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Industrial Boiler MACT Compliance Emissions Test Report

Billerud Escanaba LLC
Escanaba Mill
No. 11 Power Boiler
Escanaba, Michigan
September 13 and 20, 2022

Report Submittal Date
November 2, 2022

Project No. M223711B

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Crown Point, IN | Mendota Heights, MN | Denver, CO | Henderson, NV

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1.0 EXECUTIVE SUMMARY

Mostardi Platt conducted a Maximum Achievable Control Technology (MACT) emissions test program on the No. 11 Power Boiler at the Escanaba Mill of Billerud Escanaba LLC in Escanaba, Michigan on September 13 and 20, 2022. This report summarizes the results of the test program and test methods used.

The test location, test dates, test parameters, and test methods are summarized below.

TEST INFORMATION		
Test Location	**Test Dates**	**Test Parameters**
No. 11 Power Boiler	September 13, 2022	Carbon Monoxide (CO)
	September 20, 2022	Filterable Particulate Matter (FPM)

The purpose of the test program was to demonstrate that No. 11 Power Boiler is compliant with the Filterable Particulate Matter (FPM) and Carbon Monoxide (CO) applicable emission limits under *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters* promulgated at 40 CFR Part 63, Subpart DDDDD Table 2 subcategory 13 for hybrid suspension grate units designed to burn biomass/bio-based solids.

TEST RESULTS				
Test Location	**Test Date**	**Test Parameter**	**Emission Limits**	**Emission Rate**
No. 11 Power Boiler	9/20/2022	FPM	0.44 lb/MMBtu (Heat Input)	0.0035 lb/MMBtu (Heat Input)
	9/13/2022	CO	3,500 ppmvd @ 3% O_2	209.8 ppmvd @ 3% O_2

A fourth FPM test run was performed on 9/20/22 due to fluctuation in operations. All four runs are included in the emission rate average. Emissions on a lb/mmBtu basis were calculated using an F-Factor of 9.682 dscf/mmBtu given by the plant.

The identifications of the individuals associated with the test program are summarized below.

TEST PERSONNEL INFORMATION		
Location	**Address**	**Contact**
Test Facility	Billerud Escanaba LLC 7100 County Road 426 M.5 Rd Escanaba, Michigan 49829	Mr. Adam Becker Environmental Engineer (906) 233-2929 (phone) Adam.Becker@versoco.com
Testing Company Representative	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Mr. Michael P. Sather Senior Project Manager 630-993-2100 (phone) msather@mp-mail.com

The test crew consisted of D. Jordan, N. Colangelo, and M Sather of Mostardi Platt.

2.0 TEST METHODOLOGY

Emissions testing was conducted following the methods specified in 40CFR60, Appendix A. A schematic of the test section diagram is found in Appendix B and schematics of the sampling trains used are included in Appendix C. Calculation nomenclature and sample calculations are included in Appendix D. Laboratory analysis data are found in Appendix E. Copies of analyzer print-outs for each test run are included in Appendix F and field data sheets are found in Appendix G.

The following methodologies were used during the test program:

Method 1 Traverse Point Determination

Test measurement points were selected in accordance with Method 1. The characteristics of the measurement locations are summarized below.

Test Location	Stack Diameter	Upstream Distance	Downstream Distance	Test Parameter	Number of Sampling Points
No. 11 Boiler	14 Feet	>2.0	>8.0	FPM	1224
				CO	6 (single port)

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.

Method 2 Volumetric Flowrate Determination

Gas velocity was measured following Method 2, for purposes of calculating stack gas volumetric flow rate and FPM emission rates. An S-type pitot tube, differential pressure gauge, thermocouple and temperature readout were used to determine gas velocity at each sample point. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H.

Method 3A Carbon Dioxide (CO_2) and Oxygen (O_2) Determination

A Servomex analyzer was used to determine O_2 and CO_2 concentrations in the stack gas. Linearity calibrations were performed prior to sampling, and mid-range and zero calibration checks were performed after each test run. Final O_2 and CO_2 concentrations were corrected for calibration error of the instrument. The instrument has a nondispersive infrared-based detector and operates in a range of 0-25% for O_2 and 0-20% for CO_2. Calibration data is presented in the Appendix H and copies of the gas cylinder certifications are found in Appendix I.

Method 5 Filterable Particulate Matter Determination

Stack gas filterable particulate matter concentrations and emission rates were determined in accordance with Method 5. The probe and filter housing were maintained at a temperature of 250°F - 273°F. An Environmental Supply Company, Inc. sampling train was used to sample stack

gas at an isokinetic rate. Four impingers were utilized, the first two each containing 100 ml of deionized water, the third was empty, and the fourth contained approximately 200 grams of silica gel. The impingers were weighed prior to and after each test run in order to determine moisture content of the stack gas. The total sample time was 60 minutes with 24 sample points used (12 points per port, 2 total ports). A minimum of 1 dry standard cubic meters was sampled for each run.

