

# Introduction

**1.0 Introduction**

Alliance Source Testing, LLC (AST) was retained by American Bath Group, LLC (ABG) to conduct compliance testing at the Aquatic Company facility in Three Rivers, Michigan. Portions of the facility are subject to provisions of the 40 CFR Part 63, Subpart WWWW – National Emissions Standards for Hazardous Air Pollutants (NESHAP) and the facility’s Michigan Department of Environment, Great Lakes and Energy (EGLE) Permit No. MI-ROP-B2025-2021. Testing was conducted to determine the emission rate of volatile organic compounds (VOC) at the inlet and outlet of one (1) Regenerative Thermal Oxidizer (RTO) associated with the fiberglass reinforced plastic production line (FRPPL). The mass emission rates were used to determine the destruction efficiency (DE) of VOC at the RTO. A permanent total enclosure (PTE) evaluation was performed on the FRPPL booth enclosure.

**1.1 Source and Control System Descriptions**

The RTO is a Durr Model RL-10-V1-85 with an exhaust gas flow rate of approximately 100,000 acfm.

**1.2 Project Team**

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

**Table 1-1  
Project Team**

<b>Facility Personnel</b>	Dave Clouser
<b>Regulatory Personnel</b>	Chance Collins Trevor Drost
<b>AST Personnel</b>	Justin Bernard Samuel Hines Sydney Weaver

**1.3 Site Specific Test Plan/Test Protocol & Notification**

Testing was conducted in accordance with the Site Specific Test Plan (SSTP)/test protocol submitted to the EGLE by the Aquatic Company.

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## Summary of Results

## 2.0 Summary of Results

AST conducted compliance testing at the ABG facility in Three Rivers, Michigan on September 21-22, 2021. Testing consisted of determining the emission rates of VOC at the inlet and outlet of the RTO.

Table 2-1 provides a summary of the emission testing results with comparisons to the applicable Subpart WWWW and EGLE permit limits. This table also provides a summary of the process operating and control system data collected during testing. Any difference between the summary results listed in the following table and the detailed results contained in appendices is due to rounding for presentation.

**Table 2-1  
Summary of Results**

<b>Emissions Data</b>				
<b>Run Number</b>	<b>Run 1</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Average</b>
<b>Date</b>	<b>9/21/21</b>	<b>9/22/21</b>	<b>9/22/21</b>	<b>--</b>
<b>Volatile Organic Compounds Data</b>				
Emission Factor, lb/ton resin	27.1	32.5	28.9	29.5
Permit Limit, lb/ton resin	--	--	--	88
<b>Percent of Limit, %</b>	--	--	--	<b>34</b>
Emission Factor, lb/ton gelcoat	68.9	101.9	100.3	90.4
Permit Limit, lb/ton gelcoat	--	--	--	267
<b>Percent of Limit, %</b>	--	--	--	<b>34</b>
Inlet Emission Rate, lb/hr	120.4	159.7	137.8	139.3
Outlet Emission Rate, lb/hr	15.4	19.1	15.7	16.7
Reduction Efficiency, %	87.2	88.1	88.6	88.0
<b>Process Operating / Control System Data</b>				
<b>Run Number</b>	<b>Run 1</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Average</b>
<b>Date</b>	<b>9/21/21</b>	<b>9/22/21</b>	<b>9/22/21</b>	<b>--</b>
Resin Rate, lb/hr	1,136	1,171	1,090	1,132
Gelcoat Rate, lb/hr	447	374	314	378
RTO Chamber Temperature	1,659	1,658	1,652	1,656

<sup>1</sup> The laboratory results for Runs 1-3 C<sub>2</sub>H<sub>6</sub> were below the laboratory RDL, the RDL was used to calculate emissions. See Appendix B for individual results.

<sup>2</sup> The CO<sub>2</sub> Runs 1 & 2 averages were negative after bias correction and were set to zero.

# Testing Methodology

### 3.0 Testing Methodology

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

**Table 3-1  
Source Testing Methodology**

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1 & 2	Full Velocity Traverses
Oxygen/Carbon Dioxide	3A	Instrumental Analysis
Moisture Content	4	Gravimetric Analysis
Volatile Organic Compounds	25A	Instrumental Analysis
Permanent Total Enclosure	204	--
Gas Dilution System Certification	205	---

#### 3.1 U.S. EPA Reference Test Methods 1 and 2 – Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-2 in U.S. EPA Reference Test Method 1.

