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Relative Accuracy Test
Audit Test Report

Billerud Quinnesec LLC
Quinnesec Mill
Package Boiler Outlet Duct,
Waste Fuel Boiler Outlet Duct,
Recovery Boiler Outlet Duct, and
Lime Kiln Stack
Quinnesec, Michigan
Project No. M242110A

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Billerud Quinnesec LLC
Quinnesec Mill
Package Boiler Outlet Duct, Waste Fuel Boiler Outlet Duct, Recovery Boiler Outlet Duct, and Lime Kiln Stack
Quinnesec, Michigan
Test Dates: May 21 through 23, 2024

Report Submittal Date
July 9, 2024

Project No. M242110A

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

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1.0 EXECUTIVE SUMMARY

Mostardi Platt conducted a Relative Accuracy Test Audit (RATA) test program for Billerud Quinnesec LLC at the Quinnesec, Michigan facility. This report summarizes the results of the test program and test methods used.

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

TEST INFORMATION		
Test Locations	**RATA Test Dates**	**Test Parameters**
Package Boiler Outlet Duct	May 21, 2024	Nitrogen Oxides (NO_X), Carbon Monoxide (CO), and Oxygen (O_2)
Waste Fuel Boiler Outlet Duct	May 23, 2024	NO_X, Sulfur Dioxide (SO_2), Carbon Dioxide (CO_2), O_2, and Volumetric Flow
Recovery Boiler Outlet Duct	May 22 and 23, 2024	NO_X, SO_2, O_2, CO, Total Reduced Sulfur (TRS), and Volumetric Flow
Lime Kiln Stack	May 21, 2024	TRS and O_2

The purpose of the test program was to demonstrate the relative accuracy of the parameters listed above. Selected results of the test program are summarized below. A complete summary of emission test results, for each location, follows the narrative portion of this report.

TRS results were corrected to eight percent O_2 on the Recovery Boiler and ten percent O_2 on the Lime Kiln.

PACKAGE BOILER OUTLET DUCT				
Date	**Parameter**	**Units**	**Acceptance Criteria**	**Relative Accuracy**
5/21/2024	NO_X	lb/mmBtu	< 20% of the mean reference method value	7.35%
	NO_X	lb/hr	< 20% of the mean reference method value	3.42%
	O_2	% dry	< 20% of the mean reference method value	1.83%
	CO	lb/mmBtu	< 5% of applicable standard of 0.12 lb/hr	3.06% of applicable standard of 0.12 lb/MMBtu
	CO	ppm	< 5 ppm mean difference + confidence coefficient	3.17 ppm mean difference + confidence coefficient
	CO	lb/hr	< 5% of applicable standard of 25.5 lb/hr	1.78% of applicable standard of 25.5 lb/hr

WASTE FUEL BOILER OUTLET DUCT				
Date	**Parameter**	**Units**	**Acceptance Criteria**	**Relative Accuracy**
5/23/2024	NO_X	lb/mmBtu	< 20% of the mean reference method value	6.17%
	NO_X	lb/hr	< 20% of the mean reference method value	12.09%
	CO_2	% dry	< 20% of the mean reference method value	0.54%
	O_2	% dry	< 20% of the mean reference method value	3.02%
	SO_2	lb/mmBtu	< 20% of the mean reference method value	0.00%
	SO_2	lb/hr	< 10% of applicable standard of 476 lb/hr	0.51% of applicable standard of 476 lb/hr
	Volumetric Flow	dscfm	< 20% of the mean reference method value	14.36%

RECOVERY BOILER OUTLET DUCT				
Date	**Parameter**	**Units**	**Acceptance Criteria**	**Relative Accuracy**
5/22/2024	NO_X	ppmvd @ 8% O_2	< 20% of the mean reference method value	3.39%
	O_2	% dry	< 20% of the mean reference method value	6.08%
	SO_2	ppmvd @ 8% O_2	< 10% of applicable standard of 50 ppmvd@ 8% O_2	0.87% of applicable standard of 50 ppmvd @ 8% O_2
	CO	ppmvd @ 8% O_2	< 5% of applicable standard of 500 ppmvd@ 8% O_2	1.22% of applicable standard of 425 ppmvd @ 8% O_2
5/22/2024 & 5/23/2024	TRS	ppmvd @ 8% O_2	< 20% of the mean reference method value	10.19%
5/22/2024	Volumetric Flow	dscfm	< 20% of the mean reference method value	1.83%

LIME KILN STACK				
Date	**Parameter**	**Units**	**Acceptance Criteria**	**Relative Accuracy**
5/21/2024	TRS	ppmvd @ 10% O_2	< 20% of the mean reference method value	14.23%
	O_2	% dry	< 20% of the mean reference method value	8.97%

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	XF003141B	124.8 ppm	3/4/2032
NO_X	Airgas	ALM-023821	150.8 ppm	1/24/2031
NO_X	Airgas	CC48275	300.5 ppm	1/24/2032
SO_2	Airgas	CC439581	12.15 ppm	6/1/2025
SO_2	Airgas	CC285356	12.17 ppm	10/18/2026
SO_2	Airgas	CC501703	25.05 ppm	10/18/2026
SO_2	Airgas	CC488384	248.5 ppm	8/7/2031
SO_2	Airgas	CC280724	496.4 ppm	9/1/2031
O_2	Airgas	CC35454	5.077%	2/12/2032
O_2	Airgas	CC403240	9.041%	2/6/2032
O_2	Airgas	CC47224	9.151%	2/6/2032
O_2	Airgas	CC440339	21.93%	7/7/2030
CO_2	Airgas	CC309474	9.940%	5/1/2031
CO_2	Airgas	CC709438	19.17%	6/23/2031
CO	Airgas	XF003141B	78.02 ppm	3/4/2032
CO	Airgas	000006	173.5 ppm	2/23/2027
CO	Airgas	CC218918	470.6 ppm	3/23/2030
CO	Airgas	CC713835	920.9 ppm	8/12/2027

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

Location	**Address**	**Contact**
Test Facility	Billerud Quinnesec LLC W-679 U. S. Highway 2 Quinnesec, Michigan 49876	Ms. Paula LaFleur Environmental Engineer (906) 779-3494 (phone) paula.lafleur@billerud.com
Testing Company Representative	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Mr. Christopher Jensen Senior Project Manager (630) 993-2100 (phone) cjensen@mp-mail.com

The test crew consisted of B. Truett, J. Jimenez, T. Yanowsky, and C. Jensen of Mostardi Platt.

2.0 TEST METHODOLOGY

Emissions testing was conducted following the methods specified in 40CFR, Part 40 CFR, Part 60, Appendix A. Schematics of the test section diagrams and sampling trains used are included in Appendix A and B, respectively. Copies of example calculation and nomenclature are included in Appendix C. Copies of analyzer print-outs for each test run are included in Appendix D. CEM data and process data as provided by Billerud Quinnesec, LLC are included in Appendix E.

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.

Location	Upstream Distance	Downstream Distance	Test Parameter	Number of Sampling Points
Waste Fuel Boiler Outlet Duct	20 feet	100 feet	Volumetric Flow	18
Recovery Boiler Outlet Duct	20 feet	80 feet		

Method 2 Volumetric Flowrate Determination

Gas velocity was measured following Method 2, for purposes of calculating stack gas volumetric flow rate at the Waste Fuel Boiler Outlet Duct and Recovery Boiler Outlet Duct. An S-type pitot tube, differential pressure gauge, thermocouple and temperature readout were used to determine gas velocity at each sample point at each test location. Copies of field data sheets are included in Appendix F. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix G. This testing met the performance specifications as outlined in the Method.

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

Stack gas O_2 and/or CO_2 concentrations were determined in accordance with USEPA Method 3A. Servomex analyzers were used to determine the O_2 and/or CO_2 concentrations in the manner specified in the Method. Each 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 and the CO_2 operates in the nominal range of 0 to 20% 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 and/or CO_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 H. This testing met the performance specifications as outlined in the Method.

