1.0 Introduction

Alliance Technical Group, LLC (Alliance) was retained by Louisiana-Pacific Corporation (LP) to conduct compliance testing at the Sagola, MI facility. The facility operates under the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permit to Install (PTI) 24-22. Testing was conducted to determine the emission rates of particulate matter (PM) and particulate matter less than 10 microns (PM10) from the Press RCO.

1.1 Facility Description

The Louisiana-Pacific Corporation Sagola Plant is an orientated strand board manufacturing facility that produces siding used for various construction applications. The facility is identified by the NAICS Code 321219.

The plant purchases small diameter logs that are debarked and fed to a waferizer. The bark removed from the logs is used as fuel for the thermal oil heater. The waferizer flakes the logs into strands, which are approximately three (3) inches long by one (1) inch wide, and 0.03125 (1/32) of an inch thick. The wet flakes go through a rotary dryer, which reduces the flake moisture content from approximately 50% down to 5%. The flakes are then captured by a cyclone and the exhaust gas passes through a wet electrostatic precipitator (WESP) followed by a regenerative thermal oxidizer (RTO).

The flakes collected by the primary cyclone drop into a rotary screen, which separates usable flake and small wood pieces (fines). The material passing through the screen is used as fuel in the dryers, the usable flake is routed to the blenders. Wax, resin, and zinc borate are mixed with the flakes in the blenders. Formers then evenly distribute the resinated flakes into a continuous mat of flakes onto moving conveyor. The continuous mat is separated into press size segments by the flying cut-off-saw. After the flying cut-off saw, a paper overlay is added to the mat of flake.

The loader conveys the mats into the press; with the combination of heat (supplied by the thermal oil heater) and pressure, the mats are turned into solid boards of various predetermined thickness. The emissions from the pressing process are captured within an enclosure and routed to a Regenerative Catalytic Oxidizer (RCO). The boards are unloaded from the press and cut with saw blades to various lengths and widths of siding. The dust created by the finishing process will be reused on the forming line in the production of more mats that will be pressed.

1.2 Source and Control System Descriptions

Emissions from the board pressing process are captured within an enclosure and routed to a Regenerative Catalytic Oxidizer (RCO). The RCO includes a catalyst that enables lower temperature treatment of the pressing process gases. A preventative maintenance program is in place to ensure the RCO and catalyst operate in an efficient manner. RCO performance testing was previously conducted on August 24, 2021, as required by the Plant's ROP and 40 CFR Part 63, Subpart DDDD-NESHAP for Plywood and Composite Wood Products.

Each of these flexible groups includes a newly installed baghouse manufactured by Schenck Process LLC to control emissions from various plant sources (FGBH7 is planned for future installation). The baghouses are continuously operating self-cleaning units that use medium pressure high volume air to clean the bags. Maintenance and inspection programs have been developed to ensure these new baghouses operate at optimum efficiency.

1.3   Project Team

Personnel involved in this project are identified in the following table.

Table 1-1: Project Team

Facility Personnel	Joe Bal
Regulatory Personnel	Andrew Riley
Alliance Personnel	Colin Kelly Stefan Schultz

2.0 Summary of Results

Alliance conducted compliance testing at the LP facility in Sagola, MI on November 14, 2023. Testing consisted of determining the emission rates of PM and PM10 at the Press RCO.

Table 2-1 provides a summary of the emission testing results. Any difference between the summary results listed in the following table and the detailed results contained in appendices is due to rounding for presentation.

Table 2-1: Summary of Results – Press RCO

Emissions Data				
Run Number	Run 1	Run 2	Run 3	Average
Date	11/14/23	11/14/23	11/14/23	--
Filterable PM10 Data				
Concentration, grain/dscf	2.7E-04	4.3E-04	3.9E-04	3.6E-04
Emission Rate, lb/hr	0.19	0.30	0.27	0.25
Emission Factor, lb/ton	0.0069	0.011	0.010	0.0094
Filterable Particulate Matter Data				
Concentration, grain/dscf	7.9E-04	7.9E-04	1.0E-03	8.7E-04
Emission Rate, lb/hr	0.54	0.56	0.71	0.60
Emission Factor, lb/ton	0.020	0.021	0.027	0.023
Condensable Particulate Matter Data				
Concentration, grain/dscf	0.0011	0.0014	0.0011	0.0012
Emission Rate, lb/hr	0.78	0.95	0.78	0.84
Emission Factor, lb/ton	0.029	0.035	0.029	0.031
PM10 Data				
Concentration, grain/dscf	0.0014	0.0018	0.0015	0.0016
Emission Rate, lb/hr	0.96	1.3	1.0	1.1
Emission Factor, lb/ton	0.036	0.047	0.039	0.041

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3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix D.

