Executive Summary

Arauco North America (Arauco) retained Apex Companies, LLC (Apex) to conduct air emissions testing at the Arauco facility in Grayling, Michigan. The purpose of the air emission testing was to evaluate compliance with certain emission limits in Michigan Department of Environment, Great Lakes, and Energy (EGLE) Draft Permit to Install (PTI) No. 59-16G, dated March 23, 2021.

The emission units tested were:

- FGDRYERRTO – Dryer Regenerative Thermal Oxidizer RTO1 (RTO)
- EUFORMING – Forming Baghouses BH11 and BH13

The testing followed United States Environmental Protection Agency (USEPA) Reference Methods 1 through 5, 201A, 202, and 320.

Detailed results are presented in Tables 1 through 4 after the Tables Tab of this report. The following tables summarize the results of the testing conducted on May 18 and 19, 2021.

FGDRYERRTO Emissions Results

Parameter	Unit	Average Result	Permit Limit
Acetaldehyde	lb/hr	1.2	3.5
Formaldehyde	lb/hr	0.92	3.5
$PM_{2.5}$	lb/hr	8.4	16.55

$PM_{2.5}$: particulate matter less than 2.5 microns in diameter
lb/hr: pound per hour

EUFORMING Emissions Results

Parameter	Unit	Average Result	Permit Limit
EUFORMING (BH11 and BH13)			
Acetaldehyde	lb/hr	1.0	2.9
Formaldehyde	lb/hr	0.53	0.76
BH11			
PM, PM_{10}, $PM_{2.5}$	gr/dscf	0.002	0.002
	lb/hr	0.99	1.05

PM: particulate matter
lb/hr: pound per hour
gr/dscf: grain per dry standard cubic foot

1.0 Introduction

1.1 Summary of Test Program

Arauco North America (Arauco) retained Apex Companies, LLC (Apex) to conduct air emissions testing at the Arauco facility in Grayling, Michigan. The purpose of the air emission testing was to evaluate compliance with certain emission limits in Michigan Department of Environment, Great Lakes, and Energy (EGLE) Draft Permit to Install (PTI) No. 59-16G, dated March 23, 2021.

The testing followed United States Environmental Protection Agency (USEPA) Reference Methods 1 through 5, 201A, 202, and 320.

Table 1-1 lists the emission sources tested, parameters, and test dates.

Table 1-1
Sources Tested, Parameters, and Test Dates

Source	Test Parameter(s)	Test Date(s)
FGDRYERRTO	Acetaldehyde, Formaldehyde, Particulate matter less than 2.5 microns ($PM_{2.5}$)	May 18 and 19, 2021
EUFORMING Baghouse BH11	Acetaldehyde, Formaldehyde, Particulate matter (PM)	May 19, 2021
EUFORMING Baghouse BH13	Acetaldehyde, Formaldehyde	May 19, 2021

1.2 Key Personnel

The key personnel involved in this test program are listed in Table 1-2. Mr. David Kawasaki, with Apex, led the emission testing program. Mr. James Osga, with Arauco, provided process coordination and recorded operating parameters. Mr. Jeremy Howe, with EGLE, witnessed the testing and verified production parameters were recorded.

Table 1-2
Key Contact Information

Arauco	Apex
James Osga Environmental Manager – Grayling **Arauco North America** 5851 Arauco Road Grayling, Michigan 49738 Phone: 989.745.1333 james.osga@arauco.com	David Kawasaki, QSTI Staff Consultant **Apex Companies, LLC** 46555 Humboldt Drive, Suite 103 Novi, Michigan 48377 Phone: 248.590.5134 david.kawasaki@apexcos.com
EGLE	
Karen Kajiya-Mills Technical Programs Unit Supervisor **EGLE Air Quality Division** **Technical Programs Unit** Constitution Hall, 2nd Floor, South 525 West Allegan Street Lansing, Michigan 48909 Phone: 517.256.0880 kajiya-millsk@michigan.gov	Robert Dickman Environmental Quality Analyst **EGLE Air Quality Division** **Cadillac District Office** 120 West Chapin Street Cadillac, Michigan 49601 Phone: 231.876.4412 dickmanr@michigan.gov

2.0 Source and Sampling Locations

2.1 Process Description

Arauco operates a medium-density particleboard plant located at 5851 Arauco Road in Grayling, Michigan. The facility includes a woodyard and conducts wood furnish preparation, drying, forming, pressing, cooling, finishing, and other related operations. Refer to Figure 2-1 for a diagram showing the manufacturing process.

Operating parameters were measured and recorded by Arauco personnel during testing. Table 2-1 summarizes the operating conditions during testing. Additional operating parameter data are included in Appendix F.

Table 2-1
Dryer Feed Rate
May 18 and 19, 2021

Run	Dryer Feed Rate (dried ton/hour)
1	41.60
2	45.32
3	44.94
4	42.84
5	44.02
6	45.07
Average	**43.97**

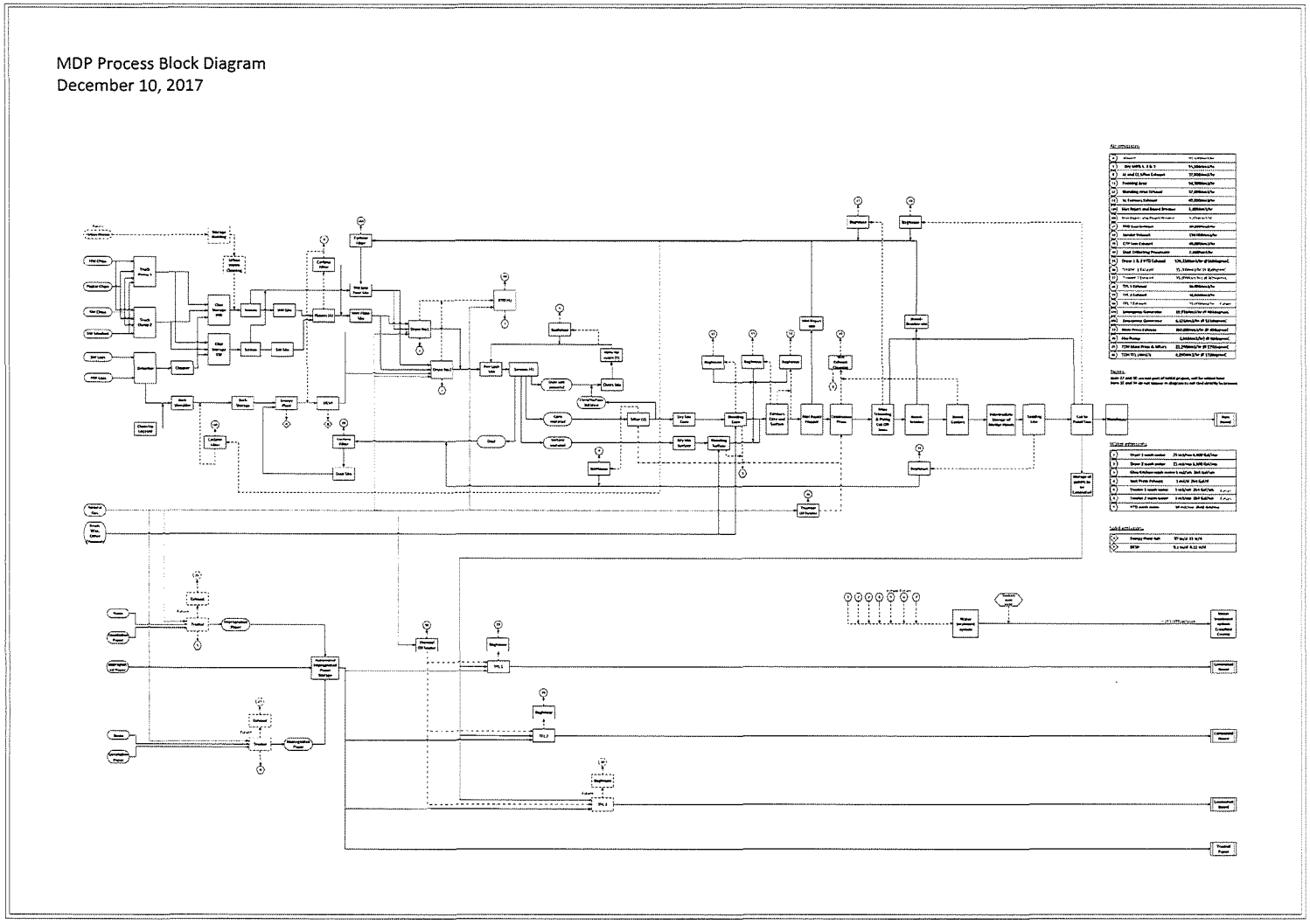

Figure 2-1. Process Block Diagram

2.2 Control Equipment Description

2.2.1 FGDRYERRTO – RTO1

Gaseous emissions from the process equipment are normally exhausted through Dryer RTO1.

