



Compliance Emissions Test Program Test Report

**Billerud Escanaba LLC
Escanaba Mill
Smelt Dissolving Tank Outlet,
Escanaba, Michigan
May 17, 2023**

**Report Submittal Date
June 30, 2023**

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Project No. M232012B

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TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY	1
2.0 TEST METHODOLOGY	2
Method 1 Traverse Point Determination.....	2
Method 2 Volumetric Flowrate Determination	2
Method 3A Oxygen (O ₂)/Carbon Dioxide (CO ₂) Determination.....	2
Method 4 Moisture Determination	3
Method 5 Filterable Particulate Matter (FPM) Determination	3
Method 16C Total Reduced Sulfur (TRS) Determination	3
3.0 TEST RESULTS SUMMARIES.....	5
4.0 CERTIFICATION.....	6
APPENDICES	
Appendix A - Plant Operating Data	8
Appendix B - Test Section Diagram	13
Appendix C - Sample Train Diagrams	16
Appendix D - Calculation Nomenclature and Formulas	20
Appendix E - Laboratory Sample Analysis	30
Appendix F - Reference Method Test Data (Computerized Sheets).....	32
Appendix G - Field Data Sheets	42
Appendix H - Calibration Data	50
Appendix I - Gas Cylinder Certifications	64

1.0 EXECUTIVE SUMMARY

Mostardi Platt conducted an emission compliance test program for Billerud Escanaba LLC at the Escanaba Mill on the Smelt Dissolving Tank Outlet on May 17, 2023. This report summarizes the results of the test program and test methods used.

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

TEST INFORMATION		
Test Location	Test Date	Test Parameters
Smelt Dissolving Tank Stack	May 17, 2023	Filterable Particulate Matter (FPM) and Total Reduced Sulfur (TRS)

The purpose of the test program was to demonstrate compliance of the above emissions with the permitted limits. Selected results of the test program are summarized below. A complete summary of emission test results follows the narrative portion of this report.

TEST RESULTS				
Test Location	Test Date	Test Parameter	Emission Limit	Emission Rate
Smelt Dissolving Tank Stack	5/17/2023	Filterable Particulate Matter	0.15 lb/1000 lbs of exhaust gases calculated on a dry basis	0.091 lb/1000 lbs of exhaust gases calculated on a dry basis
			0.20 lb/ton of BLS*	0.083 lb/ton BLS
	5/17/2023	TRS	0.0084 g/kg of black liquor solids	0.0082 g/kg of black liquor solids

*The 0.20 lb/ton BLS limit was only included upon request of EGLE. This compliance test was not to comply with conditions for this limit.

Emissions on g/kg of black liquor solids (BLS) basis were calculated with daily rate of BLS supplied by Billerud Escanaba LLC personnel. Plant operating data as provided by Billerud Escanaba LLC is included in Appendix A.

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

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

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

2.0 TEST METHODOLOGY

Emissions testing were conducted following the methods specified in 40 CFR, Part 60, Appendix A. Schematics of the test section diagrams and sampling trains used are found in Appendix B and C, respectively. Calculation nomenclature and sample calculations are found in Appendix D. Sample analysis data are found in Appendix E. Copies of reference method data and field data sheets for each test run are included in Appendix F and G, respectively.

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 location are summarized below.

TEST POINT INFORMATION							
Location	Stack Diameter (Feet)	No. of Ports	Port Length (Inches)	Upstream Diameters	Downstream Diameters	Test Parameter	Number of Sampling Points
Smelt Dissolving Tank Outlet	4.0	2	4	2.5	2.5	TRS	3
						FPM	24

Method 2 Volumetric Flowrate Determination

Gas velocity was measured following Method 2, for purposes of calculating stack gas volumetric flow rate at all test locations. 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. All locations have passed the null point pitot check and the results are on file.

Method 3A Oxygen (O₂)/Carbon Dioxide (CO₂) Determination

A Servomex analyzer was used to determine O₂ and CO₂ concentrations in the stack gas. Integrated gas samples were collected for the duration of the Method 5 sampling run. Readings were recorded with a data logging system. Linearity calibrations were performed prior to sample analysis, and mid-range calibration checks were performed after each test. Final O₂ and CO₂ concentrations were corrected for calibration error of the instrument. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H and gas cylinder certifications are presented in Appendix I.

Method 4 Moisture Determination

USEPA Method 4, 40CFR60, Appendix A, was utilized to determine water (H₂O) content of the exhaust gas in conjunction with the Method 5 sampling train. 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.

All of the equipment used is calibrated in accordance with the specifications of the Method. Copies of field data sheets are in Appendix G. Calibration data is presented in Appendix H. This testing meets the performance specifications as outlined in the Method.

Method 5 Filterable Particulate Matter (FPM) Determination

Stack gas FPM concentrations and emission rates were determined in accordance with USEPA Method 5, 40CFR60, Appendix A at all test locations. An Environmental Supply Company, Inc. sampling train was used to sample stack gas at an isokinetic rate, as specified in the Method utilizing Pallflex TX40HI45 filters. Particulate matter in the sample probe was recovered using a DI water rinse. The probe wash and filter catch were analyzed by Mostardi Platt in accordance with the Method in the Elmhurst, Illinois 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 are presented in Appendix H.