Method 4 Moisture Determination

USEPA Method 4, 40CFR60, Appendix A, was utilized to determine water (H_2O) content of the exhaust gas Waste Fuel Boiler Outlet Duct and Recovery Boiler Outlet Duct. 100 milliliters (ml) of water were added to each of the first two impingers, the third impinger was left empty, and the fourth impinger was charged with approximately 200 grams of silica gel. The impingers were placed in an ice bath to maintain the sampled gas passed through the silica gel impinger outlet below 68°F in order to increase the accuracy of the sampled dry gas volume measurement. The water volumes

of the impinger train were measured and the silica gel was weighed before and after each test run to determine the mass of moisture condensed.

Each sample was extracted through a heated stainless-steel probe and filter assembly at a constant sample rate of approximately 0.75 cubic feet per minute, which was maintained throughout the course of the test run. Approximately 21 dry standard cubic feet (dscf) were sampled for, each moisture run. After each run, a leak check of the sampling train was performed at a vacuum greater than the sampling vacuum to determine if any leakage had occurred during sampling. Following the leak check, the impingers were removed from the ice bath, water levels were measured, and the silica gel weight was recorded.

All of the equipment used was calibrated in accordance with the specifications of the Method.

Copies of field data sheets are included in Appendix F. Calibration data is presented in Appendix G. This testing met the performance specifications as outlined in the Method.

Method 6C Sulfur Dioxide (SO_2) Determination

Stack gas SO_2 concentrations and emission rates were determined in accordance with USEPA Method 6C, 40CFR60, Appendix A at the Waste Fuel Boiler Outlet Duct and Recovery Boiler Outlet Duct. A Thermo Scientific Model 43C Pulsed Fluorescence Sulfur Dioxide Analyzer was used to determine sulfur dioxide concentrations, in the manner specified in the Method. The instrument for the Recovery Boiler operated in the nominal range of 0 ppm to 100 ppm with the specific range determined by the high-level span calibration gas of 90.56 ppm. The instrument for the Waste Fuel Boiler operated in the nominal range of 0 ppm to 500 ppm with the specific range determined by the high-level span calibration gas of 496.4 ppm.

The Model 43C High Level is based on the principle that SO_2 molecules absorb ultraviolet (UV) light and become excited at one wavelength, then decay to a lower energy state emitting UV light at a different wavelength. Specifically,

$$SO_2 + h\nu_1 \rightarrow SO_2^* \rightarrow SO_2 + h\nu_2$$

The sample is drawn into the Model 43C High Level through the sample bulkhead. The sample passes a pressure sensor then flows through a capillary and a flow sensor. The sample then flows into the fluorescence chamber, where pulsating UV light excites the SO_2 molecules. The condensing lens focuses the pulsating UV light into the mirror assembly. The mirror assembly contains four selective mirrors that reflect only the wavelengths which excite SO_2 molecules. As the excited SO_2 molecules decay to lower energy states they emit UV light that is proportional to the SO_2 concentration. The bandpass filter allows only the wavelengths emitted by the excited SO_2 molecules to reach the photomultiplier tube (PMT). The PMT detects the UV light emission from the decaying SO_2 molecules. The photodetector, located at the back of the fluorescence chamber, continuously monitors the pulsating UV light source and is connected to a circuit that compensates for fluctuations in the UV light.

The sample then flows to the pump and is exhausted out the exhaust bulkhead of the analyzer. The Model 43C High Level outputs the SO_2 concentration to 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.

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

Method 7E Nitrogen Oxide (NO_X) Determination

Stack gas NO_X concentrations and emission rates were determined in accordance with USEPA Method 7E, 40CFR60, Appendix A, at the Package Boiler Outlet Duct, Waste Fuel Boiler Outlet Duct, and Recovery Boiler Outlet Duct. 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 of 300.5 ppm.

The Model 42i operates 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 NO_2 molecules decay to lower energy states. Specifically,

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

Nitrogen dioxide (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 molybdenum NO_2-to-NO converter heated to about 205°C. The flue gas sample is drawn into the Model 42*i* through the sample bulkhead. The sample flows through 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 (NO_X mode). A flow sensor prior to the reaction chamber measures the sample flow. Dry air enters the Model 42*i* through the dry air bulkhead, passes through a flow switch, and then through a silent discharge ozonator. The ozonator generates the ozone needed for the chemiluminescent reaction. At the reaction chamber, the ozone reacts with the NO in the sample to produce excited NO_2 molecules. A photomultiplier tube (PMT) housed in a thermoelectric cooler detects the luminescence generated during this reaction. From the reaction chamber, the exhaust travels through the ozone (O_3) converter to the pump, and is released through the vent.

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 outputs NO, NO_2, and NO_X concentrations to the front panel display, the analog outputs, and also makes the data available over the serial or ethernet connection.

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 G. Copies of the gas cylinder certifications are found in Appendix H. The NO_2 to NO converter tests can be found in Appendix I. This testing met the performance specifications as outlined in the Method.

Method 10 Carbon Monoxide (CO) Determination

Stack gas CO concentrations and emission rates were determined in accordance with USEPA Method 10, 40CFR60, Appendix A at the Package Boiler Outlet Duct and Recovery Boiler Outlet Duct. A Fischer Scientific Model 48C Gas Filter Correlation Carbon Monoxide was used to determine carbon monoxide concentrations, in the manner specified in the Method. The instrument operated in the nominal range of 0 ppm to 500 ppm or 1,000 ppm with the specific range determined by the high-level span calibration gas of 173.5 ppm and 920.9 ppm.

The Model 48C High Level is based on the principle that CO absorbs infrared radiation at a wavelength of 4.6 microns. Because infrared absorption is a nonlinear measurement technique, it is necessary for the instrument electronics to transform the basic analyzer signal into a linear output. The Model 48C High Level uses an exact calibration curve to accurately linearize the instrument output over any range up to a concentration of 20,000 ppm. The sample is drawn into the analyzer through the sample bulkhead. The sample flows through the optical bench. Radiation from an infrared source is chopped and then passed through a gas filter alternating between CO and N2. The radiation then passes through a narrow bandpass interference filter and enters the optical bench where absorption by the sample gas occurs. The infrared radiation then exits the optical bench and falls on an infrared detector. The CO gas filter acts to produce a reference beam which cannot be further attenuated by CO in the sample cell. The N_2 side of the filter wheel is transparent to the infrared radiation and therefore produces a measure beam which can be absorbed by CO in the cell. The chopped detector signal is modulated by the alternation between the two gas filters with an amplitude related to the concentration of CO in the sample cell. Other gases do not cause modulation of the detector signal since they absorb the reference and measure beams equally. Thus, the GFC system responds specifically to CO. The Model 48C High Level outputs the CO concentration to 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.

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

Method 16C Total Reduced Sulfur (TRS) Determination

Integrated gas samples were extracted from the Lime Kiln and Recovery Boiler Outlet Duct gas streams in accordance with Method 16C (SO2 Monitor), 40CFR60, for the determination of total reduced sulfur (TRS) emissions from stationary sources. This method selectively removed sulfur dioxide (SO_2) by bubbling the gas sample through a citrate buffer solution, then thermally oxidizing TRS compounds present to SO_2. A portion of the gas stream was conveyed to the gas analyzer for determination of SO_2 content. Prior to sampling, the SO_2 analyzer was zeroed and calibrated with high-range, mid-range, and zero gases. After each test run, zero and mid-range calibration gases were introduced to check calibration.

Interferences caused by particulate matter entering the sampling train were eliminated by the use of a heated filter medium placed at the end of the heated Teflon®-lined (or glass-lined) probe.

Prior to field sampling, an optional 30-minute system performance test was performed to validate the sampling train components and procedure. The checks involved sampling a known concentration of hydrogen sulfide (H_2S) and comparing the analyzed concentration with the known concentration. The H_2S recovery gas was mixed with combustion gas in a dilution system. The flowrates were adjusted to generate an H_2S concentration in the range of the stack gas. The samples were collected and analyzed in the same manner as a normal stack test. The sample was collected through the end of the probe to ensure extraction of a representative sample. System validations were performed following each one-hour test in the same manner as the system performance test.

A list of calibration gases used and the results of all calibration and other required quality assurance checks can be found in Appendix G. Copies of calibration gas certifications can be found in Appendix H.