There are two identical rotary dryers that receive green wood flakes from the flakers. The heat for these dryers is provided by the thermal energy plant as well as natural gas burners located on each dryer. The thermal energy plant combusts wood derived fuel, including bark, sawdust and other wood waste from the process. The exhaust from the energy plant is controlled by a dry electrostatic precipitator prior to entering the dryers. The flakes are separated from the dryer exhaust by classifiers (cyclones) and the dryer exhaust is then treated by the RTO before exiting the stack (identified in the PTI as SV-24).

The RTO consists of three identical, but separately controlled, combustion chambers. A fourth combustion chamber is under construction, so that the facility will have the capability of having a chamber on standby in case of a malfunction or bake-out requirements in another RTO chamber. The RTO is fired with natural gas, with a total heat input of 25 million British thermal units (MMBtu/hr) for the four combustion chambers. The RTO was operated at or above the combustion chamber temperature established in the most recent MACT testing.

Operating parameters were measured and recorded by Arauco personnel during testing. Table 2-2 summarizes the operating conditions during testing of the RTO. Additional operating parameter data are included in Appendix F.

Table 2-2
RTO Operating Data
May 18 and 19, 2021

Run	Average Operating Temperature (°F)			Natural Gas Usage (ft^3/hr)
	RTO1	RTO2	RTO3	
1	1,578	1,579	1,581	99,748
2	1,566	1,578	1,579	94,736
3	1,569	1,577	1,578	103,885
4	1,575	1,576	1,576	99,321
5	1,583	1,576	1,576	92,868
6	1,578	1,575	1,576	96,033
Average	**1,575**	**1,577**	**1,578**	**97,765**

2.2.2 EUFORMING – BH11 and BH13

The dried flakes from the dryers are sized and fed into the blending and forming operation prior to pressing. There are two mechanical blenders that mix the flakes with a measured amount of resins, catalysts, and wax emulsions in a precisely measured blend. Urea-formaldehyde (UF) resin is used in the production of particleboard. One blender is for the larger core material and one blender is for the smaller surface material.

From the surface blender, the flakes are sent on conveyors to the surface formers. From the core blender, the material is sent on conveyors to the core formers. The formers create layers with the core material being 'sandwiched' between surface layers in the proper amounts according to the product being pressed. The exhaust from the formers are controlled by Baghouse BH11 and Baghouse BH13 and exhausted through SV-11 and SV-13.

Operating parameters were measured and recorded by Arauco personnel during testing. Tables 2-3 and 2-4 summarize the operating conditions during testing of BH11 and BH13. Additional operating parameter data are included in Appendix F.

Table 2-3
BH11 Operating Data
May 19, 2021

Run	Pressure Drop (mbar)
1	5.05-5.12
2	4.91-5.02
3	5.35-5.50
Average	**5.10-5.21**

Table 2-4
BH13 Operating Data
May 19, 2021

Run	Pressure Drop (mbar)
1	1.82-1.90
2	1.76-1.83
3	1.71-1.74
Average	**1.76-1.82**

2.3 Flue Gas Sampling Locations

2.3.1 FGDRYERRTO Outlet Sampling Location

Four sampling ports oriented at 90° to one another are located in a straight section of a 123 inch-internal-diameter duct. The sampling ports are located:

- Approximately 39 feet (3.8 duct diameters) from the nearest downstream disturbance.
- Approximately 33 feet (3.2 duct diameters) from the nearest upstream disturbance.

The sampling ports are accessible via stairs. A photograph of the FGDRYERRTO sampling location is presented in Figure 2-2. Figure 1 in the Appendix depicts the FGDRYERRTO sampling ports and traverse point locations.

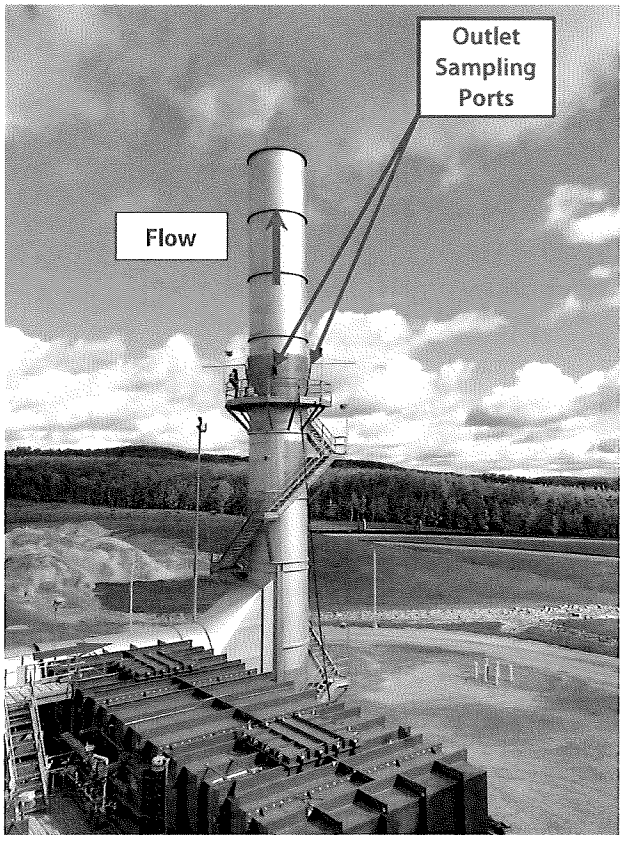

Figure 2-2. FGDRYERRTO Outlet Sampling Location

2.3.2 EUFORMING BH11 Sampling Location

Three sampling ports oriented at 90° to one another are located in a straight section of a 49.25 inch-internal-diameter duct. The sampling ports are located:

- Approximately 16 feet (3.9 duct diameters) from the nearest downstream disturbance.
- Approximately 50 feet (12.2 duct diameters) from the nearest upstream disturbance.

The sampling ports are accessible via aerial lift. A photograph of the EUFORMING BH11 sampling location is presented in Figure 2-3. Figure 2 in the Appendix depicts the EUFORMING BH11 sampling ports and traverse point locations.

2.3.3 EUFORMING BH13 Sampling Location

Three sampling ports oriented at 90° to one another are located in a straight section of a 39.25 inch-internal-diameter duct. The sampling ports are located:

- Approximately 16 feet (4.9 duct diameters) from the nearest downstream disturbance.
- Approximately 50 feet (15.3 duct diameters) from the nearest upstream disturbance.

The sampling ports are accessible via ladder. A photograph of the EUFORMING BH13 sampling location is presented in Figure 2-3. Figure 3 in the Appendix depicts the EUFORMING BH13 sampling ports and traverse point locations.

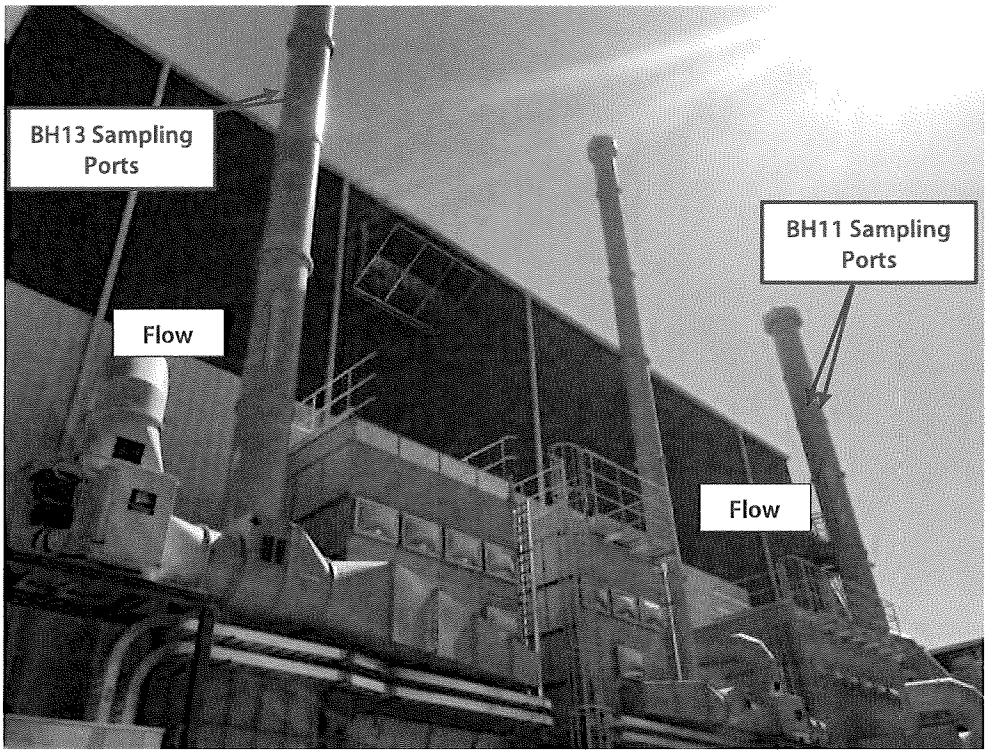

Figure 2-3. EUFORMING BH11 and BH13 Outlet Sampling Locations

2.4 Process Sampling Locations

Process sampling was not required during this test program. A process sample is a sample that is analyzed for operational parameters, such as calorific value of a fuel (e.g., natural gas, coal), organic compound content (e.g., paint coatings), or composition (e.g., polymers).