Method 16C Total Reduced Sulfur (TRS) Determination

An integrated gas sample was extracted from the Smelt Dissolving Tank gas stream in accordance with Method 16C (monitor), 40CFR60, for the determination of total reduced sulfur (TRS) emissions from stationary sources. This method selectively removed sulfur dioxide (SO₂) by bubbling the gas sample through a citrate buffer solution, then thermally oxidizing TRS compounds present to SO₂. A portion of the gas stream was conveyed to the gas analyzer for determination of SO₂ content. Prior to sampling, the SO₂ 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 (H₂S) and comparing the analyzed concentration with the known concentration. The H₂S recovery gas was mixed with combustion gas in a dilution system. The flowrates were adjusted to generate an H₂S 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.

Sampling included three one-hour runs followed by one 30-minute system validation. A description of the test train utilized is appended. Sampling train preparation was in accordance with Method 16C, 40CFR60, and included the following:

1. All probes, filter holders, and sampling lines were cleaned prior to each test.
2. The SO₂ scrubber was charged with 100 ml of citrate buffer solution into each of the first two impingers prior to each test. Citrate buffer solution was prepared by dissolving 300 g of potassium citrate (or 284 g of sodium citrate) and 41 g of anhydrous citric acid in one liter of water. The pH of the solution was then adjusted to between 5.4 and 5.6 with potassium citrate or citric acid, as required.
3. The probe and heated filter media were maintained at approximately 250°F to prevent moisture condensation.
4. The thermal oxidation furnace was maintained at 800°C±100°C during the test time.
5. The SO₂ portion of the train was prepared and analyzed in accordance with the methods described for sulfur dioxide testing listed previously.

The validations involved sampling a known concentration of hydrogen sulfide (H₂S) and comparing the analyzed concentration with the known concentration. The H₂S recovery gas was mixed with combustion gas in a dilution system. The flowrates were adjusted to generate an H₂S 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 set of three, one-hour tests.

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

3.0 TEST RESULTS SUMMARIES

Client: Billerud Escanaba, LLC
Facility: Escanaba Mill
Test Location: Smelt Dissolving Tank Stack
Test Method: 5

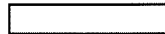
	Source Condition	normal	normal	normal	
	Date	5/17/23	5/17/23	5/17/23	
	Start Time	11:30	15:30	18:30	
	End Time	12:40	16:40	19:40	
	Run 1	Run 2	Run 3	Average	
Stack Conditions					
Average Gas Temperature, °F		176.6	177.5	178.9	177.7
Flue Gas Moisture, percent by volume		42.2%	43.9%	45.6%	43.9%
Average Flue Pressure, in. Hg		29.87	29.87	29.87	29.87
Gas Sample Volume, dscf		35.701	47.682	34.664	39.349
Average Gas Velocity, ft/sec		45.650	46.176	46.492	46.106
Gas Volumetric Flow Rate, acfm		34,419	34,816	35,054	34,763
Gas Volumetric Flow Rate, dscfm		16,467	16,164	15,721	16,117
Gas Volumetric Flow Rate, scfm		28,497	28,787	28,918	28,734
Average %CO ₂ by volume, dry basis		0.5	0.5	0.5	0.5
Average %O ₂ by volume, dry basis		19.5	19.5	19.5	19.5
Isokinetic Variance		101.1	107.3	102.9	103.8
Black Liquer Solids, ton/hr		79.2	79.2	79.2	79.2
Filterable Particulate Matter (Method 5)					
grams collected		0.10354	0.14238	0.11727	0.12106
grains/acf		0.0214	0.0214	0.0234	0.0221
grains/dscf		0.0447	0.0461	0.0522	0.0477
lb/hr		6.316	6.383	7.034	6.578
lb/1000 lb of stack gas		0.086	0.088	0.100	0.091
lb/ton BLS		0.080	0.081	0.089	0.083

Billerud Escanaba Mill Smelt Dissolving Tank Stack Reference Method Test Data									
Test No.	Date	Start Time	End Time	TRS as SO ₂ , ppm (dry)	O ₂ , % (dry)	TRS as SO ₂ ppmvd @ 8% O ₂	Volumetric Flow DSCFM	TRS as SO ₂ lb/hr	grams TRS/kg bls
1	05/17/23	11:30	12:29	9.68	19.92	127.42	16,467	1.59	0.0100
2	05/17/23	15:30	16:29	4.26	19.87	53.38	16,164	0.69	0.0043
3	05/17/23	18:30	19:29	10.25	19.89	130.86	15,721	1.60	0.0101
Average				8.06	19.89	103.89	16,117	1.29	0.0082

APPENDICES

Appendix A - Plant Operating Data

Smelt Dissolving Tank Operating Parameters TRS and PM Testing								
	Date & Time	BLS	Steam Flow KPPH	Opacity %	East Duct	West Duct	Scrubber Fan	Fan Status amps
		Production Rate MMlbs/day			Scrubber Flow gpm	Scrubber Flow gpm	Nozzel Flow gpm	
Run 1	Start 5/17/2023 11:30	3.80	486	1	33	34	72	131
	Stop 5/17/2023 12:39							
Run 2	Start 5/17/2023 15:30	3.80	489	1	33	34	73	132
	Stop 5/17/2023 16:39							
Run 3	Start 5/17/2023 18:30	3.80	486	1	33	34	73	130
	Stop 5/17/2023 19:29							