3.0 TEST RESULT SUMMARIES

Client: Billerud Quinnesec, LLC
Facility: Quinnesec Mill
Project #: M242110
Fuel Type: Natural Gas

Location: Package Boiler Outlet Duct
Date: 5/21/24
Test Method: 7E, 3A
Fuel Factor: 8710

O2 based NOx lb/mmBtu RATA

CEM Analyzer Information

NO_x Monitor/Model:	Thermo 42iQ	**NO_x Serial # :**	1180090011
O2 Monitor/Model:	Thermo CTL902C	**O2 Serial # :**	1180390002

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	05/21/24	08:35	08:55	0.05	0.04	0.01	0.0001
1	2	05/21/24	09:07	09:27	0.05	0.05	0.00	0.0000
1	3	05/21/24	09:35	09:55	0.05	0.05	0.00	0.0000
0	4	05/21/24	10:04	10:24	0.05	0.04	0.01	0.0001
1	5	05/21/24	10:34	10:54	0.05	0.05	0.00	0.0000
1	6	05/21/24	11:04	11:24	0.05	0.05	0.00	0.0000
1	7	05/21/24	11:34	11:54	0.05	0.05	0.00	0.0000
1	8	05/21/24	12:04	12:24	0.05	0.05	0.00	0.0000
1	9	05/21/24	12:34	12:54	0.05	0.05	0.00	0.0000
1	10	05/21/24	13:06	13:26	0.05	0.05	0.00	0.0000
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**0.050**		**RM avg**	
				Mean CEM Value	**0.049**		**CEM avg**	
				Sum of Differences	**0.010**		**di**	
				Mean Difference	**0.001**		**d**	
				Sum of Differences Squared	**0.000**		**di^2**	
				Standard Deviation	**0.003**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.003**		**cc**	
				Relative Accuracy	**7.35**		**RA**	

Client: Billerud Quinnesec, LLC **Location:** Package Boiler Outlet Duct
Facility: Quinnesec Mill **Date:** 5/21/24
Project #: M242110 **Test Method:** 7E, 2
Applicable Standard: 41.9

NO_x lb/hr RATA

CEM Analyzer Information

NO_x Monitor/Model:			Thermo 42iQ		**NO_x Serial # :**		1180090011	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM NO_x lb/hr**	**CEM NO_x lb/hr**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/21/24	08:35	08:55	7.66	7.48	0.18	0.0324
1	2	05/21/24	09:07	09:27	7.74	7.52	0.22	0.0484
1	3	05/21/24	09:35	09:55	7.81	7.54	0.27	0.0729
0	4	05/21/24	10:04	10:24	7.85	7.51	0.34	0.1156
1	5	05/21/24	10:34	10:54	7.79	7.57	0.22	0.0484
1	6	05/21/24	11:04	11:24	7.79	7.55	0.24	0.0576
1	7	05/21/24	11:34	11:54	7.86	7.59	0.27	0.0729
1	8	05/21/24	12:04	12:24	7.84	7.57	0.27	0.0729
1	9	05/21/24	12:34	12:54	7.79	7.55	0.24	0.0576
1	10	05/21/24	13:06	13:26	7.83	7.56	0.27	0.0729
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**7.790**		**RM avg**	
				Mean CEM Value	**7.548**		**CEM avg**	
				Sum of Differences	**2.180**		**di**	
				Mean Difference	**0.242**		**d**	
				Sum of Differences Squared	**0.536**		**di^2**	
				Standard Deviation	**0.032**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.024**		**cc**	
				Relative Accuracy	**3.42**		**RA**	

Client: Billerud Quinnesec, LLC
Location: Package Boiler Outlet Duct
Facility: Quinnesec Mill
Date: 5/21/24
Project #: M242110
Test Method: 3A

O_2 % (dry) RATA

CEM Analyzer Information

O_2 Monitor/Model:			Thermo CTL902C		O_2 Serial # :		1180390002	
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	05/21/24	08:35	08:55	3.8	3.8	0.0	0.00
1	2	05/21/24	09:07	09:27	3.9	4.0	-0.1	0.01
1	3	05/21/24	09:35	09:55	4.2	4.1	0.1	0.01
1	4	05/21/24	10:04	10:24	4.0	4.0	0.0	0.00
1	5	05/21/24	10:34	10:54	4.1	4.1	0.0	0.00
1	6	05/21/24	11:04	11:24	4.3	4.3	0.0	0.00
1	7	05/21/24	11:34	11:54	3.9	4.0	-0.1	0.01
0	8	05/21/24	12:04	12:24	3.9	4.0	-0.1	0.01
1	9	05/21/24	12:34	12:54	4.0	4.1	-0.1	0.01
1	10	05/21/24	13:06	13:26	4.0	4.0	0.0	0.00
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**4.022**		**RM avg**	
				Mean CEM Value	**4.044**		**CEM avg**	
				Sum of Differences	**-0.200**		**di**	
				Mean Difference	**-0.022**		**d**	
				Sum of Differences Squared	**0.040**		**di^2**	
				Standard Deviation	**0.067**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.051**		**cc**	
				Relative Accuracy	**1.83**		**RA**	

Client: Billerud Quinnesec, LLC | **Location:** Package Boiler Outlet Duct
Facility: Quinnesec Mill | **Date:** 5/21/24
Project #: M242110 | **Test Method:** 10, 3A
Fuel Type: Natural Gas | **Fuel Factor:** 8710

Applicable Standard: 0.12

O2 based CO lb/mmBtu RATA

CEM Analyzer Information

CO Monitor/Model:	Thermo 48iQ	**CO Serial # :**	1180930081
O2 Monitor/Model:	Thermo CTL902C	**O2 Serial # :**	1180390002

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO lb/MMBtu	CEM CO lb/MMBtu	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/21/24	08:35	08:55	0.01	0.01	0.00	0.000000
1	2	05/21/24	09:07	09:27	0.00	0.01	-0.01	0.000100
1	3	05/21/24	09:35	09:55	0.00	0.00	0.00	0.000000
1	4	05/21/24	10:04	10:24	0.00	0.00	0.00	0.000000
1	5	05/21/24	10:34	10:54	0.00	0.00	0.00	0.000000
1	6	05/21/24	11:04	11:24	0.00	0.00	0.00	0.000000
1	7	05/21/24	11:34	11:54	0.01	0.01	0.00	0.000000
0	8	05/21/24	12:04	12:24	0.00	0.01	-0.01	0.000100
1	9	05/21/24	12:34	12:54	0.01	0.01	0.00	0.000000
1	10	05/21/24	13:06	13:26	0.01	0.01	0.00	0.000000

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**0.004**	**RM avg**
Mean CEM Value	**0.006**	**CEM avg**
Sum of Differences	**-0.010**	**di**
Mean Difference	**-0.001**	**d**
Sum of Differences Squared	**0.000**	**di^2**
Standard Deviation	**0.003**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.003**	**cc**
Relative Accuracy - APS	**3.06**	**RA**

[A] Relative accuracy based upon +/- 5% of applicable standard

Client: Billerud Quinnesec, LLC **Location:** Package Boiler Outlet Duct
Facility: Quinnesec Mill **Date:** 5/21/24
Project #: M242110 **Test Method:** 10
Applicable Standard: 195

CO ppmvd RATA

CEM Analyzer Information

CO Monitor/Model:		Thermo 48iQ			**CO Serial # :**		1180930081	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM CO ppmvd**	**CEM CO ppmvd**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/21/24	08:35	08:55	10.4	13.6	-3.2	10.24
1	2	05/21/24	09:07	09:27	6.3	9.1	-2.8	7.84
1	3	05/21/24	09:35	09:55	2.9	5.4	-2.5	6.25
1	4	05/21/24	10:04	10:24	4.8	7.6	-2.8	7.84
1	5	05/21/24	10:34	10:54	3.3	6.0	-2.7	7.29
1	6	05/21/24	11:04	11:24	2.5	5.2	-2.7	7.29
0	7	05/21/24	11:34	11:54	9.3	13.0	-3.7	13.69
1	8	05/21/24	12:04	12:24	5.6	8.9	-3.3	10.89
1	9	05/21/24	12:34	12:54	8.2	10.8	-2.6	6.76
1	10	05/21/24	13:06	13:26	6.4	9.9	-3.5	12.25
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**5.600**		**RM avg**	
				Mean CEM Value	**8.500**		**CEM avg**	
				Sum of Differences	**-26.100**		**di**	
				Mean Difference	**-2.900**		**d**	
				Sum of Differences Squared	**76.650**		**di^2**	
				Standard Deviation	**0.346**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.266**		**cc**	
				Relative Accuracy - APS	**3.17**		**ppm + cc difference[A]**	

[A] Relative accuracy based upon alternate performance standard of +/- 5 ppm CO plus the confidence coefficient.

