

## Executive Summary

Decorative Panels International, Inc. (DPI) retained Apex Companies, LLC (Apex) to conduct air emissions testing at the DPI facility in Alpena, Michigan. The purpose of the air emission testing was to evaluate compliance with certain emission limits and requirements in (1) Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit (ROP) No. MI-ROP-B1476-2015a, effective April 6, 2016, and (2) National Emissions Standards for Hazardous Air Pollutants (NESHAP): Industrial Boilers and Process Heaters, 40 CFR 63, Subpart DDDDD. The emission unit tested was EUBOILER#3.

The testing followed United States Environmental Protection Agency (USEPA) Reference Methods 1, 2, 3A, 4, 5, 10, 19, 26A, 29, and 205.

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 March 9 and 10, 2021.

### EUBOILER#3 Emissions Results

Parameter	Unit	Average Result	Permit Limit
Particulate matter	lb/MMBtu	$4.8 \times 10^{-3}$	$3.7 \times 10^{-2}$
	lb/1,000 lb	0.0042	0.50
Mercury	lb/MMBtu	$2.9 \times 10^{-7}$	$5.7 \times 10^{-6}$
Carbon monoxide	ppmvd @ 3% O <sub>2</sub>	1,051	1,500
Hydrogen chloride	lb/MMBtu	$5.6 \times 10^{-4}$	$2.2 \times 10^{-2}$

lb/MMBtu: pound per million British thermal unit

lb/1,000 lb: pound per one thousand pounds of exhaust gas, corrected to 50% excess air

ppmvd @ 3% O<sub>2</sub>: parts per million by volume, on a dry basis, corrected to 3% oxygen

Note: emission limits for HCl and CO represent limits shown in ROP-B1476-2015a and Table 2 to Subpart DDDDD of Part 63.

# 1.0 Introduction

## 1.1 Summary of Test Program

Decorative Panels International, Inc. (DPI) retained Apex Companies, LLC (Apex) to conduct air emissions testing at the DPI facility in Alpena, Michigan. The purpose of the air emission testing was to evaluate compliance with certain emission limits and requirements in (1) Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit (ROP) No. MI-ROP-B1476-2015a, effective April 6, 2016, and (2) National Emissions Standards for Hazardous Air Pollutants (NESHAP): Industrial Boilers and Process Heaters, 40 CFR 63, Subpart DDDDD.

The testing followed United States Environmental Protection Agency (USEPA) Reference Methods 1, 2, 3A, 4, 5, 10, 19, 26A, 29, and 205.

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

**Table 1-1  
Source Tested, Parameters, and Test Dates**

Source	Test Parameter	Test Date
EUBOILER#3	Particulate matter (PM) Mercury (Hg)	March 9, 2021
	Carbon monoxide (CO) Hydrogen chloride (HCl)	March 10, 2021

## 1.2 Key Personnel

The key personnel involved in this test program are listed in Table 1-2. Mr. David Kawasaki, Staff Consultant with Apex, led the emission testing program. Mr. Timothy Rombach, Senior Environmental Engineer with DPI, provided process coordination and recorded operating parameters. Mr. Matthew Karl, Environmental Quality Analyst, and Ms. Rebecca Radulski, Environmental Engineer, with EGLE, witnessed the testing and verified production parameters were recorded.



**Table 1-2  
Key Contact Information**

DPI	Apex
Timothy Rombach Senior Environmental Engineer <b>Decorative Panels International, Inc.</b> 416 Ford Avenue Alpena, Michigan 49707 Phone: 989.356.8568 timothy.rombach@decpanels.com	David Kawasaki, QSTI Staff Consultant <b>Apex Companies, LLC</b> 46555 Humboldt Drive, Suite 103 Novi, Michigan 48377 Phone: 248.590.5134 david.kawasaki@apexcos.com
EGLE	
Karen Kajiya-Mills Technical Programs Unit Supervisor <b>EGLE Air Quality Division</b> <b>Technical Programs Unit</b> Constitution Hall, 2 <sup>nd</sup> Floor, South 525 West Allegan Street Lansing, Michigan 48909 Phone: 517.256.0880 kajiya-millsk@michigan.gov	Rebecca Radulski Environmental Engineer <b>EGLE Air Quality Division</b> <b>Gaylord Field Office</b> 2100 West M-32 Gaylord, Michigan 49735 Phone: 989.217.0051 radulskir@michigan.gov



## 2.0 Source and Sampling Locations

### 2.1 Process Description

Decorative Panels International, Inc. produces a variety of hardboard products including wall paneling, pegboard, and marker board. Hardwood chips, such as aspen, ash, maple, and beech, are purchased and stored in an outdoor raw material storage area and reclaimed into silos. The wood chips are cooked and softened in one of four digesters using steam injection and ground into wood pulp fibers.

The pulp fibers are conveyed to a forming machine, which forms a mat of un-pressed hardboard. The mats are processed through a Coe® dryer and cut using a trimmer and panel brush. The mats are conveyed to one of two hardboard lines, Line 1 or 3. Line 2 was historically operated but has since been decommissioned.

On the hardboard lines, the mats enter a predryer, a press, cooler, and tempering area. The predryer ensures the mat has the desired moisture content before the mat enters presses that heat and form hardboard. The hardboard is coated with linseed or Oxi-Cure® oil in the tempering area. The oil tempers the board thereby increasing its strength and “paintability.” Once the board has been tempered, it is superheated to cure the binding resins in the bake ovens (No. 3 Press line only). The hardboard is humidified to approximate atmospheric conditions to limit warping. The boards are inspected, graded, cut, and packed for shipping.

The EUBOILER#3 source supplies heat and process steam to the facility. The boiler is rated at 60,000 pounds of steam per hour and was constructed in 1961. The boiler uses burners to combust natural gas or other fuels. The energy from combustion heats water wall tubes containing water to produce steam. The steam/water mixture flows into an upper steam drum that acts as a phase separator. The steam is directed to the facility and used in the hardboard production process. The water from the steam drum is returned to water wall tubes in the furnace where it is re-heated to produce steam and continue the process.

Operating parameters have been established during previous testing in 2017. Per the Boiler MACT, the following operating restrictions apply to EUBOILER#3:

- Maintain O<sub>2</sub> at 7.0% or more, on a 30-day rolling average.
- Maintain load at or below 55.31 thousand pounds per hour (kph) steam, on a 30-day rolling average.

EUBOILER#3 is considered an existing wet biomass boiler under 40 CFR 63 Subpart DDDDD. The unit was tested under normal operating conditions and within the parameters for oxygen and load as established under previous stack testing. Boiler fuel type (i.e., natural gas) and quantity, steam load (lb/hr), and flue gas oxygen concentration were recorded by DPI during each test run. Table 2-1 summarizes the operating conditions during testing of EUBOILER#3. Additional operating parameter data are included in Appendix F.