Start Time: 5/17/2023 11:30
 End Time: 5/17/2023 12:39

Averages: 3.80 486.18 0.62 32.71 33.63 71.86 130.90

Interval	1 min	Time	BLS Production Rate	Steam Flow	Opacity	East Duct	West Duct	Scrubber Fan	Fan Status
			MMlbs/day	KPPH	%	Scrubber Flow	Scrubber Flow	Nozzel Flow	AMPS
			15-f0116	15-f0100a.4	15-a0850.4	15-f0304.4	15-f0305.4	15-f0303.4	15-i0314.4
		5/17/2023 11:30	3.80	493.52	0.66	34.97	35.99	78.48	131.69
		5/17/2023 11:31	3.80	492.62	0.54	35.01	36.02	78.59	131.69
		5/17/2023 11:32	3.80	493.08	0.80	35.10	36.11	78.74	132.33
		5/17/2023 11:33	3.80	500.83	1.03	35.16	36.17	78.94	131.99
		5/17/2023 11:34	3.80	495.50	0.74	35.20	36.25	79.08	132.19
		5/17/2023 11:35	3.80	483.66	0.39	35.28	36.29	79.19	131.34
		5/17/2023 11:36	3.80	480.50	0.53	35.26	36.28	79.15	130.59
		5/17/2023 11:37	3.80	482.50	0.76	35.25	36.27	79.18	130.74
		5/17/2023 11:38	3.80	483.62	0.53	35.30	36.29	79.22	131.67
		5/17/2023 11:39	3.80	483.45	0.71	35.32	36.30	79.29	131.49
		5/17/2023 11:40	3.80	483.37	0.50	35.35	36.32	79.27	131.18
		5/17/2023 11:41	3.80	491.01	0.48	35.37	36.31	79.22	131.36
		5/17/2023 11:42	3.80	495.36	0.70	35.43	36.37	79.30	131.11
		5/17/2023 11:43	3.80	496.39	0.50	35.48	36.40	79.50	131.31
		5/17/2023 11:44	3.80	499.77	0.62	35.49	36.43	79.45	130.59
		5/17/2023 11:45	3.80	496.33	0.62	35.47	36.44	79.46	130.34
		5/17/2023 11:46	3.80	486.12	0.74	35.51	36.44	79.52	130.27
		5/17/2023 11:47	3.80	476.70	0.58	35.47	36.38	79.41	130.50
		5/17/2023 11:48	3.80	468.35	0.52	35.41	36.31	79.28	131.83
		5/17/2023 11:49	3.80	470.41	0.79	34.97	35.84	78.25	131.54
		5/17/2023 11:50	3.80	478.35	0.74	33.96	34.79	75.88	130.74
		5/17/2023 11:51	3.80	481.87	0.65	34.04	34.79	75.83	129.91
		5/17/2023 11:52	3.80	484.20	0.75	33.48	34.24	72.42	128.61
		5/17/2023 11:53	3.80	492.95	0.62	33.22	33.96	70.86	128.29
		5/17/2023 11:54	3.80	499.02	0.74	33.33	34.08	70.55	128.83
		5/17/2023 11:55	3.80	494.70	0.73	33.37	34.12	70.71	128.43
		5/17/2023 11:56	3.80	485.85	0.63	33.49	34.24	70.91	128.27
		5/17/2023 11:57	3.80	485.64	0.58	33.54	34.25	70.96	128.17
		5/17/2023 11:58	3.80	487.17	0.55	33.49	34.22	70.97	129.02
		5/17/2023 11:59	3.80	489.83	0.56	33.22	33.96	70.40	129.56
		5/17/2023 12:00	3.80	495.16	0.40	32.90	33.64	69.62	128.89
		5/17/2023 12:01	3.80	490.72	0.74	32.93	33.67	69.73	128.19
		5/17/2023 12:02	3.80	489.28	0.61	32.46	33.25	68.71	127.57
		5/17/2023 12:03	3.80	490.18	0.56	31.84	32.64	67.22	126.91
		5/17/2023 12:04	3.80	489.96	0.53	30.92	31.80	65.10	126.63
		5/17/2023 12:05	3.80	485.45	0.72	30.93	31.83	66.32	126.89
		5/17/2023 12:06	3.80	475.64	0.67	30.91	31.81	68.36	127.78
		5/17/2023 12:07	3.80	473.41	0.63	30.96	31.84	68.43	128.69
		5/17/2023 12:08	3.80	479.83	0.59	30.84	31.74	67.67	130.40
		5/17/2023 12:09	3.80	482.53	0.52	30.55	31.47	67.50	131.21
		5/17/2023 12:10	3.80	486.04	0.58	30.30	31.21	66.81	130.69
		5/17/2023 12:11	3.80	490.89	0.44	30.14	31.03	66.07	130.67
		5/17/2023 12:12	3.80	497.55	0.39	29.98	30.93	65.14	130.70
		5/17/2023 12:13	3.80	500.28	0.55	29.67	30.68	64.78	131.15
		5/17/2023 12:14	3.80	500.26	0.45	29.64	30.64	64.54	131.74
		5/17/2023 12:15	3.80	497.82	0.60	29.58	30.62	64.33	130.89
		5/17/2023 12:16	3.80	494.79	0.54	29.55	30.59	64.40	131.30
		5/17/2023 12:17	3.80	489.42	0.86	29.63	30.61	64.36	131.83
		5/17/2023 12:18	3.80	482.37	0.64	29.65	30.70	64.42	132.20
		5/17/2023 12:19	3.80	479.13	0.68	29.64	30.67	64.46	131.14
		5/17/2023 12:20	3.80	475.48	0.64	29.60	30.63	64.39	131.60
		5/17/2023 12:21	3.80	472.02	0.35	29.60	30.60	64.45	131.68
		5/17/2023 12:22	3.80	468.28	0.65	29.80	30.86	64.91	132.45
		5/17/2023 12:23	3.80	467.79	0.62	30.06	31.06	65.74	134.41
		5/17/2023 12:24	3.80	473.27	0.64	30.55	31.54	67.05	134.23
		5/17/2023 12:25	3.80	479.82	0.52	30.91	31.93	68.61	133.73
		5/17/2023 12:26	3.80	488.79	0.64	31.41	32.39	70.04	135.25
		5/17/2023 12:27	3.80	491.73	0.74	31.91	32.87	71.34	135.25
		5/17/2023 12:28	3.80	479.35	0.62	32.29	33.24	72.27	136.84
		5/17/2023 12:29	3.80	470.62	0.61	32.48	33.44	72.81	137.33

