IMPACT COMPLIANCE & TESTING

EMISSION TEST REPORT

Report Title	RESULTS OF REGENERATIVE THERMAL OXIDIZER AND COATING LINE VOC CONTROL EFFICIENCY DETERMINATION
Report Date	June 2, 2022
Test Dates	May 24 – 25, 2022

Facility Information	
Name	Cadon Plating & Coatings, LLC
Street Address	3715 Eleventh St.
City, County	Wyandotte, Monroe
Phone	(734) 282-8100

Facility Permit Information			
State Registration No.:	A7972	Permit to Install No.:	252-00D

Testing Contractor	
Company Mailing Address	Impact Compliance & Testing, Inc. 4180 Keller Rd., Ste. B Holt, MI 48842
Phone	(517) 268-0043
Project No.	2200121

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

RESULTS OF REGENERATIVE THERMAL OXIDIZER AND
COATING LINE
VOC CONTROL EFFICIENCY DETERMINATION

CADON PLATING & COATINGS, LLC
JACKSON, MICHIGAN

1.0 INTRODUCTION

Cadon Plating & Coatings, LLC (Cadon) operates surface coating and finishing operations at its facility in Wyandotte, Wayne County, Michigan. Cadon recently completed installation of a dipspin coating line (EU-LINE4) that was authorized by Permit to Install (PTI) No. 252-00D (dated October 19, 2021) issued by the Michigan Department of Environment, Great Lakes and Energy, Air Quality Division (EGLE-AQD).

Volatilized solvents from the parts coating processes are captured using a process ventilation system and directed to the regenerative thermal oxidizer (RTO) for the destruction of hydrocarbons. Condition V.2 for the emission group FG-RTO requires Cadon to verify the capture efficiency of the air collection system associated with EU-LINE4 and destruction efficiency of the RTO within 180 days of commencement of trial operation of EU-LINE4. Trial operation began on EU-LINE4 on November 12, 2021. EGLE-AQD granted a test date extension to May 24 – 25, 2022. This test event is to verify the EU-LINE4 capture and RTO destruction efficiency.

Testing was performed to determine the volatile organic compound (VOC):

1. Capture efficiency of the EU-LINE4 process ventilation system based on a comparison of the total hydrocarbon (THC) mass flowrate for captured and THC uncaptured exhaust gas streams from a non-fugitive enclosure.

2. Destruction efficiency of the RTO based on a comparison of the THC mass flowrate for the RTO inlet and THC mass flowrate for the exhaust gas stream.

The VOC capture and destruction efficiency determination testing was performed May 24 – 25, 2022 by Impact Compliance and Testing, Inc. representatives Max Fierro, Andrew Eisenberg and Clay Gaffey. The project was coordinated by Cadon representative Mr. Keith Miller.

Ms. Regina Angelloti and Ms. Katherine Koster of the EGLE-AQD were on-site to observe portions of the compliance testing. The exhaust gas sampling and analysis was performed using procedures specified in the Test Plan submitted to EGLE-AQD dated March 24, 2022 and approved by the regulatory agency.

Appendix 1 provides a copy of the test plan approval letter issued by the EGLE-AQD.

1.1 Project Contact Information

Questions regarding this emission test report should be directed to:

Andy Rusnak, QSTI
Technical Manager
Impact Compliance and Testing, Inc.
4180 Keller Rd., Ste. B
Holt, MI 48842
(517) 381-3283
andy.rusnak@impactcandt.com

Mr. Keith Miller
Plant Manager
Cadon Plating & Coatings, LLC
3715 Eleventh St.
Wyandotte, MI 48182
(734) 288-3819
keith.miller@cadonplating.com

1.2 Report Certification

This test report was prepared by Impact Compliance and Testing, Inc. based on field sampling data collected by Impact Compliance and Testing, Inc. Facility process data were collected and provided by Cadon employees or representatives. This test report has been reviewed by Cadon representatives and approved for submittal to the EGLE-AQD.

I certify that the testing was conducted in accordance with the approved test plan unless otherwise specified in this report. I believe the information provided in this report and its attachments are true, accurate, and complete.

Report Prepared By:

Andy Rusnak, QSTI
Technical Manager
Impact Compliance and Testing, Inc.