Table 3-1: Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1 & 2	Full Velocity Traverses
Oxygen/Carbon Dioxide	3/3A	Integrated Bag / Instrumental Analysis
Moisture Content	4	Gravimetric Analysis
Particulate Matter (PM/PM10)	201A/202	Isokinetic Sampling

3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-1 in U.S. EPA Reference Test Method 1.

Full velocity traverses were conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

Stack gas velocity pressure and temperature readings were recorded during each test run. The data collected was utilized to calculate the volumetric flow rate in accordance with U.S. EPA Reference Test Method 2.

3.2 U.S. EPA Reference Test Method 3/3A – Oxygen/Carbon Dioxide

The oxygen (O_2) and carbon dioxide (CO_2) testing was conducted in accordance with U.S. EPA Reference Test Method 3/3A. One (1) integrated Tedlar bag sample was collected during each test run. The bag samples were analyzed on site with a gas analyzer. The remaining stack gas constituent was assumed to be nitrogen for the stack gas molecular weight determination. The quality control measures are described in Section 3.5.

3.3 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content (BWS) was determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train consisted of a series of chilled impingers. Prior to testing, each impinger was filled with a known quantity of water or silica gel. Each impinger was analyzed gravimetrically before and after each test run on the same balance to determine the amount of moisture condensed.

3.4 U.S. EPA Reference Test Methods 201A and 202 – PM <10 microns

The PM10 testing was conducted in accordance with U.S. EPA Reference Test Methods 201A and 202. The complete sampling system consisted of a stainless-steel nozzle, PM10 in-stack cyclone, in-stack filter holder, pre-weighed quartz filter, heated glass-lined probe extension, un-weighed Teflon filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of a coiled condenser and four (4) chilled impingers. The first and second impingers were initially empty, the third contained 100 mL of de-ionized water and the last

impinger contained 200-300 grams of silica gel. The un-weighed 90 mm Teflon filter was placed between the second and third impinger. The probe liner heating system was maintained at a temperature of 248 ±25°F, and the impinger temperature was maintained at 68°F or less throughout testing. The temperature of the Teflon filter was maintained greater than 65°F but less than or equal to 85°F.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run. If condensate was collected in the first dry impinger, then the front-half of the sample train (the nozzle, probe, and heated pre-weighed filter) and the coil condenser were removed, and a glass bubbler was connected to the first impinger. If needed, de-ionized ultra-filtered (DIUF) water was added to the first impinger to raise the water level above the bubbler. Zero nitrogen was connected to the bubbler, and a 60-minute purge at 14 liters per minute was conducted. After the completion of the nitrogen purge the impinger contents were measured for moisture gain.

The pre-weighed quartz filter was carefully removed and placed in container 1. The front half of the filter holder and back-half of the PM10 cyclone were rinsed six (6) times with acetone to remove any adhering particulate matter, and these rinses were recovered in container 2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for filterable particulate matter analysis.

The contents of impingers 1 and 2 were recovered in container CPM Cont. #1. The back half of the filterable PM filter holder, probe extension, coil condenser, impingers 1 and 2 and all connecting glassware were rinsed with DIUF water and then rinsed with acetone, followed by hexane. The water rinses were added to container CPM Cont. #1 while the solvent rinses were recovered in container CPM Cont. #2. The Teflon filter was removed from the filter holder and placed in container CPM Cont. #3. The front half of the condensable PM filter holder was rinsed with DIUF water and then with acetone, followed by hexane. The water rinse was added to container CPM Cont. #1 while the solvent rinses were added to container CPM Cont. #2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for condensable particulate matter analysis.

3.5 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 3/3A

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Low-Level gas was introduced directly to the analyzer. After adjusting the analyzer to the Low-Level gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas. For the Calibration Error Test, Low, Mid, and High-Level calibration gases were sequentially introduced directly to the analyzer. All values were within 2.0 percent of the Calibration Span or 0.5% absolute difference.

At the completion of testing, the data was also saved to the Alliance server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at Alliance's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.