**Table 2-1**  
**Summary of EUBOILER#3 Operating Data**

Date (2021)	Run	Wood Fuel Input (ton/hr)	Gas Fuel Input† (100 ft <sup>3</sup> /hr)	Steam Load (1,000 lb/hr)	Flue Gas O <sub>2</sub> (%)	Flue Gas Opacity (%)
March 9	1	3.95	171.7	47.22	8.5	0.4
	2	3.95	171.7	47.83	8.5	0.3
	3	3.95	171.7	47.78	8.7	0.3
	<b>Average</b>	<b>3.95</b>	<b>171.7</b>	<b>47.60</b>	<b>8.5</b>	<b>0.3</b>
March 10	1	3.15	173.0	48.16	8.2	0.2
	2	3.15	173.0	47.09	8.0	0.3
	3	3.15	173.0	47.66	8.5	0.2
	<b>Average</b>	<b>3.15</b>	<b>173.0</b>	<b>47.64</b>	<b>8.2</b>	<b>0.2</b>

† Gas fuel input was recorded as the hourly average for the day.

## 2.2 Control Equipment Description

EUBOILER#3 utilizes multi-clone collectors and a 2-field electrostatic precipitator (ESP) to control emissions. The multi-clone collectors use cyclones and inertia to remove particles from the gas stream. As the flue enters the cyclones, centrifugal force is applied using venturis and a conical shaped chamber. The incoming gas is forced into a cyclonic motion, down, and along the walls of the chamber. As the air nears the bottom of the chamber it changes directions and flows up through the center of a cyclone tube. The inertial momentum of the entrained particles causes them to move along the side walls and collect at the bottom of the chamber where they accumulate in a hopper. The particle-reduced air exits the cyclone tube and then is ducted to either another cyclone chamber or into the ESP for further pollution control.

The ESP uses voltage to generate an electrostatic charge on vertically hung collection plates, which attract particulate matter in the flue. By removing the charge from the collection plates and using a series of plate rappers, the particulate matter is released from the plates and collected at the bottom of the ESP in a hopper for removal. The air is then directed to the SVBOIL123-STK58 stack where it is discharged to atmosphere. During compliance testing, emissions from other units were routed to an alternate stack so that the only discharge through SVBOIL123-STK58 was from EUBOILER#3.

Operating parameters were measured and recorded by DPI personnel during testing. Table 2-2 summarizes the operating conditions of the ESP during testing of EUBOILER#3. Additional operating parameter data are included in Appendix F.

**Table 2-2**  
**Summary of ESP Operating Data**

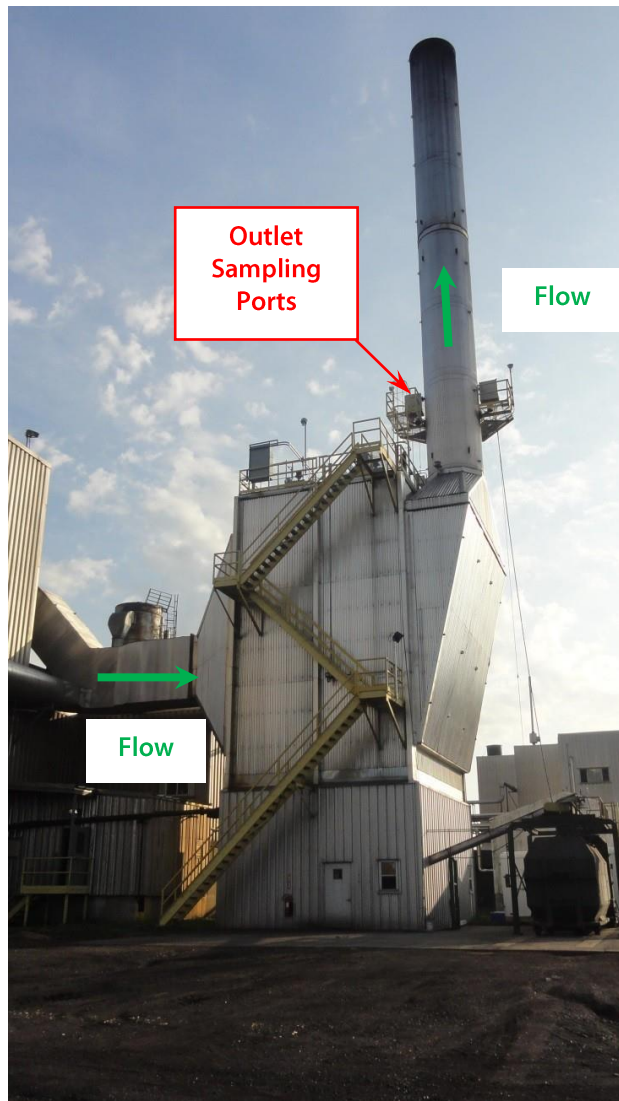
Date (2021)	Run	ESP1 Voltage (kVDC)	ESP1 Current (mADC)	ESP2 Voltage (kVDC)	ESP2 Current (mADC)
March 9	1	41	95	41	277
	2	41	108	41	301
	3	41	125	41	310
	<b>Average</b>	<b>41</b>	<b>109</b>	<b>41</b>	<b>296</b>

## 2.3 Flue Gas Sampling Locations

Two sampling ports oriented at 90° to one another are located in a straight section of an 84 inch-internal-diameter duct. The sampling ports are located:

- Approximately 75 feet (10.7 duct diameters) from the nearest downstream disturbance.
- Approximately 15 feet (2.1 duct diameters) from the nearest upstream disturbance.

The sampling ports are accessible via stairs and ladder. A photograph of the EUBOILER#3 sampling location is presented in Figure 2-1. Figure 1 in the Appendix depicts the EUBOILER#3 sampling ports and traverse point locations.



**Figure 2-1. EUBOILER#3 Outlet Sampling Location**



## 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 testing was to evaluate compliance of the EUBOILER#3 source with certain emission limits and requirements in (1) EGLE ROP MI-ROP-B1476-2015a, effective April 6, 2016, and (2) NESHAP: Industrial Boilers and Process Heaters, 40 CFR 63, Subpart DDDDD.