2.0 SOURCE AND SAMPLING LOCATION DESCRIPTION

2.1 Metal Parts Coating Line

Cadon operates dip spin coating lines that apply high performance corrosion-resistant coatings to miscellaneous metal parts (e.g., fasteners, nuts, bolts).

In each coating line parts are loaded into a feed bin and conveyed into the dip-spin coating section. In the dip-spin coating section, a steel basket containing the miscellaneous metal parts is submerged in a coating reservoir. The coating reservoir is then lowered and the basket is spun to remove excess coating from the surface of the coated parts. The excess coating is collected on the interior freeboard surface of the coating reservoir and gravity drains to the liquid level within the reservoir. The coated parts are then dropped to a conveyor that transports them through a two-zone curing oven and a cool down zone. At the exit of the cool down zone the parts are dropped to a final product collection bin.

EU-LINE4 is installed in a nonfugitive enclosure.

2.2 Type and Typical Quantity of Raw and Finished Materials Used in each Process

The high performance coatings are solvent or water based. Coatings are received from the manufacturer and diluted (reduced) with organic solvents or water as appropriate prior to their application. During the compliance testing coatings reduced with water and organic solvents were applied.

2.3 Emission Control System Description

Each coating line exhausts process air from the:

1. Dip-spin coating booth,
2. Capture hood or tunnel installed over the conveyor, where the coated parts are dropped from the basket;
3. Curing oven; and
4. Cool down zone.

Solvent laden process air exhausted from the dip-spin coating booths, conveyor hoods, and the coating ovens are combined and exhausted to the VOC emissions control system. Process air exhausted from the cool down zone contains low concentrations of VOC (approximately 10 ppm measured as propane) and are exhausted directly to the ambient atmosphere.

The RTO system consists of a variable frequency drive (VFD) inlet fan, rotary energy recovery chambers and a high-temperature combustion chamber containing natural gas-fired burners.

Fan speed is controlled (by the VFD controller) to maintain an appropriate vacuum within the process air collection system and direct the collected air to the RTO unit. The solvent laden air enters the RTO unit through the inlet manifold into the base of the rotary energy recovery chamber where it is preheated as it travels through the heat exchange media. The temperature of the preheated air is increased in the combustion chamber to complete the oxidation of hydrocarbons in the process air stream. The heated air flows through the outlet energy recovery chamber and is cooled (which raises the temperature of the heat exchange media) prior to being discharged to the ambient air through the vertical exhaust stack.

The energy recovery chambers are constantly rotating so that the heated heat exchange media (which was used to cool the exiting gas stream) becomes the preheating heat exchange media that is used to preheat the incoming solvent laden air.

2.4 Sampling Locations and Velocity Measurements

The sampling location for the:

- RTO inlet was in the 42-inch diameter main header duct (prior to the Line No. 2 exhaust tie-in) and in the 28-inch diameter Line No. 2 exhaust duct. Both measurement points are prior to RTO system fan.
- RTO outlet was in the 53x30-inch rectangular vertical exhaust stack.
- Line No. 4 captured gas stream was in the 26-inch diameter Line No. 4 exhaust duct.
- Line No. 4 uncaptured gas stream was in the 35.75-inch diameter Line No. 4 oven cooldown exhaust.

Velocity traverse locations for each sampling point were determined in accordance with USEPA Method 1. A cyclonic flow check was performed for each measurement location to verify acceptability of the flow profile. Exhaust gas velocity pressure and temperature were measured at each sampling location in accordance with USEPA Method 2 using an S-type Pitot tube connected to a red-oil manometer. A K-type thermocouple mounted to the Pitot tube was used for temperature measurements. The Pitot tube and connective tubing were periodically leak-checked to verify the integrity of the measurement system.

Appendix 2 provides diagrams of the test sampling locations.

3.0 SUMMARY OF RESULTS

3.1 Purpose and Objectives of the Tests

The coating lines and emissions control system are operated pursuant to the conditions of EGLE-AQD Permit to Install No. 252-00D, issued October 19, 2021.