Client: Billerud Quinnesec, LLC **Location:** Package Boiler Outlet Duct
Facility: Quinnesec Mill **Date:** 5/21/24
Project #: M242110 **Test Method:** 10, 2
Applicable Standard: 25.5

CO lb/hr RATA

CEM Analyzer Information

CO Monitor/Model:		Thermo 48iQ		**CO Serial # :**		1180930081	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM CO lb/hr**	**CEM CO lb/hr**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/21/24	08:35	08:55	1.4	1.8	-0.4	0.16
1	2	05/21/24	09:07	09:27	0.8	1.2	-0.4	0.16
1	3	05/21/24	09:35	09:55	0.4	0.7	-0.3	0.09
1	4	05/21/24	10:04	10:24	0.6	1.0	-0.4	0.16
1	5	05/21/24	10:34	10:54	0.4	0.8	-0.4	0.16
1	6	05/21/24	11:04	11:24	0.3	0.7	-0.4	0.16
1	7	05/21/24	11:34	11:54	1.2	1.7	-0.5	0.25
0	8	05/21/24	12:04	12:24	0.7	1.2	-0.5	0.25
1	9	05/21/24	12:34	12:54	1.1	1.4	-0.3	0.09
1	10	05/21/24	13:06	13:26	0.8	1.3	-0.5	0.25
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**0.778**		**RM avg**	
				Mean CEM Value	**1.178**		**CEM avg**	
				Sum of Differences	**-3.600**		**di**	
				Mean Difference	**-0.400**		**d**	
				Sum of Differences Squared	**1.480**		**di^2**	
				Standard Deviation	**0.071**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.054**		**cc**	
				Relative Accuracy - APS	**1.78**		**RA**	

[A] Relative accuracy based upon +/- 5% of applicable standard

Client: Billerud Quinnesec, LLC
Facility: Quinnesec Mill
Project #: M242110
Fuel Type: Other

Location: Waste Fuel boiler Outlet Duct
Date: 5/23/24
Test Method: 7E, 3A
Fuel Factor: 9518

O2 based NOx lb/mmBtu RATA

CEM Analyzer Information

NO_x Monitor/Model:	Thermo 42iQ	**NO_x Serial # :**	1180030057
O2 Monitor/Model:	Thermo CTL902C	**O2 Serial # :**	1180530001

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	05/23/24	08:15	08:35	0.19	0.20	-0.01	0.0001
1	2	05/23/24	08:58	09:18	0.18	0.19	-0.01	0.0001
0	3	05/23/24	09:40	10:00	0.13	0.14	-0.01	0.0001
1	4	05/23/24	10:20	10:40	0.19	0.19	0.00	0.0000
1	5	05/23/24	11:00	11:20	0.18	0.18	0.00	0.0000
1	6	05/23/24	11:38	11:58	0.18	0.19	-0.01	0.0001
1	7	05/23/24	12:17	12:37	0.17	0.18	-0.01	0.0001
1	8	05/23/24	12:56	13:16	0.18	0.19	-0.01	0.0001
1	9	05/23/24	13:34	13:54	0.17	0.18	-0.01	0.0001
1	10	05/23/24	14:12	14:32	0.19	0.20	-0.01	0.0001

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**0.181**	**RM avg**
Mean CEM Value	**0.189**	**CEM avg**
Sum of Differences	**-0.070**	**di**
Mean Difference	**-0.008**	**d**
Sum of Differences Squared	**0.001**	**di^2**
Standard Deviation	**0.004**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.003**	**cc**
Relative Accuracy	**6.17**	**RA**

Client: Billerud Quinnesec, LLC **Location:** Waste Fuel boiler Outlet Duct
Facility: Quinnesec Mill **Date:** 5/23/24
Project #: M242110 **Test Method:** 7E, 2
Applicable Standard: 437

NO_x lb/hr RATA

CEM Analyzer Information

NO_x Monitor/Model:	Thermo 42iQ	**NO_x Serial # :**	1180030057

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x lb/hr	CEM NO_x lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/23/24	08:15	08:35	83.2	72.9	10.3	106.09
1	2	05/23/24	08:58	09:18	75.0	65.6	9.4	88.36
1	3	05/23/24	09:40	10:00	60.7	54.1	6.6	43.56
1	4	05/23/24	10:20	10:40	80.7	73.0	7.7	59.29
0	5	05/23/24	11:00	11:20	77.6	66.2	11.4	129.96
1	6	05/23/24	11:38	11:58	70.2	66.2	4.0	16.00
1	7	05/23/24	12:17	12:37	76.5	67.7	8.8	77.44
1	8	05/23/24	12:56	13:16	75.5	68.3	7.2	51.84
1	9	05/23/24	13:34	13:54	71.5	66.6	4.9	24.01
1	10	05/23/24	14:12	14:32	76.6	68.6	8.0	64.00

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**74.433**	**RM avg**
Mean CEM Value	**67.000**	**CEM avg**
Sum of Differences	**66.900**	**di**
Mean Difference	**7.433**	**d**
Sum of Differences Squared	**530.590**	**di^2**
Standard Deviation	**2.040**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**1.568**	**cc**
Relative Accuracy	**12.09**	**RA**

Client: Billerud Quinnesec, LLC **Location:** Waste Fuel boiler Outlet Duct
Facility: Quinnesec Mill **Date:** 5/23/24
Project #: M242110 **Test Method:** 3A

CO_2 % (dry) RATA

CEM Analyzer Information

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO_2 % (dry)	CEM CO_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/23/24	08:15	08:35	13.0	13.0	0.0	0.00
0	2	05/23/24	08:58	09:18	13.1	13.0	0.1	0.01
1	3	05/23/24	09:40	10:00	14.5	14.6	-0.1	0.01
1	4	05/23/24	10:20	10:40	13.4	13.4	0.0	0.00
1	5	05/23/24	11:00	11:20	13.5	13.5	0.0	0.00
1	6	05/23/24	11:38	11:58	12.8	12.8	0.0	0.00
1	7	05/23/24	12:17	12:37	13.6	13.6	0.0	0.00
1	8	05/23/24	12:56	13:16	13.6	13.5	0.1	0.01
1	9	05/23/24	13:34	13:54	13.9	13.8	0.1	0.01
1	10	05/23/24	14:12	14:32	13.2	13.1	0.1	0.01

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**13.500**	**RM avg**
Mean CEM Value	**13.478**	**CEM avg**
Sum of Differences	**0.200**	**di**
Mean Difference	**0.022**	**d**
Sum of Differences Squared	**0.040**	**di^2**
Standard Deviation	**0.067**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.051**	**cc**
Relative Accuracy	**0.54**	**RA**

Client: Billerud Quinnesec, LLC **Location:** Waste Fuel boiler Outlet Duct
Facility: Quinnesec Mill **Date:** 5/23/24
Project #: M242110 **Test Method:** 3A

O_2 % (dry) RATA

CEM Analyzer Information

O_2 Monitor/Model:	Thermo CTL902C	O_2 Serial # :	1180530001

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)
0	1	05/23/24	08:15	08:35	7.1	7.4	-0.3	0.09
1	2	05/23/24	08:58	09:18	7.1	7.3	-0.2	0.04
1	3	05/23/24	09:40	10:00	5.5	5.7	-0.2	0.04
1	4	05/23/24	10:20	10:40	6.7	6.9	-0.2	0.04
1	5	05/23/24	11:00	11:20	6.6	6.8	-0.2	0.04
1	6	05/23/24	11:38	11:58	7.4	7.6	-0.2	0.04
1	7	05/23/24	12:17	12:37	6.5	6.7	-0.2	0.04
1	8	05/23/24	12:56	13:16	6.6	6.8	-0.2	0.04
1	9	05/23/24	13:34	13:54	6.3	6.5	-0.2	0.04
1	10	05/23/24	14:12	14:32	7.0	7.2	-0.2	0.04