Location: **Louisiana-Pacific Sagola Plant - Sagola, MI**
Source: **Press RCO**
Project No.: **AST-2023-4440**
Run No./Method: Run 1/Method 201A

Meter Pressure (Pm), in. Hg

$$Pm = Pb + \frac{\Delta H}{13.6}$$

where,

Pb	28.83	= barometric pressure, in. Hg
ΔH	0.500	= pressure differential of orifice, in H_2O
Pm	28.87	= in. Hg

Absolute Stack Gas Pressure (Ps), in. Hg

$$Ps = Pb + \frac{Pg}{13.6}$$

where,

Pb	28.83	= barometric pressure, in. Hg
Pg	-0.65	= static pressure, in. H_2O
Ps	28.78	= in. Hg

Standard Meter Volume (Vmstd), dscf

$$Vmstd = \frac{17.636 \times Y \times Vm \times Pm}{Tm}$$

where,

Y	0.9979	= meter correction factor
Vm	58.000	= meter volume, cf
Pm	28.87	= absolute meter pressure, in. Hg
Tm	522.5	= absolute meter temperature, °R
Vmstd	56.393	= dscf

Standard Wet Volume (Vwstd), scf

$$Vwstd = 0.04716 \times Vlc$$

where,

Vlc	26.3	= volume of H_2O collected, ml
Vwstd	1.240	= scf

Moisture Fraction (BWSmsd), dimensionless (measured)

$$BWS = \frac{Vwstd}{(Vwstd + Vmstd)}$$

where,

Vwstd	1.240	= standard wet volume, scf
Vmstd	56.393	= standard meter volume, dscf
BWSmsd	0.022	

Moisture Fraction (BWSsat), dimensionless (theoretical at saturated conditions)

$$BWSsat = \frac{10^{6.37-\left(\frac{2,827}{Ts+365}\right)}}{Ps}$$

where,

Ts	162.0	= stack temperature, °F
Ps	28.78	= absolute stack gas pressure, in. Hg
BWSsat	0.348	

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Location:	**Louisiana-Pacific Sagola Plant - Sagola, MI**
Source:	**Press RCO**
Project No.:	**AST-2023-4440**
Run No./Method:	Run 1/Method 201A

Moisture Fraction (BWS), dimensionless

$$BWS = BWSmsd \text{ unless } BWSsat < BWSmsd$$

where,

BWSsat	0.348	= moisture fraction (theoretical at saturated conditions)
BWSmsd	0.022	= moisture fraction (measured)
BWS	0.022	

Molecular Weight (DRY) (Md), lb/lb-mole

$$Md = (0.44 \times \% CO_2) + (0.32 \times \% O2) + (0.28(100 - \% CO_2 - \% O2))$$

where,

CO_2	0.5	= carbon dioxide concentration, %
O_2	20.5	= oxygen concentration, %
Md	28.90	= lb/lb mol

Molecular Weight (WET) (Ms), lb/lb-mole

$$Ms = Md (1 - BWS) + 18.015 (BWS)$$

where,

Md	28.90	= molecular weight (DRY), lb/lb mol
BWS	0.022	= moisture fraction, dimensionless
Ms	28.67	= lb/lb mol

Average Velocity (Vs), ft/sec

$$Vs = 85.49 \times Cp \times (\Delta P^{1/2}) avg \times \sqrt{\frac{Ts}{Ps \times Ms}}$$

where,

Cp	0.78	= pitot tube coefficient
$\Delta P^{1/2}$	0.908	= velocity head of stack gas, (in. $H_2O)^{1/2}$
Ts	621.7	= absolute stack temperature, °R
Ps	28.78	= absolute stack gas pressure, in. Hg
Ms	28.67	= molecular weight of stack gas, lb/lb mol
Vs	52.4	= ft/sec

Average Stack Gas Flow at Stack Conditions (Qa), acfm

$$Qa = 60 \times Vs \times As$$

where,

Vs	52.4	= stack gas velocity, ft/sec
As	31.50	= cross-sectional area of stack, ft²
Qa	99,139	= acfm

Average Stack Gas Flow at Standard Conditions (Qs), dscfm

$$Qs = 17.636 \times Qa \times (1 - BWS) \times \frac{Ps}{Ts}$$

where,

Qa	99,139	= average stack gas flow at stack conditions, acfm
BWS	0.022	= moisture fraction, dimensionless
Ps	28.78	= absolute stack gas pressure, in. Hg
Ts	621.7	= absolute stack temperature, °R
Qs	79,207	= dscfm

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Location:	Louisiana-Pacific Sagola Plant - Sagola, MI
Source:	Press RCO
Project No.:	AST-2023-4440
Run No./Method:	Run 1/Method 201A