Condition No. V.2. for FG-RTO (PTI No. 252-00D) states:

> *Within 180 days after commencement of trial operation of EU-LINE4, the permittee shall verify the capture efficiency of EU-LINE4 and the destruction efficiency of the RTO by testing at the owner's expense, in accordance with Department requirements.*

For the RTO destruction efficiency (DE) determination the RTO inlet and exhaust gas streams were simultaneously monitored for three (3) one-hour test periods during which the VOC, oxygen (O_2) and carbon dioxide (CO_2) concentrations were determined. Moisture content for the gas streams was also determined.

For the RTO capture efficiency (CE) determination the Line No. 4 captured exhaust gas stream and the uncaptured Line No. 4 cooldown oven exhaust gas stream were simultaneously monitored for three (3) one-hour test periods during which the VOC concentrations were measured using instrumental analyzers.

3.2 Variations from Normal Sampling Procedures or Operating Conditions

The testing was performed in accordance with the Test Protocol dated May 16, 2022 and specified USEPA test methods.

During the RTO DE testing the velocity traverse performed on the Line No. 2 exhaust duct and main header to the RTO were performed immediately prior to the start of the test run and at the end of the test run instead of during the test run as was proposed in the test protocol. This was done because the ports were sealed during the test run to prevent dilution of the sample with ambient air.

No variations from the normal operating conditions of the RTO occurred during the testing program.

All instrument calibrations and sampling period results satisfied the quality assurance verifications required by USEPA Methods 3A and 25A. EGLE requested that the measured VOC test concentrations be drift corrected using the measured calibration readings and the equations contained in USEPA Method 7E.

3.3 Process Operating Conditions During the Compliance Testing

Three (3) coating booths (Line Nos. 2, 3 and 4) were operated during the DE compliance test periods. Line No. 4 was operated during the CE compliance test periods. The booths applied solvent-based coatings.

Line operation was interrupted periodically for paint checks, viscosity adjustments, paint changes, basket changes, and lot separation, which is typical of normal operations. These process interruptions were kept to a minimum during the compliance test periods. Process information was recorded on production log sheets with other critical operating data.

Tables 3.1 and 3.2 present a summary of the production data for the test days.

The average recorded RTO combustion chamber temperature was 1,520 °F and the RTO fan was operated at 49.2 Hz.

Appendix 3 provides RTO temperature records.

The Line No. 2 curing oven temperature was operated at 396 °F, the Line No. 3 curing oven temperature was operated at 511 °F and the Line No. 4 curing oven temperature was operated at 492 °F.

Appendix 3 provides a records of the coating usage and curing oven temperatures.

3.4 Summary of Air Pollutant Sampling Results

The RTO inlet and exhaust gas streams were monitored simultaneously during three (3) one-hour test periods to determine the VOC mass flowrate entering and exiting the RTO for VOC destruction efficiency (DE) determination. The calculated VOC DE for the RTO averaged 96.1% by weight. The oxidizer operated at an average chamber temperature of 1,520 °F.

In a separate demonstration, the Line No. 4 captured process exhaust gas stream and Line No. 4 oven cooldown uncaptured exhaust were monitored simultaneously during three (3) test periods to determine the VOC capture efficiency (CE). The calculated VOC CE for the Line No. 4 process air collection system averaged 91.9% by weight. Observations of airflow direction performed during the test periods verified that the direction of airflow at each facility NDO is inward relative to the enclosure.

PTI No. 252-00D specifies a RTO DE of 95% and Line No. 4 CE of 80%. The results of the test event demonstrated compliance with the DE and CE design parameters.

Table 3.3 presents a summary of the compliance test results.

Table 3.1 Summary of production data during May 24, 2022 DE test event

Parameter	Test Run No. 1	Test Run No. 2	Test Run No. 3
Line No. 2			
B18 Coating Applied (gal)	3	2	2
PM Acetate Reducer Applied (gal)	1	2	2
Line No. 3			
BO6JA Coating/SC150 Reducer Applied (gal)	4	4	4
Line No. 4			
BO6JA Coating Applied (gal)	2	2	2
SC150 Reducer Applied (gal)	2	2	2

Table 3.2 Summary of production data during May 25, 2022 CE test event

Parameter	Test Run No. 1	Test Run No. 2	Test Run No. 3
Line No. 4			
BO6JA Coating Applied (gal)	2	2	2
SC150 Reducer Applied (gal)	1	1	2