Start Time: 5/17/2023 15:30
 End Time: 5/17/2023 16:39

Averages: 3.80 489.10 0.63 32.66 33.51 72.60 131.67

Interval	1 min	Time	BLS Production	Steam Flow	Opacity	East Duct	West Duct	Scrubber Fan	Fan Status
			Rate MMlbs/day	KPPH	%	Scrubber Flow gpm	Scrubber Flow gpm	Nozzel Flow gpm	AMPS
			15-f0116	15-f0100a.4	15-a0850.4	15-f0304.4	15-f0305.4	15-f0303.4	15-i0314.4
		5/17/2023 15:30	3.80	484.22	0.49	32.84	33.65	72.96	129.61
		5/17/2023 15:31	3.80	489.38	0.58	33.09	33.92	73.64	129.62
		5/17/2023 15:32	3.80	496.56	0.69	33.47	34.31	74.58	130.75
		5/17/2023 15:33	3.80	502.06	0.73	33.48	34.31	74.59	130.79
		5/17/2023 15:34	3.80	502.41	0.53	33.50	34.30	74.60	132.61
		5/17/2023 15:35	3.80	502.57	0.37	33.47	34.29	74.62	132.78
		5/17/2023 15:36	3.80	505.63	0.52	33.31	34.12	74.20	132.27
		5/17/2023 15:37	3.80	498.27	0.59	33.12	33.95	73.72	132.51
		5/17/2023 15:38	3.80	493.57	0.46	33.02	33.84	73.49	132.30
		5/17/2023 15:39	3.80	490.21	0.62	32.96	33.78	73.36	131.94
		5/17/2023 15:40	3.80	488.76	0.53	32.82	33.64	73.02	131.54
		5/17/2023 15:41	3.80	490.14	0.49	32.76	33.59	72.90	131.94
		5/17/2023 15:42	3.80	489.03	0.33	32.76	33.59	72.82	131.92
		5/17/2023 15:43	3.80	491.09	0.38	32.73	33.58	72.81	131.94
		5/17/2023 15:44	3.80	493.66	0.35	32.70	33.55	72.73	131.09
		5/17/2023 15:45	3.80	495.80	0.48	32.71	33.56	72.74	130.97
		5/17/2023 15:46	3.80	495.76	0.55	32.73	33.56	72.76	132.42
		5/17/2023 15:47	3.80	496.17	0.50	32.74	33.58	72.72	132.36
		5/17/2023 15:48	3.80	494.67	0.72	32.73	33.56	72.73	132.39
		5/17/2023 15:49	3.80	486.74	0.65	32.70	33.53	72.71	133.62
		5/17/2023 15:50	3.80	483.98	0.76	32.67	33.50	72.65	134.73
		5/17/2023 15:51	3.80	482.27	0.55	32.66	33.49	72.60	134.92
		5/17/2023 15:52	3.80	480.05	0.49	32.67	33.51	72.60	133.92
		5/17/2023 15:53	3.80	475.17	0.49	32.58	33.41	72.37	134.53
		5/17/2023 15:54	3.79	473.19	0.44	32.60	33.43	72.39	133.91
		5/17/2023 15:55	3.80	470.69	0.60	32.61	33.43	72.43	133.10
		5/17/2023 15:56	3.80	472.27	0.63	32.62	33.43	72.49	132.06
		5/17/2023 15:57	3.80	474.21	0.84	32.61	33.43	72.47	130.63
		5/17/2023 15:58	3.80	480.21	0.73	32.60	33.43	72.46	130.84
		5/17/2023 15:59	3.80	478.45	0.60	32.61	33.44	72.50	130.62
		5/17/2023 16:00	3.80	481.08	0.79	32.62	33.46	72.51	131.08
		5/17/2023 16:01	3.80	489.40	0.75	32.65	33.47	72.57	131.46
		5/17/2023 16:02	3.80	491.83	0.85	32.64	33.49	72.50	131.42
		5/17/2023 16:03	3.80	494.99	0.55	32.30	33.17	71.81	132.70
		5/17/2023 16:04	3.80	491.45	0.91	31.69	32.60	70.20	132.63
		5/17/2023 16:05	3.80	484.97	0.84	32.05	32.94	71.13	132.58
		5/17/2023 16:06	3.80	484.48	0.68	32.18	33.06	71.40	131.74
		5/17/2023 16:07	3.80	484.10	0.55	32.29	33.16	71.64	132.26
		5/17/2023 16:08	3.80	487.32	0.48	32.39	33.27	71.87	131.97
		5/17/2023 16:09	3.80	481.92	0.90	32.45	33.31	72.11	132.92
		5/17/2023 16:10	3.80	479.85	0.61	32.49	33.37	72.25	131.23
		5/17/2023 16:11	3.80	494.84	0.62	32.53	33.40	72.22	131.00
		5/17/2023 16:12	3.80	492.46	0.68	32.53	33.41	72.29	130.39
		5/17/2023 16:13	3.80	494.19	0.49	32.52	33.40	72.31	129.57
		5/17/2023 16:14	3.80	488.12	0.76	32.54	33.42	72.33	129.83
		5/17/2023 16:15	3.80	490.20	0.56	32.51	33.38	72.28	130.84
		5/17/2023 16:16	3.80	487.90	0.73	32.54	33.41	72.34	131.18
		5/17/2023 16:17	3.80	486.28	0.61	32.54	33.41	72.37	131.66
		5/17/2023 16:18	3.80	477.64	0.87	32.53	33.40	72.27	132.48
		5/17/2023 16:19	3.80	472.17	0.54	32.48	33.33	72.17	131.71
		5/17/2023 16:20	3.80	469.52	0.54	32.46	33.36	72.10	131.88
		5/17/2023 16:21	3.80	470.66	0.77	32.47	33.37	72.12	130.96
		5/17/2023 16:22	3.80	474.65	0.59	32.50	33.39	72.18	130.30
		5/17/2023 16:23	3.80	481.43	0.58	32.49	33.39	72.26	130.07
		5/17/2023 16:24	3.80	493.80	0.77	32.51	33.40	72.31	129.13
		5/17/2023 16:25	3.80	508.59	0.94	32.53	33.39	72.31	129.31
		5/17/2023 16:26	3.80	515.69	0.92	32.54	33.41	72.32	131.07
		5/17/2023 16:27	3.80	515.55	0.67	32.56	33.42	72.34	131.33
		5/17/2023 16:28	3.80	512.73	0.84	32.55	33.41	72.34	130.59
		5/17/2023 16:29	3.80	511.02	0.87	32.55	33.42	72.33	130.28