Full velocity traverses were conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer. Stack gas velocity pressure and temperature readings were recorded before and after each test run. The data collected was utilized to calculate the volumetric flow rate in accordance with U.S. EPA Reference Test Method 2.

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

The oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) testing was conducted in accordance with U.S. EPA Reference Test Method 3A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, heated Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. The quality control measures are described in Section 3.7.

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

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

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### **3.4 U.S. EPA Reference Test Method 25A – Volatile Organic Compounds**

The volatile organic compounds (VOC) testing was conducted in accordance with U.S. EPA Reference Test Method 25A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, heated Teflon sample line(s) and the identified gas analyzer. The quality control measures are described in Section 3.8.

### **3.5 U.S. EPA Reference Test Method 204 – Permanent Total Enclosures**

The following procedures were used to verify 100% of volatile organic compound emissions are captured at all times.

The equivalent diameters of the natural draft openings (NDOs) and the distances from each VOC emitting point to all NDOs were determined. The equivalent diameter of each exhaust duct or hood and its distance to all NDOs were also determined. Distances were calculated in terms of equivalent diameters; the equivalent diameters must be at least four.

The total surface area ( $A_T$ ) of the enclosure and the total area ( $A_N$ ) of all NDO's in the enclosure were measured. The NDO to enclosure area ratio (NEAR) was calculated as follows:  $NEAR = A_N/A_T$ . The NEAR must be less than or equal to 0.05.

Individual facial velocities (FV) for each NDO were taken using a Extech hot wire thermo-anemometer. The FV shall be at least 3,600 m/hr (200 fpm). Alternatively, the pressure differential across the enclosure could be measured. A pressure drop of 0.013 mm Hg (0.007 in. H<sub>2</sub>O) corresponds to an FV of 3,600 m/hr (200 fpm).

The direction of air flow through all NDO's inward was verified. If FV was less than 9,000 m/hr (500 fpm), the continuous inward flow or air shall be verified using streamers, smoke tubes, tracer gases, or delta P across the enclosure. The direction of air flow was monitored for at least one (1) hour, with checks made no more than 10 minutes apart. If the FV was greater than 9,000 m/hr (500 fpm), the direction of air flow through the NDOs shall be presumed to be inward at all times without continuous verification.

### **3.6 U.S. EPA Reference Test Method 205 – Gas Dilution System Certification**

A calibration gas dilution system field check was conducted in accordance with U.S. EPA Reference Method 205. Multiple dilution rates and total gas flow rates were utilized to force the dilution system to perform two dilutions on each mass flow controller. The diluted calibration gases were sent directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The analyzer response agreed within 2% of the actual diluted gas concentration. A second Protocol 1 calibration gas, with a cylinder concentration within 10% of one of the gas divider settings described above, was introduced directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The cylinder concentration and the analyzer response agreed within 2%. These steps were repeated three (3) times. Copies of the Method 205 data can be found in the Quality Assurance/Quality Control Appendix.

### **3.7 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 3A**

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

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

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe and the time required for the analyzer reading to reach 95 percent or 0.5% (whichever was less restrictive) of the gas concentration was recorded. The analyzer reading was observed until it reached a stable value, and this value was recorded. Next, Low Level gas was introduced at the probe and the time required for the analyzer reading to decrease to a value within 5.0 percent or 0.5% (whichever was less restrictive) was recorded. If the Low-Level gas was zero gas, the response was 0.5% or 5.0 percent of the upscale gas concentration (whichever was less restrictive). The analyzer reading was observed until it reached a stable value and this value was recorded. The measurement system response time and initial system bias were determined from these data. The System Bias was within 5.0 percent of the Calibration Span or 0.5% absolute difference.

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe. After the analyzer response was stable, the value was recorded. Next, Low Level gas was introduced at the probe, and the analyzer value recorded once it reached a stable response. The System Bias was within 5.0 percent of the Calibration Span or 0.5% absolute difference or the data was invalidated and the Calibration Error Test and System Bias were repeated.

Drift between pre- and post-run System Bias was within 3 percent of the Calibration Span or 0.5% absolute difference. If the drift exceeded 3 percent or 0.5%, the Calibration Error Test and System Bias were repeated.