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
EUBOILER#3	Flowrate, molecular weight, moisture content, PM, Hg	USEPA 1, 2, 3A, 4, 5, 19, 29, 205	March 9	1	8:34	11:06	Bureau Veritas Laboratories
				2	11:17	13:52	
				3	14:06	16:39	
	Flowrate, molecular weight, moisture content, CO, HCl	USEPA 1, 2, 3A, 4, 10, 19, 26A, 205	March 10	1	8:08	9:10	Bureau Veritas Laboratories
				2	9:17	10:19	
				3	10:27	11:29	

### 3.2 Field Test Changes and Issues

Communication between DPI, Apex, and EGLE allowed the testing to be completed as proposed in the December 30, 2020, Intent-to-Test Plan.

### 3.3 Summary of Results

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





**Table 3-2  
EUBOILER#3 Emissions Results**

Parameter	Unit	Run 1	Run 2	Run 3	Average Result	Permit Limit
Particulate matter	lb/MMBtu	$5.9 \times 10^{-3}$	$3.7 \times 10^{-3}$	$4.8 \times 10^{-3}$	$4.8 \times 10^{-3}$	$3.7 \times 10^{-2}$
	lb/1,000 lb	0.0052	0.0032	0.0042	<b>0.0042</b>	<b>0.50</b>
Mercury	lb/MMBtu	$2.7 \times 10^{-7}$	$2.7 \times 10^{-7}$	$3.2 \times 10^{-7}$	$2.9 \times 10^{-7}$	$5.7 \times 10^{-6}$
Carbon monoxide	ppmvd @ 3% O <sub>2</sub>	1,125	1,109	919	<b>1,051</b>	<b>1,500</b>
Hydrogen chloride	lb/MMBtu	$<4.2 \times 10^{-4}$	$8.7 \times 10^{-4}$	$<3.8 \times 10^{-4}$	$5.6 \times 10^{-4}$	$2.2 \times 10^{-2}$

lb/MMBtu: pound per million British thermal unit

lb/1,000 lb: pound per one thousand pounds of exhaust gas, corrected to 50% excess air

ppmvd @ 3% O<sub>2</sub>: parts per million by volume, on a dry basis, corrected to 3% oxygen

Note: emission limits for HCl and CO represent limits shown in ROP-B1476-2015a and Table 2 to Subpart DDDDD of Part 63.

## 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	EUBOILER#3	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)
Oxygen (O <sub>2</sub> ) and carbon dioxide (CO <sub>2</sub> )	•	3A	Determination of Oxygen and Carbon Dioxide Emissions from Stationary Sources (Instrument Analyzer Procedure)
Moisture content	•	4	Determination of Moisture Content in Stack Gases
Particulate matter (PM)	•	5	Determination of Particulate Matter Emissions from Stationary Sources
Carbon monoxide (CO)	•	10	Determination of Carbon Monoxide Emissions from Stationary Sources (Instrument Analyzer Procedure)
Emission rates calculation	•	19	Determination of Sulfur Dioxide Removal Efficiency, Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates
Hydrogen Chloride (HCl)	•	26A	Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Isokinetic Method
Mercury (Hg)	•	29	Determination of Metals Emissions from Stationary Sources
Gas dilution	•	205	Verification of Gas Dilution Systems for Field Instrument Calibrations

### 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 location and the number of traverse points for sampling and the measurement of velocity profiles. Figure 1 in the Appendix depicts the source location 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 Method 2, Section 10.0, were used during testing. Because the dimensions of the Pitot tubes met the requirements outlined in 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 was less than 20° at the sampling location. 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 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 Methods 5/29 and 26A 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 5/29 and 26A.

#### 4.1.3 Particulate Matter and Metals (USEPA Methods 5 and 29)

USEPA Methods 5, “Determination of Particulate Matter Emissions from Stationary Sources,” and 29, “Determination of Metals Emissions from Stationary Sources,” were used to measure particulate matter and metals emissions. Figure 4-1 depicts the USEPA Methods 5 and 29 sampling train.

Apex’s modular isokinetic stack sampling system consists of:

- A borosilicate glass button-hook nozzle.
- A heated (248±25°F) borosilicate glass-lined probe.
- A desiccated and pre-weighed 83-millimeter-diameter quartz 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 set of six pre-cleaned impingers with the configuration shown in Table 4-2.
- 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 29 Impinger Configuration**

Impinger Order (Upstream to Downstream)	Impinger Type	Impinger Contents	Contents
1	Modified	5% HNO3/10% H2O2	100 ml
2	Greenburg-Smith	5% HNO3/10% H2O2	100 ml
3	Modified	Empty	0 ml

**Table 4-2**  
**USEPA Methods 5 and 29 Impinger Configuration**

Impinger Order (Upstream to Downstream)	Impinger Type	Impinger Contents	Contents
4	Modified	Acidified KMnO <sub>4</sub>	100 ml
5	Modified	Acidified KMnO <sub>4</sub>	100 ml
6	Modified	Silica gel desiccant	~300 grams

Before testing, a preliminary velocity traverse was performed and an ideal nozzle size was calculated. The calculated nozzle size allowed isokinetic sampling at an average rate of approximately 0.75 cubic feet per minute (cfm). Apex selected a pre-cleaned borosilicate glass nozzle with an inner diameter that approximated the calculated ideal value. The nozzle inside diameter was measured with calipers across three cross-sectional chords. The nozzle was rinsed and connected to the borosilicate glass-lined sample probe.

The impact and static pressure openings of the Pitot tube were leak-checked at or above a pressure of 3 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 to verify the sample train leakage rate was less than 0.02 cfm. The sample probe was then inserted into the stack through the sampling port to begin sampling.

Ice and water were 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 to within ±10 % for the duration of the test.

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 Teflon-lined 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.

Next, the probe nozzle, fittings, probe liner, and front-half of the filter holder were washed and brushed (using a nylon bristle brush) three times with 100 ml of 0.1-N nitric acid (HNO<sub>3</sub>). This rinsate was collected in a glass sample container. Following the HNO<sub>3</sub> rinse, the probe nozzle, fittings, probe liner, and front-half of the filter holder were rinsed with high performance liquid chromatography (HPLC) water followed by acetone. The HPLC water and acetone rinses were discarded.