Filterable PM10 Concentration (C_{FPM10}), grain/dscf

$$C_{FPM10} = \frac{M_{FPM10} \times 0.0154}{Vmstd}$$

where,

M_{FPM10}	0.5	= FPM10 mass, mg
Vmstd	56.393	= standard meter volume, dscf
C_{FPM10}	2.7E-04	= grain/dscf

Filterable PM10 Emission Rate (ER_{FPM10}), lb/hr

$$ER_{FPM10} = \frac{C_{FPM10} \times Qs \times 60}{7.0E+03}$$

where,

C_{FPM10}	0.0003	= FPM10 concentration, grain/dscf
Qs	79,207	= average stack gas flow at standard conditions, dscfm
ER_{FPM10}	0.19	= lb/hr

Filterable PM10 Emission Factor (EF_{FPM10}), lb/ton

$$EF_{FPM10} = \frac{ER_{FPM10} \times 2.0E+03}{FR}$$

where,

ER_{FPM10}	0.19	= FPM10 emission rate, lb/hr
FR	53,420	= process feed rate, lb/hr
EF_{FPM10}	0.0069	= lb/ton

Filterable PM Concentration (C_{FPM}), grain/dscf

$$C_{FPM} = \frac{M_n \times 0.0154}{Vmstd}$$

where,

M_{FPM}	2.9	= filterable PM mass, mg
Vmstd	56.393	= standard meter volume, dscf
C_{FPM}	7.9E-04	= grain/dscf

Filterable PM Emission Rate (ER_{FPM}), lb/hr

$$ER_{FPM} = \frac{C_{FPM} \times Qs \times 60}{7.0E+03}$$

where,

C_{FPM}	7.9E-04	= filterable PM concentration, grain/dscf
Qs	79,207	= average stack gas flow at standard conditions, dscfm
ER_{FPM}	0.54	= lb/hr

Location: **Louisiana-Pacific Sagola Plant - Sagola, MI**
Source: **Press RCO**
Project No.: **AST-2023-4440**
Run No./Method: Run 1/Method 201A

Filterable Emission Factor (EF$_{FPM}$), lb/ton

$$EF_{FPM} = \frac{ER_{FPM} \times 2.0E + 03}{FR}$$

where,

ER$_{FPM}$	0.54	= filterable PM emission rate, lb/hr
FR	53,420	= process feed rate, lb/hr
EF$_{FPM}$	0.020	= lb/ton

Condensable PM Concentration (C$_{CPM}$), grain/dscf

$$C_{CPM} = \frac{M_{CPM} \times 0.0154}{Vmstd}$$

where,

M$_{CPM}$	4.2	= condensable PM mass, mg
Vmstd	56.393	= standard meter volume, dscf
C$_{CPM}$	0.0011	= grain/dscf

Condensable PM Emission Rate (ER$_{CPM}$), lb/hr

$$ER_{CPM} = \frac{C_{CPM} \times Qs \times 60}{7.0E + 03}$$

where,

C$_{CPM}$	0.0011	= condensable PM concentration, grain/dscf
Qs	79,207	= average stack gas flow at standard conditions, dscfm
ER$_{CPM}$	0.78	= lb/hr

Condensable PM Emission Factor (EF$_{CPM}$), lb/ton

$$EF_{CPM} = \frac{ER_{CPM} \times 2.0E + 03}{FR}$$

where,

ER$_{CPM}$	0.78	= condensable PM emission rate, lb/hr
FR	53,420	= process feed rate, lb/hr
EF$_{CPM}$	0.029	= lb/ton

PM10 Concentration (C$_{PM10}$), grain/dscf

$$C_{PM10} = \frac{M_{PM10} \times 0.0154}{Vmstd}$$

where,

M$_{PM10}$	5.2	= PM10 mass, mg
Vmstd	56.393	= standard meter volume, dscf
C$_{PM10}$	0.0014	= grain/dscf

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Location: Louisiana-Pacific Sagola Plant - Sagola, MI
Source: Press RCO
Project No.: AST-2023-4440
Run No./Method: Run 1/Method 201A

PM10 Emission Rate (ER$_{PM10}$), lb/hr

$$ER_{PM10} = \frac{C_{PM10} \times Qs \times 60}{7.0E + 03}$$

where,

C_{PM10}	0.0014	= PM10 concentration, grain/dscf
Qs	79,207	= average stack gas flow at standard conditions, dscfm
ER$_{PM10}$	0.96	= lb/hr

