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Relative Accuracy Test Audit
Test Report

Billerud Escanaba LLC
Escanaba Mill
No. 8 Power Boiler Stack and
No. 11 Power Boiler Stack
Escanaba, Michigan
September 13 and 15, 2022

Report Submittal Date
November 2, 2022

Project No. M223711A

A0884-test-20220913

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

Corporate Headquarters
888 Industrial Drive
Elmhurst, Illinois 60126
630-993-2100

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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 and No. 11 Power Boiler Stack on September 13 and 15, 2022. No. 8 Power Boiler also had a even day drift completed to complete the certification requirements. This report summarizes the results of the test program and test methods.

The test locations, RATA test dates, and test parameters are summarized below.

TEST INFORMATION		
Test Locations	**Test Dates**	**Test Parameters**
No. 8 Power Boiler Stack and No. 11 Power Boiler Stack	September 13 and 15, 2022	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 and No. 11 Power Boiler Stack O_2 and NO_X analyzers during the specified operating condition. The test results from this test program indicate that each CEMS meets the United States Environmental Protection Agency (USEPA) annual performance specification for relative accuracy and certifications as published in 40 Code of Federal Regulations Part 60 (40CFR60). The seven day drift data for the certification is appended.

RATA RESULTS					
Test Location	**Date**	**Parameter**	**Units**	**Relative Accuracy Acceptance Criteria**	**Relative Accuracy (RA)**
No. 8 Power Boiler Stack	9/15/22	NO_X	lb/mmBtu	≤ 20.0% of the mean reference value	3.18%
		NO_X	ppmvd	≤ 20.0% of the mean reference value	9.10%
		O_2	% dry	≤ 1% mean difference	-0.87% mean difference
No. 11 Power Boiler Stack	9/13/22	NO_X	lb/mmBtu	≤ 20.0% of the mean reference value	2.04%
		O_2	% dry	≤ 1% mean difference	0.211% 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	CC447414	0.0 ppm	4/25/2030
NO_X	Airgas	ALM-057189	148.2 ppm	1/31/2030
NO_X	Airgas	ALM-058205	284.8 ppm	7/8/2027
O_2	Airgas	ALM-057189	0.0%	1/31/2030
O_2	Airgas	CC447414	5.054%	4/25/2030
O_2	Airgas	ALM-013475	10.02%	8/23/2030

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	Mr. Adam Becker Environmental Engineer (906) 233-2929 (phone) Adam.Becker@versoco.com
Testing Company Personnel	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Mr. Michael Sather Senior Project Manager 630-993-2100 (phone) msather@mp-mail.com

The test crew consisted of D. Jordan, J. Devereux, K. West, and M. Sather 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

The sampling location for 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 7E. Sampling for NOx on Boiler 8 was at the stack location.

The following methodologies were used during the test program:

Method 3A Oxygen (O_2)/ Determination

Stack gas O_2 concentrations were determined in accordance with USEPA Method 3A. A Servomex analyzer was used to determine the O_2 concentrations in the manner specified in the Method. The instrument has a paramagnetic detector and the O_2 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 % O_2 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 1000 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 (O_3) react to produce a characteristic luminescence with an intensity linearly proportional to the NO concentration. Infrared light emission results when electronically excited nitrogen dioxide (NO_2) molecules decay to lower energy states. Specifically,

$$NO+O_3 \rightarrow NO_2+O_2+h\upsilon$$

NO_2 must first be transformed into NO before it can be measured using the chemiluminescent reaction. NO_2 is converted to NO by a stainless steel NO_2-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 NO_2-to-NO converter and then to the reaction chamber (NOx 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 NO_2 molecules. A photomultiplier tube (PMT) housed in a thermoelectric cooler detects the NO_2 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 NO_2 concentration. The Model 42i High Level outputs NO, NO_2, 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 NO_2 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. A standard Fd factor of 9,820 dscf/mmBtu for sub-bituminous coal was used to convert NO_x ppmvd to NO_x lb/mmBtu on the No. 11 Power Boiler.

3.0 TEST RESULT SUMMARIES

Client: Billerud Escanaba LLC
Facility: Escanaba Mill
Project #: M223711
Fuel Type: Natural Gas

Location: No. 8 Power Boiler Stack
Date: 9/15/22
Test Method: 7E, 3A
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	Steam Flow KLB/HR	Test Date	Start Time	End Time	RM NO_x lb/MMBtu	CEM NO_x lb/MMBtu	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	241.9	09/15/22	07:15	07:44	0.189	0.184	0.005	0.000025
0	2	266.3	09/15/22	08:00	08:29	0.165	0.158	0.007	0.000049
1	3	250.4	09/15/22	08:45	09:14	0.158	0.153	0.005	0.000025
1	4	250.3	09/15/22	09:30	09:59	0.147	0.143	0.004	0.000016
1	5	249.6	09/15/22	10:15	10:44	0.133	0.129	0.004	0.000016
1	6	256.7	09/15/22	11:00	11:29	0.128	0.126	0.002	0.000004
1	7	281.3	09/15/22	11:45	12:14	0.143	0.140	0.003	0.000009
1	8	254.7	09/15/22	12:30	12:59	0.122	0.119	0.003	0.000009
1	9	254.6	09/15/22	13:15	13:44	0.117	0.114	0.003	0.000009
1	10	254.5	09/15/22	14:00	14:29	0.117	0.113	0.004	0.000016

