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FCA US LLC
Warren Truck Assembly Plant
Warren, Michigan

Final Report

E-Coat Total Hydrocarbon Destruction Efficiency Testing
RWDI # 1600240
December 2, 2015

[redacted]

SUBMITTED TO

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SUBMITTED BY

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RECEIVED
DEC 03 2015
AIR QUALITY DIV.

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EXECUTIVE SUMMARY

RWDI AIR Inc. (RWDI) was retained by FCA US LLC to complete destruction efficiency for volatile organic compounds on the rotary regenerative thermal oxidizer (RTO) controlling the oven emissions from the EU-UniPrime at Warren Truck Assembly Plant (WTAP). As outlined in WTAP's Renewable Operating Permit No. MI-ROP-B2767-2011, the EU-Uniprime shall not operate unless the associated thermal oxidizer for the ovens is installed and operating properly. Section III (Process/Operational Restriction(s)) notes that:

> *"The permittee shall not operate EU-Uniprime unless the associated thermal oxidizer for the ovens is installed and operating properly. Proper operation of the Thermal Oxidizer includes maintaining a minimum 3-hour average combustion chamber temperature no more than 50 degrees Fahrenheit below 1450°F or the average combustion chamber temperature during the most recent acceptable performance test that demonstrated the equivalent destruction efficiency and has been accepted by the AQD District Supervisor.* ***(R 336.1910, 64.6(c)(i)&(ii), R 366.1213(3))***.

Cathodic electrodeposition primer (electrocoat) is applied to vehicle bodies. The application process consists of vehicle bodies being submerged in an enclosed electrocoat dip tank. The vehicles proceed through a curing oven where volatile organic compounds are released into a rotary regenerative thermal oxidizer (RTO). The emissions from the RTO are directed to a stack.

Three 1-hour tests concurrently at the inlet and outlet were conducted in order to determine the average destruction efficiency of the RTO. Stack gas velocity, gas composition and moisture were also taken once during the three (3) 1-hour tests. The sampling was conducted from November 5, 2015. Sampling was witnessed by Mr. Mark Dziadosz from the Southeast Michigan Air Quality Division of the State of Michigan Department of Environmental Quality

The sampling train for VOC consisted of a flame ionization analyzer as described in USEPA Method 25a. VOC concentrations were continuously collected via heated sample lines from both the inlet and outlet of the EU-Uniprime RTO simultaneously.

Results of the sampling program are outlined in the following table. Results of individual tests are presented in the Appendices.

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E-Coat Oxidizer – Summary of Results – Destruction Efficiency Based on Concentration

Test ID	Date	Start	End	Vehicles per hour	Inlet VOC (propane) (ppmv)	Outlet VOC (propane) (ppmv)	Outlet Methane (as propane) (ppmv)	Outlet NMVOC THC (propane) (ppmv)	Destruction Efficiency [1]
Test 1	2015-11-05	6:45	7:46	37	106	17.7	7.2	10.4	90.1%
Test 2	2015-11-05	8:16	9:18	36	96	13.0	6.9	6.0	93.7%
Test 3	2015-11-05	9:50	10:50	31	90	13.1	7.4	5.6	93.8%
				Average	97	14.6	7.2	7.4	92.5%

Notes:

[1] Destruction Efficiency is calculated based on total NMVOC
VOC – Volatile Organic Compounds
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ppmv – parts per million by volume

E-Coat Oxidizer – Summary of Results – Destruction Efficiency Based on Mass Rates

RTO Combustion Chamber Temperature (°F)	Vehicles per hour	Inlet VOC (propane) (lb/hr)	Inlet NMVOC (propane) (lb/hr)	Destruction Efficiency [1]
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1. INTRODUCTION

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2. SOURCE DESCRIPTION

2.1 Facility Description

WTAP is located at 21500 Mound Road in Warren, Michigan. The facility completes assembly and paint operations for the Ram Trucks. Cathodic electrodeposition primer (electrocoat) is applied to vehicle bodies. The application process consists of vehicle bodies being submerged in an enclosed electrocoat dip tank. The vehicles proceed through a curing oven where volatile organic compounds are released into a rotary regenerative thermal oxidizer (RTO). The emissions from the RTO are directed to a stack.

