



**Relative Accuracy Test Audit
Test Report**

**Billerud Escanaba LLC
Escanaba Mill
No. 8 Power Boiler Stack**

**Escanaba, Michigan
May 16, 2023**

**Report Submittal Date
June 27, 2023**

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Mostardi Platt

Project No. M232012A

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1.0 EXECUTIVE SUMMARY

Mostardi Platt conducted a Continuous Emissions Monitoring System (CEMS) Relative Accuracy Test Audit (RATA) test program for Billerud Escanaba LLC at the Escanaba Mill in Escanaba, Michigan, on the No. 8 Power Boiler Stack on May 16, 2023. This report summarizes the results of the test program and test methods.

The test location, test date, and test parameters are summarized below.

TEST INFORMATION		
Test Locations	Test Dates	Test Parameters
No. 8 Power Boiler Stack	May 16, 2023	Oxygen (O ₂) and Nitrogen Oxides (NO _x)

The purpose of the test program was to demonstrate the relative accuracies of the No. 8 Power Boiler Stack O₂ and NO_x analyzers during the specified operating condition. The test results from this test program indicate that the CEMS meets the United States Environmental Protection Agency (USEPA) annual performance specification for relative accuracy as published in 40 Code of Federal Regulations Part 60 (40CFR60).

RATA RESULTS					
Test Location	Date	Parameter	Units	Relative Accuracy Acceptance Criteria	Relative Accuracy (RA)
No. 8 Power Boiler Stack	5/16/23	NO _x	lb/mmBtu	≤ 20.0% of the mean reference value	1.02%
		NO _x	ppmvd	≤ 20.0% of the mean reference value	0.81%
		O ₂	% dry	≤ 1% mean difference	0.122% mean difference

The gas cylinders used to perform the RATA are summarized below.

GAS CYLINDER INFORMATION				
Parameter	Gas Vendor	Cylinder Serial Number	Cylinder Value	Expiration Date
NO _x	Airgas	XC018478B	0 ppm	12/7/2030
NO _x	Airgas	XC024265B	238.5 ppm	2/28/2031
NO _x	Airgas	CC51928	458.8 ppm	3/1/2031
O ₂	Airgas	XC024265B	0%	2/28/2031
O ₂	Airgas	XC018478B	11.99%	12/7/2030
O ₂	Airgas	CC360927	22.76%	3/18/2030

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

TEST PERSONNEL INFORMATION		
Location	Address	Contact
Test Coordinator and Test Facility	Billerud Escanaba LLC 7100 County Road 426 M.5 Rd Escanaba, MI 49829	Ms. Amanda Freele Environmental Engineer (906) 233-2603 (phone) Amanda.Freele@billerud.com
Testing Company Personnel	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Mr. Daniel Kossack Senior Project Supervisor 630-993-2100 (phone) dkossack@mp-mail.com

The test crew consisted of A. Diaz, E. Riha, J. Jimenez and D. Kossack of Mostardi Platt.

2.0 TEST METHODOLOGY

Emission testing was conducted following the USEPA methods specified in 40CFR60, Appendix A, in addition to the Mostardi Platt Quality Manual. Schematics of the test section diagram and sampling trains used are included in Appendix A and B respectively. Calculation nomenclature are included in Appendix C. Copies of analyzer print-outs and field data sheets for each test run are included in Appendix D. CEM data and process data as provided by Billerud Escanaba LLC are included in Appendix E.

Parameter	USEPA Reference Method	Notes/Remarks
O ₂ %	USEPA Method 3A, 40CFR60, Appendix A	Instrument Analysis of O ₂ % on a dry basis
NO _x	USEPA Method 7E, 40CFR60, Appendix A	Instrument Analysis of NO _x ppmvd to calculate NO _x lb/mmBtu
Fd	USEPA Method 19, 40CFR60, Appendix A	Standard fuel factors of 8,710 and 9,820 dscf/mmBtu were used to calculate lb/mmBtu

Sampling for NO_x on Boiler 8 was at the stack location.