To determine the number of sampling points, a gas stratification check was conducted prior to initiating testing. The pollutant concentrations were measured at three points (16.7, 50.0 and 83.3 percent of the measurement line). Each traverse point was sampled for a minimum of twice the system response time. The pollutant concentration at each traverse point did not differ more than 5 percent or 0.3% (whichever was less restrictive) of the average pollutant concentration. Therefore, single point sampling was conducted during the test runs. If the pollutant concentration did not meet these specifications but differed less than 10 percent or 0.5% from the average concentration, then three (3) point sampling was conducted (stacks less than 7.8 feet in diameter - 16.7, 50.0 and 83.3 percent of the measurement line; stacks greater than 7.8 feet in diameter - 0.4, 1.0, and 2.0 meters from the stack wall). If the pollutant concentration differed by more than 10 percent or 0.5% from the average concentration, then sampling was conducted at a minimum of twelve (12) traverse points. Copies of stratification check data can be found in the Quality Assurance/Quality Control Appendix.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a \*.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the AST server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager

**3.8 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 25A**

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

Within two (2) hours prior to testing, zero gas was introduced through the sampling system to the analyzer. After adjusting the analyzer to the Zero gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas, and the time required for the analyzer reading to reach 95 percent of the gas concentration was recorded to determine the response time. Next, Low and Mid-Level gases were introduced through the sampling system to the analyzer, and the response was recorded when it was stable. All values were less than +/- 5 percent of the calibration gas concentrations.

Mid Level gas was introduced through the sampling system. After the analyzer response was stable, the value was recorded. Next, Zero gas was introduced through the sampling system, and the analyzer value recorded once it reached a stable response. The Analyzer Drift was less than +/- 3 percent of the span value.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a \*.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the AST server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.

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# Appendix A

Location: Aquatic Company - Three Rivers, MI  
 Source: Regenerative Thermal Oxidizer (RTO) Inlet & Outlet  
 Project No.: 2021-1712  
 Run No. /Method: Run 1 / Method 25A

**THC - Outlet Concentration (as C3H8) ( $C_{THC}$ ), ppmvd**

$$C_{THC} = \frac{C_{THCw}}{1 - BWS}$$

where,

$$\begin{aligned} C_{THCw} &= \frac{28.1}{0.016} = \text{THC - Outlet Concentration (as C3H8), ppmvw} \\ BWS &= \frac{0.016}{28.6} = \text{moisture fraction, unitless} \\ C_{THC} &= \frac{28.6}{28.6} = \text{ppmvd} \end{aligned}$$

**THC - Outlet Emission Rate (as C3H8) ( $ER_{THC}$ ), lb/hr**

$$ER_{THC} = \frac{C_{THC} \times MW \times Qs \times 60 \times \frac{m^3}{hr} \times 28.32 \times \frac{lb}{ft^3}}{24.04 \times \frac{L}{g-mole} \times 1.0E06 \times 454 \times \frac{g}{lb}}$$

where,

$$\begin{aligned} C_{THC} &= \frac{28.6}{44.1} = \text{THC - Outlet Concentration (as C3H8), ppmvd} \\ MW &= \frac{44.1}{85,059} = \text{THC molecular weight, g/g-mole} \\ Qs &= \frac{85,059}{16.7} = \text{stack gas volumetric flow rate at standard conditions, dscfm} \\ ER_{THC} &= \frac{16.7}{16.7} = \text{lb/hr} \end{aligned}$$

**THC - Outlet Emission Factor (as C3H8) ( $EF_{THCPPT}$ ), lb/ton**

$$EF_{THC} = \frac{ER_{THC} \times 2,000}{FR} \frac{lb}{ton}$$

where,

$$\begin{aligned} ER_{THC} &= \frac{16.7}{1,136} = \text{THC - Outlet Emission Rate (as C3H8), lb/hr} \\ FR &= \frac{1,136}{29.4} = \text{Feed Rate, lb/hr} \\ EF_{THC} &= \frac{29.4}{29.4} = \text{lb/ton} \end{aligned}$$