n	9	
t(0.975)	2.306	
Mean Reference Method Value	0.139	RM avg
Mean CEM Value	0.136	CEM avg
Sum of Differences	0.033	di
Mean Difference	0.004	d
Sum of Differences Squared	0.000	di^2
Standard Deviation	0.001	sd
Confidence Coefficient 2.5% Error (1-tail)	0.001	cc
Relative Accuracy	3.18	RA

Client: Billerud Escanaba LLC
Facility: Escanaba Mill
Project #: M223711

Location: No. 8 Power Boiler Stack
Date: 9/15/22
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	Steam Flow KLB/HR	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	241.9	09/15/22	07:15	07:44	134.4	123.8	10.6	112.36
0	2	266.3	09/15/22	08:00	08:29	117.6	106.2	11.4	129.96
1	3	250.4	09/15/22	08:45	09:14	112.6	103.0	9.6	92.16
1	4	250.3	09/15/22	09:30	09:59	104.8	96.4	8.4	70.56
1	5	249.6	09/15/22	10:15	10:44	94.4	86.8	7.6	57.76
1	6	256.7	09/15/22	11:00	11:29	91.4	85.0	6.4	40.96
1	7	281.3	09/15/22	11:45	12:14	102.0	93.6	8.4	70.56
1	8	254.7	09/15/22	12:30	12:59	86.7	80.3	6.4	40.96
1	9	254.6	09/15/22	13:15	13:44	83.5	77.0	6.5	42.25
1	10	254.5	09/15/22	14:00	14:29	83.4	76.4	7.0	49.00

n	9	
t(0.975)	2.306	
Mean Reference Method Value	99.244	RM avg
Mean CEM Value	91.367	CEM avg
Sum of Differences	70.900	di
Mean Difference	7.878	d
Sum of Differences Squared	576.570	di^2
Standard Deviation	1.501	sd
Confidence Coefficient 2.5% Error (1-tail)	1.154	cc
Relative Accuracy	9.10	RA

Client: Billerud Escanaba LLC
Facility: Escanaba Mill
Project #: M223711

Location: No. 8 Power Boiler Stack
Date: 9/15/22
Test Method: 3A

O_2 % (dry) RATA

CEM Analyzer Information

O_2 Monitor/Model:	TEI 25595003	O_2 Serial # :	CC111105-5

1=accept 0=reject	Test Run	Steam Flow KLB/HR	Test Date	Start Time	End Time	RM O_2 % (dry)	CEM O_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	241.9	09/15/22	07:15	07:44	5.5	6.3	-0.8	0.64
1	2	266.3	09/15/22	08:00	08:29	5.4	6.3	-0.9	0.81
1	3	250.4	09/15/22	08:45	09:14	5.4	6.3	-0.9	0.81
1	4	250.3	09/15/22	09:30	09:59	5.4	6.3	-0.9	0.81
1	5	249.6	09/15/22	10:15	10:44	5.4	6.3	-0.9	0.81
1	6	256.7	09/15/22	11:00	11:29	5.4	6.3	-0.9	0.81
0	7	281.3	09/15/22	11:45	12:14	5.4	6.4	-1.0	1.00
1	8	254.7	09/15/22	12:30	12:59	5.4	6.3	-0.9	0.81
1	9	254.6	09/15/22	13:15	13:44	5.4	6.2	-0.8	0.64
1	10	254.5	09/15/22	14:00	14:29	5.4	6.2	-0.8	0.64

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**5.411**	**RM avg**
Mean CEM Value	**6.278**	**CEM avg**
Sum of Differences	**-7.800**	**di**
Mean Difference	**-0.867**	**d**
Sum of Differences Squared	**6.780**	**di^2**
Standard Deviation	**0.050**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.038**	**cc**
Relative Accuracy	**-0.87**	**RA**

[A] Alternate Performance Standard for O_2 analyzers of ≤ 1.0 % for annual RATA testing.