Table 3.3 Summary of VOC control efficiency test results

Operating Parameter / Test Measurement	Test No.1 Results	Test No.2 Results	Test No.3 Results	Average
FG-RTO				
RTO Temperature (°F)	1522	1508	1529	1520
Destruction Efficiency (%)	95.8	96.2	96.4	96.4
Permitted Limit (%)	--	--	--	95
Line No. 4				
Capture Efficiency (%)	95.5	89.9	90.3	91.9
Permitted Limit (%)	--	--	--	80

4.0 SAMPLING AND ANALYTICAL PROCEDURES

The compliance testing consisted of the determination of total hydrocarbon (THC) concentration and air flowrate for the gas streams entering and exiting the RTO emission control system, and the captured and uncaptured gas streams exiting the Line No. 4 enclosure.

4.1 Summary of USEPA Test Methods

Impact Compliance and Testing, Inc. performed the exhaust gas and pollutant measurements in accordance with the following USEPA reference test methods:

Method 1	Velocity and sampling locations based on physical stack measurements.
Method 2	Gas flowrate determined using a type S Pitot tube.
Method 3A	RTO exhaust gas O_2 and CO_2 content determined using instrumental analyzers.
Method 3	RTO inlet and Line No. 4 enclosure exhaust O_2 and CO_2 content determined by Fyrite® combustion gas analyzers.
Method 4	Gas moisture based on the water weight gain in chilled impingers for the RTO exhaust gas streams. Moisture for all other sampling locations determined by wet bulb/dry bulb temperature measurements.
Method 25A	Total hydrocarbon concentration using a flame ionization analyzer (FIA) compared to a propane standard.
Method 204B	Determination of VOC emissions in captured vapor streams
Method 204E	Determination of VOC emissions from uncaptured vapor streams from a building enclosure (BE)

4.2 VOC Destruction Efficiency Determination

RTO VOC destruction efficiency was determined based on the simultaneous sampling of the RTO inlet and exhaust gas streams during three (3) one-hour sampling periods. THC concentration in the RTO inlet was measured by a Thermo Environment Instruments (TEI) Model 51 flame ionization detector (FID) according to USEPA Method 25A as described in Section 4.4 of this document. The RTO inlet THC sampling location was prior to the RTO but after the Line No. 2 exhaust duct tie-in (i.e., contained exhaust from all coating lines). THC concentration in the RTO exhaust was measured by a TEI Model 51c flame ionization detector (FID) according to USEPA Method 25A as described in Section 4.4 of this document.

Gas properties for the RTO inlet were determined pursuant to USEPA Methods 3 and 4 using Fyrite® gas scrubbers to determine carbon dioxide and oxygen (CO_2/O_2) content and moisture by the wet bulb/dry bulb approximation method. Gas properties for the RTO exhaust were determined pursuant to USEPA Methods 3A and 4 using instrumental analyzers to determine CO_2/O_2 content and moisture by the chilled impinger method.

Air velocity measurements for each sampling location were performed during each one-hour test period or prior to an after each test period using a type-S Pitot tube in accordance to USEPA Method 2. The RTO inlet gas flowrate was determined by adding the gas flowrate in the main header prior to the Line No. 2 tie-in to the gas flowrate in the Line No. 2 exhaust duct. The THC sampling location did not meet the Method 1 criteria for gas flowrate measurements, therefore, gas flowrate measurements were taken upstream at locations that met the Method 1 criteria.

4.3 VOC Capture Efficiency Determination

The Line No. 4 enclosure operates as a non-fugitive enclosure (a permanent total enclosure with uncontrolled atmospheric exhausts). The enclosure contains the three (3) coating booths and transfer conveyors. VOC capture efficiency was determined by a gas/gas capture efficiency protocol around the enclosure. A total of two (2) FID instruments were used simultaneously to measure the THC concentration in the captured and uncaptured gas streams. The:

- Line No. 4 exhaust to the RTO (captured gas stream) was monitored continuously using a TEI Model 51 FID analyzer and the captured VOC mass flowrate was determined using USEPA Method 204B.