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AIR QUALITY DIVISION

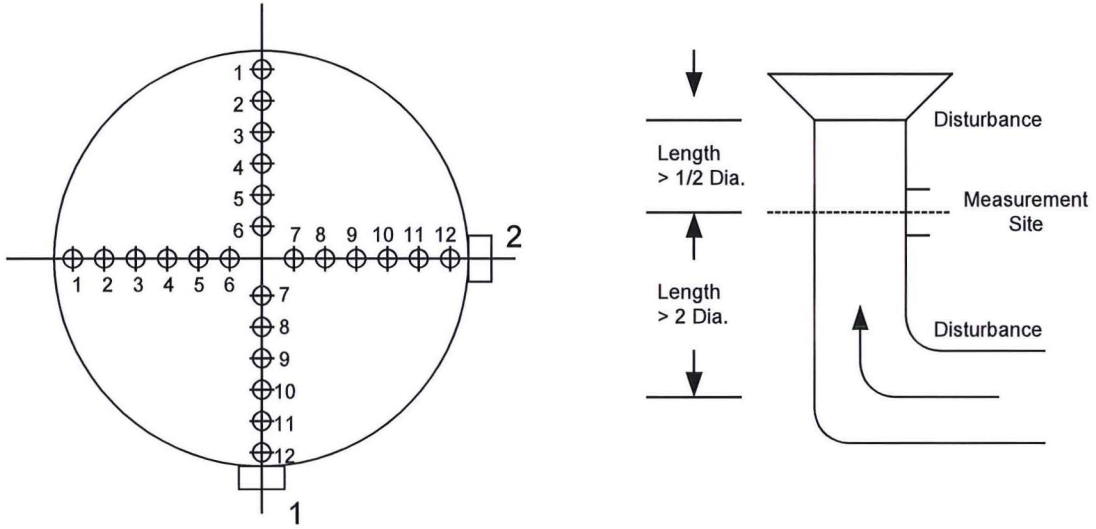
Start Time: 5/17/2023 18:30
 End Time: 5/17/2023 19:29