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**6.633**	**RM avg**
Mean CEM Value	**6.833**	**CEM avg**
Sum of Differences	**-1.800**	**di**
Mean Difference	**-0.200**	**d**
Sum of Differences Squared	**0.360**	**di^2**
Standard Deviation	**0.000**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.000**	**cc**
Relative Accuracy	**3.02**	**RA**

Client: Billerud Quinnesec, LLC | **Location:** Waste Fuel boiler Outlet Duct
Facility: Quinnesec Mill | **Date:** 5/23/24
Project #: M242110 | **Test Method:** 6C, 3A
Fuel Type: Other | **Fuel Factor:** 9518

Applicable Standard: 1.2

O2 based SO2 lb/mmBtu RATA

CEM Analyzer Information

SO_2 Monitor/Model:	Thermo 43iQ	**SO_2 Serial # :**	1180930080
O2 Monitor/Model:	Thermo CTL902C	**O2 Serial # :**	1180530001

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM SO_2 lb/MMBtu	CEM SO_2 lb/MMBtu	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/23/24	08:15	08:35	0.0	0.0	0.0	0.000
1	2	05/23/24	08:58	09:18	0.0	0.0	0.0	0.000
1	3	05/23/24	09:40	10:00	0.0	0.0	0.0	0.000
1	4	05/23/24	10:20	10:40	0.0	0.0	0.0	0.000
1	5	05/23/24	11:00	11:20	0.0	0.0	0.0	0.000
1	6	05/23/24	11:38	11:58	0.0	0.0	0.0	0.000
0	7	05/23/24	12:17	12:37	0.1	0.0	0.1	0.010
1	8	05/23/24	12:56	13:16	0.0	0.0	0.0	0.000
1	9	05/23/24	13:34	13:54	0.1	0.1	0.0	0.000
1	10	05/23/24	14:12	14:32	0.0	0.0	0.0	0.000

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**0.011**	**RM avg**
Mean CEM Value	**0.011**	**CEM avg**
Sum of Differences	**0.000**	**di**
Mean Difference	**0.000**	**d**
Sum of Differences Squared	**0.000**	**di^2**
Standard Deviation	**0.000**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.000**	**cc**
Relative Accuracy	**0.00**	**RA**

Client: Billerud Quinnesec, LLC **Location:** Waste Fuel boiler Outlet Duct
Facility: Quinnesec Mill **Date:** 5/23/24
Project #: M242110 **Test Method:** 6C, 2
Applicable Standard: 476

SO2 lb/hr RATA

CEM Analyzer Information

SO_2 Monitor/Model:			Thermo 43iQ		SO_2 Serial # :		1180930080	
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM SO_2 lb/hr	CEM SO_2 lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/23/24	08:15	08:35	3.5	1.9	1.6	2.56
1	2	05/23/24	08:58	09:18	2.4	0.4	2.0	4.00
1	3	05/23/24	09:40	10:00	3.7	6.1	-2.4	5.76
1	4	05/23/24	10:20	10:40	5.0	6.5	-1.5	2.25
1	5	05/23/24	11:00	11:20	3.3	2.1	1.2	1.44
1	6	05/23/24	11:38	11:58	4.6	3.1	1.5	2.25
0	7	05/23/24	12:17	12:37	26.2	18.7	7.5	56.25
1	8	05/23/24	12:56	13:16	20.5	19.5	1.0	1.00
1	9	05/23/24	13:34	13:54	42.8	39.3	3.5	12.25
1	10	05/23/24	14:12	14:32	6.7	4.5	2.2	4.84
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**10.278**		**RM avg**	
				Mean CEM Value	**9.267**		**CEM avg**	
				Sum of Differences	**9.100**		**di**	
				Mean Difference	**1.011**		**d**	
				Sum of Differences Squared	**36.350**		**di^2**	
				Standard Deviation	**1.842**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**1.416**		**cc**	
				Relative Accuracy - APS	**0.51**		**RA[A]**	

[A] Relative accuracy based upon +/- 10% of applicable standard of 476 lb/hr

Client: Billeruid Quinnesec, LLC **Test Location:** Waste Fuel Boiler Outlet Duct
Facility: Quinnesec Mill **Test Date:** 5/23/2024
Project #: M242110 **Test Method:** 2

Volumetric Flow RATA - Normal Load
CEM Analyzer Information

Flow Monitor/Model:	Deterich	**Flow Serial # :**	22-F-C-179,274797.01.1

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	Reference Method Flow DSCFM	CEM Flow DSCFM	(RM-CEM) Difference (di)	(RM-CEM) Difference ^{2} (di^2)
1	1	05/23/24	8:15	8:35	104,865	89,326	15,539	241,460,521
0	2	05/23/24	8:58	9:18	100,194	85,299	14,895	221,861,025
1	3	05/23/24	9:40	10:00	98,896	85,945	12,951	167,728,401
1	4	05/23/24	10:20	10:40	101,138	90,514	10,624	112,869,376
1	5	05/23/24	11:00	11:20	100,878	84,678	16,200	262,440,000
1	6	05/23/24	11:38	11:58	94,453	86,534	7,919	62,710,561
1	7	05/23/24	12:17	12:37	102,319	88,482	13,837	191,462,569
1	8	05/23/24	12:56	13:16	97,719	86,591	11,128	123,832,384
1	9	05/23/24	13:34	13:54	94,153	85,942	8,211	67,420,521
1	10	05/23/24	14:12	14:32	97,539	86,091	11,448	131,056,704

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**99106.667**	**RM avg**
Mean CEM Value	**87122.556**	**CEM avg**
Sum of Differences	**107857.000**	**di**
Mean Difference	**11984.111**	**d**
Sum of Differences Squared	**1360981037.000**	**di^2**
Standard Deviation	**2924.268**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**2247.788**	**cc**
Relative Accuracy	**14.36**	**RA**

Client: Billerud Quinnesec, LLC **Location:** Recovery Boiler Outlet Duct
Facility: Quinnesec Mill **Date:** 5/22/24
Project #: M242110 **Test Method:** 7E, 3A
Applicable Standard: 110

NOx ppmvd @ 8% O2 RATA

CEM Analyzer Information

NO_x Monitor/Model:			Thermo 42iQ			**NO_x Serial # :**	1180090013	
O_2 Monitor/Model:			Thermo CTL902C			**O_2 Serial # :**	1180240002	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM NOx ppmvd @ 8 %O2**	**CEM NOx ppmvd @ 8 %O2**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/22/24	09:35	09:55	83.5	81.4	2.1	4.41
1	2	05/22/24	10:18	10:38	83.7	80.7	3.0	9.00
1	3	05/22/24	11:02	11:22	87.4	84.3	3.1	9.61
1	4	05/22/24	11:46	12:06	83.0	80.5	2.5	6.25
1	5	05/22/24	12:32	12:52	83.8	81.5	2.3	5.29
1	6	05/22/24	13:14	13:34	77.0	74.6	2.4	5.76
0	7	05/22/24	13:56	14:16	78.9	75.9	3.0	9.00
1	8	05/22/24	14:38	14:58	85.4	82.5	2.9	8.41
1	9	05/22/24	15:18	15:38	86.7	84.2	2.5	6.25
1	10	05/22/24	15:58	16:18	87.8	85.2	2.6	6.76
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**84.256**		**RM avg**	
				Mean CEM Value	**81.656**		**CEM avg**	
				Sum of Differences	**23.400**		**di**	
				Mean Difference	**2.600**		**d**	
				Sum of Differences Squared	**61.740**		**di^2**	
				Standard Deviation	**0.335**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.258**		**cc**	
				Relative Accuracy	**3.39**		**RA**	

Client: Billerud Quinnesec, LLC **Location:** Recovery Boiler Outlet Duct
Facility: Quinnesec Mill **Date:** 5/22/24
Project #: M242110 **Test Method:** 3A