PM10 Emission Factor (EF$_{PM10}$), lb/ton

$$EF_{PM10} = \frac{ER_{PM10} \times 2.0E + 03}{FR}$$

where,

ER$_{PM10}$	0.96	= PM10 emission rate, lb/hr
FR	53,420	= process feed rate, lb/hr
EF$_{PM10}$	0.036	= lb/ton

Location: Louisiana-Pacific Sagola Plant - Sagola, MI
Source: Press RCO
Project No.: AST-2023-4440
Parmater: PM

Run Number		Run 1	Run 2	Run 3	Average
Date		11/14/23	11/14/23	11/14/23	-
Start Time		9:17	12:45	16:05	-
Stop Time		11:47	15:26	18:37	-
INPUT DATA					
Run Time, min	(θ)	144.3	154.9	148.6	149.3
Product Rate, ton/hr	(FR)	26.71	26.94	26.67	26.77
Product Rate, lb/hr	(FR)	53,420	53,880	53,340	53,547
Barometric Pressure, in. Hg	(Pb)	28.83	28.73	28.67	28.74
Meter Correction Factor	(Y)	0.9979	0.9979	0.9979	0.9979
Orifice Calibration Value	$(\Delta H@)$	1.830	1.830	1.830	1.830
Meter Volume, ft^3	(Vm)	58.000	62.700	59.650	60.117
Meter Temperature, °F	(Tm)	62.8	67.1	66.6	65.5
Meter Temperature, °R	(Tm)	522.5	526.8	526.3	525.2
Meter Orifice Pressure, in. WC	(ΔH)	0.500	0.497	0.496	0.498
Volume H2O Collected, mL	(Vlc)	26.3	23.5	27.9	25.9
Nozzle Diameter, in	(Dn)	0.163	0.163	0.163	0.163
Area of Nozzle, ft^2	(An)	0.00014	0.00014	0.00014	0.00014
Filterable PM10 (Filter) Mass, mg	$(M_{FPM2.5})$	<u>0.5</u>	<u>0.5</u>	<u>0.5</u>	0.5
Filterable PM10 (Rinse) Mass, mg	(M_{FPM10})	<u>0.5</u>	1.2	0.9	0.9
Filterable >PM10 Mass, mg	(M_{FPM})	1.9	1.4	2.4	1.9
Condensable PM Mass, mg	(M_{CPM})	4.2	5.3	4.2	4.6
Filterable PM10 Mass, mg	(M_{FPM10})	1.0	1.7	1.4	1.4
Filterable PM Mass, mg	(M_{FPM})	2.9	3.1	3.8	3.3
PM10 Mass, mg (FPM10 + CPM)	(M_{PM10})	5.2	7.0	5.6	5.9
CALCULATED DATA					
Standard Meter Volume, ft^3	(Vmstd)	56.393	60.261	57.264	57.973
Standard Water Volume, ft^3	(Vwstd)	1.240	1.108	1.316	1.221
Sampling Rate, acfm	(Qs)	0.49	0.49	0.49	0.49
Moisture Fraction Measured	(BWSmsd)	0.022	0.018	0.022	0.021
Moisture Fraction @ Saturation	(BWSsat)	0.348	0.354	0.351	0.351
Moisture Fraction	(BWS)	0.022	0.018	0.022	0.021
Meter Pressure, in Hg	(Pm)	28.87	28.77	28.71	28.780
Volume at Nozzle, ft^3	(Vn)	70.581	75.490	72.161	72.744
Isokinetic Sampling Rate, % (+/- 20%)	(I)	107.2	103.3	103.7	104.8
DGM Calibration Check Value, % (+/- 5%)	(Y_{qa})	0.8	1.3	0.4	0.8
Particle Cut Diameter (PM2.5), um (+/-0.25 um)	(D_{50IV})	2.40	2.42	2.43	2.41
Particle Cut Diameter (PM10), um (+/-1 um)	(D_{50})	10.7	10.7	10.7	10.7
Reynolds Number	(Nre)	2,730	2,704	2,692	2709
Cunningham Correction Factor	(C)	1.076	1.076	1.076	1.076
Gas Viscosity, mpoise	(μ)	205.34	205.82	205.23	205.46
RECALCULATED DATA					
Cunningham Correction Factor	(Cr)	1.079	1.079	1.079	1.079
Particle Cut Diameter, um	(D_{50-1})	2.39	2.41	2.42	2.41
Ratio of D_{50} and D_{50-1} (+/- 0.01)	(Z)	1.00	1.00	1.00	1.00
EMISSION CALCULATIONS					
Filterable PM10 Concentration, grain/dscf	(C_{FPM10})	2.7E-04	4.3E-04	3.9E-04	3.6E-04
Filterable PM10 Emission Rate, lb/hr	(ER_{FPM10})	0.19	0.30	0.27	0.25
Filterable PM10 Emission Factor, lb/ton	(EF_{FPM10})	0.0069	0.011	0.010	0.0094
Filterable PM Concentration, grain/dscf	(C_{FPM})	7.9E-04	7.9E-04	1.0E-03	8.7E-04
Filterable PM Emission Rate, lb/hr	(ER_{FPM})	0.54	0.56	0.71	0.60
Filterable PM Emission Factor, lb/ton	(EF_{FPM})	0.020	0.021	0.027	0.023
Condensable PM Concentration, grain/dscf	(C_{CPM})	0.0011	0.0014	0.0011	0.0012
Condensable PM Emission Rate, lb/hr	(ER_{CPM})	0.78	0.95	0.78	0.84
Condensable PM Emission Factor, lb/ton	(EF_{CPM})	0.029	0.035	0.029	0.031
Total PM Concentration, grain/dscf	$(C_{PM2.5})$	0.0019	0.0021	0.0022	0.0021
Total PM Emission Rate, lb/hr	$(ER_{PM2.5})$	1.32	1.51	1.50	1.44
Total PM Emission Factor, lb/ton	$(EF_{PM2.5})$	0.049	0.056	0.056	0.054
PM10 Concentration, grain/dscf	(C_{PM10})	0.0014	0.0018	0.0015	0.0016
PM10 Emission Rate, lb/hr	(ER_{PM10})	0.96	1.3	1.0	1.1
PM10 Emission Factor, lb/ton	(EF_{PM10})	0.036	0.047	0.039	0.041