- One (1) oven cooldown zone exhaust (uncaptured) was monitored continuously during each test period using a TEI Model 51c FID analyzer.

The total uncaptured VOC mass emission rate was determined using USEPA Method 204E.

The CO_2/O_2 content for each gas stream was comparable to ambient air and verified using Fyrite® gas scrubbers. Moisture content of all gas streams was determined based on wet bulb-dry bulb temperature measurements. Air velocity measurements were performed for each gas stream during each capture efficiency test period using a type S Pitot tube in accordance with USEPA Method 2.

During each capture efficiency test period, the direction of airflow into the enclosure through all open natural draft openings (primarily manway doors, enclosure opening sweeps or overhead doors) were verified using chemical airflow indicator tubes (smoke tubes). Observations of airflow direction performed during the test periods verified that the direction of airflow at each facility NDO is inward relative to the enclosure.

4.4 Instrumental Analyzer Operating Procedures

THC concentration in the exhaust gas streams identified in the previous section was determined by USEPA Method 25A, *Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer*. Throughout each test period, a gas sample from each measurement location was delivered to the instrument rack using a heated Teflon sample line and extractive gas sampling system. Hydrocarbon concentrations were determined using a TEI Model 51c or TEI Model 51 FID instrument. The sampled gas stream was not dried prior to being introduced to the FID instruments; therefore, THC concentration measurements correspond to standard conditions with no moisture correction.

CO_2/O_2 content for the RTO exhaust was monitored continuously throughout the VOC DE test periods using a Servomex 1440D infrared (IR) analyzer for CO_2 and a paramagnetic sensor for O_2 in accordance with USEPA Method 3A. The sampled gas stream was dried prior to analysis using a refrigerant-based condenser equipped with a peristaltic pump to remove moisture from the sampled gas stream. Therefore, CO_2 and O_2 concentration measurements were performed on a dry gas basis.

At the conclusion of each test period, instrument calibration was verified against a mid-range (or representative up-scale) calibration gas and zero gas. The FID instruments were calibrated with certified concentrations of propane in air and zeroed using hydrocarbon-free air. The CO_2/O_2 analyzer was calibrated using certified concentrations of CO_2 and O_2 in nitrogen and zeroed using nitrogen. Concentrations measured with the instrumental analyzers were adjusted for calibration error and zero drift using the procedures in Method 7E.

The TEI Model 51c and 51 FID analyzers and Servomex CO_2/O_2 analyzer were rack-mounted in a mobile sampling trailer. Instrument response for each analyzer was recorded on an ESC Model 8816 data logging system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

4.5 Quality Assurance Procedures

Accuracy of the instrumental analyzers used to measure THC, O_2 and CO_2 concentration was verified prior to and at the conclusion of each test period using the calibration procedures in Methods 25A, 3A and 7E. Prior to the first test period, appropriate high-range, mid-range and low-range span gases (USEPA protocol 1 certified calibration gases) followed by a zero gas (hydrocarbon free air or nitrogen) were introduced into each sampling system to verify instrument response and sampling system integrity. The calibration gas was delivered to the sampling system through a spring-loaded check valve and a stainless steel "Tee" installed at the base of the sample probe.

The gas divider used to obtain intermediate calibration gas concentrations had been NIST-certified within the previous year with a primary flow standard in accordance with USEPA Method 205 and were verified in the field according the procedures in Method 205, Section 3.2.

The Pitot tubes used for velocity pressure measurements were inspected for mechanical integrity and physical design prior to the field measurements. The gas velocity measurement trains (Pitot tube, connecting tubing and incline manometer) were leak-checked prior to the field measurements and periodically throughout the testing period. The absence of cyclonic flow was also verified for each measurement point.

The Nutech® Model 2010 sampling console and dry gas meter, which was used to extract a metered amount of exhaust gas from the RTO exhaust stack for moisture determination, was calibrated prior to and after the test event using the critical orifice calibration technique specified in USEPA Method 5. The digital pyrometer in the Nutech metering console was calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

Appendix 4 provides information and quality assurance data for the equipment and instrumental analyzers used for the destruction and capture efficiency test periods (calibration data, copies of calibration gas certificates, gas divider certification, Pitot tube integrity inspection sheets, and meter box critical orifice calibration records).