Client: Billerud Escanaba LLC
Facility: Escanaba Mill
Project #: M223711
Fuel Type: Coal, Sub-Bituminous

Location: No. 11 Power Boiler Breeching
Date: 9/13/22
Test Method: 7E, 3A
Fuel Factor: 9820

O2 based NOx lb/mmBtu RATA

NO_x Monitor/Model:			Thermo 42i		NO_x Serial # :		1308857366	
O2 Monitor/Model:			Thermo 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) Difference^2 (di^2)
1	1	09/13/22	07:10	07:39	0.166	0.164	0.002	0.000004
1	2	09/13/22	07:50	08:19	0.154	0.154	0.000	0.000000
1	3	09/13/22	08:35	09:04	0.148	0.145	0.003	0.000009
1	4	09/13/22	09:18	09:47	0.206	0.197	0.009	0.000081
1	5	09/13/22	10:00	10:29	0.395	0.401	-0.006	0.000036
1	6	09/13/22	10:40	11:09	0.409	0.418	-0.009	0.000081
0	7	09/13/22	11:30	11:59	0.413	0.424	-0.011	0.000121
1	8	09/13/22	12:12	12:41	0.163	0.166	-0.003	0.000009
1	9	09/13/22	12:53	13:22	0.186	0.184	0.002	0.000004
1	10	09/13/22	13:32	14:01	0.169	0.171	-0.002	0.000004
				n	9			
				t(0.975)	2.306			
				Mean Reference Method Value	0.222		RM avg	
				Mean CEM Value	0.222		CEM avg	
				Sum of Differences	-0.004		di	
				Mean Difference	0.000		d	
				Sum of Differences Squared	0.000		di^2	
				Standard Deviation	0.005		sd	
				Confidence Coefficient 2.5% Error (1-tail)	0.004		cc	
				Relative Accuracy	2.04		RA	

Client: Billerud Escanaba LLC
Facility: Escanaba Mill
Project #: M223711

Location: No. 11 Power Boiler Breeching
Date: 9/13/22
Test Method: 3A

O_2 % (dry) RATA

CEM Analyzer Information

O_2 Monitor/Model:			Thermo 25595003		O_2 Serial # :		CC111105-5	
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM O_2 % (dry)	CEM O_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	09/13/22	07:10	07:39	7.1	6.8	0.3	0.09
1	2	09/13/22	07:50	08:19	7.3	7.1	0.2	0.04
1	3	09/13/22	08:35	09:04	7.1	6.8	0.3	0.09
0	4	09/13/22	09:18	09:47	8.0	7.5	0.5	0.25
1	5	09/13/22	10:00	10:29	8.3	7.9	0.4	0.16
1	6	09/13/22	10:40	11:09	8.2	7.9	0.3	0.09
1	7	09/13/22	11:30	11:59	8.1	7.7	0.4	0.16
1	8	09/13/22	12:12	12:41	7.8	7.7	0.1	0.01
1	9	09/13/22	12:53	13:22	7.8	7.8	0.0	0.00
1	10	09/13/22	13:32	14:01	7.0	7.1	-0.1	0.01
				n		9		
				t(0.025)		2.306		
				Mean Reference Method Value		7.633	RM avg	
				Mean CEM Value		7.422	CEM avg	
				Sum of Differences		1.900	di	
				Mean Difference		0.211	d	
				Sum of Differences Squared		0.650	di^2	
				Standard Deviation		0.176	sd	
				Confidence Coefficient 2.5% Error (1-tail)		0.136	cc	
				Relative Accuracy - APS		0.211	% difference [A]	

[A] Alternate Performance Standard for O_2 analyzers of ≤ 1.0 % for annual RATA testing,

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.

MOSTARDI PLATT

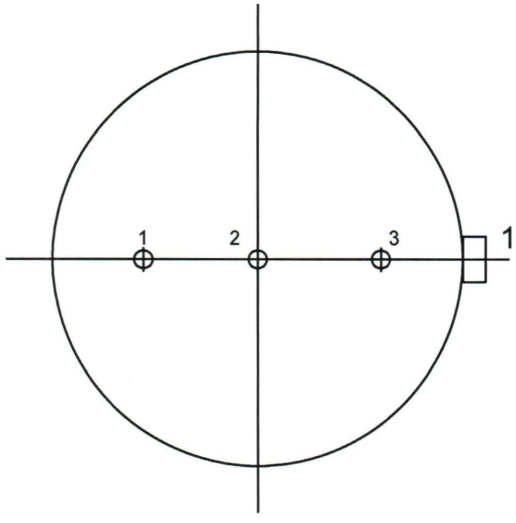
Michael Sather — Program Manager

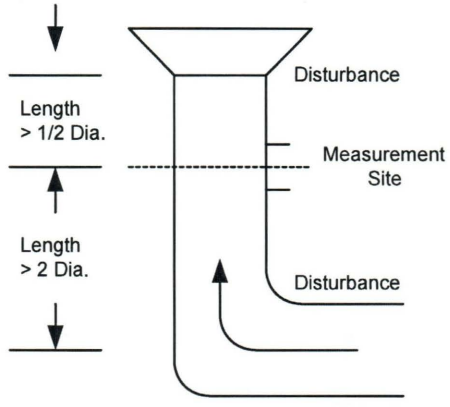
Scott W. Banach — Quality Assurance

APPENDICES

Appendix A - Test Section Diagrams

GASEOUS TRAVERSE FOR ROUND DUCTS





Job: Verso Corporation
Escanaba Mill
Escanaba, Michigan

Date: September 13, 2022

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

USEPA Methods 3A and 7E Extractive Gaseous Sampling Diagram