Underlined values are total results that have been calculated based on MDL values for any sample fractions which were below the MDL.

Location: Louisiana-Pacific Sagola Plant - Sagola, MI
Source: Press RCO
Project No.: AST-2023-4440
Parameter: PM

Run Number		Run 1	Run 2	Run 3	Average
Date		11/14/23	11/14/23	11/14/23	-
Start Time		9:17	12:45	16:05	-
Stop Time		11:47	15:26	18:37	-
Run Time, min		144.3	154.9	148.6	149.3
VELOCITY HEAD, in. WC					
Point 1		0.74	0.87	0.93	0.85
Point 2		0.84	0.84	0.87	0.85
Point 3		0.85	0.93	0.83	0.87
Point 4		0.90	0.87	0.92	0.90
Point 5		0.77	0.88	0.88	0.84
Point 6		0.80	0.85	0.84	0.83
Point 7		0.84	0.89	0.89	0.87
Point 8		0.82	0.87	0.83	0.84
Point 9		0.85	0.95	0.84	0.88
Point 10		0.82	0.88	0.81	0.84
Point 11		0.81	0.88	0.85	0.85
Point 12		0.87	0.85	0.88	0.87
CALCULATED DATA					
Square Root of ΔP	(in. WC)$^{1/2}$	0.908	0.938	0.929	0.925
Pitot Tube Coefficient	(Cp)	0.78	0.78	0.78	0.78
Barometric Pressure, in. Hg	(Pb)	28.83	28.73	28.67	28.74
Static Pressure, in. WC	(Pg)	-0.65	-0.65	-0.65	-0.65
Stack Pressure, in. Hg	(Ps)	28.78	28.68	28.62	28.70
Stack Cross-sectional Area, ft^2	(As)	31.50	31.50	31.50	31.50
Temperature, °F	(Ts)	162.0	162.6	162.2	162.3
Temperature, °R	(Ts)	621.7	622.3	621.8	621.9
Moisture Fraction Measured	(BWSmsd)	0.022	0.018	0.022	0.021
Moisture Fraction @ Saturation	(BWSsat)	0.348	0.354	0.351	0.351
Moisture Fraction	(BWS)	0.022	0.018	0.022	0.021
O2 Concentration, %	(O2)	20.5	20.5	20.4	20.5
CO2 Concentration, %	(CO2)	0.5	0.4	0.4	0.4
Molecular Weight, lb/lb-mole (dry)	(Md)	28.90	28.88	28.88	28.89
Molecular Weight, lb/lb-mole (wet)	(Ms)	28.67	28.69	28.64	28.66
Velocity, ft/sec	(Vs)	52.4	54.3	53.8	53.5
VOLUMETRIC FLOW RATE					
At Stack Conditions, acfm	(Qa)	99,139	102,543	101,774	101,152
At Standard Conditions, dscfm	(Qs)	79,207	81,854	80,761	80,607