5.0 TEST RESULTS AND DISCUSSION

5.1 RTO VOC Destruction Efficiency

The RTO inlet and exhaust gas streams were sampled May 24, 2022 for three (3) one-hour test periods to determine VOC concentration and volumetric flowrate for each gas stream. Inlet and outlet THC concentration was monitored continuously using flame ionization analyzers. Air flowrate measurements were performed during each test period or prior to and after each test period.

VOC mass flowrate (as propane) into and out of the control device was calculated using the following equation:

$$M_{VOC} = Q\,[C_{VOC}]\,MW\,(60\ min/hr) / V_M / 1E{+}06$$

Where:
M_{VOC} = Mass flowrate VOC (lb/hr)
Q = Volumetric flowrate corrected to standard conditions (scfm)
C_{VOC} = VOC concentration (ppmv as propane)
MW = Molecular weight of propane (44.1 lb/lb-mol)
V_M = Molar volume of ideal gas at standard conditions (385 scf/lb-mol)

VOC destruction efficiency was determined based on the ratio of the inlet and outlet THC mass flowrate:

$$VOC\ DE = [1 - (M_{VOC,out} / M_{VOC,in})] \times 100\%$$

The average measured THC concentration for the combined coating line exhaust to the RTO was 243 parts per million by volume (ppmv) measured as propane. The average measured volumetric flowrate into the RTO was 19,441 standard cubic feet per minute (scfm), resulting in an average VOC mass flowrate of 32.4 pounds per hour (lb/hr) into the RTO.

The average measured THC concentration in the RTO exhaust was 11.8 ppmv as propane. Based on the measured flowrate of 15,447 scfm, the calculated exit VOC mass flowrate was 1.26 lb/hr, resulting in an average VOC DE of 96.1 percent by weight (% wt.)

Table 5.1 presents measured gas conditions and results for the VOC destruction efficiency test periods.

Appendix 5 provides calculations and field data sheets used to determine VOC mass flow rate and destruction efficiency for each one-hour test period.

Appendix 7 provides records of the instrumental analyzer response raw data.

5.2 Line No. 4 Enclosure VOC Capture Efficiency

A total of one (1) uncaptured exhaust (oven cooldown zone exhaust) and one captured gas stream (Line No. 4 exhaust duct to RTO) were measured to determine VOC capture efficiency. Three (3) one-hour capture efficiency test periods were performed. The gas streams were monitored continuously throughout each capture efficiency test period.

The captured VOC mass flowrate (M_{VOC}) was calculated using the equation presented in the previous section, which is consistent with procedures presented in USEPA Method 204B, *Volatile Organic Compound Emissions in Captured Stream.* The uncaptured VOC mass flowrate for the uncaptured exhaust was calculated using the same equation and the procedures presented in Method 204E, *Volatile Organic Compound Emissions in Uncaptured Stream from Building Enclosure.* VOC capture efficiency was determined by the ratio of the captured VOC mass flow to total measured VOC mass flow using the following equation:

$$CE_{VOC} = \frac{M_{VOC,\,Cap}}{M_{VOC,\,Cap} + M_{VOC,Uncap}} \quad (100\ \%)$$

Where:

CE_{VOC} = VOC capture efficiency (% weight)
$M_{VOC,\,Cap}$ = VOC mass flowrate for captured stream (lb/hr)
$M_{VOC,\,Uncap}$ = VOC mass flowrate in uncaptured exhaust (lb/hr)

The average measured VOC mass flowrate for the captured gas stream was 17.9 lb/hr compared to an average measured uncaptured VOC mass emission rate of 1.43 lb/hr. This results in a calculated average capture efficiency of 91.9% by weight.

Table 5.2 presents measured captured and uncaptured Line No. 4 enclosure exhaust gas conditions and results for the VOC capture efficiency test periods.

Appendix 6 provides calculations and field data sheets used to determine exhaust gas conditions and volumetric flowrates and calibrations for each test period.

Appendix 7 provides records of the instrumental analyzer response raw data.

5.3 Line No. 4 Enclosure Verification

Twelve (12) natural draft openings (NDOs) in the Line No. 4 enclosure were monitored. Once during each test period the direction of airflow through each NDO was verified using chemical smoke tubes.

