CAPTURE AND DESTRUCTION EFFICIENCY TEST REPORT

for

EU-PAINTLINE-1

at

Plasan Carbon Composites
3195 Wilson Drive, NW
Walker, Michigan

Test Date: September 27, 2016

Report Date: October 18, 2016

Report Due Date: November 27, 2016

Prepared by:

Environmental Partners, Inc.
305 Hoover Boulevard, Suite 200
Holland, Michigan 49423

EXECUTIVE SUMMARY

A compliance stack test program was performed at the Plasan Carbon Composites manufacturing facility located at 3195 Wilson Drive NW, Walker, Michigan on September 27, 2016. The purpose of the test program was to determine the Volatile Organic Compound (VOC) capture and destruction efficiencies for paint line #1 (EU-PAINTLINE-1). EU-PAINTLINE-1 is a conveyorized plastic parts coating operation, with a regenerative thermal oxidizer used to control emissions released from the paint booths, flash tunnel, and the radiant zone (first portion) of the cure oven.

The test program was conducted in accordance with the test plan dated July 21, 2016, and confirmed by the Michigan Department of Environmental Quality (MDEQ) by letter dated August 3, 2016. A copy of the test plan and the MDEQ confirmation letter is included in Appendix A.

The paint process evaluated is regulated by the Michigan issued New Source Review Permit to Install No. 130-12C. The testing was conducted to satisfy FG-PAINT special condition number V.2 and to confirm compliance with special condition number IV.3.

The overall compliance test program was coordinated by Mr. Bruce Connell, of Environmental Partners, Inc. The compliance test program was performed by The Stack Test Group. Plant operations were coordinated by Mr. Randy Jesberg, Plasan Carbon Composites. The compliance test program was witnessed by Mr. Tom Gaslolit, and Ms. Kaitlyn DeVries of the MDEQ-AQD. The results of testing, as presented in Table 1, indicate that the process control equipment was in compliance with the above stated permit conditions.

Table 1 – Emissions Test Summary

TEST	**RTO INLET (lb/hr)**	**RTO OUTLET (lb/hr)**	**OVEN EXHAUST (lb/hr)**	**CAPTURE EFFICIENCY (%)**	**DESTRUCTION EFFICIENCY (%)**
1	18.62	1.56	0.27	98.57%	91.61%
2	18.52	1.56	0.19	98.98%	91.59%
3	18.54	1.47	0.18	99.04%	92.07%
AVG	18.56	1.53	0.21	98.88%	91.76%
PERMIT				**92.5%**	**95%**

1.0 PROCESS AND CONTROLS SYSTEMS DESCRIPTION

The Paint Line #1 (EU-PAINTLINE-1) is a conveyorized coating line consisting of a wash line, dry-off oven, a single paint spray booth with two (2) sections (auto & manual), an enclosed flash tune, and a cure oven consisting of a radiant zone and convection zone. The system is completely enclosed with the exception of the load / unload section where parts are added and coated parts removed. The regenerative thermal oxidizers (RTO) controls emissions from both sections of the paint application booth, the flash tunnel, and the radiant zone (first section) of the cure oven. Emissions from the convection zone of the cure oven are directed to atmosphere.

The paint spray booth is equipped with down draft, dry filter particulate controls and four robotic paint applicators equipped with bells. Paint is supplied to each robot from a central paint mix (Kitchen) area. The robots are equipped with flow meters which provide paint volume usage (as mixed) in cubic centimeters. Products are either coated with a primer or a clear coat but never both.

The regenerative thermal oxidizer is TANN Regenerative Thermal Oxidizer with a rated airflow rate of 14,000 scfm and a design destruction efficiency of 95%.

In accordance with Special Condition IV.3 of FGPAINT (PTI #130-12C) the oxidizer must maintain a minimum combustion chamber temperature above 1400°F when operating the coating line. Appendix B contains both periodic hand written recordings of the combustion chamber temperature and a table of values downloaded from the RTO's data-logging system for the combustion chamber.

During the day of testing, sampling was conducted in the RTO inlet, RTO exhaust stack, and the convection zone exhaust stack. In addition, differential pressure readings were recorded across the paint booth entrance and smoke observations were documented at the cure oven exit to demonstrate that the paint envelope was under negative pressure to the surrounding area. These observations are located in Appendix B

During each destruction efficiency emissions test, sampling was conducted simultaneously at the inlet and outlet of the control device, while the controlled equipment was operating under representative operating conditions. Capture efficiency testing was conducting by sampling simultaneously at the RTO inlet and convection zone discharge.