Particulate matter in the sample probe was recovered utilizing acetone; a minimum of three passes of the probe brush through the entire probe was performed, followed by a visual inspection of the acetone exiting the probe. If the acetone solution exiting the probe was clear, the wash was considered complete; if not, another pass of the brush through the probe was made and inspected until the solution was clear. The nozzle was then removed from the probe and cleaned in a similar manner, utilizing an appropriately sized nozzle brush. The filter housing was washed a minimum of three times with acetone and inspected for cleanliness, and the filter was placed in its corresponding petri dish. The acetone wash and the filter were labeled and marked, then analyzed off site at the Mostardi Platt laboratory. Sample analysis data are found in Appendix E. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data is provided in Appendix H.

Method 10 Carbon Monoxide (CO) Determination

Stack gas CO concentrations and emission rates were determined in accordance with Method 10. A Thermo Fischer Scientific 48 Series Gas Filter Correlation Carbon Monoxide Analyzer was used to determine carbon monoxide concentrations, in the manner specified in the Method. The instrument operates in a range of 0 ppm to the high-level span calibration gas.

A list of calibration gases used and the results of all calibration and other required quality assurance checks are provided in Appendix H. Copies of calibration gas certifications are also provided in Appendix I. This testing met the performance specifications as outlined in the Method.

3.0 TEST RESULTS SUMMARIES

Client: Billerud Corporation
Facility: Escanaba Mill
Test Location: No. 11 Power Boiler Stack
Test Method: 5

Source Condition	Normal	Normal	Normal	Normal	
Date	9/20/22	9/20/22	9/20/22	9/20/22	
Start Time	8:40	10:53	12:45	14:40	
End Time	9:55	12:04	13:55	15:49	
	Run 1	Run 2	Run 3	Run 4	Average
Stack Conditions					
Average Gas Temperature, °F	389.7	389.4	387.9	386.7	388.4
Flue Gas Moisture, percent by volume	17.1%	22.7%	22.1%	23.3%	21.3%
Average Flue Pressure, in. Hg	29.05	29.05	29.05	29.05	29.05
Gas Sample Volume, dscf	41.893	37.096	36.975	36.867	38.208
Average Gas Velocity, ft/sec	35.800	35.729	35.990	35.850	35.842
Gas Volumetric Flow Rate, acfm	330,657	330,006	332,415	331,125	331,051
Gas Volumetric Flow Rate, dscfm	165,389	153,931	156,492	153,857	157,417
Gas Volumetric Flow Rate, scfm	199,492	199,157	200,966	200,482	200,024
Average $\%CO_2$ by volume, dry basis	13.0	13.7	12.8	12.4	13.0
Average $\%O_2$ by volume, dry basis	6.8	6.2	7.3	7.7	7.0
Isokinetic Variance	109.5	104.2	102.1	103.6	104.9
Calculated Fuel Factor Fd, dscf/mmBtu	9,682.0	9,682.0	9,682.0	9,682.0	9,682.0
Filterable Particulate Matter (Method 5)					
grams collected	0.00315	0.00996 ≤	0.00104	0.00278 ≤	0.00423
mg/dscm	2.655	9.482 ≤	0.993	2.663 ≤	3.9483
mg/wscm	2.201	7.329 ≤	0.774	2.042 ≤	3.0867
grains/acf	0.0006	0.0019 ≤	0.0002	0.0005 ≤	0.0008
grains/dscf	0.0012	0.0041 ≤	0.0004	0.0012 ≤	0.0017
lb/hr	1.645	5.466 ≤	0.582	1.534 ≤	2.307
lb/mmBtu (Calculated Fd Factor)	0.0024	0.0081 ≤	0.0009	0.0025 ≤	0.0035

Billerud Escanaba LLC Escanaba Mill No. 11 Power Boiler Stack Gaseous Summary						
Test No.	Date	Start Time	End Time	CO ppmvd	O_2 % (dry)	CO ppmvd @ 3% O_2
1	09/13/22	07:40	08:39	143.0	5.0	161.0
2	09/13/22	09:00	09:59	212.0	5.3	243.3
3	09/13/22	10:15	11:14	197.5	5.2	225.2
Average				184.2	5.2	209.8

4.0 CERTIFICATION

Mostardi Platt is pleased to have been of service to Billerud Escanaba LLC. If you have any questions regarding this test report, please do not hesitate to contact us at 630-993-2100.

As project manager, I hereby certify that this test report represents a true and accurate summary of emissions test results and the methodologies employed to obtain those results, and the test program was performed in accordance with the methods specified in this test report.

MOSTARDI PLATT

Michael P. Sather — Project Supervisor

Scott W. Banach — Quality Assurance

APPENDICES

Appendix A - Plant Operating Data