**NMEHC Concentration (as C3H8) ( $C_{NMEHC}$ ), ppmvd**

$$C_{NMEHC} = C_{THC} - C_{CH4} - C_{C2H6}$$

where,

$$\begin{aligned} C_{THC} &= \frac{28.58}{1.89} = \text{THC Concentration (as C3H8), ppmvd} \\ C_{CH4} &= \frac{1.89}{0.13} = \text{CH4 Concentration (as C3H8), ppmvd} \\ C_{C2H6} &= \frac{0.13}{26.4} = \text{C2H6 Concentration (as C3H8), ppmvd} \\ C_{NMEHC} &= \frac{26.4}{26.4} = \text{ppmvd} \end{aligned}$$

**NMEHC Emission Rate (as C3H8) ( $ER_{NMEHC}$ ), lb/hr**

$$ER_{NMEHC} = \frac{C_{NMEHC} \times MW \times Qs \times 60 \times \frac{m^3}{hr} \times 28.32 \times \frac{lb}{ft^3}}{24.04 \times \frac{L}{g-mole} \times 1.0E06 \times 454 \times \frac{g}{lb}}$$

where,

$$\begin{aligned} C_{NMEHC} &= \frac{26.4}{44.1} = \text{NMEHC Concentration (as C3H8), ppmvd} \\ MW &= \frac{44.1}{85,059} = \text{NMEHC molecular weight, g/g-mole} \\ Qs &= \frac{85,059}{15.4} = \text{stack gas volumetric flow rate at standard conditions, dscfm} \\ ER_{NMEHC} &= \frac{15.4}{15.4} = \text{lb/hr} \end{aligned}$$

**NMEHC Emission Factor (as C3H8) ( $EF_{NMEHCPT}$ ), lb/ton**

$$EF_{NMEHC} = \frac{ER_{NMEHC} \times 2,000}{FR} \frac{lb}{ton}$$

where,

$$\begin{aligned} ER_{NMEHC} &= \frac{15.4}{1,136} = \text{NMEHC Emission Rate (as C3H8), lb/hr} \\ FR &= \frac{1,136}{27.1} = \text{Feed Rate, lb/hr} \\ EF_{NMEHC} &= \frac{27.1}{27.1} = \text{lb/ton} \end{aligned}$$

**NMEHC - Outlet Reduction Efficiency ( $RE_{NMEHC}$ ), %**

$$RE_{NMEHC} = \frac{ER_{NMEHC_i} - ER_{NMEHC}}{ER_{NMEHC_i}} \times 100$$

where,

$$\begin{aligned} ER_{NMEHC_i} &= \frac{120.4}{15.4} = \text{NMEHC}_i \text{ (as C3H8) Emission Rate, lb/hr} \\ ER_{NMEHC} &= \frac{15.4}{87.2} = \text{NMEHC (as C3H8) Emission Rate, lb/hr} \\ RE_{NMEHC} &= \frac{87.2}{87.2} = \% \end{aligned}$$

Location Aquatic Company - Three River, MI  
 Source Regenerative Thermal Oxidizer (RTO) Inlet  
 Project No. 2021-1712  
 Run No. 1  
 Parameter(s) VFR

Meter Pressure (Pm), in. Hg

$$P_m = P_b + \frac{\Delta H}{13.6}$$

where,

$P_b = \frac{29.00}{1} =$  barometric pressure, in. Hg  
 $\Delta H = \frac{1.000}{1} =$  pressure differential of orifice, in H<sub>2</sub>O  
 $P_m = \frac{29.07}{1} =$  in. Hg

Absolute Stack Gas Pressure (Ps), in. Hg

$$P_s = P_b - \frac{P_g}{13.6}$$

where,

$P_b = \frac{29.00}{1} =$  barometric pressure, in. Hg  
 $P_g = \frac{-2.70}{1} =$  static pressure, in. H<sub>2</sub>O  
 $P_s = \frac{28.80}{1} =$  in. Hg

Standard Meter Volume (Vmstd), dscf

$$Vmstd = \frac{17.636 \times V_m \times P_m \times Y}{T_m}$$

where,

$Y = \frac{1.000}{1} =$  meter correction factor  
 $V_m = \frac{36.060}{1} =$  meter volume, cf  
 $P_m = \frac{29.07}{1} =$  absolute meter pressure, in. Hg  
 $T_m = \frac{545.4}{1} =$  absolute meter temperature, °R  
 $Vmstd = \frac{33.898}{1} =$  dscf