The following methodologies were used during the test program:

Method 3A Oxygen (O₂)/ Determination

Stack gas O₂ concentrations were determined in accordance with USEPA Method 3A. A Servomex analyzer was used to determine the O₂ concentrations in the manner specified in the Method. The instrument has a paramagnetic detector and the O₂ operates in the nominal range of 0% to 25% with the specific range determined by the high-level calibration gas. High-range calibrations were performed using USEPA Protocol gas. Zero nitrogen (a low ppm pollutant in balance nitrogen calibration gases) was introduced during other instrument calibrations to check instrument zero. High- and a mid-range % O₂ levels in balance nitrogen were also introduced. Zero and mid-range calibrations were performed using USEPA Protocol gas after each test run. Copies of the gas cylinder certifications are found in Appendix G. This testing met the performance specifications as outlined in the Method.

Method 7E Nitrogen Oxides (NO_x) Determination

Stack gas NO_x concentrations and emission rates were determined in accordance with USEPA Method 7E, 40CFR60, Appendix A. A Thermo Scientific Model 42i Chemiluminescence Nitrogen Oxides Analyzer was used to determine nitrogen oxides concentrations, in the manner specified in the Method. The instrument operated in the nominal range of 0 ppm to 500 ppm with the specific range determined by the high-level span calibration gas.

The Model 42i High Level is based on the principle that nitric oxide (NO) and ozone (O₃) react to produce a characteristic luminescence with an intensity linearly proportional to the NO concentration. Infrared light emission results when electronically excited nitrogen dioxide (NO₂) molecules decay to lower energy states. Specifically,



NO₂ must first be transformed into NO before it can be measured using the chemiluminescent reaction. NO₂ is converted to NO by a stainless steel NO₂-to-NO converter heated to about 625°C. The flue gas air sample is drawn into the Model 42i High Level through the sample bulkhead. The sample flows through a particulate filter, a capillary, and then to the mode solenoid valve. The solenoid valve routes the sample either straight to the reaction chamber (NO mode) or through the NO₂-to-NO converter and then to the reaction chamber (NO_x mode).

Dry air enters the Model 42i High Level through the dry air bulkhead, through a flow sensor, and then through a silent discharge ozonator. The ozonator generates the necessary ozone concentration needed for the chemiluminescent reaction. The ozone reacts with the NO in the ambient air sample to produce electronically excited NO₂ molecules. A photomultiplier tube (PMT) housed in a thermoelectric cooler detects the NO₂ luminescence.

The NO and NO_x concentrations calculated in the NO and NO_x modes are stored in memory. The difference between the concentrations is used to calculate the NO₂ concentration. The Model 42i High Level outputs NO, NO₂, and NO_x concentrations to both the front panel display and the analog outputs.

Stack gas was delivered to the analyzer via a Teflon[®] sampling line, heated to a minimum temperature of 250°F. Excess moisture in the stack gas was removed using a refrigerated condenser. The entire system was calibrated in accordance with the Method, using certified calibration gases introduced at the probe, before and after each test run. This testing met the performance specifications as outlined in the Method.

A list of calibration gases used and the results of all calibration and other required quality assurance checks are found in Appendix F. Copies of the gas cylinder certifications are found in Appendix G. The NO₂ to NO converter test can be found in Appendix H. This testing met the performance specifications as outlined in the Method.

Method 19 Determination of Nitrogen Oxides (NO_x) Emission Rates

Stack gas NO_x emission rates were determined in accordance with USEPA Method 19, 40CFR60, Appendix A. A standard Fd factor of 8,710 dscf/mmBtu for natural gas was used to convert NO_x ppmvd to NO_x lb/mmBtu on the No. 8 Power Boiler.