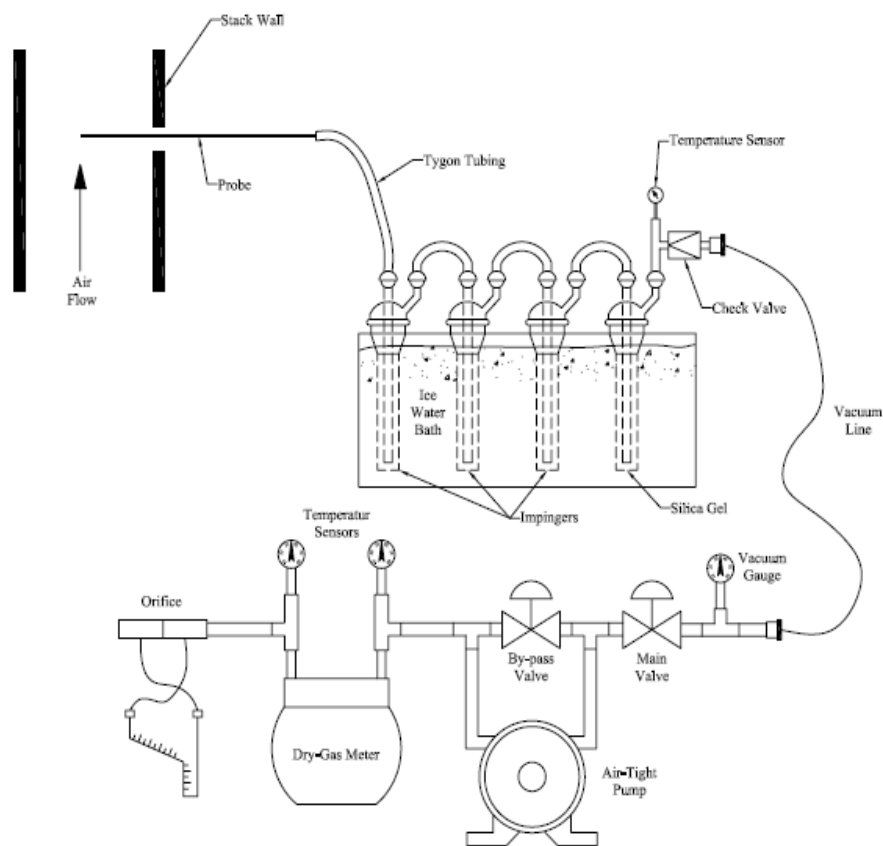
At the end of a test run, the liquid collected in each impinger was measured using a scale to within ±0.5 grams; these measurements were used to calculate the moisture content of the flue gas.

The contents of Impingers 1 and 2 were transferred to two glass sample containers. Impingers 1 and 2, the filter support, the back half of the filter housing, and connecting glassware were thoroughly rinsed with 100 ml of 0.1-N HNO<sub>3</sub>, and the rinsates were added to the sample containers in which the contents of the first two impingers were stored.

The weight of the contents of Impinger 3 were measured, and the contents transferred to a glass sample container. This impinger was rinsed with 100 ml of 0.1-N HNO<sub>3</sub>, and the rinsate was added to the glass sample container.

The weight of liquid in Impingers 4 and 5 were measured and the contents transferred to a glass sample container. The impingers and connecting glassware were triple-rinsed with acidified  $\text{KMnO}_4$  solution and the rinsate was added to the Impingers 4 and 5 sample containers. Subsequently, these impingers were rinsed with 100 ml of HPLC water, and the rinsate was added to the sample container. Because deposits may still be visible on the impinger surfaces after the water rinse, 25 ml of 8-N hydrochloric acid (HCl) was used to wash these impingers and connecting glassware. This 8-N HCl rinsate was collected in a separate sample container containing 200 ml of water.

The silica gel impinger was weighed as part of the measurement of the flue gas moisture content. The sample containers were stored and 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 and 29 Sampling Train**

#### 4.1.4 Oxygen, Carbon Dioxide, and Carbon Monoxide (USEPA Methods 3A and 10)

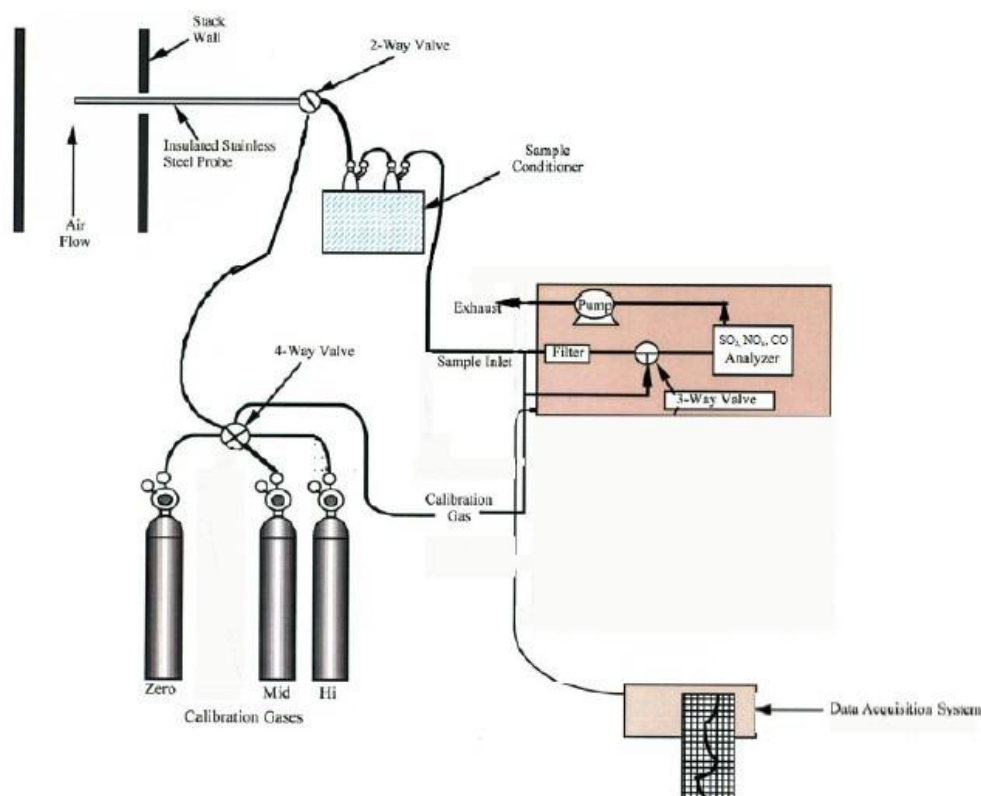
USEPA Method 3A, "Determination of Oxygen and Carbon Dioxide Concentrations from Stationary Sources (Instrumental Analyzer Procedure)," was used to measure oxygen ( $\text{O}_2$ ) and carbon dioxide ( $\text{CO}_2$ ) concentrations in the flue gas. USEPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)," was used to measure carbon monoxide ( $\text{CO}$ ) concentrations in the flue gas.

Flue gas was continuously sampled in the stack and conveyed to an analyzer for concentration measurements. Flue gas was extracted from the stack through:

- A stainless-steel probe.

- Heated Teflon sample line to prevent condensation.
- A chilled Teflon impinger train (equipped with a peristaltic pump) to remove moisture from the sampled gas stream prior to entering the analyzer.
- O<sub>2</sub>, CO<sub>2</sub>, and CO analyzers.