3.0 Summary and Discussion of Results

3.1 Objectives and Test Matrix

The objective of the air emission testing was to evaluate compliance with certain emission limits in EGLE Draft PTI No. 59-16G, dated March 23, 2021.

Table 3-1 summarizes the sampling and analytical matrix.

Table 3-1
Sampling and Analytical Matrix

Sampling Location	Sample/Type of Pollutant	Sample Method	Date (2021)	Run	Start Time	End Time	Analytical Laboratory
FGDRYERRTO	Flowrate, molecular weight, moisture content, acetaldehyde, formaldehyde	USEPA 1-3, 320	May 18	1	10:53	11:53	Not applicable
				2	12:15	13:15	
				3	13:35	14:35	
	Flowrate, molecular weight, moisture content, $PM_{2.5}$	USEPA 1-4, 201A/202	May 19	4	15:06	16:10	Bureau Veritas Laboratories
				5	18:21	19:25	
				6	19:34	20:40	
EUFORMING BH11	Flowrate, molecular weight, moisture content, PM, acetaldehyde, formaldehyde	USEPA 1-4, 5/202, 320	May 19	1	8:00	9:36	Bureau Veritas Laboratories
				2	10:00	11:00	
				3	11:23	12:23	
EUFORMING BH13	Flowrate, molecular weight, moisture content, acetaldehyde, formaldehyde	USEPA 1-3, 320	May 19	1	13:52	14:52	Not applicable
				2	15:00	16:00	
				3	16:20	17:20	

3.2 Field Test Changes and Issues

Communication between Arauco, Apex, and EGLE allowed the testing to be completed as proposed in the April 16, 2021, Intent-to-Test Plan, and the April 27, 2021 Intent-to-Test Plan Amendment, with the following exceptions:

- Test Runs 1 through 3, for $PM_{2.5}$ testing at the FGDRYERRTO source, were invalidated on-site by Mr. Jeremy Howe, with EGLE. Three additional test runs were conducted for $PM_{2.5}$.
- When the Pitot tube, used for USEPA Method 201A at the FGDRYERRTO source, was calibrated post-test, the calibrated Pitot correction factor (C_p) resulted in several isokinetic variations outside of the range allowed by the Method. USEPA Method 201A allows no more than two of the twelve sampling points' isokinetic variations to be outside the range of 80 to 120%. Test Runs 4 through 6 each had three to four isokinetic variations outside of the range. The overall isokinetic variation for each test run was within the range allowed by the Method. However, because the $PM_{2.5}$ results were approximately half of the permit limit, and because previous testing of total PM was just above the permit limit for $PM_{2.5}$, EGLE allowed the results of this testing to be used for purposes of compliance. Correspondence between Mr. David Kawasaki, with Apex, and Mr. Jeremy Howe, with EGLE, allowing the use of these results is included in Appendix D.

3.3 Summary of Results

The results of testing are presented in Tables 3-2 and 3-3. Detailed results are presented in the Appendix Tables 1 through 4 after the Tables Tab of this report. Sample calculations are presented in Appendix B.

Table 3-2
FGDRYERRTO Emissions Results

Parameter	Unit	Run 1	Run 2	Run 3	Average Result	Permit Limit
Acetaldehyde	lb/hr	1.2	1.1	1.2	**1.2**	**3.5**
Formaldehyde	lb/hr	0.92	0.92	0.92	**0.92**	**3.5**
$PM_{2.5}$	lb/hr	11	6.7	7.4	**8.4**	**16.55**

$PM_{2.5}$: particulate matter less than 2.5 microns in diameter
lb/hr: pound per hour

Table 3-3
EUFORMING Emissions Results

Parameter	Unit	Run 1	Run 2	Run 3	Average Result	Permit Limit
EUFORMING (BH11 and BH13)						
Acetaldehyde	lb/hr	0.93	0.99	1.2	**1.0**	**2.9**
Formaldehyde	lb/hr	0.31	0.61	0.67	**0.53**	**0.76**
BH11						
PM, PM_{10}, $PM_{2.5}$	gr/dscf	0.002	0.002	0.002	**0.002**	**0.002**
	lb/hr	1.02	0.98	0.97	**0.99**	**1.05**

PM: particulate matter
lb/hr: pound per hour
gr/dscf: grain per dry standard cubic foot

4.0 Sampling and Analytical Procedures

Apex measured emissions in accordance with USEPA sampling methods. Table 4-1 presents the emissions test parameters and sampling methods.

Table 4-1
Emission Testing Methods

Parameter	RTO	BH11	BH13	USEPA Reference	
				Method	Title
Sampling ports and traverse points	•	•	•	1	Sample and Velocity Traverses for Stationary Sources
Velocity and flowrate	•	•	•	2	Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)
Molecular weight	•	•	•	3	Gas Analysis for the Determination of Dry Molecular Weight
Moisture content	•	•		4	Determination of Moisture Content in Stack Gases
Filterable particulate matter (FPM)		•		5	Determination of Particulate Matter Emissions from Stationary Sources
Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$)	•			201A	Determination of PM_{10} and $PM_{2.5}$ Emissions from Stationary Sources (Constant Sampling Rate Procedure)
Condensable particulate matter (CPM)	•	•		202	Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources
Formaldehyde, acetaldehyde, moisture content	•	•	•	320	Measurements of Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared

4.1 Emission Test Methods

4.1.1 Volumetric Flowrate (USEPA Methods 1 and 2)

USEPA Method 1, "Sample and Velocity Traverses for Stationary Sources," was used to evaluate the sampling locations and the number of traverse points for sampling and the measurement of velocity profiles. Figures 1 through 3 in the Appendix depict the source locations and traverse points.

USEPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)," was used to measure flue gas velocity and calculate volumetric flowrates. S-type Pitot tubes and thermocouple assemblies, calibrated in accordance with USEPA Method 2, Section 10.0, were used during testing. Because the dimensions of the Pitot tubes met the requirements outlined in USEPA Method 2, Section 10.1, and are within the specified limits, the baseline Pitot tube coefficient of 0.84 (dimensionless) was assigned. The digital manometer and thermometer are calibrated using calibration standards that are traceable to National Institute of Standards and Technology (NIST). Pitot tube inspection sheets are included in Appendix A.

Cyclonic Flow Check. Apex evaluated whether cyclonic flow was present at the sampling locations. Cyclonic flow is defined as a flow condition with an average null angle greater than 20°. The direction of flow can be determined by

aligning the Pitot tube to obtain zero (null) velocity head reading—the direction would be parallel to the Pitot tube face openings or perpendicular to the null position. By measuring the angle of the Pitot tube face openings in relation to the stack walls when a null angle is obtained, the direction of flow is measured. If the absolute average of the flow direction angles is greater than 20°, the flue gas is considered to be cyclonic at that sampling location and an alternative location should be selected.

The average of the measured traverse point flue gas velocity null angles were less than 20° at the sampling locations. The measurements indicate the absence of cyclonic flow.

Field data sheets are included in Appendix C. Computer-generated field data sheets are included in Appendix D.

4.1.2 Molecular Weight (USEPA Method 3)

USEPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight," was used to determine the molecular weight of the flue gas. Flue gas was extracted from the stack through a probe and directed into a Fyrite® gas analyzer. The concentrations of carbon dioxide (CO_2) and oxygen (O_2) were measured by chemical absorption to within ±0.5%. The average CO_2 and O_2 results of the grab samples were used to calculate molecular weight.

4.1.3 Moisture Content (USEPA Method 4)

USEPA Method 4, "Determination of Moisture Content in Stack Gases" was used to determine the moisture content of the flue gas. Prior to testing, the moisture content was estimated using measurements from previous testing, psychrometric charts and/or water saturation vapor pressure tables. These data were used in conjunction with preliminary velocity head pressure and temperature data to calculate flue gas velocity, nozzle size, and to establish the isokinetic sampling rate for the USEPA Methods 5, 201A, and 202 sampling. For each sampling run, moisture content of the flue gases was measured using the Reference Method outlined in Section 2 of USEPA Method 4 in conjunction with the performance of USEPA Methods 5, 201A, and 202.

4.1.4 Particulate Matter (USEPA Methods 5 and 202)

USEPA Methods 5, "Determination of Particulate Emissions from Stationary Sources," and 202, "Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources," were used to measure particulate matter emissions. Figure 4-1 depicts the USEPA Methods 5 and 202 sampling train.

The USEPA Method 5 sampling train collects filterable particulate matter (FPM). The USEPA Method 202 sampling train collects condensable particulate matter (CPM), which is defined as material that is in vapor phase at stack conditions, but that which condenses and/or reacts upon cooling and dilution in the ambient air to form solid or liquid PM immediately after discharge from the stack. USEPA Method 202 collects the CPM using a water-dropout impinger, modified Greenburg-Smith impinger, and a Teflon filter.