Standard Wet Volume (Vwstd), scf

$$Vwstd = 0.04716 \times V_{lc}$$

where,

$V_{lc} = \frac{15.8}{1} =$  Volume of H<sub>2</sub>O collected, ml  
 $Vwstd = \frac{0.745}{1} =$  scf

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

$$BWS_{sat} = \frac{10^{0.37 \cdot \left( \frac{2.527}{T_s + 363} \right)}}{P_s}$$

where,

$T_s = \frac{79.4}{1} =$  stack temperature, °F  
 $P_s = \frac{28.8}{1} =$  absolute stack gas pressure, in. Hg  
 $BWS_{sat} = \frac{0.0}{1} =$  dimensionless

Moisture Fraction (BWS), dimensionless

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

where,

$Vwstd = \frac{0.745}{1} =$  standard wet volume, scf  
 $Vmstd = \frac{33.898}{1} =$  standard meter volume, dscf  
 $BWS = \frac{0.022}{1} =$  dimensionless

Moisture Fraction (BWS), dimensionless

$$BWS = BWS_{msd} \text{ unless } BWS_{sat} < BWS_{msd}$$

where,

$BWS_{sat} = \frac{0.035}{1} =$  moisture fraction (theoretical at saturated conditions)  
 $BWS_{msd} = \frac{0.022}{1} =$  moisture fraction (measured)  
 $BWS = \frac{0.022}{1}$

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

$$Md = (0.44 \times \% CO_2) + (0.32 \times \% O_2) + (0.25 (100 - \% CO_2 - \% O_2))$$

where,

$CO_2 = \frac{0.0}{1} =$  carbon dioxide concentration, %  
 $O_2 = \frac{21.1}{1} =$  oxygen concentration, %  
 $Md = \frac{28.84}{1} =$  lb/lb mol

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

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

where,

$Md = \frac{28.84}{1} =$  molecular weight (DRY), lb/lb mol  
 $BWS = \frac{0.022}{1} =$  moisture fraction, dimensionless  
 $Ms = \frac{28.61}{1} =$  lb/lb mol

Location Aquatic Company - Three River, MI  
 Source Regenerative Thermal Oxidizer (RTO) Inlet  
 Project No. 2021-1712  
 Run No. 1  
 Parameter(s) VFR

Average Velocity (Vs), ft/sec

$$V_s = 85.49 \times C_p \times (\Delta P^{1/2})_{avg} \times \sqrt{\frac{T_s}{P_s \times M_s}}$$

where,

$C_p$  0.84 = pitot tube coefficient  
 $\Delta P^{1/2}$  0.921 = average pre/post test velocity head of stack gas, (in. H<sub>2</sub>O)<sup>1/2</sup>  
 $T_s$  539.0 = average pre/post test absolute stack temperature, °R  
 $P_s$  28.80 = absolute stack gas pressure, in. Hg  
 $M_s$  28.61 = molecular weight of stack gas, lb/lb mol  
 $V_s$  53.5 = ft/sec

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

$$Q_a = \phi \times V_s \times A_s$$

where,

$V_s$  53.5 = stack gas velocity, ft/sec  
 $A_s$  27.49 = cross-sectional area of stack, ft<sup>2</sup>  
 $Q_a$  88,219 = acfm

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

$$Q_{sd} = 17.636 \times Q_a \times (1 - BWS) \times \frac{P_s}{T_s}$$

where,

$Q_a$  88,219 = average stack gas flow at stack conditions, acfm  
 BWS 0.022 = moisture fraction, dimensionless  
 $P_s$  28.80 = absolute stack gas pressure, in. Hg  
 $T_s$  539.0 = average pre/post test absolute stack temperature, °R  
 $Q_s$  81,341 = dscfm