Figure 4-2 depicts the USEPA Methods 3A and 10 sampling train. Data was recorded at 1-second intervals on a computer equipped with data acquisition software. Recorded concentrations were averaged over the duration of each test run.




**Figure 4-2. USEPA Methods 3A and 10 Sampling Train**

Prior to testing, a 3-point stratification test was conducted at 17, 50, and 83% of the stack diameter for at least twice the response time to determine the minimum number of traverse points to be sampled.

The pollutant concentrations were measured using an analyzer calibrated with zero-, mid-, and high-USEPA-Traceability-Protocol-certified calibration gases. The mid-level gas was 40 to 60% of the high-level (also referred to as span) gas.

**Calibration Error Check.** A calibration error check was performed by introducing zero-, mid-, and high-level calibration gases directly into the analyzer. The calibration error check was performed to verify the analyzer response was within  $\pm 2\%$  of the certified calibration gas introduced.





**System Bias Test.** Prior to each test run, a system bias test was performed where known concentrations of calibration gases were introduced at the probe tip to measure if an analyzer's response was within  $\pm 5\%$  of the introduced calibration gas concentrations. At the conclusion of each test run, an additional system-bias check was performed to evaluate the analyzer drift from pre- and post-test system-bias checks. The system-bias check evaluates the analyzer drift against the  $\pm 3\%$  quality assurance/quality control (QA/QC) requirement.

The analyzer drift data was used to correct the measured flue gas concentrations. Recorded concentrations were averaged over the duration of each test run.

#### 4.1.5 Emission Rate (USEPA Method 19)

USEPA Method 19, "Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates," was used to calculate emission rates of PM, HCl, and Hg in pounds per million British thermal units. Oxygen concentrations and standard F-factors from USEPA Method 19, Table 19-2 were used to calculate emission rates using USEPA Method 19 Equation 19-1:

$$E = C_d F_d \left( \frac{20.9}{20.9 - \%O_{2d}} \right)$$

Where:

- E = Pollutant emission rate (lb/MMBtu)
- $C_d$  = Pollutant concentration, dry basis (lb/dscf)
- $F_d$  = F factor (dscf/MMBtu)
- $\%O_{2d}$  = Oxygen concentration, dry basis (% dry)

#### 4.1.6 Hydrogen Chloride (USEPA Method 26A)

USEPA Method 26A, "Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources," was used to measure hydrogen chloride emissions. Figure 4-3 depicts the USEPA Method 26A sampling train.

Apex's modular isokinetic stack sampling system consists of:

- A borosilicate glass button-hook nozzle.
- A heated borosilicate glass-lined probe maintained at a temperature greater than 248°F.
- A desiccated and untared 83-millimeter-diameter Teflon fiber filter in a filter box maintained at a temperature above 248°F.
- A set of four pre-cleaned impingers with the configuration shown in Table 4-3.
- A sampling line.
- An Environmental Supply® control case equipped with a pump, dry-gas meter, and calibrated orifice.

**Table 4-3**  
**USEPA Method 26A Impinger Configuration**

Impinger Order (Upstream to Downstream)	Impinger Type	Impinger Contents	Contents
1	Greenburg-Smith	0.1N H <sub>2</sub> SO <sub>4</sub>	100 ml
2	Greenburg-Smith	0.1N H <sub>2</sub> SO <sub>4</sub>	100 ml
3	Modified	Empty	0 ml
4	Modified	Silica gel desiccant	~300 grams

Before testing, a preliminary velocity traverse was performed and a nozzle size was calculated that allowed isokinetic sampling. Apex selected a pre-cleaned borosilicate glass nozzle that had an inner diameter that approximated the calculated value. The nozzle was measured with calipers across three cross-sectional chords; rinsed and brushed with Type 3 deionized water and proof-rinsed with 0.1-N H<sub>2</sub>SO<sub>4</sub>; and connected to the borosilicate glass-lined 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 monitored for approximately 1 minute to measure that the sample train leakage rate was less than 0.02 cfm. The sample probe was then inserted into the sampling port to begin sampling.

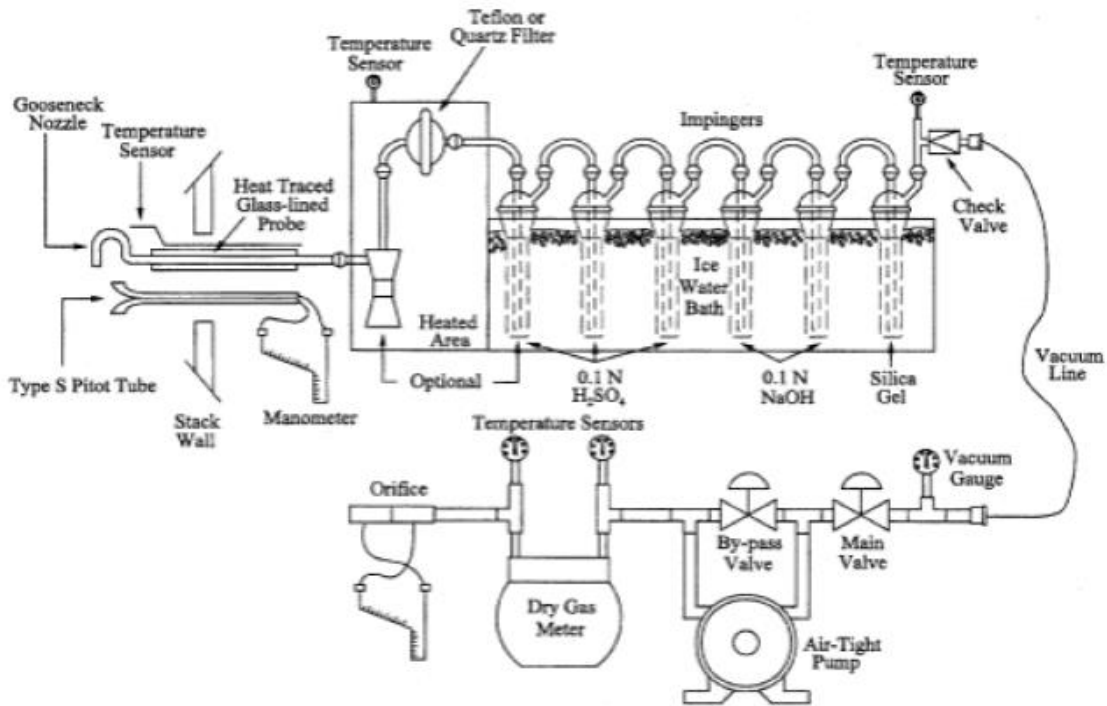
Ice was placed around the impingers, and the probe and filter temperatures were allowed to stabilize to a temperature above 248°F before sampling. After the desired operating conditions were coordinated with the facility, testing was initiated.