O_2 % (dry) RATA

CEM Analyzer Information

O_2 Monitor/Model:			Thermo CTL902C		O_2 Serial # :		1180240002	
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	05/22/24	09:35	09:55	5.2	5.4	-0.2	0.04
1	2	05/22/24	10:18	10:38	5.3	5.5	-0.2	0.04
1	3	05/22/24	11:02	11:22	5.3	5.6	-0.3	0.09
1	4	05/22/24	11:46	12:06	5.5	5.8	-0.3	0.09
1	5	05/22/24	12:32	12:52	5.3	5.6	-0.3	0.09
1	6	05/22/24	13:14	13:34	4.8	5.1	-0.3	0.09
0	7	05/22/24	13:56	14:16	4.6	4.9	-0.3	0.09
1	8	05/22/24	14:38	14:58	4.8	5.1	-0.3	0.09
1	9	05/22/24	15:18	15:38	5.0	5.3	-0.3	0.09
1	10	05/22/24	15:58	16:18	4.9	5.2	-0.3	0.09
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**5.122**		**RM avg**	
				Mean CEM Value	**5.400**		**CEM avg**	
				Sum of Differences	**-2.500**		**di**	
				Mean Difference	**-0.278**		**d**	
				Sum of Differences Squared	**0.710**		**di^2**	
				Standard Deviation	**0.044**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.034**		**cc**	
				Relative Accuracy	**6.08**		**RA**	

Client: Billerud Quinnesec, LLC **Location:** Recovery Boiler Outlet Duct
Facility: Quinnesec Mill **Date:** 5/22/24
Project #: M242110 **Test Method:** 6C, 3A
Applicable Standard: 50

SO2 ppmvd @ 8% O2 RATA

CEM Analyzer Information

SO_2 Monitor/Model:			Thermo 43iQ			**SO_2 Serial # :**	1180090009	
O_2 Monitor/Model:			Thermo CTL902C			**O_2 Serial # :**	1180240002	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM SO2 ppmvd @ 8 %O2**	**CEM SO2 ppmvd @ 8 %O2**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/22/24	09:35	09:55	0.4	0.7	-0.3	0.09
1	2	05/22/24	10:18	10:38	1.0	0.6	0.4	0.16
1	3	05/22/24	11:02	11:22	0.1	0.6	-0.5	0.25
1	4	05/22/24	11:46	12:06	0.7	0.5	0.2	0.04
1	5	05/22/24	12:32	12:52	0.9	0.5	0.4	0.16
0	6	05/22/24	13:14	13:34	2.0	0.5	1.5	2.25
1	7	05/22/24	13:56	14:16	1.5	0.5	1.0	1.00
1	8	05/22/24	14:38	14:58	0.5	0.6	-0.1	0.01
1	9	05/22/24	15:18	15:38	0.4	0.6	-0.2	0.04
1	10	05/22/24	15:58	16:18	0.4	0.6	-0.2	0.04
				n		**9**		
				t(0.975)		**2.306**		
				Mean Reference Method Value		**0.656**	**RM avg**	
				Mean CEM Value		**0.578**	**CEM avg**	
				Sum of Differences		**0.700**	**di**	
				Mean Difference		**0.078**	**d**	
				Sum of Differences Squared		**1.790**	**di^2**	
				Standard Deviation		**0.466**	**sd**	
				Confidence Coefficient 2.5% Error (1-tail)		**0.358**	**cc**	
				Relative Accuracy - APS		**0.87**	**RA[A]**	

[A] Relative accuracy based upon +/- 10% of applicable standard of 50 ppmvd @ 8% O_2

Client: Billerud Quinnesec, LLC **Location:** Recovery Boiler Outlet Duct
Facility: Quinnesec Mill **Date:** 5/22/24
Project #: M242110 **Test Method:** 10, 3A
Applicable Standard: 425

CO ppmvd @ 8% O2 RATA

CEM Analyzer Information

CO Monitor/Model:	Thermo 48iQ				**CO Serial # :**		11706800002	
O_2 Monitor/Model:	Thermo CTL902C				**O_2 Serial # :**		1180240002	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM CO ppmvd @ 8 %O2**	**CEM CO ppmvd @ 8 %O2**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/22/24	09:35	09:55	5.4	2.9	2.5	6.25
1	2	05/22/24	10:18	10:38	35.6	33.5	2.1	4.41
1	3	05/22/24	11:02	11:22	22.9	15.7	7.2	51.84
1	4	05/22/24	11:46	12:06	22.4	18.6	3.8	14.44
1	5	05/22/24	12:32	12:52	16.7	18.0	-1.3	1.69
1	6	05/22/24	13:14	13:34	99.1	99.2	-0.1	0.01
1	7	05/22/24	13:56	14:16	73.8	75.2	-1.4	1.96
1	8	05/22/24	14:38	14:58	10.1	6.0	4.1	16.81
1	9	05/22/24	15:18	15:38	25.0	17.7	7.3	53.29
0	10	05/22/24	15:58	16:18	14.1	6.7	7.4	54.76
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**34.556**		**RM avg**	
				Mean CEM Value	**31.867**		**CEM avg**	
				Sum of Differences	**24.200**		**di**	
				Mean Difference	**2.689**		**d**	
				Sum of Differences Squared	**150.700**		**di^2**	
				Standard Deviation	**3.272**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**2.515**		**cc**	
				Relative Accuracy - APS	**1.22**		**RA**	

[A] Relative accuracy based upon +/- 5% of applicable standard of 425 ppmvd @ 8% O_2

Client: Billerud Quinnesec, LLC | **Location:** Recovery Boiler Outlet Duct
Facility: Quinnesec Mill | **Date:** 5/22 and 5/23
Project #: M242110 | **Test Method:** 16C, 3A
Applicable Standard: 10

TRS as SO2 ppmvd @ 8% O2 RATA

CEM Analyzer Information

TRS Monitor/Model:			Thermo 43iQ		**TRS Serial # :**		1180090014	
O_2 Monitor/Model:			Thermo CTL902C		**O_2 Serial # :**		1180240002	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM TRS as SO2 ppmvd @ 8 %O2**	**CEM TRS ppmvd @ 8 %O2**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/22/24	12:32	12:52	1.0	1.0	0.0	0.00
1	2	05/22/24	13:14	13:34	1.3	1.1	0.2	0.04
1	3	05/22/24	13:56	14:16	0.8	1.0	-0.2	0.04
1	4	05/22/24	15:18	15:38	1.1	1.1	0.0	0.00
1	5	05/22/24	15:58	16:18	1.2	1.2	0.0	0.00
1	6	05/22/24	16:36	16:56	1.2	1.2	0.0	0.00
1	7	05/23/24	08:19	08:39	0.8	0.7	0.1	0.01
1	8	05/23/24	09:06	09:26	0.7	0.6	0.1	0.01
1	9	05/23/24	09:52	10:12	0.8	0.9	-0.1	0.01
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**0.989**		**RM avg**	
				Mean CEM Value	**0.978**		**CEM avg**	
				Sum of Differences	**0.100**		**di**	
				Mean Difference	**0.011**		**d**	
				Sum of Differences Squared	**0.110**		**di^2**	
				Standard Deviation	**0.117**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.090**		**cc**	
				Relative Accuracy	**10.19**		**RA**	

Client: Billerud Quinnesec, LLC
Facility: Quinnesec Mill
Project #: M242110

Test Location: Recovery Boiler Outlet Duct
Test Date: 5/22/2024
Test Method: 2

Volumetric Flow RATA - Normal Load
CEM Analyzer Information

Flow Monitor/Model:	OSI-OFS 2000W				**Flow Serial # :**		15110807E	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**Reference Method Flow DSCFM**	**CEM Flow DSCFM**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference ^{2} (di^2)**
1	1	05/22/24	9:00	9:25	185,457	186,915	-1,458	2,126,931
1	2	05/22/24	9:27	9:35	186,597	186,799	-202	40,925
1	3	05/22/24	10:10	10:15	188,452	186,177	2,275	5,173,350
1	4	05/22/24	10:16	10:26	188,828	186,481	2,347	5,508,878
1	5	05/22/24	10:30	10:40	189,003	186,833	2,170	4,708,900
0	6	05/22/24	11:30	11:36	192,755	187,152	5,603	31,393,609
1	7	05/22/24	11:37	11:47	191,713	187,631	4,082	16,658,642
1	8	05/22/24	11:48	11:58	193,134	187,791	5,343	28,548,718
1	9	05/22/24	12:30	12:40	189,301	187,597	1,704	2,902,253
1	10	05/22/24	12:45	12:55	186,188	188,094	-1,906	3,632,836
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**188741.233**		**RM avg**	
				Mean CEM Value	**187146.444**		**CEM avg**	
				Sum of Differences	**14353.100**		**di**	
				Mean Difference	**1594.789**		**d**	
				Sum of Differences Squared	**69301433.330**		**di^2**	
				Standard Deviation	**2408.611**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**1851.419**		**cc**	
				Relative Accuracy	**1.83**		**RA**	