Dry Gas Meter Calibration Check (Yqa), dimensionless

$$Y_{q,r} = \left( \frac{\phi}{T_m} \times \frac{\sqrt{\frac{0.0319 \times T_m \times 29}{\Delta H \cdot \bar{g} \times \left( P_b - \frac{\Delta H \cdot \bar{g}}{13.6} \right) \times 1.67}}}{\sqrt{\Delta H \cdot \bar{g}}} \right) \times 100$$

where,

$Y$  1 = meter correction factor, dimensionless  
 $\phi$  60 = run time, min.  
 $V_m$  36.06 = total meter volume, def  
 $T_m$  545.4 = absolute meter temperature, °R  
 $\Delta H @$  1.828 = orifice meter calibration coefficient, in. H<sub>2</sub>O  
 $P_b$  29.00 = barometric pressure, in. Hg  
 $\Delta H_{avg}$  1.000 = average pressure differential of orifice, in. H<sub>2</sub>O  
 $M_d$  28.84 = molecular weight (DRY), lb/lb mol  
 $(\Delta H)^{1/2}$  1.000 = average squareroot pressure differential of orifice, (in. H<sub>2</sub>O)<sup>1/2</sup>  
 $Y_{qa}$  4.5 = dimensionless

## Appendix B

Location Aquatic Company - Three Rivers, MI  
Source Regenerative Thermal Oxidizer (RTO) Inlet & Outlet  
Project No. 2021-1712

Run Number		Run 1	Run 2	Run 3	Average
Date		9/21/21	9/22/21	9/22/21	--
Start Time		13:50	6:30	8:20	--
Stop Time		14:50	7:30	9:20	--
<b>Source Data</b>					
Resin Rate, lb/hr	FR	1,136	1,171	1,090	1,132
Gelcoat Rate, lb/hr	FR	447	374	314	378
<b>Input Data - Inlet</b>					
Moisture Fraction, dimensionless	BWSI	0.022	0.025	0.022	0.023
Volumetric Flow Rate (M1-4), dscfm	QsI	81,341	78,999	79,510	79,950
<b>Input Data - Outlet</b>					
Moisture Fraction, dimensionless	BWS	0.016	0.019	0.019	0.018
Volumetric Flow Rate (M1-4), dscfm	Qs	85,059	85,783	84,882	85,241
<b>Calculated Data - Inlet</b>					
O <sub>2i</sub> Concentration, % dry	C <sub>O<sub>2i</sub></sub>	21.10	21.07	20.86	21.01
CO <sub>2i</sub> Concentration, % dry	C <sub>CO<sub>2i</sub></sub>	<u>0.00</u>	<u>0.00</u>	0.02	0.01
THCi (as C3H8) Concentration, ppmvd	C <sub>THCi</sub>	217.63	296.56	254.51	256.23
THCi (as C3H8) Concentration, ppmvw	C <sub>THCi<sub>w</sub></sub>	212.84	289.14	248.91	250.30
THCi (as C3H8) Emission Rate, lb/hr	ER <sub>THCi</sub>	121.54	160.85	138.94	140.44
<b>VOC Calculated Data - Inlet</b>					
CH4 Concentration, ppmvd	C <sub>CH4</sub>	5.64	5.70	5.72	5.69
CH4 Concentration (as C3H8), ppmvd	C <sub>CH4 as propane</sub>	1.88	1.90	1.91	1.90
CH4 Emission Rate, lb/hr	ER <sub>CH4</sub>	1.15	1.12	1.14	1.14
C2H6 Concentration, ppmvd	C <sub>C2H6</sub>	<u>0.20</u>	<u>0.20</u>	<u>0.20</u>	0.20
C2H6 Concentration (as C3H8), ppmvd	C <sub>C2H6 as propane</sub>	0.13	0.13	0.13	0.13
C2H6 Emission Rate, lb/hr	ER <sub>C2H6</sub>	0.076	0.074	0.074	0.075
NMEHCi (as C3H8) Concentration, ppmvd	C <sub>NMEHCi</sub>	215.6	294.5	252.5	254.2
NMEHCi (as C3H8) Concentration, ppmvw	C <sub>NMEHCi<sub>w</sub></sub>	210.9	287.2	246.9	248.3
NMEHCi (as C3H8) Emission Rate, lb/hr	ER <sub>NMEHCi</sub>	120.4	159.7	137.8	139.3
<b>Calculated Data - Outlet</b>					
O <sub>2</sub> Concentration, % dry	C <sub>O<sub>2</sub></sub>	20.82	20.61	20.63	20.69
CO <sub>2</sub> Concentration, % dry	C <sub>CO<sub>2</sub></sub>	0.20	0.18	0.20	0.19
THC (as C3H8) Concentration, ppmvd	C <sub>THC</sub>	28.6	34.5	29.2	30.8
THC (as C3H8) Concentration, ppmvw	C <sub>THC<sub>w</sub></sub>	28.1	33.8	28.6	30.2
THC (as C3H8) Emission Rate, lb/hr	ER <sub>THC</sub>	16.7	20.3	17.0	18.0
THC (as C3H8) Emission Factor, lb/ton resin	EF <sub>THC PPT</sub>	29.4	34.7	31.2	31.8
THC (as C3H8) Emission Factor, lb/ton gelcoat	EF <sub>THC PPT</sub>	74.7	108.7	108.4	97.2
<b>VOC Calculated Data - Outlet</b>					
CH4 Concentration, ppmvd	C <sub>CH4</sub>	5.67	5.56	5.62	5.62
CH4 Concentration (as C3H8), ppmvd	C <sub>CH4 as propane</sub>	1.89	1.85	1.87	1.87
CH4 Emission Rate, lb/hr	ER <sub>CH4</sub>	1.20	1.19	1.19	1.20
C2H6 Concentration, ppmvd	C <sub>C2H6</sub>	<u>0.20</u>	<u>0.20</u>	<u>0.20</u>	0.20
C2H6 Concentration (as C3H8), ppmvd	C <sub>C2H6 as propane</sub>	0.13	0.13	0.13	0.13
C2H6 Emission Rate, lb/hr	ER <sub>C2H6</sub>	0.080	0.080	0.079	0.080
NMEHC (as C3H8) Concentration, ppmvd	C <sub>NMEHC</sub>	26.4	32.3	27.0	28.6
NMEHC (as C3H8) Concentration, ppmvw	C <sub>NMEHC<sub>w</sub></sub>	26.0	31.7	26.5	28.1
NMEHC (as C3H8) Emission Rate, lb/hr	ER <sub>NMEHC</sub>	15.4	19.1	15.7	16.7
NMEHC (as C3H8) Emission Factor, lb/ton resin	EF <sub>NMEHC PPT</sub>	27.1	32.5	28.9	29.5
NMEHC (as C3H8) Emission Factor, lb/ton gelcoat	EF <sub>NMEHC PPT</sub>	68.9	101.9	100.3	90.4
<b>Reduction Efficiency Data</b>					
NMEHC (as C3H8) Reduction Efficiency, %	RE <sub>NMEHC (as C3H8)</sub>	87.2	88.1	88.6	88.0