Stack parameters (e.g., flue velocity, temperature) were monitored to establish an isokinetic sampling rate within ±10 % for the duration of the test.

At the conclusion of a test run and the post-test leak check, the sampling train was disassembled and the impingers and filter housing were transported to the recovery trailer. The filter was removed from the filter housing and discarded. The nozzle and probe liner, and the front half of the filter housing were rinsed with deionized water to remove any existing particulate matter. The deionized water rinses were discarded.

At the end of a test run, the liquid weight collected in each impinger, including the silica gel impinger, were measured using an electronic scale; these weights were used to calculate the moisture content of the flue gas. The contents of Impingers 1 and 2, back half of the filter housing, and connecting glassware were placed in a container with a Teflon cap screw liner. The described glassware was rinsed three times with deionized water and the rinsate was placed in that same sample container. The sample container was labeled as 0.1-N H<sub>2</sub>SO<sub>4</sub>, marked at the liquid level, and sealed. 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 4-3. USEPA Method 26A Sampling Train**

#### 4.1.7 Gas Dilution (USEPA Method 205)

USEPA Method 205, "Verification of Gas Dilution Systems for Field Instrument Calibrations," was used to introduce known values of calibration gases into the analyzers. The gas dilution system consists of calibrated orifices or mass flow controllers and dilutes a high-level calibration gas to within  $\pm 2\%$  of predicted values. The gas divider is capable of diluting gases at set increments and was evaluated for accuracy in the field in accordance with USEPA Method 205.

Prior to testing, the gas divider dilutions were measured to evaluate that they were within  $\pm 2\%$  of predicted values. Two sets of three dilutions of the high-level calibration gas were performed. In addition, a certified mid-level calibration gas was introduced into an analyzer; this calibration gas concentration was within  $\pm 10\%$  of a gas divider dilution concentration.

## 4.2 Process Data

DPI 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 are suspended from EPA 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 5/29 and 26A Sampling Train QA/QC**

Parameter	Run 1	Run 2	Run 3	Method Requirement	Comment
<b>USEPA Method 5/29</b>					
Average velocity pressure head (in H <sub>2</sub> O)	0.12	0.11	0.13	>0.05 in H <sub>2</sub> O	Valid
Sampling train post-test leak check	0 ft <sup>3</sup> for 1 min at 6 in Hg	0 ft <sup>3</sup> for 1 min at 7 in Hg	0 ft <sup>3</sup> for 1 min at 7 in Hg	<0.020 ft <sup>3</sup> for 1 minute at a vacuum ≥ recorded during test	Valid
Sampling vacuum (in Hg)	5	6	6		
<b>USEPA Method 26A</b>					
Average velocity pressure head (in H <sub>2</sub> O)	0.12	0.13	0.12	>0.05 in H <sub>2</sub> O	Valid
Sampling train post-test leak check	0.005 ft <sup>3</sup> for 1 min at 12 in Hg	0 ft <sup>3</sup> for 1 min at 5 in Hg	0 ft <sup>3</sup> for 1 min at 7 in Hg	<0.020 ft <sup>3</sup> for 1 minute at a vacuum ≥ recorded during test	Valid
Sampling vacuum (in Hg)	4 to 8	4 to 5	3		

### 5.2.3 Instrument Analyzer QA/QC

The instrument analyzer sampling trains described in Section 4.1 were audited for measurement accuracy and data reliability. The analyzers passed the applicable calibration criteria. Table 5-2 summarizes the gas cylinders used during this test program. Analyzer calibration, bias, and drift data are included in Appendix A.

**Table 5-2  
Calibration Gas Cylinder Information**

Parameter	Gas Vendor	Cylinder Serial Number	Cylinder Value	Expiration Date
Nitrogen	Airgas	CC104648	99.9995%	9/10/2028
Oxygen, Carbon dioxide	Airgas	XC035409B	22.05% 22.59%	3/13/2028
Carbon monoxide	Airgas	XC034476B	126.8 ppm	10/29/2022
Carbon monoxide	Airgas	CC27329.	1,005 ppm	12/26/2025

### 5.2.4 Dry-Gas Meter QA/QC

Table 5-3 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 5-3  
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	0.994 (2/25/2021)	1.002 (3/25/2021)	0.008	±0.05	Valid

### 5.2.5 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.

### 5.2.6 Laboratory Blanks QA/QC

QA/QC blanks were analyzed for the parameters of interest. The results are presented in Table 5-4. Blank corrections were not applied to the sample results. Blank and sample laboratory results are included in Appendix E.

**Table 5-4**  
**Laboratory Blanks QA/QC**

Sample Identification	Result	Comment
Method 5 Filter Blank	2.20 mg	Reporting limit is 0.30 milligrams.
Method 5 Acetone Blank	0.8 mg	Reporting limit is 0.5 milligrams. Sample volume was approximately 100 milliliters.
Method 29 Filter/Rinse Blank (1B)	<0.015 µg	Reporting limit is 0.015 micrograms.
Method 29 HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub> Blank (2B)	<0.15 µg	Reporting limit is 0.15 micrograms.
Method 29 HNO <sub>3</sub> Blank (3A)	<0.005 µg	Reporting limit is 0.005 micrograms.
Method 29 KMnO <sub>4</sub> /H <sub>2</sub> SO <sub>4</sub> Blank (3B)	<0.02 µg	Reporting limit is 0.02 micrograms.
Method 29 HCl Blank (3C)	0.014 µg	Reporting limit is 0.013 micrograms.
Method 26A H <sub>2</sub> SO <sub>4</sub> Blank	<200 µg	Reporting limit is 200 micrograms. Sample volume was approximately 95 milliliters.