The inlet and outlet sampling location for the EU-Uniprime RTO met the USEPA Method 1 criteria. Therefore, the inlet and outlet sampling locations were used for VOC destruction efficiency as well as stack gas velocity, composition and moisture. Three 1-hour tests concurrently at the inlet and outlet were taken for the destruction efficiency testing. Stack gas velocity, gas composition and moisture were measured once during the three (3) 1-hour tests since the temperature did not vary more than 50°F from 1375°F.

The sampling train for VOC consisted of a flame ionization analyzer as described in USEPA Method 25a. The gas was continuously sampled via heated sample lines from both the inlet and outlet of the EU-Uniprime RTO simultaneously.

3. SAMPLE LOCATION

Continuous emissions monitoring (CEM) for total VOCs, as propane occurred on the inlet of the oxidizer. Total VOCs were monitored at a single point in the middle of the duct and exhaust stack. The outlet locations were tested at upper platform of the stack. Proper sampling ports were used for the outlet locations.

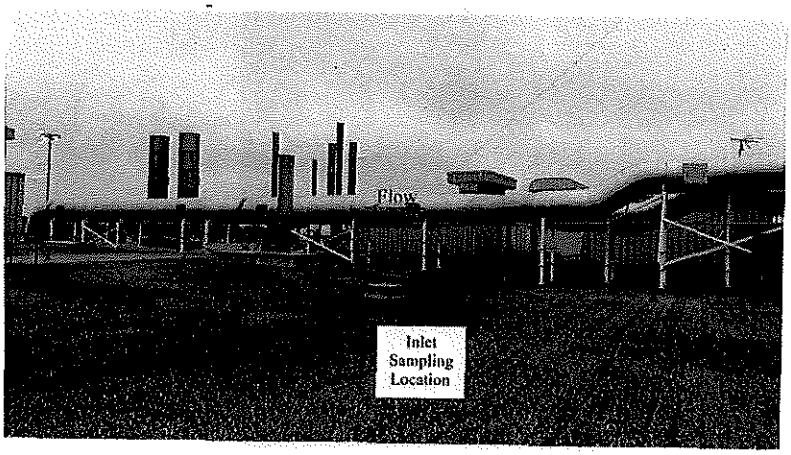

Figure 1: EU Uniprime RTO Inlet Location

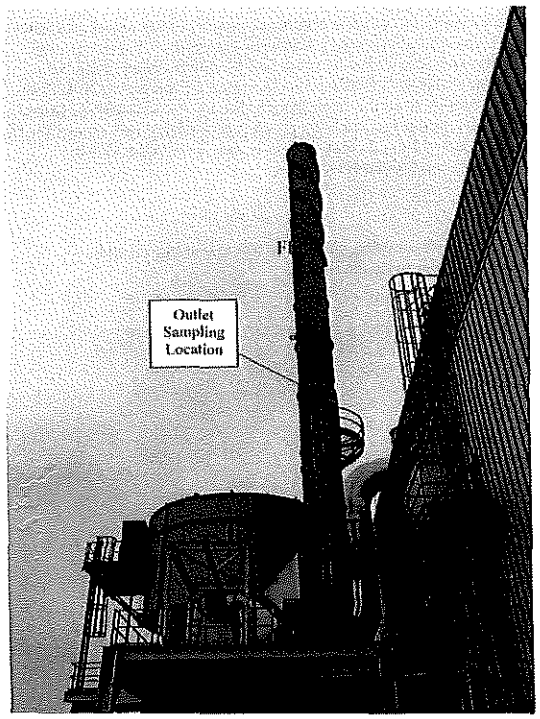

Figure 2: EU Uniprime RTO Outlet Location

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4. SAMPLING METHODOLOGY

4.1 Testing Methodology

The following table summarizes the test methodologies that were followed during this program.

Table 1: Summary of Test Methodology

Parameter	Proposed Method
Velocity, Temperature, Flow rate	USEPA Method 1 to 4
Total VOCs	USEPA[a] Method 25A (CEM)
Total Methane and Total Non-Methane VOCs	USEPA[2] Method 25A (CEM)

Notes: [1] USEPA = United States Environmental Protection Agency

4.2 Description of Testing Methodology

The following section provides brief descriptions of the sampling methods.

4.2.1 Stack Velocity, Temperature, and Volumetric Flow Rate Determination

The exhaust velocities and flow rates were determined following the USEPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate". Velocity measurements were taken with a pre-calibrated S-Type pitot tube on the inlet and a pre-calibrated standard pitot on the outlet. All pressure readings were taken with an incline manometer. Volumetric flow rates were determined following the equal area method as outlined in USEPA Method 2. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a Type K chromel-alumel thermocouple in conjunction with a digital temperature indicator. As noted in the Notification for testing, flow measurements were only completed once during the testing at the inlet and outlet of the RTO.