Figure 1
Coating Line Process Schematic

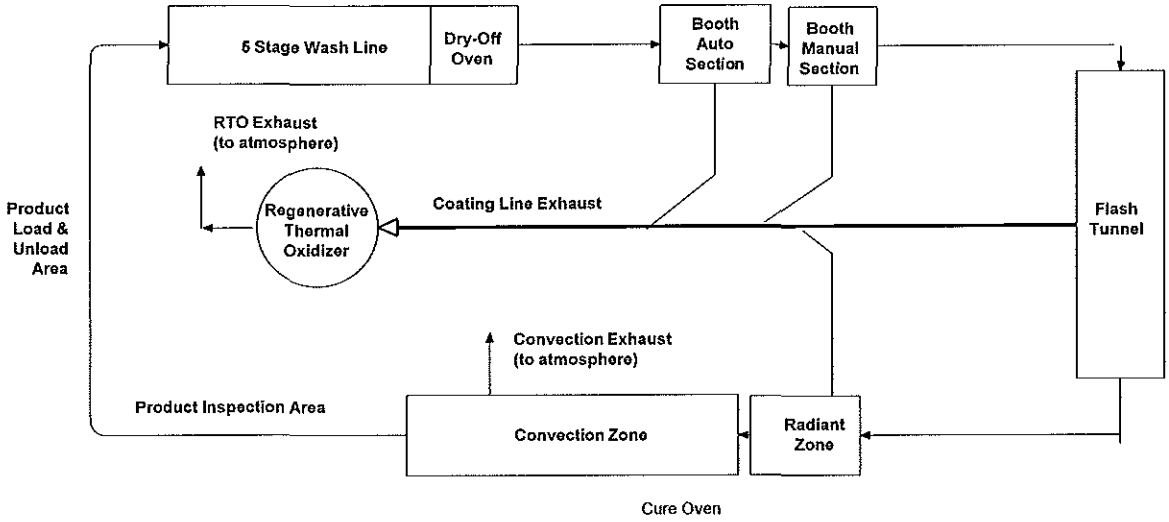

Figure 1
Process and Control Equipment Diagram
Plasan Carbon Composites, Inc.
Walker, Michigan

2.0 TEST METHODOLOGIES

Three one-hour test runs were performed at the inlet and outlet of the oxidizer unit. For each test run, the concentrations and mass emission rates of VOCs at the inlet and outlet test locations were compared in order to determine the VOC destruction efficiency. All tests were conducted in accordance with USEPA Methods 1-4, and 25A, as described in the *Code of Federal Regulations, Title 40, Part 60, Appendix A*. Descriptions of these methods are as follows:

USEPA Method	Description
1	Sample and Velocity Traverses for Stationary Sources
2	Determination of Stack Gas Velocity and Volumetric Flow Rate
3	Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight
4	Determination of Moisture Content in Stack Gases
18	Measurement of Gaseous Organic Compound Emissions by Gas Chromatography
25A	Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

2.1 Volumetric Flow Rate Determination – USEPA Methods 1 - 4

The volumetric flow rate of the exhaust was determined following USEPA Methods 1 through 4. Velocity measurement points were selected in accordance with USEPA Method 1. Gas stream velocities were determined using a Type-S pitot tube and inclined manometer in accordance with USEPA Method 2.

Two velocity measurements were made at each test location for each one hour test run, one just before and one just after each test. The completion of the first and second test runs were reasonably temporally coincidental to the start of the subsequent test runs, therefore the ending velocity measurement for the previous test run was utilized as the beginning velocity measurement for the subsequent test run.

Concentrations of carbon dioxide were determined using the instrumental analyzer technique in accordance with USEPA Method 3A. Gas stream moisture contents were determined by passing the exhaust sample gas through a series of four chilled impingers containing pre-measured amounts of absorbing solution, followed by an impinger containing silica gel. Volumetric determinations were made of moisture gain, and equivalent water vapor volumes were determined in accordance with USEPA Method 4.

2.2 Total Gaseous Organic Concentration Determination – USEPA Method 25A

The procedures outlined in USEPA Method 25A were followed to determine the total gaseous organic concentration in the exhaust streams at the inlet and outlet of the oxidizer. For each test run, a gas sample was collected continuously for a minimum of 60 minutes from a single representative sampling point. The gas sample stream was passed through a heated filter and stainless steel probe, and drawn to a flame ionization analyzer via a Teflon sample line that was heated to at least 250°F. Both the inlet and outlet concentrations were measured with a JUM Model 3-300A Flame Ionization Analyzer.

The flame ionization analyzer was pre-calibrated in the applicable ranges. Appropriate mid-range and zero calibration gases were introduced, and the analyzer response was checked between each test run, as well as after the final test run. Calibration gases consisted of certified (Protocol 1) concentrations of propane in air. Sixty one-minute averages for each run were totaled and averaged to determine an average organic concentration for each of the three test runs. Organic concentrations are expressed on a parts per million by volume as propane (ppmv C_3H_8) basis.