### 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 was 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.



## 6.0 Limitations

The information and opinions rendered in this report are exclusively for use by Decorative Panels International, Inc. Apex Companies, LLC will not distribute or publish this report without consent of Decorative Panels International, Inc. 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



**Table 1**  
**EUBOILER#3 O<sub>2</sub> and CO<sub>2</sub> Results**  
**Decorative Panels International**  
**Alpena, Michigan**  
**Apex Project No. 11021-000002.00**  
**Sampling Date: March 9, 2021**

<b>Parameter</b>	<b>Run 1</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Average</b>
Test Time	8:34-11:06	11:17-13:51	14:06-16:39	
O <sub>2</sub> Concentration (C <sub>AVG</sub> , %)	11.9	12.0	12.4	<b>12.1</b>
<b>Average Corrected O<sub>2</sub> Concentration (C<sub>Gas</sub>, %)</b>	<b>12.4</b>	<b>12.6</b>	<b>13.0</b>	<b>12.6</b>
CO <sub>2</sub> Concentration (C <sub>AVG</sub> , %)	6.7	6.8	6.5	<b>6.7</b>
<b>Average Corrected CO<sub>2</sub> Concentration (C<sub>Gas</sub>, %)</b>	<b>6.8</b>	<b>6.9</b>	<b>6.6</b>	<b>6.8</b>





**Table 2 - EUBOILER#3 Mercury and Particulate Matter Results**

Facility	Decorative Panels International				
Source Designation	EUBOILER#3				
Test Date	Mar 9, 2021	Mar 9, 2021	Mar 9, 2021		
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average	
Meter Temperature, $T_m$	°F	43	41	34	39
Meter Pressure, $P_m$	in Hg	29.96	29.95	29.97	29.96
Measured Sample Volume, $V_m$	ft <sup>3</sup>	123.85	118.35	124.25	122.15
Sample Volume, $V_m$	std ft <sup>3</sup>	129.30	124.06	132.24	128.53
Sample Volume, $V_m$	std m <sup>3</sup>	3.66	3.51	3.74	3.64
Condensate Volume, $V_w$	std ft <sup>3</sup>	17.74	15.21	16.51	16.49
Gas Density, $\rho_s$	std lb/ft <sup>3</sup>	0.0732	0.0736	0.0734	0.0734
Total weight of sampled gas	lb	10.759	10.243	9.987	10.330
Nozzle Size, $A_n$	ft <sup>2</sup>	0.0010085	0.0010085	0.0010085	0.0010085
Isokinetic Variation, I	%	100	101	100	101
<b>Stack Data</b>					
Average Stack Temperature, $T_s$	°F	342	345	343	344
Molecular Weight Stack Gas-dry, $M_d$	lb/lb-mole	29.59	29.60	29.58	29.59
Molecular Weight Stack Gas-wet, $M_w$	lb/lb-mole	28.19	28.33	28.29	28.27
Stack Gas Specific Gravity, $G_s$		0.97	0.98	0.98	0.98
Percent Moisture, $B_{ws}$	%	12.07	10.92	11.10	11.36
Water Vapor Volume (fraction)		0.121	0.109	0.111	0.114
Pressure, $P_s$	in Hg	29.76	29.76	29.76	29.76
Average Stack Velocity, $V_s$	ft/sec	24.67	23.21	24.98	24.29
Area of Stack	ft <sup>2</sup>	38.48	38.48	38.48	38.48
<b>Exhaust Gas Flowrate</b>					
Flowrate	ft <sup>3</sup> /min, actual	56,976	53,595	57,685	56,086
Flowrate	ft <sup>3</sup> /min, standard wet	37,318	34,951	37,716	36,662
Flowrate	ft <sup>3</sup> /min, standard dry	32,815	31,135	33,530	32,493
Flowrate	m <sup>3</sup> /min, standard dry	929	882	949	920
<b>Mercury</b>					
<b>Collected Mass</b>					
Mercury	mg	0.00070	0.00066	0.00078	0.00072
<b>Concentration</b>					
Mercury	mg/dscf	0.0000054	0.0000054	0.0000059	0.0000056
<b>Mass Emission Rate</b>					
Mercury	lb/MMBtu	0.00000027	0.00000027	0.00000032	0.00000029
Mercury	lb/hr	0.000024	0.000022	0.000026	0.000024
<b>Particulate Matter</b>					
<b>Collected Mass</b>					
Particulate Matter Acetone Wash	mg	12.8	0.8	1.3	5.0
Particulate Matter Filter	mg	2.50	8.10	10.6	7.1
Total Filterable Particulate Matter (FPM)	mg	15.3	8.9	11.9	12.0
<b>Concentration</b>					
Particulate Matter (FPM)	mg/dscf	0.118	0.07	0.09	0.09
Particulate Matter (FPM)	grain/dscf	0.0018	0.0011	0.0014	0.0014
<b>Mass Emission Rate</b>					
Particulate Matter (FPM)	lb/MMBtu	0.0059	0.0037	0.0048	0.0048
Particulate Matter (FPM)	lb/hr	0.51	0.30	0.40	0.40
PM lb/1000 lb @ 50% EA	lb/(1,000 lb, dry)	0.0052	0.0032	0.0042	0.0042



**Table 3**  
**EUBOILER#3 O<sub>2</sub>, CO<sub>2</sub>, and CO Results**  
**Decorative Panels International**  
**Alpena, Michigan**  
**Apex Project No. 11021-000002.00**  
**Sampling Date: March 10, 2021**

Parameter	Run 1	Run 2	Run 3	Average
Test Time	8:08-9:09	9:17-10:17	10:27-11:30	
O <sub>2</sub> Concentration (C <sub>Avg</sub> , %)	12.2	11.7	11.9	<b>11.9</b>
<b>Average Corrected O<sub>2</sub> Concentration (C<sub>Gas</sub>, %)</b>	<b>12.7</b>	<b>12.2</b>	<b>12.3</b>	<b>12.4</b>
CO <sub>2</sub> Concentration (C <sub>Avg</sub> , %)	6.6	7.0	6.8	<b>6.8</b>
<b>Average Corrected CO<sub>2</sub> Concentration (C<sub>Gas</sub>, %)</b>	<b>6.6</b>	<b>7.0</b>	<b>6.8</b>	<b>6.8</b>
CO Concentration (C <sub>Avg</sub> , ppmvd)	514.3	538.4	438.7	<b>497.1</b>
Average Corrected CO Concentration (C <sub>Gas</sub> , ppmvd)	515.9	540.0	440.3	<b>498.7</b>
<b>Average Corrected CO Concentration (@ 3% O<sub>2</sub>, ppmvd)</b>	<b>1,125</b>	<b>1,109</b>	<b>919</b>	<b>1,051</b>
ppmvd: part per million by volume, dry basis dscfm: dry standard cubic feet per minute				