Client: Billerud Quinnesec, LLC **Location:** Lime Kiln
Facility: Quinnesec Mill **Date:** 5/21/24
Project #: M242110 **Test Method:** 16C, 3A
Applicable Standard: 10

TRS as SO2 ppmvd @ 10% O2 RATA

CEM Analyzer Information

TRS Monitor/Model:			Thermo 43iQ		**TRS Serial # :**		1180090014	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM TRS as SO2 ppmvd @ 10 %O2**	**CEM TRS ppmvd @ 10 %O2**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/21/24	09:29	09:49	2.4	2.3	0.1	0.01
1	2	05/21/24	10:43	11:03	1.4	1.1	0.3	0.09
1	3	05/21/24	11:22	11:42	1.2	1.1	0.1	0.01
1	4	05/21/24	12:29	12:49	1.1	1.3	-0.2	0.04
1	5	05/21/24	13:27	13:47	1.1	1.1	0.0	0.00
1	6	05/21/24	14:08	14:28	1.3	1.2	0.1	0.01
1	7	05/21/24	15:11	15:31	1.6	1.5	0.1	0.01
1	8	05/21/24	15:58	16:18	1.7	1.4	0.3	0.09
1	9	05/21/24	16:37	16:57	1.1	1.2	-0.1	0.01
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**1.433**		**RM avg**	
				Mean CEM Value	**1.356**		**CEM avg**	
				Sum of Differences	**0.700**		**di**	
				Mean Difference	**0.078**		**d**	
				Sum of Differences Squared	**0.270**		**di^2**	
				Standard Deviation	**0.164**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.126**		**cc**	
				Relative Accuracy	**14.23**		**RA**	

Client: Billerud Quinnesec, LLC **Location:** Lime Kiln
Facility: Quinnesec Mill **Date:** 5/21/24
Project #: M242110 **Test Method:** 3A

O_2 % (dry) RATA

CEM Analyzer Information

O_2 Monitor/Model:			Thrmo CTL902C		O_2 Serial # :		1180570001	
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	05/21/24	09:29	09:49	2.83	3.24	-0.41	0.17
1	2	05/21/24	10:43	11:03	4.45	4.52	-0.07	0.00
1	3	05/21/24	11:22	11:42	4.21	4.57	-0.36	0.13
1	4	05/21/24	12:29	12:49	3.68	4.10	-0.42	0.18
1	5	05/21/24	13:27	13:47	4.40	4.50	-0.10	0.01
1	6	05/21/24	14:08	14:28	4.09	4.22	-0.13	0.02
1	7	05/21/24	15:11	15:31	3.40	3.65	-0.25	0.06
1	8	05/21/24	15:58	16:18	4.00	4.33	-0.33	0.11
1	9	05/21/24	16:37	16:57	4.60	4.52	0.08	0.01
				n	9			
				t(0.975)	2.306			
				Mean Reference Method Value	3.962		RM avg	
				Mean CEM Value	4.183		CEM avg	
				Sum of Differences	-1.990		di	
				Mean Difference	-0.221		d	
				Sum of Differences Squared	0.684		di^2	
				Standard Deviation	0.175		sd	
				Confidence Coefficient 2.5% Error (1-tail)	0.134		cc	
				Relative Accuracy	8.97		RA	

4.0 CERTIFICATION

Mostardi Platt is pleased to have been of service to Billerud Quinnesec, 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

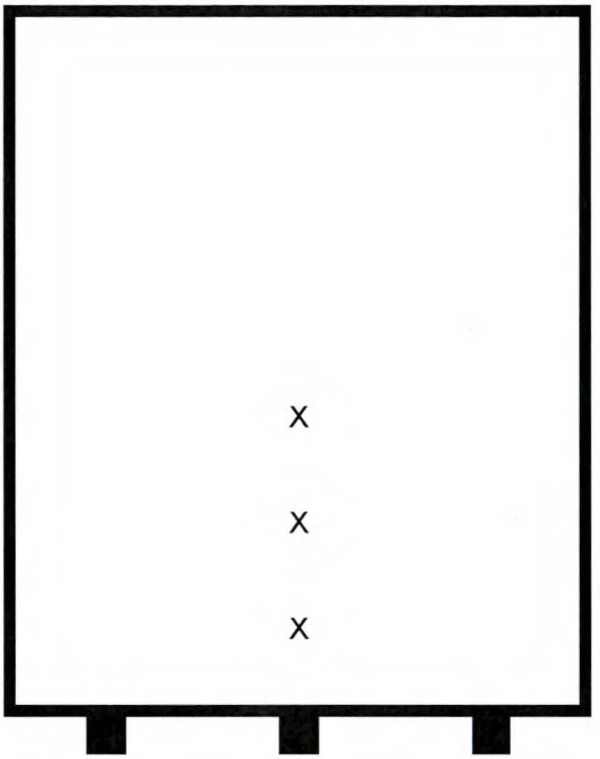
Christopher E. Jensen — Program Manager

Scott W. Banach — Quality Assurance

APPENDICES

Appendix A - Test Section Diagrams

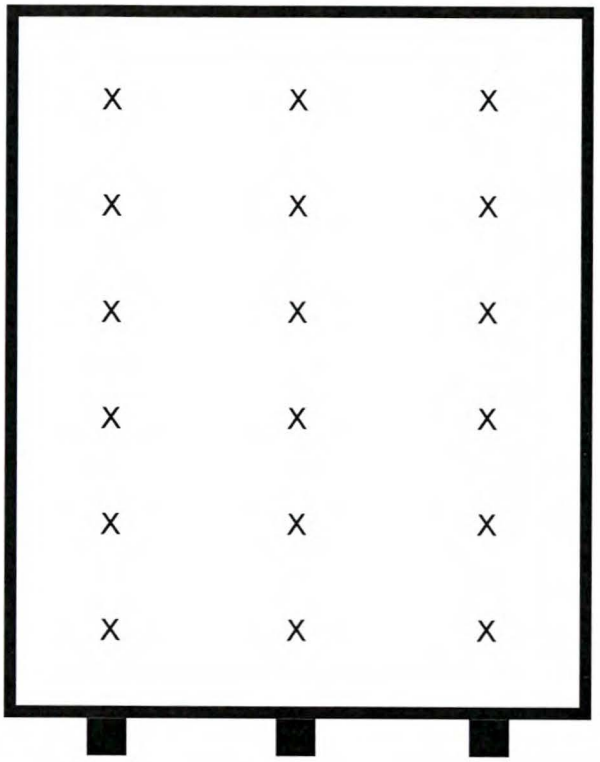
THREE POINT GASEOUS TRAVERSE FOR RECTANGULAR DUCTS



Job:	Billerud Quinnesec LLC Quinnesec, Michigan
Date:	May 21, 2024
Test Location:	Package Boiler Duct
Length:	5.5 Feet
Width:	7.5 Feet
Area:	41.25 Square Feet
Upstream Distance:	~75 Feet
Downstream Distance:	~40 Feet
No. Test Ports:	1
Tests Points per Port:	3