2.3 Gaseous Organic Compound Concentration Determination – USEPA Method 18

The procedures outlined in USEPA Method 18 were followed to determine the amount of methane gas present in the outlet of the oxidizer. For each test run, a bag sample was collected in the RTO outlet test port and later submitted to a laboratory for analysis under gas chromatography. The results as reported in ppmv were used to correct the discharge concentration.

Samples were not collected from the RTO inlet as this had no known source of methane. VOC emission results for each test are presented on a concentration basis (parts per million by volume as propane, ppmv C_3H_8), and mass emission rate basis (pounds per hour as propane). The capture efficiency of the paint system was calculated by comparing the mass of VOCs measured at the RTO inlet to the sum of VOC mass removed from the paint system at the RTO inlet and convection oven exhaust stack.

The VOC destruction efficiency of the oxidizer was calculated by comparing the mass of VOC measured at the oxidizer inlet to the mass of VOC measured in the oxidizer exhaust for each test run., The capture efficiency and destruction efficiency data is reported as an arithmetic average of the three test runs. The results from both capture and destruction efficiency testing are shown in Table 5.

3.0 PRESENTATION OF PRODUCTION DATA

The MDEQ-AQD stack test approval letter, dated August 3, 2016 requested that the process be operated at a maximum achievable rate. On the day of testing, the paint line was operating at a conveyor speed of 4.0 feet per minute.

Table 2 presents a summary of the process data for each test run. Table 3 presents a summary of the combustion chamber temperatures during each test. A copy of the process data for each test run and the RTO combustion chamber data is provided in Appendix B.

Table 2 – Process Summary Data

Test No.	Parts	Paint Resin (liters)	Hardener (liters)	Uncontrolled VOCs (lbs)
1	69 Corvette Hoods 21 Corvette Roofs	18.693	6.324	27.1
2	51 Corvette Hoods 39 Corvette Roofs 10 Rockers 16 Splitters	20.572	6.950	29.78
3	75 Corvette Hoods 21 Corvette Roofs	20.313	6.872	29.41

Table 3 – RTO Combustion Chamber Temperature Summary

RTO Combustion Zone	Test 1	Test 2	Test 3
Combustion Chamber Min °F	1462	1462	1462
Combustion Chamber Avg °F	1506	1507	1506

Table 4 – Paint Enclosure Differential Pressure Measurements/Observations

	Test 1	Test 2	Test 3
Paint Booth Entrance			
Differential Pressure Min – in. H_20	-0.005	-0.005	-0.005
Differential Pressure Max – in H_2O	-0.011	-0.010	-0.010
Differential Pressure Avg – in. H_20	-0.008	-0.008	-0.008
Cure Oven Exit			
Smoke Observation	Negative	Negative	Negative

4.0 PRESENTATION AND DISCUSSION OF TEST RESULTS

The results of the compliance test program are summarized in the following tables:

Table 5
TANN Destruction Efficiency Test Summary

Parameter	**1**	**2**	**3**	**Avg.[1]**
Start Time	09:00	10:15	11:30	
Stop Time	10:00	11:15	12:35	
Inlet Volumetric Flow Rate (scfm)	13,034	12,951	13,026	13,004
Inlet VOC Concentration (ppmv C_3H_8)	208.5	208.7	207.7	208.3
Inlet VOC Mass Emission Rate (lbs/hr C_3H_8)	18.62	18.52	18.54	18.56
Outlet Volumetric Flow Rate (scfm)	14,909	14,760	14,811	14,826
Outlet VOC Concentration (ppmv C_3H_8) less methane	15.3	15.4	14.5	15.1
Outlet VOC Mass Emission Rate (lbs/hr C_3H_8)	1.56	1.56	1.47	1.53
Cure Oven Exit Volumetric Flow Rate (scfm)	3,077	2,943	2,840	2,953
Cure Oven Exit VOC Concentration (ppmv C_3H_8)	12.8	9.3	9.3	10.5
Cure Oven Exit VOC Mass Emission Rate (lbs/hr C_3H_8)	0.27	0.19	0.18	0.21
VOC Capture Efficiency (%)	**98.57**	**98.98**	**99.04**	**98.88**
VOC Destruction Efficiency (%)	**91.61**	**91.59**	**92.07**	**91.76**

The test plan and MDEQ acknowledgement letter, process operational data, control device data, summary calculations, field test data sheets, VOC concentration readings, equipment calibrations and calibration gas certification sheets are included in the following Appendices:

Appendix	Description
A	Test Plan and Letter of Approval
B	Process and Control Device Operating Parameters and Field Test Data Sheets
C	Stack Test Group Report