3.0 TEST RESULT SUMMARIES

Client: Billerud Escanaba, LLC					Location: No. 8 Power Boiler Stack			
Facility: Escanaba Mill					Date: 5/16/23			
Project #: M232012					Test Method: 7E, 3A			
Fuel Type: Natural Gas					Fuel Factor: 8710			
O2 based NOx lb/mmBtu RATA								
CEM Analyzer Information								
NO_x Monitor/Model:			Thermo 42 IQ		NO_x Serial # :		1181030037	
O2 Monitor/Model:			TEI 25595003		O2 Serial # :		CC111105-5	
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x lb/MMBtu	CEM NO_x lb/MMBtu	(RM-CEM) Difference (di)	(RM-CEM) Difference² (di²)
1	1	05/16/23	09:20	09:50	0.119	0.118	0.001	0.000001
1	2	05/16/23	10:20	10:50	0.110	0.110	0.000	0.000000
0	3	05/16/23	11:10	11:40	0.118	0.116	0.002	0.000004
1	4	05/16/23	11:55	12:25	0.112	0.112	0.000	0.000000
1	5	05/16/23	12:40	13:10	0.116	0.115	0.001	0.000001
1	6	05/16/23	13:25	13:55	0.120	0.121	-0.001	0.000001
1	7	05/16/23	14:10	14:40	0.122	0.123	-0.001	0.000001
1	8	05/16/23	15:00	15:30	0.130	0.129	0.001	0.000001
1	9	05/16/23	15:47	16:17	0.122	0.120	0.002	0.000004
1	10	05/16/23	16:40	17:10	0.127	0.126	0.001	0.000001
n					9			
t(0.975)					2.306			
Mean Reference Method Value					0.120		RM avg	
Mean CEM Value					0.119		CEM avg	
Sum of Differences					0.004		di	
Mean Difference					0.000		d	
Sum of Differences Squared					0.000		di²	
Standard Deviation					0.001		sd	
Confidence Coefficient 2.5% Error (1-tail)					0.001		cc	
Relative Accuracy					1.02		RA	

Client: Billerud Escanaba, LLC **Location:** No. 8 Power Boiler Stack
Facility: Escanaba Mill **Date:** 5/16/23
Project #: M232012 **Test Method:** 7E

NO_x ppmvd RATA
CEM Analyzer Information

NO _x Monitor/Model:		Thermo 42 IQ			NO _x Serial # :		1181030037	
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO _x ppmvd	CEM NO _x ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	05/16/23	09:20	09:50	87.2	86.2	1.0	1.00
1	2	05/16/23	10:20	10:50	81.4	81.3	0.1	0.01
1	3	05/16/23	11:10	11:40	86.9	85.7	1.2	1.44
1	4	05/16/23	11:55	12:25	82.2	82.7	-0.5	0.25
1	5	05/16/23	12:40	13:10	85.4	85.4	0.0	0.00
1	6	05/16/23	13:25	13:55	88.6	89.8	-1.2	1.44
0	7	05/16/23	14:10	14:40	89.3	91.0	-1.7	2.89
1	8	05/16/23	15:00	15:30	95.7	95.8	-0.1	0.01
1	9	05/16/23	15:47	16:17	90.1	89.3	0.8	0.64
1	10	05/16/23	16:40	17:10	93.9	94.1	-0.2	0.04
n					9			
t(0.975)					2.306			
Mean Reference Method Value					87.933		RM avg	
Mean CEM Value					87.811		CEM avg	
Sum of Differences					1.100		di	
Mean Difference					0.122		d	
Sum of Differences Squared					4.830		di ²	
Standard Deviation					0.766		sd	
Confidence Coefficient 2.5% Error (1-tail)					0.589		cc	
Relative Accuracy					0.81		RA	