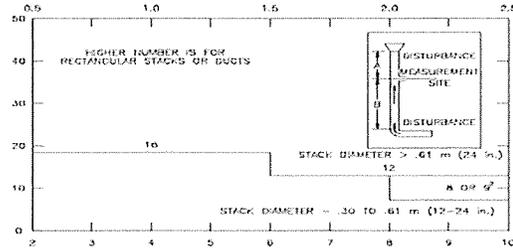
Underlined lab results were ND.

Underlined and italicized run averages were negative after bias correction and were set to zero.

Location Aquatic Company - Three River, MI  
Source Regenerative Thermal Oxidizer (RTO) Inlet  
Project No. 2021-1712  
Date: 09/21/21

**Stack Parameters**

Duct Orientation: Horizontal  
Duct Design: Circular  
Distance from Far Wall to Outside of Port: 72.00 in  
Nipple Length: 1.00 in  
Depth of Duct: 71.00 in  
Cross Sectional Area of Duct: 27.49 ft<sup>2</sup>  
No. of Test Ports: 2  
Number of Readings per Point: 2  
Distance A: 16.5 ft  
Distance A Duct Diameters: 2.8 (must be > 0.5)  
Distance B: 7.0 ft  
Distance B Duct Diameters: 1.2 (must be > 2)  
Minimum Number of Traverse Points: 16  
Actual Number of Traverse Points: 16  
Measurer (Initial and Date): STH  
Reviewer (Initial and Date): JJB



**CIRCULAR DUCT**

**LOCATION OF TRAVERSE POINTS**  
Number of traverse points on a diameter

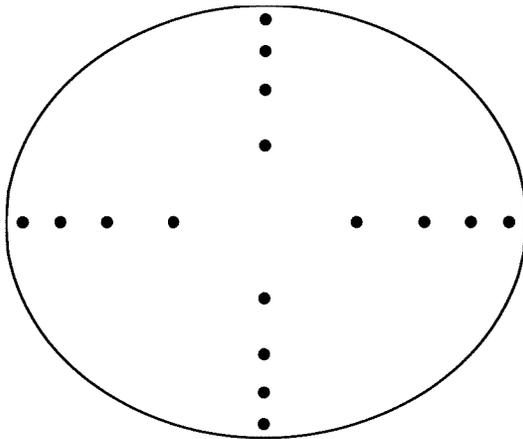
	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--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