Apex's modular isokinetic stack sampling system consists of the following:

- A stainless steel or glass button-hook nozzle.
- A heated (248±25°F) stainless steel or glass-lined probe.
- A desiccated and pre-weighed 83-millimeter-diameter glass fiber filter (manufactured to at least 99.95% efficiency (<0.05 % penetration) for 0.3-micron dioctyl phthalate smoke particles) in a heated (248±25°F) filter box.
- A USEPA Method 23-type stack gas condenser.
- A set of four pre-cleaned impingers with the configuration shown in Table 4-2.

- A second (back-half) CPM filter holder inserted between the second and third impingers and maintained at a temperature less than 85°F.
- A sampling line.
- An Environmental Supply® control case equipped with a pump, dry-gas meter, and calibrated orifice.

Table 4-2
USEPA Methods 5 and 202 Impinger Configuration

Impinger Order (Upstream to Downstream)	Impinger Type	Impinger Contents	Contents
1	Modified - knockout	Empty	0 grams
2	Modified	Empty	0 grams
CPM filter			
3	Modified	HPLC Water	~100 grams
4	Modified	Silica desiccant	~300 grams

Prior to testing, a preliminary velocity traverse was performed and a nozzle size was calculated that would allow isokinetic sampling at an average rate of approximately 0.7 cubic feet per minute (cfm). Apex selected a pre-cleaned nozzle that has an inner diameter that approximated the calculated ideal value. The nozzle was inspected and measured with calipers across three cross-sectional chords to evaluate the inside diameter; rinsed and brushed with acetone; and connected to the sample probe.

The impact and static pressure openings of the Pitot tube were leak-checked at or above a velocity head of 3.0 inches of water for more than 15 seconds. The sampling train was leak-checked by capping the nozzle tip and applying a vacuum of approximately 10 inches of mercury to the sampling train. The dry-gas meter was then monitored (for approximately 1 minute) to measure that the sample train leak rate was less than 0.02 cubic feet per minute (cfm). The probe and filter heaters were turned on, and the sample probe was inserted into the sampling port to begin sampling.

Ice was placed around the impingers, and the probe and filter temperatures were allowed to stabilize at 248±25 °F before each sample run. After the desired operating conditions were coordinated with the facility, testing was initiated.

Stack parameters (e.g., flue velocity, temperature) were monitored to establish the isokinetic sampling rate within 100±10 % for the duration of the test. Data was recorded at each of the traverse points.

At the conclusion of a test run and the post-test leak check, the sampling train was disassembled, and the impingers and filter were transported to the recovery area. The filter was recovered using tweezers and placed in a Petri dish. The Petri dish was immediately labeled and sealed with Teflon tape. The nozzle, probe, and the front half of the filter holder assembly were brushed and, at a minimum, triple-rinsed with acetone to recover particulate matter. The acetone rinses were collected in pre-cleaned sample containers.

At the end of a test run, the mass of liquid collected in each impinger was measured using a scale to within ±0.5 grams; these masses were used to calculate moisture content of the flue gas. The impinger train was then purged with nitrogen, at a minimum flow rate of 14 liters per minute, for a minimum of one hour. The purpose of the nitrogen purge was to remove any dissolved sulfur dioxide gases from the impinger.

The contents of the first two impingers were collected in a glass sample container labeled as CPM Container 1. The back of the filter-holder, condenser, Impingers 1 and 2, front-half of the CPM filter holder, and all connecting glassware were rinsed twice with HPLC water and the recovery rinsate was added to CPM Container 1.

Following the HPLC water rinse, the back of the filter-holder, condenser, Impingers 1 and 2, front-half of the CPM filter holder, and all connecting glassware were rinsed with acetone and then rinsed twice with hexane. The acetone and hexane rinses were collected in a glass sample container labeled as CPM Container 2.

The CPM filter was recovered using Teflon-lined tweezers and placed in a Petri dish; the dish was sealed with Teflon tape, and labeled as CPM Container 3. The mass of condensate collected in Impingers 3 and 4 were measured to calculate the moisture content of the flue gas; these impingers were not recovered.

Apex labeled each container with the test number, test location, and test date, and marked the level of liquid on the outside of the container. Immediately after recovery, the sample containers were stored. The sample containers were transported to Bureau Veritas Laboratories in Mississauga, Ontario, Canada for analysis. The laboratory analytical results are included in Appendix E.

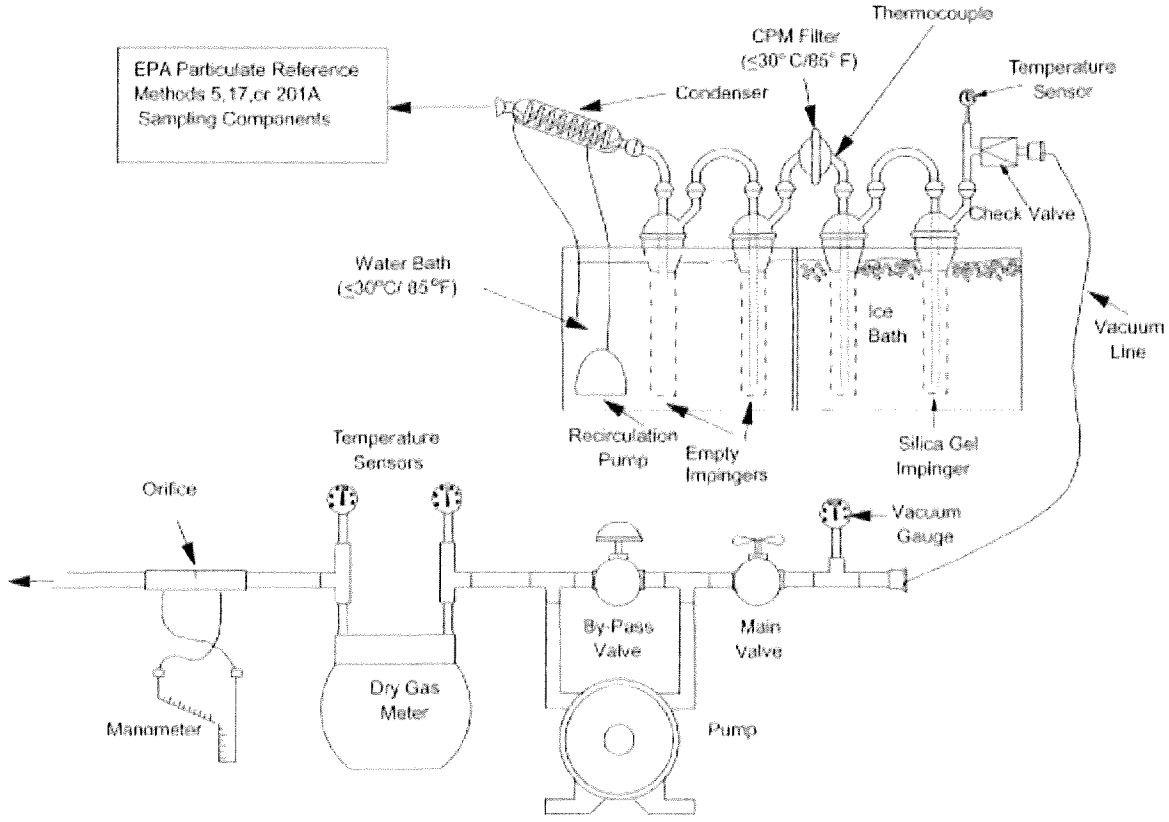

Figure 4-1. USEPA Methods 5, 201A, and 202 Sampling Train

4.1.5 Particulate Matter Less Than 2.5 Microns in Diameter (USEPA Methods 201A and 202)

USEPA Methods 201A, "Determination of PM_{10} and $PM_{2.5}$ Emissions from Stationary Sources (Constant Sampling Rate Procedure)," and 202, "Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources," were used to measure particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) emissions. Figure 4-1 depicts the USEPA Methods 201A and 202 sampling train.

The USEPA Method 201A cyclone collects filterable particulate matter less than 2.5 microns in diameter. Particulate matter greater than 2.5 microns in diameter are isolated in the cyclone, and can also be collected and analyzed. The combination can be used to measure total filterable particulate matter. The USEPA Method 202 sampling train collects condensable particulate matter (CPM), which is defined as material that is in vapor phase at stack conditions, but that which condenses and/or reacts upon cooling and dilution in the ambient air to form solid or liquid PM immediately after discharge from the stack. USEPA Method 202 collects the CPM using a water-dropout impinger, modified Greenburg-Smith impinger, and a Teflon filter.

Apex's modular isokinetic stack sampling system consists of the following:

- An Environmental Supply® $PM_{2.5}$ stainless steel cyclone.
- A desiccated and pre-weighed 47-millimeter-diameter glass fiber filter (manufactured to at least 99.95% efficiency (<0.05 % penetration) for 0.3-micron dioctyl phthalate smoke particles).
- A USEPA Method 23-type stack gas condenser.
- A set of four pre-cleaned impingers with the configuration shown in Table 4-3.
- A second (back-half) CPM filter holder inserted between the second and third impingers and maintained at a temperature less than 85°F.
- A sampling line.
- An Environmental Supply® control case equipped with a pump, dry-gas meter, and calibrated orifice.