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Client: Billerud Escanaba, LLC				Location: No. 8 Power Boiler Stack				
Facility: Escanaba Mill				Date: 5/16/23				
Project #: M232012				Test Method: 3A				
O₂ % (dry) RATA								
CEM Analyzer Information								
O₂ Monitor/Model:			TEI 25595003		O₂ Serial # :		CC111105-5	
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM O₂ % (dry)	CEM O₂ % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference² (di²)
1	1	05/16/23	09:20	09:50	5.0	5.0	0.0	0.00
1	2	05/16/23	10:20	10:50	4.9	4.8	0.1	0.01
1	3	05/16/23	11:10	11:40	4.9	4.8	0.1	0.01
1	4	05/16/23	11:55	12:25	4.9	4.8	0.1	0.01
1	5	05/16/23	12:40	13:10	4.9	4.8	0.1	0.01
1	6	05/16/23	13:25	13:55	4.9	4.7	0.2	0.04
1	7	05/16/23	14:10	14:40	5.0	4.8	0.2	0.04
1	8	05/16/23	15:00	15:30	4.9	4.7	0.2	0.04
1	9	05/16/23	15:47	16:17	4.8	4.7	0.1	0.01
0	10	05/16/23	16:40	17:10	4.9	4.7	0.2	0.04
n					9			
t(0.975)					2.306			
Mean Reference Method Value					4.911		RM avg	
Mean CEM Value					4.789		CEM avg	
Sum of Differences					1.100		di	
Mean Difference					0.122		d	
Sum of Differences Squared					0.170		di²	
Standard Deviation					0.067		sd	
Confidence Coefficient 2.5% Error (1-tail)					0.051		cc	
Relative Accuracy - APS					0.122		mean difference	

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 the program 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. The test program was performed in accordance with the test methods and the Mostardi Platt Quality Manual, as applicable.

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Daniel Kossack

Program Manager



Scott W. Banach

Quality Assurance

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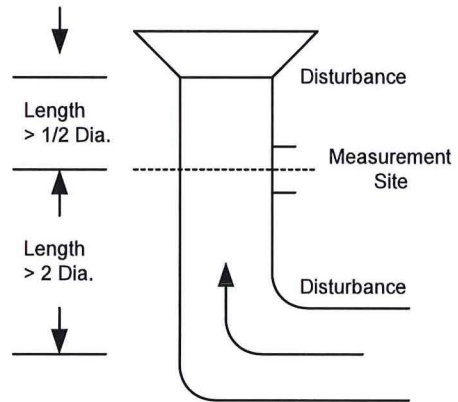
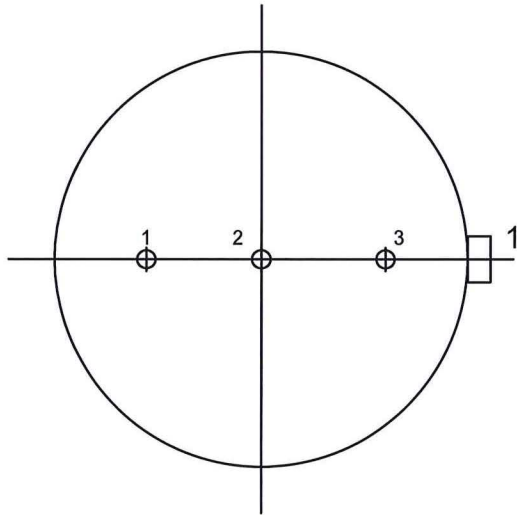
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APPENDICES

Appendix A - Test Section Diagrams

GASEOUS TRAVERSE FOR ROUND DUCTS



Job: Verso Corporation
 Escanaba Mill
 Escanaba, Michigan

Date: May 16, 2023

Test Location: No. 8 Power Boiler Stack

Stack Diameter: 7.0 Feet

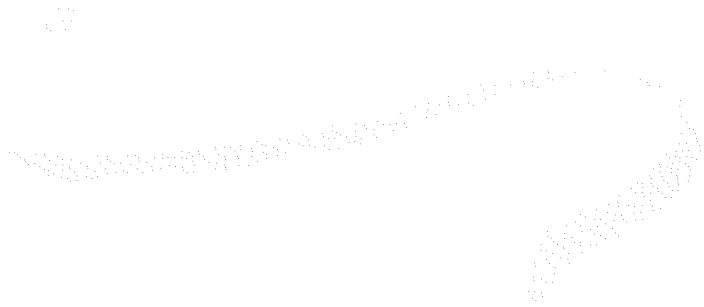
Stack Area: 38.485 Square Feet

No. Sample Points: 3

Distance from Inside Wall
 To Traverse Point:

1. 83.3 % of diameter
2. 50.0 % of diameter
3. 16.7 % of diameter

Appendix B - Sample Train Diagram



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USEPA Methods 3A and 7E Extractive Gaseous Sampling Diagram