Averages: 3.80 485.98 0.71 33.14 33.93 72.80 129.59

Interval	1 min	BLS Production Rate MMlbs/day	Steam Flow KPPH	Opacity %	East Duct Scrubber Flow gpm	West Duct Scrubber Flow gpm	Scrubber Fan Nozzel Flow gpm	Fan Status AMPS
	Time	15-f0116	15-f0100a.4	15-a0850.4	15-f0304.4	15-f0305.4	15-f0303.4	15-i0314.4
	5/17/2023 18:30	3.80	474.31	0.84	32.79	33.58	72.15	130.05
	5/17/2023 18:31	3.80	476.16	0.96	32.80	33.60	72.15	128.34
	5/17/2023 18:32	3.80	481.43	0.59	32.81	33.61	72.14	126.58
	5/17/2023 18:33	3.80	486.21	0.59	32.84	33.63	72.29	125.55
	5/17/2023 18:34	3.80	487.73	0.69	32.85	33.64	72.24	126.68
	5/17/2023 18:35	3.80	490.43	1.20	32.82	33.62	72.21	129.03
	5/17/2023 18:36	3.80	488.99	0.73	32.83	33.61	72.21	129.98
	5/17/2023 18:37	3.80	483.76	0.86	32.82	33.63	72.20	130.19
	5/17/2023 18:38	3.80	483.07	0.82	32.84	33.63	72.18	129.83
	5/17/2023 18:39	3.80	483.16	0.46	32.83	33.63	72.21	129.99
	5/17/2023 18:40	3.80	484.59	0.66	32.85	33.66	72.23	129.93
	5/17/2023 18:41	3.80	481.83	0.83	32.92	33.69	72.41	130.73
	5/17/2023 18:42	3.80	485.57	0.92	32.91	33.72	72.37	129.48
	5/17/2023 18:43	3.80	490.11	0.79	32.93	33.72	72.46	129.54
	5/17/2023 18:44	3.80	485.34	0.75	32.94	33.74	72.36	129.37
	5/17/2023 18:45	3.80	484.25	0.69	32.97	33.77	72.44	128.30
	5/17/2023 18:46	3.80	489.44	0.99	32.96	33.79	72.46	128.65
	5/17/2023 18:47	3.80	495.62	0.81	32.98	33.78	72.56	128.74
	5/17/2023 18:48	3.80	496.72	1.19	32.99	33.78	72.49	128.97
	5/17/2023 18:49	3.80	488.93	0.78	33.00	33.79	72.48	129.77
	5/17/2023 18:50	3.80	496.67	0.66	33.00	33.81	72.49	130.41
	5/17/2023 18:51	3.80	494.34	0.58	33.01	33.82	72.55	131.63
	5/17/2023 18:52	3.80	490.79	0.77	33.03	33.82	72.52	130.86
	5/17/2023 18:53	3.80	479.30	0.78	32.99	33.81	72.52	131.24
	5/17/2023 18:54	3.80	470.83	0.58	33.00	33.79	72.40	131.50
	5/17/2023 18:55	3.80	470.65	0.62	32.93	33.74	72.34	131.66
	5/17/2023 18:56	3.80	474.92	0.77	32.96	33.73	72.31	130.28
	5/17/2023 18:57	3.80	478.23	0.67	32.95	33.73	72.30	129.79
	5/17/2023 18:58	3.80	479.28	0.68	32.94	33.73	72.35	129.68
	5/17/2023 18:59	3.80	491.25	0.90	32.97	33.75	72.37	129.30
	5/17/2023 19:00	3.80	495.33	0.77	33.03	33.81	72.52	129.40
	5/17/2023 19:01	3.80	493.84	0.66	33.11	33.89	72.67	130.60
	5/17/2023 19:02	3.80	486.61	0.48	33.13	33.93	72.71	131.13
	5/17/2023 19:03	3.80	481.27	0.61	32.59	33.42	71.38	130.68
	5/17/2023 19:04	3.80	477.29	0.49	32.04	32.89	70.01	130.15
	5/17/2023 19:05	3.80	475.59	0.61	32.48	33.29	71.18	130.78
	5/17/2023 19:06	3.80	480.73	0.64	32.71	33.51	71.70	130.69
	5/17/2023 19:07	3.80	490.38	0.56	32.78	33.56	71.87	130.72
	5/17/2023 19:08	3.80	493.10	0.58	32.81	33.60	71.96	131.64
	5/17/2023 19:09	3.80	497.38	0.79	32.89	33.65	72.15	132.12
	5/17/2023 19:10	3.80	492.95	0.60	32.90	33.68	72.18	131.09
	5/17/2023 19:11	3.80	476.30	0.44	32.96	33.73	72.26	131.56
	5/17/2023 19:12	3.80	469.84	0.90	32.98	33.73	72.25	130.50
	5/17/2023 19:13	3.80	471.74	0.87	32.98	33.75	72.32	130.51
	5/17/2023 19:14	3.80	472.75	0.46	33.01	33.77	72.35	129.78
	5/17/2023 19:15	3.80	478.98	0.56	33.02	33.80	72.42	129.87
	5/17/2023 19:16	3.80	485.03	0.62	33.02	33.80	72.41	129.36
	5/17/2023 19:17	3.80	483.24	0.55	33.03	33.81	72.43	128.20
	5/17/2023 19:18	3.80	482.97	0.67	33.04	33.83	72.47	126.67
	5/17/2023 19:19	3.80	492.40	0.48	33.04	33.84	72.55	125.37
	5/17/2023 19:20	3.80	500.92	0.50	32.99	33.79	72.40	126.95
	5/17/2023 19:21	3.80	504.57	0.62	33.51	34.29	73.67	127.22
	5/17/2023 19:22	3.80	501.80	0.72	34.10	34.89	75.12	128.77
	5/17/2023 19:23	3.80	501.13	0.47	34.42	35.22	75.78	128.58
	5/17/2023 19:24	3.80	501.79	0.80	34.56	35.39	76.19	127.96
	5/17/2023 19:25	3.80	500.47	0.91	34.64	35.47	76.38	128.35
	5/17/2023 19:26	3.80	495.01	0.94	34.72	35.54	76.54	129.53
	5/17/2023 19:27	3.80	485.81	0.79	34.74	35.55	76.60	129.05
	5/17/2023 19:28	3.80	473.20	0.76	34.76	35.58	76.59	130.56
	5/17/2023 19:29	3.80	472.55	0.81	34.78	35.59	76.63	131.74