Table 4-3
USEPA Methods 201A and 202 Impinger Configuration

Impinger Order (Upstream to Downstream)	Impinger Type	Impinger Contents	Contents
1	Modified - knockout	Empty	0 grams
2	Modified	Empty	0 grams
CPM filter			
3	Modified	HPLC Water	~100 grams
4	Modified	Silica desiccant	~300 grams

Prior to testing, a preliminary velocity traverse was performed and a nozzle size was calculated that would allow isokinetic sampling at a constant flowrate, while maintaining the required cut-off diameter of the cyclone. Apex selected a pre-cleaned nozzle that had an inner diameter that approximated the calculated ideal value. The nozzle was inspected and measured with calipers across three cross-sectional chords to evaluate the inside diameter; rinsed and brushed with acetone; and connected to the sample probe.

The impact and static pressure openings of the Pitot tube were leak-checked at or above a velocity head of 3.0 inches of water for more than 15 seconds. The sampling train was leak-checked by capping the nozzle tip and applying a vacuum of approximately 5 inches of mercury to the sampling train. The dry-gas meter was then monitored (for approximately 1 minute) to measure that the sample train leak rate was less than 0.02 cubic feet per minute (cfm).

Ice was placed around the impingers. After the desired operating conditions were coordinated with the facility, testing was initiated.

Stack parameters (e.g., flue velocity, temperature) were monitored to establish the isokinetic sampling rate within 100±20 % for the duration of the test and at each sampling point. Data was recorded at each of the traverse points.

At the conclusion of a test run and the post-test leak check, the sampling train was disassembled, and the impingers and filter were transported to the recovery area. The filter was recovered using tweezers and placed in a Petri dish. The Petri dish was immediately labeled and sealed with Teflon tape. The inner annulus of the $PM_{2.5}$ cyclone and the front half of the filter holder assembly were brushed and, at a minimum, triple-rinsed with acetone to recover particulate matter. The acetone rinses were collected in pre-cleaned sample containers. Particulate matter greater than 2.5 microns in diameter were discarded.

At the end of each test run, the mass of liquid collected in each impinger was measured using a scale to within ±0.5 grams; these masses were used to calculate moisture content of the flue gas. The impinger train was then purged with nitrogen, at a minimum flow rate of 14 liters per minute, for a minimum of one hour. The purpose of the nitrogen purge was to remove any dissolved sulfur dioxide gases from the impinger.

The contents of the first two impingers were collected in a glass sample container labeled as CPM Container 1. The back of the filter-holder, condenser, Impingers 1 and 2, front-half of the CPM filter holder, and all connecting glassware were rinsed twice with HPLC water and the recovery rinsate was added to CPM Container 1.

Following the HPLC water rinse, the back of the filter-holder, condenser, Impingers 1 and 2, front-half of the CPM filter holder, and all connecting glassware were rinsed with acetone and then rinsed twice with hexane. The acetone and hexane rinses were collected in a glass sample container labeled as CPM Container 2.

The CPM filter was recovered using Teflon-lined tweezers and placed in a Petri dish; the dish was sealed with Teflon tape, and labeled as CPM Container 3. The mass of condensate collected in Impingers 3 and 4 were measured to calculate the moisture content of the flue gas; these impingers were not recovered.

Apex labeled each container with the test number, test location, and test date, and marked the level of liquid on the outside of the container. Immediately after recovery, the sample containers were stored. The sample containers were transported to Bureau Veritas Laboratories in Mississauga, Ontario, Canada for analysis. The laboratory analytical results are included in Appendix E.

4.1.6 Acetaldehyde, Formaldehyde, and Moisture Content (USEPA Method 320)

USEPA Method 320, "Measurements of Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared (FTIR) Spectroscopy," was used to measure acetaldehyde, formaldehyde, and moisture content in the flue gas. Gaseous samples were withdrawn from the stack and transferred to an MKS Instruments MultiGas 2030 FTIR spectrometer.

The sample gas was directed through a heated probe, heated filter and heated transfer line connected to the FTIR. The probe, filter, transfer line, and FTIR were maintained at 191°C (375°F) during testing. The acetaldehyde, formaldehyde, and moisture concentrations were measured based on their infrared absorbance compared to reference spectra. The FTIR analyzer scanned the sample gas approximately once per second. A data point was generated every half-minute as the co-addition of 32 scans.

FTIR quality assurance procedures followed USEPA Method 320. A calibration transfer standard (CTS) was analyzed before and after testing. Acetaldehyde matrix spiking was performed prior to testing. Section 3.29 of USEPA Method 320 allows the use of a surrogate analyte for the purposes of analyte spiking. Acetaldehyde was chosen as a surrogate to formaldehyde for the following reason:

- Acetaldehyde's physical and chemical properties are similar to those of formaldehyde. Formaldehyde is the C1 aldehyde (CH2O); acetaldehyde is the C2 aldehyde (CH3CHO).

The analyte spikes were set to a target dilution ratio of 1:10 or less. Valid tests required spike recoveries to be within the USEPA Method 320 allowance of 100±30%.

The FTIR Report is included in Appendix E. Figure 4-2 depicts the USEPA Method 320 sampling train.

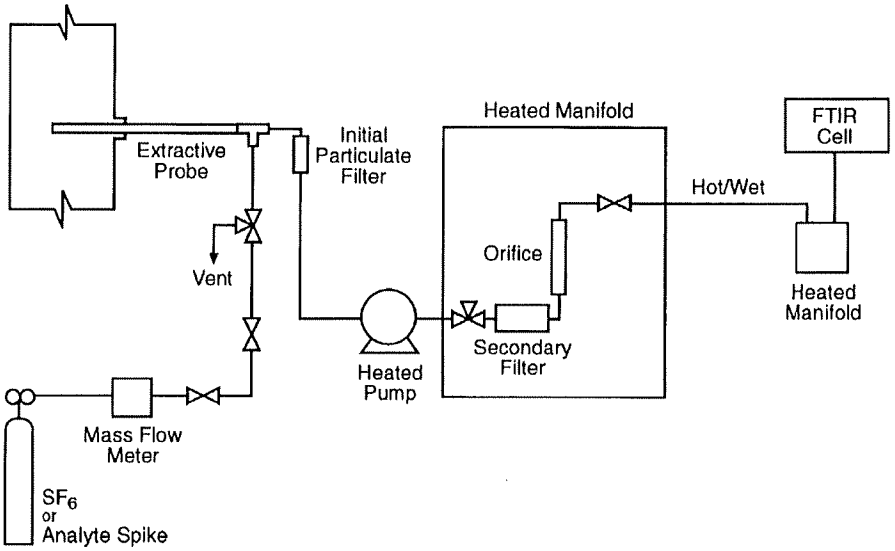

Figure 4-2. USEPA Method 320 Sampling Train

4.2 Process Data

Arauco recorded process data during testing. EGLE personnel verified the requested operating and process data were recorded. Process data are included in Appendix F.

5.0 Quality Assurance and Quality Control

5.1 QA/QC Procedures

Equipment used in this emissions test program passed Quality Assurance (QA) and Quality Control (QC) procedures. Refer to Appendix A for equipment calibrations. Before testing, the sampling equipment was cleaned, inspected, and calibrated according to procedures outlined in the applicable USEPA sampling method and USEPA's "Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III, Stationary Source-Specific Methods."

5.2 QA/QC Audits

Onsite QA/QC procedures (i.e., Pitot tube inspections, nozzle size verifications, leak check, calculation of isokinetic sampling rates, calibrations) were performed in accordance with the respective USEPA sampling methods. Equipment inspection and calibration measurements are presented in Appendix A.

Offsite QA audits include dry-gas meter and thermocouple calibrations.

5.2.1 Audit Sample Results QA/QC

QA audit samples were not proposed during this test program. Currently, audit samples for the parameters to be measured are not available from the USEPA Stationary Source Audit Program.

5.2.2 Sampling Train QA/QC

The sampling trains described in Section 4.1 were audited for measurement accuracy and data reliability. Table 5-1 summarizes the QA/QC audits conducted on each sampling train.

Table 5-1
USEPA Methods 5, 201A, and 202 Sampling Train QA/QC

Parameter	Run 4	Run 5	Run 6	Method Requirement	Comment
FGDRYERRTO					
Average velocity pressure head (in H_2O)	0.90	0.93	0.92	>0.05 in H_2O	Valid
Sampling train post-test leak check	0 ft^3 for 1 min at 4 in Hg	0 ft^3 for 1 min at 5 in Hg	0 ft^3 for 1 min at 5 in Hg	<0.020 ft^3 for 1 minute at a vacuum ≥ recorded during test	Valid
Sampling vacuum (in Hg)	2	2	2		
Parameter	**Run 1**	**Run 2**	**Run 3**	**Method Requirement**	**Comment**
EUFORMING BH11					
Average velocity pressure head (in H_2O)	1.3	1.4	1.4	>0.05 in H_2O	Valid
Sampling train post-test leak check	0 ft^3 for 1 min at 6 in Hg	0 ft^3 for 1 min at 7 in Hg	0 ft^3 for 1 min at 7 in Hg	<0.020 ft^3 for 1 minute at a vacuum ≥ recorded during test	Valid
Sampling vacuum (in Hg)	3 to 4	3 to 5	4		

5.2.3 Dry-Gas Meter QA/QC

Table 5-2 summarizes the dry-gas meter calibration checks in comparison to the acceptable USEPA tolerance. Complete dry-gas meter calibrations are included in Appendix A.