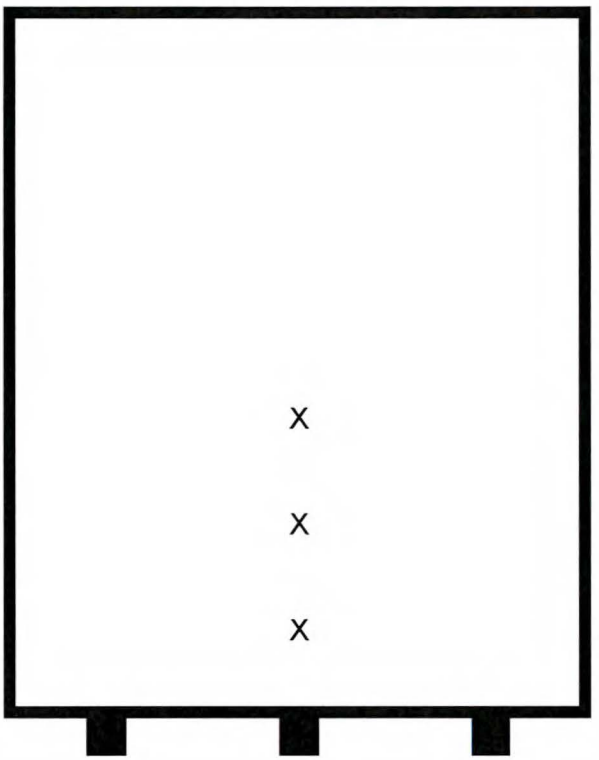
Distance from Inside Wall
To Traverse Point:
1. 2.0 Meters
2. 1.2 Meters
3. 0.4 Meters

EQUAL AREA TRAVERSE
FOR RECTANGULAR DUCTS



Job:	Billerud Quinnesec LLC Quinnesec, Michigan
Date:	May 23, 2024
Test Location:	Waste Fuel Boiler Duct
Length:	10 Feet
Width:	7 Feet
Area:	70 Square Feet
No. Test Ports:	3
Tests Points per Port:	6

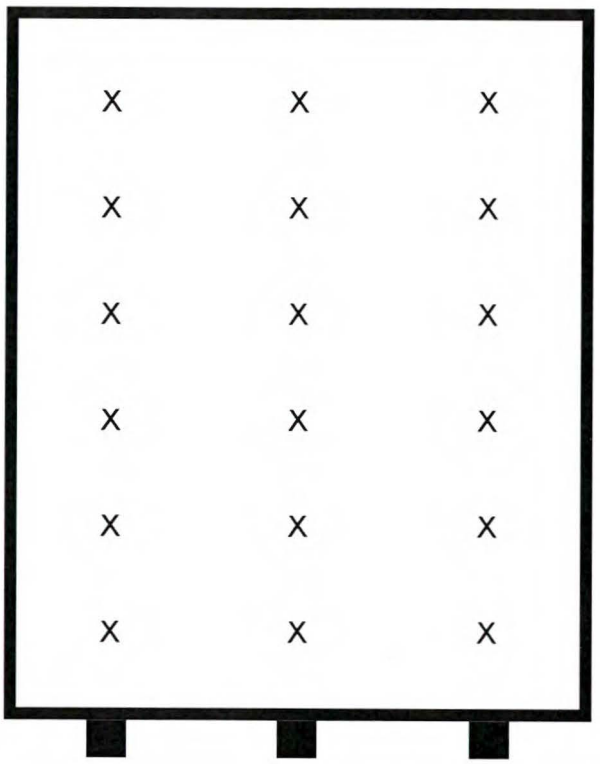
THREE POINT GASEOUS TRAVERSE
FOR RECTANGULAR DUCTS



Job:	Billerud Quinnesec LLC Quinnesec, Michigan
Date:	May 23, 2024
Test Location:	Waste Fuel Boiler Duct
Length:	10 Feet
Width:	7 Feet
Area:	70 Square Feet
Upstream Distance:	~100 Feet
Downstream Distance:	~20 Feet
No. Test Ports:	1
Tests Points per Port:	3

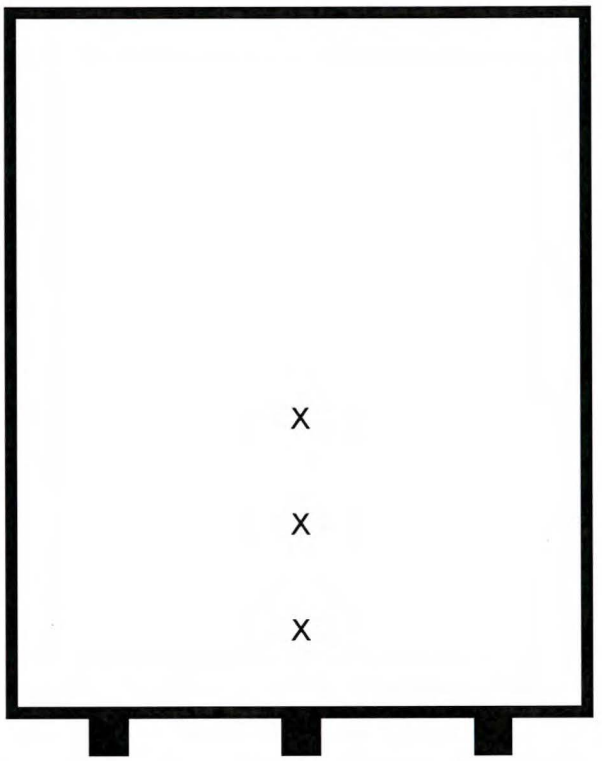
Distance from Inside Wall
To Traverse Point:
1. 2.0 Meters
2. 1.2 Meters
3. 0.4 Meters

EQUAL AREA TRAVERSE
FOR RECTANGULAR DUCTS



Job:	Billerud Quinnesec LLC Quinnesec, Michigan
Date:	May 22 and 23, 2024
Test Location:	Recovery Boiler Duct
Length:	12.25 Feet
Width:	8 Feet
Area:	98 Square Feet
No. Test Ports:	3
Tests Points per Port:	6

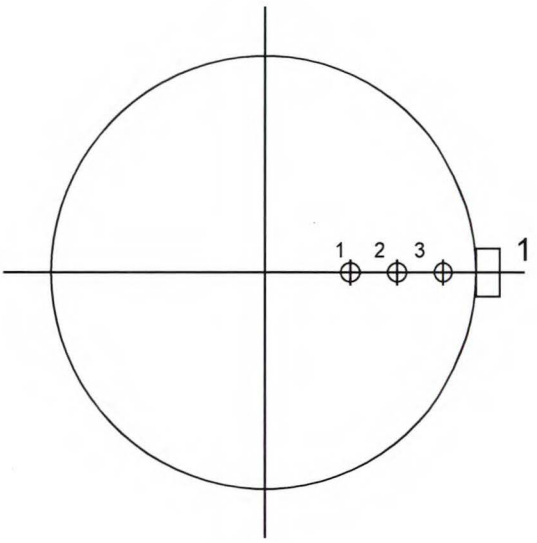
THREE POINT GASEOUS TRAVERSE
FOR RECTANGULAR DUCTS

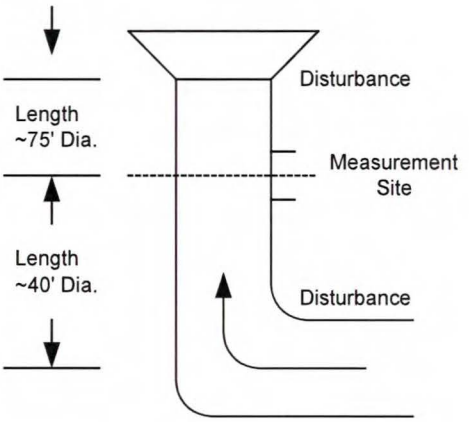


Job:	Billerud Quinnesec LLC Quinnesec, Michigan
Date:	May 22 and 23, 2024
Test Location:	Recovery Boiler Duct
Length:	12.25 Feet
Width:	8 Feet
Area:	98 Square Feet
Upstream Distance:	~90 Feet
Downstream Distance:	~25 Feet
No. Test Ports:	1
Tests Points per Port:	3

Distance from Inside Wall
To Traverse Point:
1. 2.0 Meters
2. 1.2 Meters
3. 0.4 Meters

THREE POINT GASEOUS TRAVERSE FOR ROUND DUCTS





Job:	Billerud Quinnesec LLC Quinnesec, Michigan
Date:	May 21, 2024
Test Location:	Lime Kiln Stack
Stack Diameter:	8.0 Feet
Stack Area:	50.265 Square Feet
No. Sample Points:	3
Upstream Disturbance:	~75 Feet
Downstream Disturbance	~40 Feet

Distance from Inside Wall
To Traverse Point:

1. 2.0 Meters
2. 1.2 Meters
3. 0.4 Meters