Appendix B - Test Section Diagrams

EQUAL AREA TRAVERSE FOR ROUND DUCTS



Job: Billerud Escanaba, LLC
Escanaba, Michigan

Date: May 17, 2023

Test Location: Smelt Dissolving Tank Outlet

Stack Diameter: 4.0 Feet

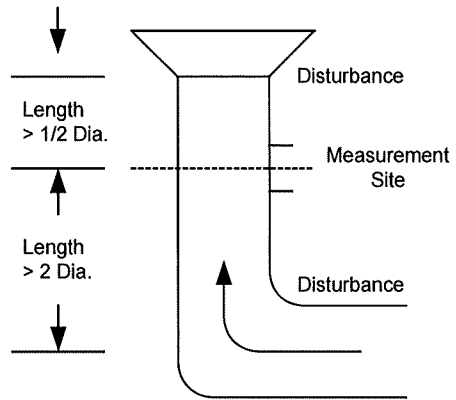
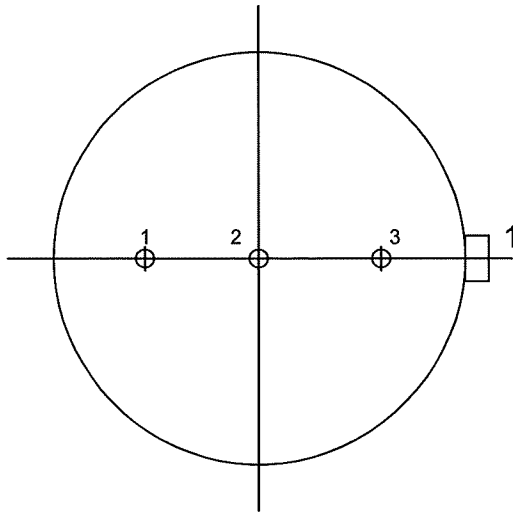
Stack Area: 12.57 Square Feet