Table 5-2
Dry-Gas Meter Calibration QA/QC

Dry-Gas Meter	Pre-test DGM Calibration Factor	Post-test DGM Calibration Factor	Difference Between Pre- and Post-test Calibrations	Acceptable Tolerance	Comment
2	1.002 (3/25/2021)	1.009 (6/1/2021)	0.007	±0.05	Valid

5.2.4 Thermocouple QA/QC

Temperature measurements using thermocouples and digital pyrometers were compared to a reference temperature prior to testing to evaluate accuracy of the equipment. The thermocouples and pyrometers measured temperature within ±1.5% of the reference temperatures and were within USEPA acceptance criteria. Thermocouple calibration sheets are included in Appendix A.

5.2.5 Laboratory Blanks QA/QC

QA/QC blanks were analyzed for the parameters of interest. The results are presented in Table 5-3. Blank corrections were applied to the sample results following USEPA Methods 5, 201A, and 202 procedures. Blank and sample laboratory results are included in Appendix E.

Table 5-3
Laboratory Blanks QA/QC

Sample Identification	Result (mg)	Comment
Method 5 Filter Blank	2.60	Reporting limit is 0.30 milligrams.
Method 5 Acetone Blank	<0.5	Reporting limit is 0.5 milligrams. Sample volume was approximately 33 milliliters.
Method 202 Field Blank - Inorganic	0.9	Reporting limit is 0.5 milligrams. Sample weight was approximately 52 grams.
Method 202 Field Blank - Organic	<1.0	Reporting limit is 1.0 milligrams. Sample weight was approximately 36 grams.
Method 202 Reagent Blank - Water	0.7	Reporting limit is 0.5 milligrams. Sample weight was approximately 46 grams.
Method 202 Reagent Blank - Acetone	<1.0	Reporting limit is 1.0 milligrams. Sample volume was approximately 41 grams.
Method 202 Reagent Blank - Hexane	1.2	Reporting limit is 1.0 milligrams. Sample weight was approximately 28 grams.
Method 202 Proof Blank - Inorganic	0.8	Reporting limit is 0.5 milligrams. Sample weight was approximately 52 grams.
Method 202 Proof Blank - Organic	<1.0	Reporting limit is 1.0 milligrams. Sample weight was approximately 46 grams.

5.3 Data Reduction and Validation

The emissions testing Project Manager and/or the QA/QC Officer validated computer spreadsheets. The computer spreadsheets were used to ensure that field calculations were accurate. Random inspection of the field data sheets were conducted to verify data have been recorded appropriately. At the completion of a test, the raw field data were entered into computer spreadsheets to provide applicable onsite emissions calculations. The computer data were checked against the raw field sheets for accuracy during review of the report.

5.4 Sample Identification and Custody

The Apex project manager was responsible for the handling and procurement of the data collected in the field. The project manager ensured the data sheets are accounted for and completed in their entirety. Applicable Chain of Custody procedures followed guidelines outlined within ASTM D4840-99 (Reapproved 2010), "Standard Guide for Sample Chain-of-Custody Procedures." Detailed sampling and recovery procedures are described in Section 4.1. For each sample collected (i.e., impinger), sample identification and custody procedures were completed as follows:

- Containers were sealed to prevent contamination.
- Containers were labeled with test number, location, and test date.
- The level of fluid was marked on the outside of the sample containers to indicate if leakage occurred prior to receipt of the samples by the laboratory.
- Containers were placed in a cooler for storage, if necessary.
- Samples were logged using guidelines outlined in ASTM D4840-99 (Reapproved 2010).
- Samples were transported to the laboratory under chain of custody.

Chains of custody and laboratory analytical results are included in Appendix E.

5.5 QA/QC Problems

Equipment audits and QA/QC procedures demonstrate sample collection accuracy and compliance for the test runs, except for the following:

- When the Pitot tube, used for USEPA Method 201A at the FGDRYERRTO source, was calibrated post-test, the calibrated Pitot correction factor (C_p) resulted in several isokinetic variations outside of the range allowed by the Method. USEPA Method 201A allows no more than two of the twelve sampling points' isokinetic variations to be outside the range of 80 to 120%. Test Runs 4 through 6 each had three to four isokinetic variations outside of the range. The overall isokinetic variation for each test run was within the range allowed by the Method. However, because the $PM_{2.5}$ results were approximately half of the permit limit, and because previous testing of total PM was just above the permit limit for $PM_{2.5}$, EGLE allowed the results of this testing to be used for purposes of compliance. Correspondence between Mr. David Kawasaki, with Apex, and Mr. Jeremy Howe, with EGLE, allowing the use of these results is included in Appendix D

6.0 Limitations

The information and opinions rendered in this report are exclusively for use by Arauco North America. Apex Companies, LLC will not distribute or publish this report without consent of Arauco North America except as required by law or court order. The information and opinions are given in response to a limited assignment and should be implemented only in light of that assignment. Apex Companies, LLC accepts responsibility for the competent performance of its duties in executing the assignment and preparing reports in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages.

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Tables

APEX

Table 1
FGDRYERRTO Gaseous Results
Arauco North America
Grayling, Michigan
Apex Project No. 11020-000020.00
Sampling Date: May 18, 2021

Parameter	Run 1	Run 2	Run 3	Average
Run Time	10:53-11:53	12:15-13:15	13:35-14:35	
Exhaust Gas Stream Volumetric Flowrate (scfm)	179,508	173,527	179,560	**177,532**
Acetaldehyde (ppmvw)	0.99	0.92	0.95	**0.95**
Acetaldehyde Mass Emission Rate (lb/hr)	1.2	1.1	1.2	**1.2**
Formaldehyde (ppmvw)	1.10	1.13	1.09	**1.11**
Formaldehyde Mass Emission Rate (lb/hr)	0.92	0.92	0.92	**0.92**

ppmvw: part per million by volume, wet basis
lb/hr: pound per hour
scfm: wet standard cubic feet per minute

APEX

Table 2
FGDRYERRTO Particulate Matter Results
Arauco North America
Grayling, Michigan
Apex Project No. 11020-000020.00
Sampling Date: May 19, 2021

Meter/Nozzle Information		Run 4	Run 5	Run 6	Average
Meter Temperature, T_m	°F	78.5	71.3	71.6	73.8
Meter Pressure, P_m	in Hg	28.82	28.82	28.82	28.82
Measured Sample Volume, V_m	ft^3	21.000	21.380	22.360	21.580
Sample Volume, V_m	std ft^3	19.873	20.507	21.437	20.606
Sample Volume, V_m	std m^3	0.56	0.58	0.61	0.58
Condensate Volume, V_w	std ft^3	6.53	6.86	6.31	6.56
Gas Density, ρ_s	std lb/ft^3	0.0685	0.0684	0.0691	0.0687
Total weight of sampled gas	lb	1.809	1.873	1.523	1.735
Nozzle Diameter	in	0.170	0.170	0.170	0.170
Nozzle Area, A_n	ft^2	1.58E-04	1.58E-04	1.58E-04	1.58E-04
Isokinetic Variation, I	%	112.5	111.9	114.4	112.9
Stack Data					
Average Stack Temperature, T_s	°F	344.0	342.1	344.5	343.5
Molecular Weight Stack Gas-dry, M_d	lb/lb-mole	29.16	29.16	29.16	29.16
Molecular Weight Stack Gas-wet, M_s	lb/lb-mole	26.40	26.36	26.62	26.46
Stack Gas Specific Gravity, G_s		0.91	0.91	0.92	0.91
Percent Moisture, B_{ws}	%	24.73	25.05	22.74	24.17
Water Vapor Volume (fraction)		0.247	0.251	0.227	0.242
Pressure, P_s	in Hg	28.74	28.74	28.74	28.74
Average Stack Velocity, V_s	ft/sec	61.46	62.46	61.87	61.93
Stack Area	ft^2	82.52	82.52	82.52	82.52
Stack Gas Viscosity, μ	micropoise	224.6	223.9	226.6	225.0
Cyclone Flow Rate, Q_s	cfm	0.654	0.661	0.669	0.661
Cut-Off Diameter, $D_{50(10)}$	microns	9.9	9.8	9.8	9.9
Cunningham Correction Factor, C		1.099	1.098	1.099	1.099
Reynold's Number, N_{Re}		2374	2408	2428	2403
Cut-Off Diameter, $D_{50(2.5)}$	microns	2.36	2.32	2.30	2.33
Exhaust Gas Flowrate					
Flowrate	ft^3/min, actual	304,263	309,224	306,306	306,598
Flowrate	ft^3/min, standard wet	191,952	195,548	193,120	193,540
Flowrate	ft^3/min, standard dry	144,477	146,554	149,210	146,747
Flowrate	m^3/min, standard dry	4,091	4,150	4,225	4,155
Collected Mass					
Filterable Particulate Matter					
PM <2.5µm Acetone Rinse	mg	0.6	<0.5	<0.5	0.5
Filter	mg	2.20	<0.30	1.70	1.4
Total Filterable Particulate Matter <2.5 µm (FPM 2.5)	mg	2.8	<0.8	2.2	1.9
Condensable Particulate Matter					
Inorganic	mg	6.7	5.4	4.4	5.5
Organic	mg	4.0	2.7	3.2	3.3
Field Train Recovery Blank‡	mg	1.9	1.9	1.9	1.9
Total Condensable Particulate Matter (CPM)	mg	8.8	6.2	5.7	6.9
Concentration					
Filterable Particulate Matter <2.5µm ($FPM_{2.5}$)	mg/dscf	0.14	<0.039	0.10	0.09
Condensable Particulate Matter (CPM)	mg/dscf	0.44	0.31	0.29	0.35
Total Particulate Matter ($PM_{2.5}$)	mg/dscf	0.58	0.35	0.39	0.44
Filterable Particulate Matter <2.5µm ($FPM_{2.5}$)	grain/dscf	0.0022	<0.00060	0.0016	0.0015
Condensable Particulate Matter (CPM)	grain/dscf	0.0068	0.0048	0.0044	0.0054
Total Particulate Matter ($PM_{2.5}$)	grain/dscf	0.0090	0.0054	0.0060	0.0068
Mass Emission Rate					
Filterable Particulate Matter <2.5µm ($FPM_{2.5}$)	lb/hr	2.7	<0.76	2.0	1.8
Condensable Particulate Matter (CPM)	lb/hr	8.5	6.0	5.7	6.7
Total Particulate Matter <2.5µm ($PM_{2.5}$)	lb/hr	11	6.7	7.4	8.4