Alliance TECHNICAL GROUP

Location **Louisiana-Pacific Sagola Plant - Sagola, MI**
Source **Press RCO**
Project No. **AST-2023-4440**
Date: **11/14/23**

Stack Parameters

Duct Orientation:	Vertical	
Duct Design:	Circular	
Distance from Far Wall to Outside of Port:	85.00	in
Nipple Length:	9.00	in
Depth of Duct:	76.00	in
Cross Sectional Area of Duct:	31.50	ft^2
No. of Test Ports:	2	
Number of Readings per Point:	1	
Distance A:	30.0	ft
Distance A Duct Diameters:	4.7	(must be > 0.5)
Distance B:	50.0	ft
Distance B Duct Diameters:	7.9	(must be > 2)
Minimum Number of Traverse Points:	12	
Actual Number of Traverse Points:	12	
Measurer:	SKS 11/14	
Reviewer:	CRK 11/14	

* HIGHER NUMBER IS FOR RECTANGULAR STACKS OR DUCTS

12 points

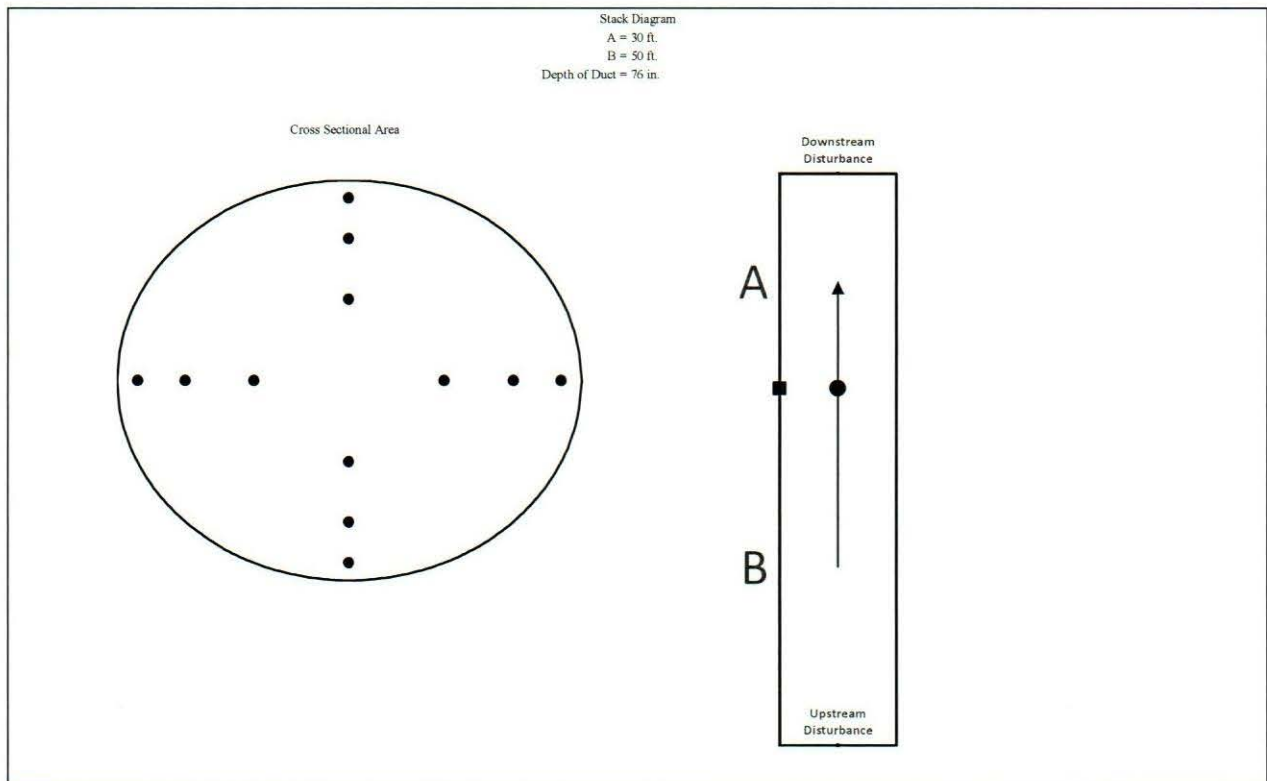8 or 9" points

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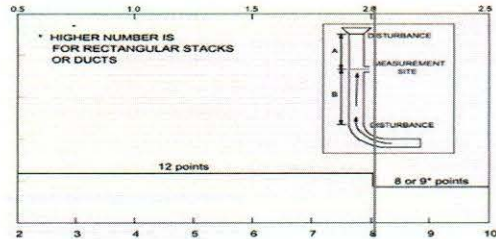
CIRCULAR DUCT