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	3.2	2.27	3.27
2	10.5	7.46	8.46
3	19.4	13.77	14.77
4	32.3	22.93	23.93
5	67.7	48.07	49.07
6	80.6	57.23	58.23
7	89.5	63.55	64.55
8	96.8	68.73	69.73
9	--	--	--
10	--	--	--
11	--	--	--
12	--	--	--

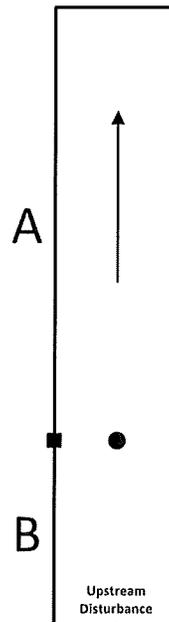
\*Percent of stack diameter from inside wall to traverse point.

Stack Diagram  
A = 16.5 ft.  
B = 7 ft.  
Depth of Duct = 71 in.

Cross Sectional Area



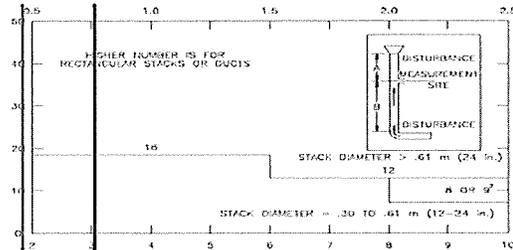
Downstream Disturbance



Location Aquatic Company - Three River, MI  
Source Regenerative Thermal Oxidizer (RTO) Outlet  
Project No. 2021-1712  
Date: 09/20/21

**Stack Parameters**

Duct Orientation: Vertical  
Duct Design: Circular  
Distance from Far Wall to Outside of Port: 72.00 in  
Nipple Length: 6.00 in  
Depth of Duct: 66.00 in  
Cross Sectional Area of Duct: 23.76 ft<sup>2</sup>  
No. of Test Ports: 2  
Number of Readings per Point: 1  
Distance A: 4.2 ft  
Distance A Duct Diameters: 0.8 (must be > 0.5)  
Distance B: 10.0 ft  
Distance B Duct Diameters: 1.8 (must be > 2)  
Minimum Number of Traverse Points: 16  
Actual Number of Traverse Points: 16  
Measurer (Initial and Date): STH  
Reviewer (Initial and Date): JJB



**CIRCULAR DUCT**

**LOCATION OF TRAVERSE POINTS**  
Number of traverse points on a diameter

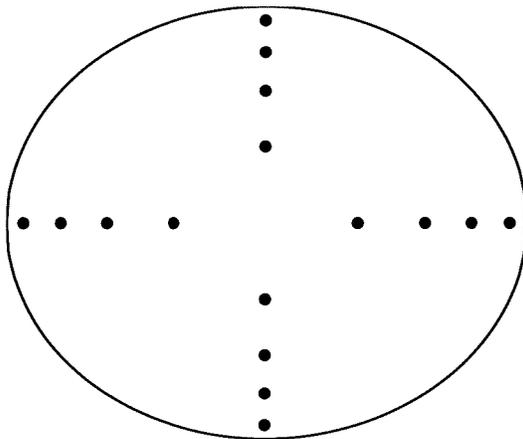
	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--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

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	3.2	2.11	8.11
2	10.5	6.93	12.93
3	19.4	12.80	18.80
4	32.3	21.32	27.32
5	67.7	44.68	50.68
6	80.6	53.20	59.20
7	89.5	59.07	65.07
8	96.8	63.89	69.89
9	--	--	--
10	--	--	--
11	--	--	--
12	--	--	--

\*Percent of stack diameter from inside wall to traverse point.

Stack Diagram  
A = 4.1666666  
B = 10 ft.  
Depth of Duct = 66 in.

Cross Sectional Area



Downstream Disturbance