‡ Field train recovery blank is subtracted from the sum of the inorganic and organic CPM to calculate the Total Condensable Particulate Matter (CPM).

APEX

Table 3
EUFORMING Gaseous Results
Arauco North America
Grayling, Michigan
Apex Project No. 11020-000020.00
Sampling Date: May 19, 2021

Parameter		Run 1	Run 2	Run 3	Average
BH11	Date	5/19/2021	5/19/2021	5/19/2021	
	Run Time	8:00-8:09, 8:45-9:36	10:00-11:00	11:23-12:23	
	Exhaust Gas Stream Volumetric Flowrate (scfm)	50,097	50,739	50,306	**50,381**
	Acetaldehyde (ppmvw)	2.01	2.21	2.59	**2.27**
	Acetaldehyde Mass Emission Rate (lb/hr)	0.69	0.77	0.89	**0.79**
	Formaldehyde (ppmvw)	0.60	1.80	2.16	**1.52**
	Formaldehyde Mass Emission Rate (lb/hr)	0.14	0.43	0.51	**0.36**
BH13	Date	5/19/2021	5/19/2021	5/19/2021	
	Run Time	13:52-14:52	15:00-16:00	16:20-17:20	
	Exhaust Gas Stream Volumetric Flowrate (scfm)	33,124	31,652	30,554	**31,777**
	Acetaldehyde (ppmvw)	1.03	1.00	1.36	**1.13**
	Acetaldehyde Mass Emission Rate (lb/hr)	0.23	0.22	0.29	**0.25**
	Formaldehyde (ppmvw)	1.11	1.26	1.10	**1.16**
	Formaldehyde Mass Emission Rate (lb/hr)	0.17	0.19	0.16	**0.17**
EUFORMING (BH11+BH13)	Acetaldehyde Mass Emission Rate (lb/hr)	0.93	0.99	1.2	**1.0**
	Formaldehyde Mass Emission Rate (lb/hr)	0.31	0.61	0.67	**0.53**

ppmvw: part per million by volume, wet basis
ppmvd: part per million by volume, dry basis
lb/hr: pound per hour
scfm: wet standard cubic feet per minute
dscfm: dry standard cubic feet per minute

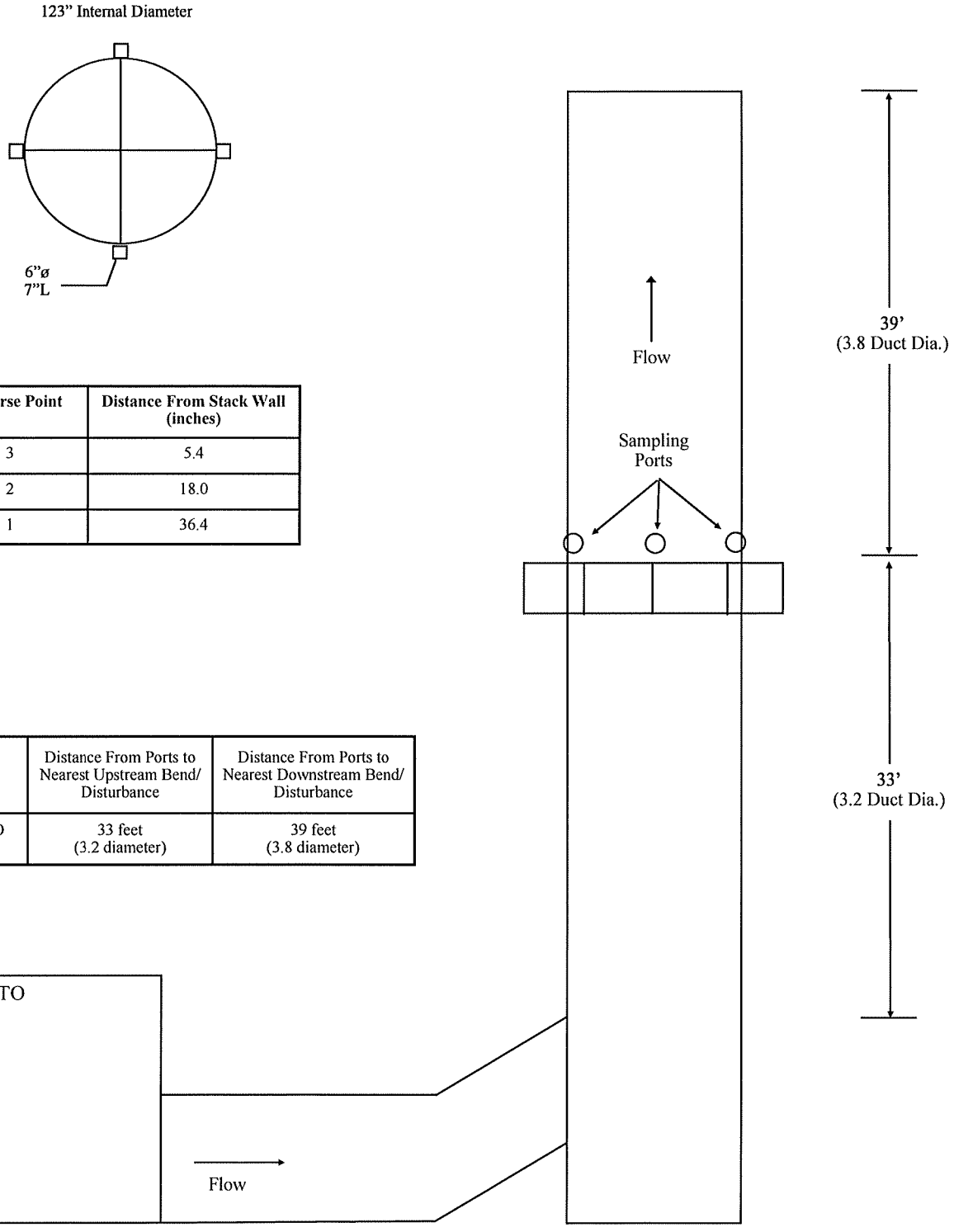
APEX

Table 4
BH11 Particulate Matter Results
Arauco North America
Grayling, Michigan
Apex Project No. 11020-000020.00
Sampling Date: May 19, 2021