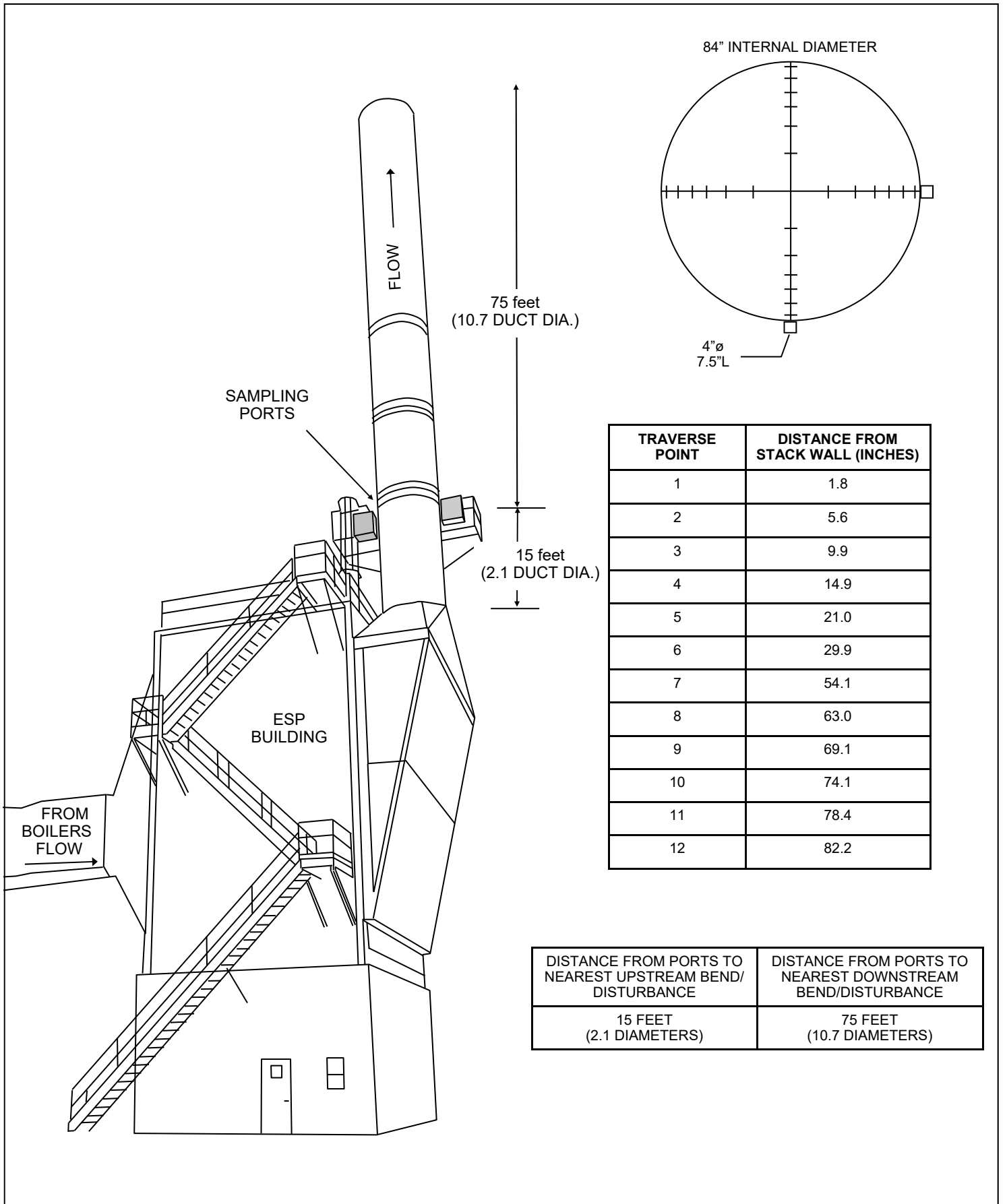


**Table 4 - EUBOILER#3 Hydrogen Chloride Results**

Facility	Decorative Panels International				
Source Designation	EUBOILER#3				
Test Date	Mar 10, 2021	Mar 10, 2021	Mar 10, 2021		
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average	
Meter Temperature, $T_m$	°F	37	39	43	40
Meter Pressure, $P_m$	in Hg	30.19	30.20	30.19	30.19
Measured Sample Volume, $V_m$	ft <sup>3</sup>	45.94	51.18	49.88	49.00
Sample Volume, $V_m$	std ft <sup>3</sup>	48.99	54.30	52.49	51.92
Sample Volume, $V_m$	std m <sup>3</sup>	1.39	1.54	1.49	1.47
Condensate Volume, $V_w$	std ft <sup>3</sup>	6.63	7.12	6.51	6.76
Gas Density, $\rho_s$	std lb/ft <sup>3</sup>	0.0732	0.0734	0.0735	0.0733
Total weight of sampled gas	lb	4.069	4.506	3.966	4.181
Nozzle Size, $A_n$	ft <sup>2</sup>	0.0010085	0.0010085	0.0010085	0.0010085
Isokinetic Variation, I	%	95	103	102	100
<b>Stack Data</b>					
Average Stack Temperature, $T_s$	°F	341	344	341	342
Molecular Weight Stack Gas-dry, $M_d$	lb/lb-mole	29.56	29.61	29.59	29.59
Molecular Weight Stack Gas-wet, $M_w$	lb/lb-mole	28.18	28.26	28.31	28.25
Stack Gas Specific Gravity, $G_s$		0.97	0.98	0.98	0.98
Percent Moisture, $B_{ws}$	%	11.93	11.60	11.03	11.52
Water Vapor Volume (fraction)		0.119	0.116	0.110	0.115
Pressure, $P_s$	in Hg	29.99	29.99	29.99	29.99
Average Stack Velocity, $V_s$	ft/sec	24.37	24.91	24.06	24.45
Area of Stack	ft <sup>2</sup>	38.48	38.48	38.48	38.48
<b>Exhaust Gas Flowrate</b>					
Flowrate	ft <sup>3</sup> /min, actual	56,269	57,530	55,565	56,455
Flowrate	ft <sup>3</sup> /min, standard wet	37,176	37,871	36,709	37,252
Flowrate	ft <sup>3</sup> /min, standard dry	32,742	33,479	32,660	32,960
Flowrate	m <sup>3</sup> /min, standard dry	927	948	925	933
<b>Hydrogen Chloride</b>					
<b>Collected Mass</b>					
Hydrogen Chloride	mg	<0.40	0.97	<0.40	0.59
<b>Concentration</b>					
Hydrogen Chloride	mg/dscf	<0.0082	0.0179	<0.0076	0.0112
<b>Mass Emission Rate</b>					
Hydrogen Chloride	lb/MMBtu	<0.00042	0.00087	<0.00038	0.00056
Hydrogen Chloride	lb/hr	<0.035	0.079	<0.033	0.049



# Figures



SCALE	NOT TO SCALE
DATE	March 26, 2021
PRJ NO.	11021-000002.00

**EUBOILER#3**  
**SAMPLING PORTS AND TRAVERSE POINT LOCATIONS**  
 Decorative Panels International  
 Alpena, Michigan



FIGURE  
**1**