LOCATION OF TRAVERSE POINTS
Number of traverse points on a diameter

	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--	--	--	89.5	--	77.4	--	64.4
8	--	--	--	--	--	--	96.8	--	85.4	--	75.0
9	--	--	--	--	--	--	--	--	91.8	--	82.3
10	--	--	--	--	--	--	--	--	97.4	--	88.2
11	--	--	--	--	--	--	--	--	--	--	93.3
12	--	--	--	--	--	--	--	--	--	--	97.9

Percent of stack diameter from inside wall to traverse point.

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	4.4	3.34	12.34
2	14.6	11.10	20.10
3	29.6	22.50	31.50
4	70.4	53.50	62.50
5	85.4	64.90	73.90
6	95.6	72.66	81.66
7	--	--	--
8	--	--	--
9	--	--	--
10	--	--	--
11	--	--	--
12	--	--	--

Stack Diagram
A = 30 ft.
B = 50 ft.
Depth of Duct = 76 in.

Cross Sectional Area

Downstream Disturbance

A

B

Upstream Disturbance

Location   Louisiana-Pacific Sagola Plant - Sagola, MI

Source   Press RCO

Project No.   AST-2023-4440

Date   11/14/23

Sample Point	Angle ($\Delta P=0$)
1	0
2	0
3	0
4	5
5	0
6	0
7	0
8	5
9	0
10	5
11	0
12	0
Average	1

Location **Louisiana-Pacific Sagola Plant - Sagola, MI**
Source **Press RCO**
Project No. **AST-2023-4440**

	O₂ Data			CO₂ Data		
	Date/Time	11/14/23	8:00 PM	Date/Time	11/14/23	8:00 PM
Make/Model/SN	Servomex	1440D	19	Servomex	1440D	01440D1/4043
Parameter	Cylinder ID	Cylinder Concentration, %	Analyzer Concentration, %	Cylinder ID	Cylinder Concentration, %	Analyzer Concentration, %
Zero Gas	Nitrogen	0.0	0.0	Nitrogen	0.0	0.0
High Range Gas	CC480181	20.9	20.7	CC480181	16.7	16.6
Mid Range Gas	CC480167	11.06	11.0	CC480167	8.48	8.5
Concentration Span, %		20.9			16.7	
Accuracy		0.4			0.3	
Run No.	Run 1		Run 2		Run 3	
Parameter	O₂ %	CO₂ %	O₂ %	CO₂ %	O₂ %	CO₂ %
Date/Time	11/14/2023	20:10	11/14/2023	20:15	11/14/2023	20:20
Analysis #1	20.50	0.50	20.50	0.40	20.40	0.40
Analysis #2	20.50	0.50	20.50	0.40	20.40	0.40
Analysis #3	20.50	0.50	20.50	0.40	20.40	0.40
Average	20.5	0.5	20.5	0.4	20.4	0.4

Location **Louisiana-Pacific Sagola Plant - Sagola, MI**
Source **Press RCO**
Project No. **AST-2023-4440**
Parameter: **PM**

Run 1		Date:	11/14/23			
	Impinger No.	1	2	3	4	Total
	Contents	empty	empty	water	silica	--
	Initial Mass, g	752.1	646.6	708.0	1793.0	3899.7
	Final Mass, g	770.0	646.7	704.8	1804.5	3926.0
	Gain, g	17.9	0.1	-3.2	11.5	26.3
Run 2		Date:	11/14/23			
	Impinger No.	1	2	3	4	Total
	Contents	empty	empty	water	silica	--
	Initial Mass, g	812.3	639.7	733.3	1801.8	3987.1
	Final Mass, g	826.1	640.0	725.3	1819.2	4010.6
	Gain, g	13.8	0.3	-8.0	17.4	23.5
Run 3		Date:	11/14/23			
	Impinger No.	1	2	3	4	Total
	Contents	empty	empty	water	silica	--
	Initial Mass, g	752.1	646.6	704.8	1804.5	3908.0
	Final Mass, g	768.1	647.0	702.2	1818.6	3935.9
	Gain, g	16.0	0.4	-2.6	14.1	27.9