The dry molecular weight of the stack gas was determined following calculations outlined in USEPA Method 3, "Determination of Molecular Weight of Dry Stack Gas". Oxygen and carbon monoxide were monitored using an electrochemical cell and a non-dispersive infrared sensor. Stack moisture content was determined through direct condensation and according to USEPA Method 4, "Determination of Moisture Content of Stack Gas". As noted in the Notification for Testing, moisture test was only complete at the outlet of the exhaust stack.

4.2.2 Continuous Emissions Monitoring for VOCs

Testing for VOCs was accomplished simultaneously at the inlet and outlet using continuous emission monitors (CEM). VOC testing followed USEPA Method 25A "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer" In order to compare inlet and outlet concentrations, the outlet concentrations of total VOCs, methane, and non-methane VOCs were converted to parts per million (ppmv) as propane. The exhaust gas sample was withdrawn from a single point at the centre of the duct/stack using a stainless steel probe. The sample proceeded through a heated filter where particulate matter was removed. The sample was then transferred via a heated Teflon® line and introduced to the analyzer (hot/wet) for measurement.

Prior to testing, instrument linearity checks and calibration error checks were conducted. USEPA protocol gases were used for all span values. The FIAs were calibrated using zero (>1% of span value) and high (80-90% of span value) sent though the system to the sample tip and returned to the analyzers. Low Span gas (25 to 35% of span value) and mid (45 to 55% of span value) were then introduced. In addition, the analyzers were calibrated (zeroed and span checked) at the completion of each test using the Zero and Mid span gases. The test runs were considered valid provided the response was within ±3% from the instrument span value. **Appendix B** contains the span value data.

Data acquisition was provided using a data logger system programmed to collect and record data at one second intervals. Average one minute concentrations were calculated from the one second measurements.

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4.3 Process Data

WTAP representatives provided production information during testing of the EU Prime Oven RTO including one minute temperature data for the RTO and vehicle throughput of the oven. The following is a table outlining the production data. Further details are provided in **Appendix C**.

Table 4.3.1: Summary of Production Data

Test Times	RTO Chamber Temperature (°F)	Average Vehicle Count (vehicles per hour)
6:45 am to 7:46 am	1378	37
8:16 am to 9:18am	1378	36
9:50 am to 10:50 am	1378	31

Stuart Duncan and Rohit Patel from FCA US LLC recorded and monitored the process during the testing to ensure the production rate was within typical normal production values. Production rates remained, on average, between 31 and 37 vehicles per hour during the testing. Prior to commencing with the testing, Mr. Duncan confirmed that the process was operating normally. No process shut downs or disruptions were encountered during the testing period.

5. RESULTS

The average emission results for this study are presented in the following tables. Detailed information regarding each test run can be found in the **Appendix B**.

Table 5.1.1: E-Coat Oxidizer – Summary of Results - Destruction Efficiency Based on Concentration

Test ID	Date	Start	End	Vehicles per hour	Inlet VOC (propane) (ppmv)	Outlet VOC (propane) (ppmv)	Outlet Methane (as propane) (ppmv)	Outlet NMVOC THC (propane) (ppmv)	Destruction Efficiency [1]
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Table 5.1.2: E-Coat Oxidizer – Summary of Results – Destruction Efficiency Based on Mass Rate

RTO Combustion Chamber Temperature (°F)	Vehicles per hour	Inlet VOC (propane) (lb/hr)	Inlet NMVOC (propane) (lb/hr)	Destruction Efficiency [1]
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Notes:
lb/hr – pounds per hour as propane
VOC – Volatile Organic Compounds
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DE: Destruction Efficiency

The velocity, temperature were measured at the inlet and outlet locations. Moisture measurements were only collected at the inlet and assumed to be applicable to the outlet as noted in the Notification for Testing. **Appendix D** contains detailed flow data.

All sampling field notes are provided in **Appendix E**. All calibration data can be found in **Appendix F**. Calibration gas certificates are provided in **Appendix G**. Sample calculations are provided in **Appendix H**.

6. CONCLUSIONS

Testing was successfully completed on November 5, 2015. All parameters were tested in accordance with referenced methodologies.