No. Points Across Diameter: 12

No. of Ports: 2

Port Length: 4 Inches

GASEOUS TRAVERSE FOR ROUND DUCTS



Job: Billerud Escanaba, LLC
Escanaba, Michigan

Date: May 17, 2023

Test Location: Smelt Dissolving Tank Outlet

Stack Diameter: 4.0 Feet

Stack Area: 12.57 Square Feet

No. Sample Points: 3

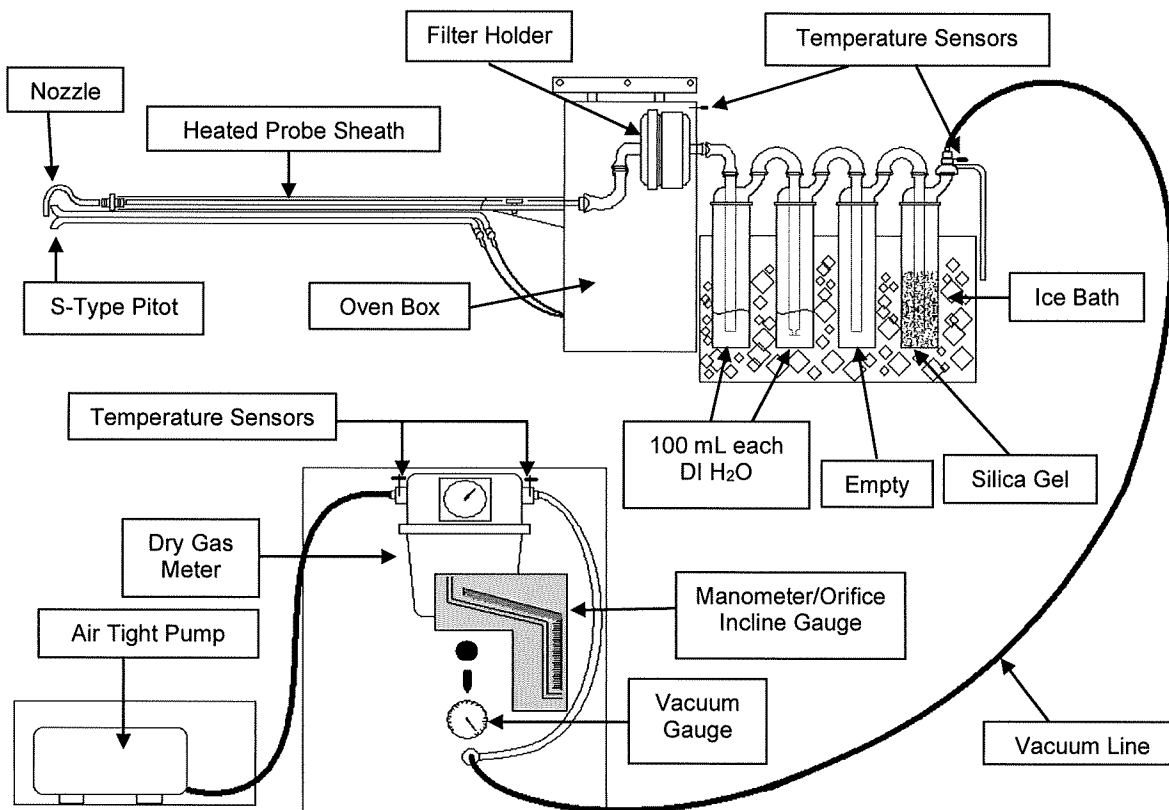
Upstream: 2.5 diameters

Downstream: 2.5 diameters

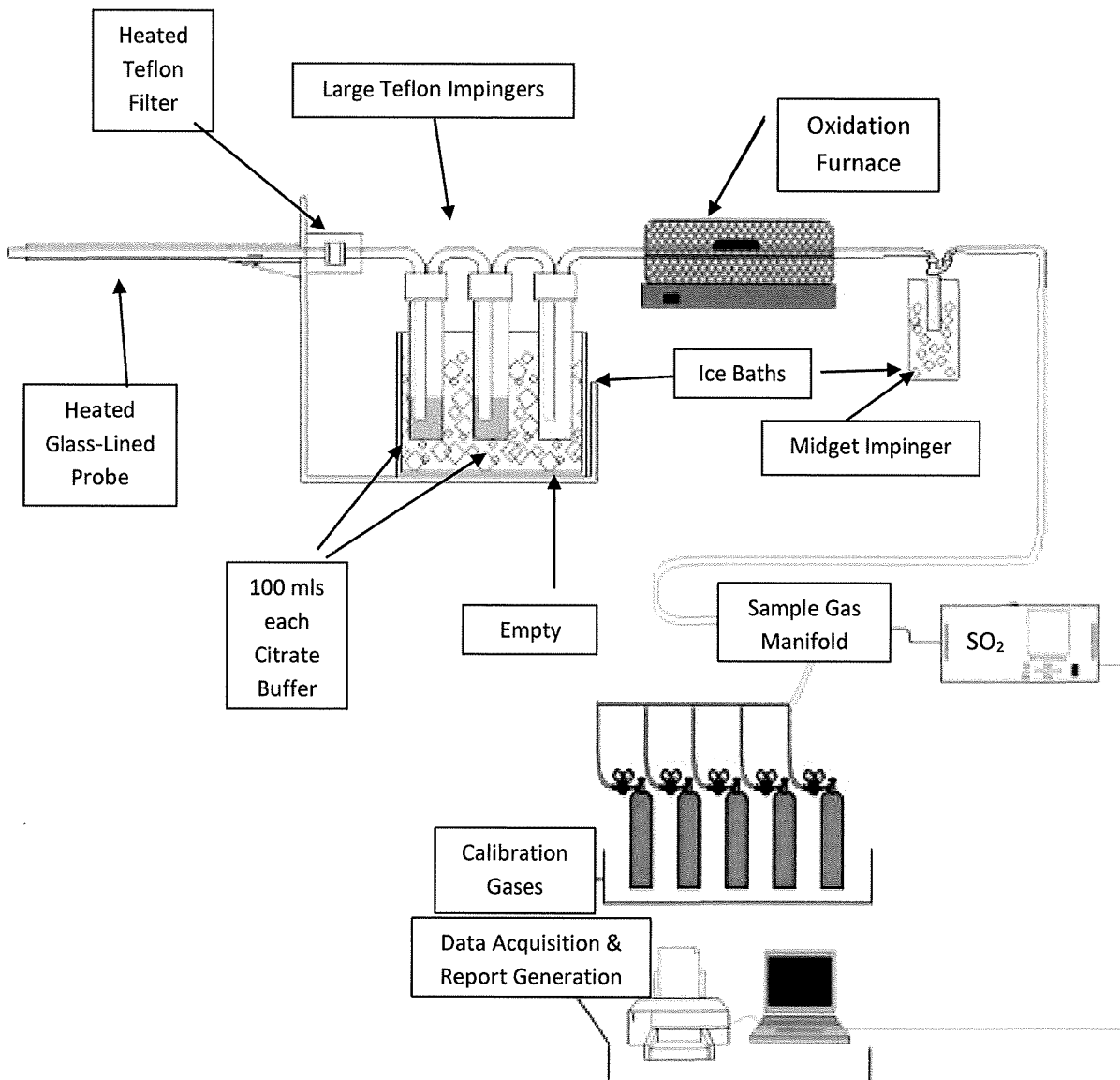
Distance from Inside Wall
To Traverse Point:

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

USEPA Method 5- Particulate Matter Sample Train Diagram



USEPA Method 16C – Total Reduced Sulfur Sample Train Diagram



Appendix D - Calculation Nomenclature and Formulas