs 5, 7, and 9 of Method 30B were invalidated due to the % Relative Deviation between the paired sorbent traps exceeding the applicable agreement requirement. Therefore, the average emissions reported for Conditions 2 and 3 have been combined using Runs 4, 6, and 8.
3) As requested by MDEQ, oxygen and carbon dioxide concentrations used to determine molecular weight and calculate heat input (MMBtu/hr) via Method 19 in association with Methods 2, 5, 26A, and 30B were quantified by analyzing the contents of integrated Tedlar bag samples collected at the stack sample location throughout each test run. Bag contents were analyzed via direct injection into a calibrated instrumental analyzer at the conclusion of each test.
4) Carbon monoxide emissions were measured at the CEMS location duct and oxygen concentrations used to correct the carbon monoxide emission concentrations to 3% oxygen were measured at this location as well.

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. 11 Boiler

Source	Operating Condition	Measured and Allowable Emissions				% of Allowable
		Pollutant	Average Measured	Allowable	Units	
No. 11 Power Boiler	Condition 1	PM	0.008	0.44	lb / MMBtu	**2%**
		CO	18	2800	ppm @ 3% O2	**1%**
		HCl	2.4E-02	2.2E-02	lb / MMBtu	**109%**
		Hg	2.0E-06	5.7E-06	lb / MMBtu	**35%**
	Condition 2	PM	0.006	0.44	lb / MMBtu	**1%**
		CO	71	2800	ppm @ 3% O2	**3%**
		HCl	3.2E-02	2.2E-02	lb / MMBtu	**146%**
	Condition 3	PM	0.006	0.44	lb / MMBtu	**1%**
		CO	54	2800	ppm @ 3% O2	**2%**
		HCl	4.3E-02	2.2E-02	lb / MMBtu	**198%**
	Mercury Runs 4,6, & 8	Hg	7.9E-07	5.7E-06	lb / MMBtu	**14%**

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.

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. 11 Performance and Equipment Specifications

Equipment	Type	Sample Interface	Parametric Signal Analyzer	Manufacturer Specified Accuracy	Monitor Range/ Output	Data Collection and Reduction Systems
Opacity Meter	Sick Optics OMD41 Opacity Monitor	Light transmission = transmitter/ receiver unit and reflector unit on precipitator outlet duct to stack	0-80%, 4-20 mA signal	±2% full scale	System span 0-80%/ 4-20 mA (max range 100%)	Data is collected in a DCS system. VIM software is used to reduce and manage the data from the DCS system.
Center Oxygen Meter	Rosemount 3000/3008 Probe Oxygen Sensor	Zirconia electrochemi-cal 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. VIM 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
East and West Oxygen Meters	Yokogawa ZR22G200 SCETQEA Oxygen Sensors	Zirconia electrochemi-cal cell positioned in the boiler	0-10%, 4-20 mA signal	Zero and span drift <2% of range maximum	Calibrated range: 0-10% O_2/ 4-20 mA (max range 25% O_2)	Data is collected in a DCS system. VIM and PI software are used to reduce and manage the data from the DCS system.
Steam Flow Meter	Rosemount MDL3051 S1CD3A3F 12A1AB3 D2E5L4M 5	Coplanar differential pressure in steam line to distribution header	1-331" H_2O, 4-20 mA, 0-900 KPPH	0.025% of span	0-331" H_2O, 4-20 mA, 0-900 KPPH	Data is collected in a DCS system. VIM 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 Tables 3-2.

Table 3-2
Boiler No. 11 CMS Calibration Frequency and Calibration Acceptance Criteria

Measurement Type	Instrument Type	Calibration Frequency	Calibration Acceptance Criteria
Opacity Meter	Sick Optics OMD41 Opacity Monitor	Daily (Zero and Span)	≤ 4% Opacity
		Quarterly (Performance Audit)	Zero Compensation: ≤ 4% Opacity
			Audit Zero: ≤ 1% Opacity
			Audit Calibration Error: ≤ 3% Opacity
			Optical Alignment: Light beam outside of acceptable alignment area
		Annual (Zero Alignment)	≤ 2% Opacity
Center Oxygen Meter	Rosemount 3000/3008 Probe Oxygen Sensor	Annual (Performance Audit)	Minimum tolerance of +/- 0.2% O_2
East and West Oxygen Meters	Yokogawa ZR22G200SCETQEA Oxygen Sensors	Annual (Performance Audit)	Minimum tolerance of +/- 0.2% O_2
Steam Flow Meter	Rosemount MDL3051S1CD3A3F12 A1AB3D2E5L4M5	Performance Evaluation During Scheduled Boiler Outage	Flow sensor with minimum tolerance of 2% of flow rate

3.5.3 Performance Evaluation Schedule

For equipment other than COMS, 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.

As previously mentioned, the COMS equipment meets the performance evaluations requirements of Performance Specification 1 under Appendix B of 40 CFR 60 and the quality control and assurance requirements of Procedure 3 under Appendix F to 40 CFR 60. Quality assurance and quality control procedures, including calibrations and audits, are conducted according the frequencies specified in Procedure 3.

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.