Meter/Nozzle Information		Run 1	Run 2	Run 3	Average
Meter Temperature, T_m	°F	60	69	76	68
Meter Pressure, P_m	in Hg	28.91	28.91	28.91	28.91
Measured Sample Volume, V_m	ft^3	43.34	41.27	40.39	41.67
Sample Volume, V_m	std ft^3	42.60	39.88	38.49	40.33
Sample Volume, V_m	std m^3	1.21	1.13	1.09	1.14
Condensate Volume, V_w	std ft^3	0.92	0.52	0.70	0.71
Gas Density, ρ_s	std lb/ft^3	0.0743	0.0745	0.0744	0.0744
Total weight of sampled gas	lb	3.232	3.010	2.944	3.062
Nozzle Size, A_n	ft^2	0.0001767	0.0001767	0.0001767	0.0001767
Isokinetic Variation, I	%	108	99	97	102
Stack Data					
Average Stack Temperature, T_s	°F	85	92	96	91
Molecular Weight Stack Gas-dry, M_d	lb/lb-mole	28.84	28.84	28.84	28.84
Molecular Weight Stack Gas-wet, M_s	lb/lb-mole	28.61	28.70	28.65	28.65
Stack Gas Specific Gravity, G_s		0.99	0.99	0.99	0.99
Percent Moisture, B_{ws}	%	2.11	1.28	1.78	1.73
Water Vapor Volume (fraction)		0.021	0.013	0.018	0.017
Pressure, P_s	in Hg	28.91	28.91	28.91	28.91
Average Stack Velocity, V_s	ft/sec	67.44	69.17	69.08	68.56
Area of Stack	ft^2	13.23	13.23	13.23	13.23
Exhaust Gas Flowrate					
Flowrate	ft^3/min, actual	53,530	54,904	54,830	54,421
Flowrate	ft^3/min, standard wet	50,097	50,739	50,306	50,381
Flowrate	ft^3/min, standard dry	49,039	50,088	49,410	49,512
Flowrate	m^3/min, standard dry	1,389	1,418	1,399	1,402
Collected Mass					
Acetone Wash	mg	1.9	2.0	1.8	1.9
Filter	mg	2.40	2.20	2.00	2.20
Total Filterable Particulate Matter (FPM)	mg	4.3	4.2	3.8	4.1
Inorganic CPM	mg	2.1	1.4	1.8	1.8
Organic CPM	mg	2.2	2.2	2.0	2.1
Field Train Recovery Blank*	mg	1.9	1.9	1.9	1.9
Total Condensable Particulate Matter (CPM)	mg	2.4	1.7	1.9	2.0
Total FPM and CPM	mg	6.7	5.9	5.7	6.1
Concentration					
Total Filterable Particulate Matter (FPM)	mg/dscf	0.1009	0.1053	0.0987	0.1017
Total Filterable Particulate Matter (FPM)	grain/dscf	0.002	0.002	0.002	0.002
Total Condensable Particulate Matter (CPM)	mg/dscf	0.056	0.043	0.049	0.049
Total Condensable Particulate Matter (CPM)	grain/dscf	0.001	0.001	0.001	0.001
Total FPM and CPM	mg/dscf	0.157	0.148	0.148	0.151
Total FPM and CPM	grain/dscf	0.002	0.002	0.002	0.002
Mass Emission Rate					
FPM	lb/hr	0.65	0.70	0.65	0.67
CPM	lb/hr	0.37	0.28	0.32	0.32
Total FPM and CPM	lb/hr	1.02	0.98	0.97	0.99

* = Field train recovery blank is subtracted from the sum of the inorganic and organic CPM to calculate the Total Condensable Particulate Matter (CPM).

Figures



Traverse Point	Distance From Stack Wall (inches)
3	5.4
2	18.0
1	36.4

	Distance From Ports to Nearest Upstream Bend/ Disturbance	Distance From Ports to Nearest Downstream Bend/ Disturbance
FGDRYERRTO Outlet	33 feet (3.2 diameter)	39 feet (3.8 diameter)

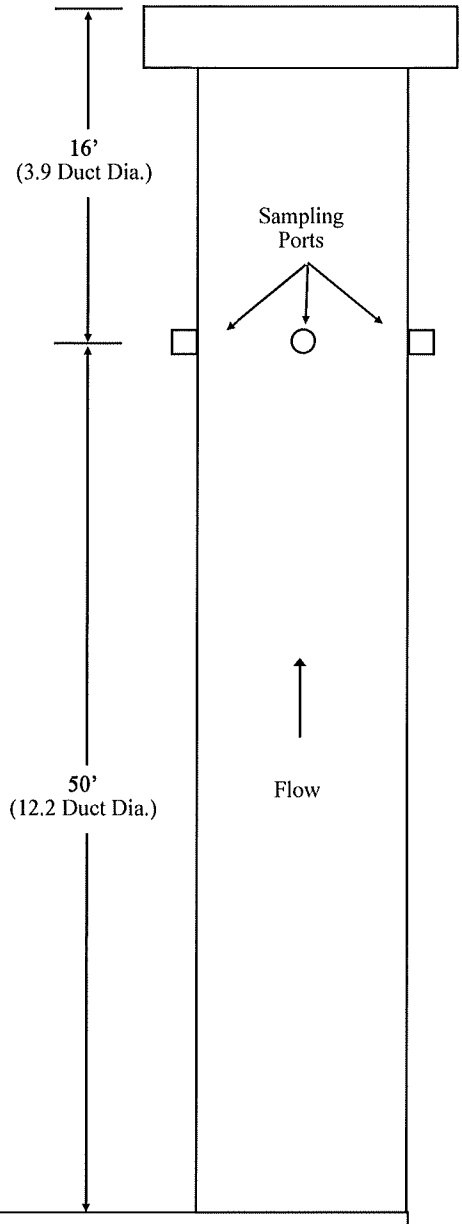
Figure 1
FGDRYERRTO Outlet Sampling Ports and Traverse Point Locations

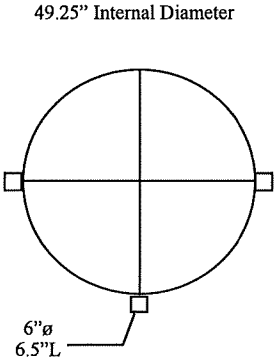
APEX

Arauco North America
5851 Arauco Road
Grayling, Michigan

Project No. 11020-000020.00

Last Revision: June 14, 2021





	Distance From Ports to Nearest Upstream Bend/Disturbance	Distance From Ports to Nearest Downstream Bend/ Disturbance
EUFORMING BH11 Outlet	50 feet (12.2 diameter)	16 feet (3.9 diameter)

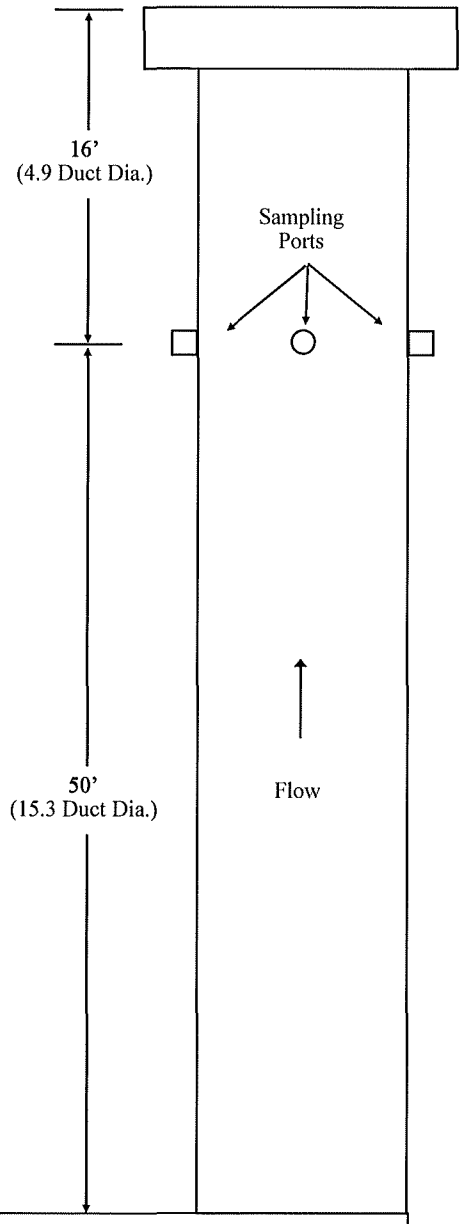
Traverse Point	Distance From Stack Wall (inches)
6	2.2
5	7.2
4	14.6
3	34.7
2	42.1
1	47.1

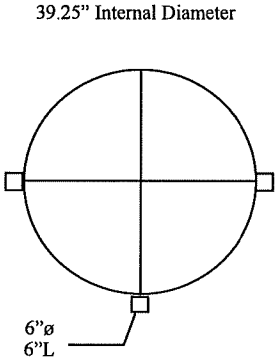
Figure 2
EUFORMING BH11 Outlet
Sampling Ports and Traverse Point Locations

APEX

Arauco North America
5851 Arauco Road
Grayling, Michigan

Project No. 11020-000020.00 | Last Revision: March 24, 2021





	Distance From Ports to Nearest Upstream Bend/Disturbance	Distance From Ports to Nearest Downstream Bend/ Disturbance
EUFORMING BH13 Outlet	50 feet (15.3 diameter)	16 feet (4.9 diameter)

Traverse Point	Distance From Stack Wall (inches)
6	1.7
5	5.7
4	11.6
3	27.6
2	33.5
1	37.5

Figure 3
EUFORMING BH13 Outlet
Sampling Ports and Traverse Point Locations

APEX

Arauco North America
5851 Arauco Road
Grayling, Michigan

Project No. 11020-000020.00 | Last Revision: March 24, 2021