Observations of airflow direction performed during the test periods verified that the direction of airflow at each Line No. 4 NDO is inward relative to the enclosure. Therefore, all fugitive emissions from Line No. 4 are either captured within the process air collection system and

directed to the RTO or exhausted to the atmosphere through the identified uncaptured oven cooldown exhaust, which were measured during the tests.

Appendix 6 provides observations for the Line No. 4 enclosure NDOs.

Table 5.1 Measured gas conditions and results for the VOC destruction efficiency test

Date Test Times	5/24/22 1006-1106	5/24/22 1155-1255	5/24/22 1330-1430	
Operating Data	**Test 1**	**Test 2**	**Test 3**	**Avg**
Line No. 2 Oven Temperature (°F)	396	397	395	396
Line No. 3 Oven Temperature (°F)	512	510	510	511
Line No. 4 Oven Temperature (°F)	492	492	492	492
RTO Average Temperature (°F)	1522	1508	1529	1520
RTO Average Fan Speed (Hz)	49.2	49.2	49.2	49.2
RTO Inlet Gas				
Main header flowrate[1] (scfm)	15,201	15,172	15,504	15,292
Line No. 2 flowrate (scfm)	4,176	4,076	4,195	4,149
Combined RTO inlet flowrate (scfm)	19,377	19,248	19,699	19,441
Average THC Conc.[2] (ppmv C_3)	268	259	201	243
Calculated VOC Mass Flow[2] (lb/hr)	35.6	34.3	27.2	32.4
RTO Exhaust Gas				
Flowrate (scfm)	16,247	14,999	15,095	15,447
Average NMHC Conc. [2] (ppmv C_3)	13.3	12.6	9.53	11.8
Calculated VOC Mass Flow[3] (lb/hr)	1.48	1.30	0.99	1.26
Calculated Destruction Efficiency[4]				
$[1 - (M_{VOC,out} / M_{VOC,in})] \times 100\%$	95.8%	96.2%	96.4%	96.1%

Table 5.1 Notes

1. Measured upstream of the Line No. 2 tie-in.
2. Total hydrocarbon concentration as propane measured using a flame ionization analyzer in accordance with USEPA Method 25A.
3. THC mass flowrate calculated as propane:
   (Gas Flowrate, scfm) (Concentration, ppmv) (44.1 lb/lbmol) (60 min/hr) / (385 scf/lbmol) / 1E+06
4. Based on VOC mass flowrate.

Table 5.2 Measured gas conditions and results for the VOC capture efficiency test

Date Test Times	5/25/22 835-935	5/25/22 1015-1115	5/25/22 1200-1300	
Line No. 4 Exhaust (Captured)	**Test 1**	**Test 2**	**Test 3**	**Avg.**
Flowrate (scfm)	7,770	7,782	7,384	7,645
Avg. THC Conc.[1] (ppmv C_3)	476	242	300	339
Calc. VOC Mass Flow[2] (lb/hr)	25.4	12.9	15.2	17.9
Line No. 4 Oven Cooldown (Uncaptured)				
Flowrate (scfm)	26,879	27,146	27,977	27,334
Avg. THC Conc.[1] (ppmv C_3)	6.48	7.82	8.46	7.59
Calc. VOC Mass Flow[2] (lb/hr)	1.20	1.46	1.63	1.43
Calculated Capture Efficiency				
Total captured mass flow (lb/hr)	25.4	12.9	15.2	17.9
Total uncaptured mass flow (lb/hr)	1.20	1.46	1.63	1.43
Capture efficiency[3]	95.5%	89.9%	90.3%	91.9%

Table 5.2 Notes

1. Total hydrocarbon concentration as propane measured using a flame ionization analyzer in accordance with USEPA Method 25A.
2. THC mass flowrate calculated as propane:
   (Gas Flowrate, scfm) (Concentration, ppmv) (44.1 lb/lbmol) (60 min/hr) / (385 scf/lbmol) / 1E+06
3. Capture efficiency determined by the ratio of the captured VOC mass flow to total measured VOC mass flow: (VOC captured) / (VOC captured + VOC uncaptured).