FINAL REPORT

FCA US LLC

DETROIT, MICHIGAN

JEFFERSON NORTH ASSEMBLY PLANT: EU-ECOAT SYSTEM VALIDATION TESTING REPORT

RWDI #2102739

August 25, 2021

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) was retained by FCA US LLC (FCA) to complete the validation emission sampling program for the dip tank versus curing oven "split" of EU-ECOAT (sources within this group are also referred to as ECOAT) volatile organic compounds (VOC) emissions at their Jefferson North Assembly Plant (JNAP) located at 2101 Connor Ave., Detroit, Michigan. JNAP operates an automobile assembly plant that produces Jeep Grand Cherokee and Dodge Durango models. Testing was done to meet requirements within Appendix 5 of Title V Renewable Operating Permit (ROP) MI ROP-N2155-2017. A copy of the ROP is provided in **Appendix A**. The sources that would be included in the testing program include:

- ST-PS-018 – Stage 2 Exhaust (ECoat Dip Tank #2);
- ST-PS-016 – Stage 1 Exhaust; (ECoat Dip Tank #1);
- ECOAT Oven Exhaust TAR (Incinerator) A Inlet (ECoat Oven); and
- ECOAT Oven Exhaust TAR (Incinerator) B Inlet (ECoat Oven).

A minimum of three concurrent 1-hour tests at each source were conducted in order to determine the average VOC emission rate "split" between the Ecoat Dip Tank and the ECoat Oven. This split effectively delineates between abated and unabated air streams exhausting from the EU-ECOAT system. Stack gas velocity was taken once during each 1-hour test for each source. A moisture analysis was taken one time at each source. The sampling was conducted on June 29, 2021. Sampling was witnessed by Ms. Regina Angellotti from the Southeast Michigan Air Quality Division of the State of Michigan Department of Environment, Great Lakes and Energy (EGLE).

The sampling train for VOC's consisted of a flame ionization detector (FID) as described in USEPA Method 25A. The samples were collected via EPA Method 18 consisting of a lung and Tedlar bag and then introduced to the back of the analyzer.

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

Source: EU-ECOAT – Run Times (June 29, 2021)

Test #	Sampling Date	Start Time	End Time
Test #1	29-Jun-21	7:37 AM	8:36 AM
Test #2	29-Jun-21	9:52 AM	10:51 AM
Test #3*	29-Jun-21	11:42 AM	1:15 PM

*For Test 3, sample bag collected during 2nd half of test leaked. As per on-site discussions with EGLE, a 3rd set has collected and used for the analysis

Source: EU-ECOAT – VOC Emissions Summary (June 29, 2021)

Test	E-Coat #1 - Dip Tank THC (lb/hr)	E-Coat #2 - Dip Tank THC (lb/hr)	E-Coat TAR A Inlet - Oven THC (lb/hr)	E-Coat TAR B Inlet - Oven THC (lb/hr)	Total THC (lb/hr)
1	1.130	0.621	2.739	3.238	7.728
2	1.067	0.662	2.425	3.368	7.521
3	0.886	0.674	2.834	3.814	8.207
Average	1.027	0.652	2.666	3.473	7.819

Source: EU-ECOAT – VOC Emission Split Summary (June 29, 2021)

Test	E-Coat #1 - Dip Tank THC (%)	E-Coat #2 - Dip Tank THC (%)	E-Coat TAR A Inlet - Oven THC (%)	E-Coat TAR B Inlet - Oven THC (%)	Total E-Coat Dip Tank Split (%)	Total E-Coat Oven Split (%)
1	14.62%	8.04%	35.44%	41.90%	22.66%	77.34%
2	14.18%	8.80%	32.24%	44.78%	22.98%	77.02%
3	10.80%	8.21%	34.53%	46.47%	19.01%	80.99%
Average	13.20%	8.35%	34.07%	44.38%	21.55%	78.45%

The results were incorporated in emission reporting beginning July 1, 2021.

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1 INTRODUCTION

RWDI USA LLC (RWDI) was retained by FCA US LLC (FCA) to complete the validation emission sampling program for the dip tank versus curing oven "split" of EU-ECOAT (sources within this group are also referred to as ECOAT) volatile organic compounds (VOC) emissions at their Jefferson North Assembly Plant (JNAP) located at 2101 Connor Ave., Detroit, Michigan. JNAP operates an automobile assembly plant that produces Jeep Grand Cherokee and Dodge Durango models. Testing was done to meet requirements within Appendix 5 of Title V Renewable Operating Permit (ROP) MI ROP-N2155-2017. A copy of the ROP is provided in **Appendix A**. The sources that would be included in the testing program include:

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- ST-PS-016 – Stage 1 Exhaust; (ECoat Dip Tank #1);
- ECOAT Oven Exhaust TAR (Incinerator) A Inlet (ECoat Oven); and
- ECOAT Oven Exhaust TAR (Incinerator) B Inlet (ECoat Oven).

A minimum of three concurrent 1-hour tests at each source were conducted in order to determine the average VOC emission rate "split". Stack gas velocity was taken once during each 1-hour test for each source. A moisture analysis was taken one time at each source. The sampling was conducted on June 29, 2021. Sampling was witnessed by Ms. Regina Angellotti from the Southeast Michigan Air Quality Division of the State of Michigan Department of Environment, Great Lakes and Energy (EGLE).

A copy of the Source Testing Plan and ROP is in **Appendix A** of this report. A copy of the approval letter is provided in **Appendix B**.

2 SOURCE DESCRIPTION

2.1 Facility Description

JNAP operates an automobile assembly plant that produces Jeep Grand Cherokee and Dodge Durango models for FCA US LLC. Under Flexible Group: EU-ECOAT, there are two (2) recuperative thermal oxidizers (also referred to as incinerators or TARs) (for abating the sole EU-ECOAT curing oven) which are not part of this testing program. Air streams were measured at the inlet of the two (2) TARs but the performance of the TARs is not addressed in this testing program. This report presents the "split" in VOC emissions between the Oven and the Dip Tank.

3 SAMPLE LOCATION

Figures 1 through **4** below depict the sources sampled. Photographs of each sampling location are presented below. Oven sampling locations are located inside the building.

Figure 1: EU-ECOAT ST-P5-016 – Stage 1 Exhaust (Dip Tank)

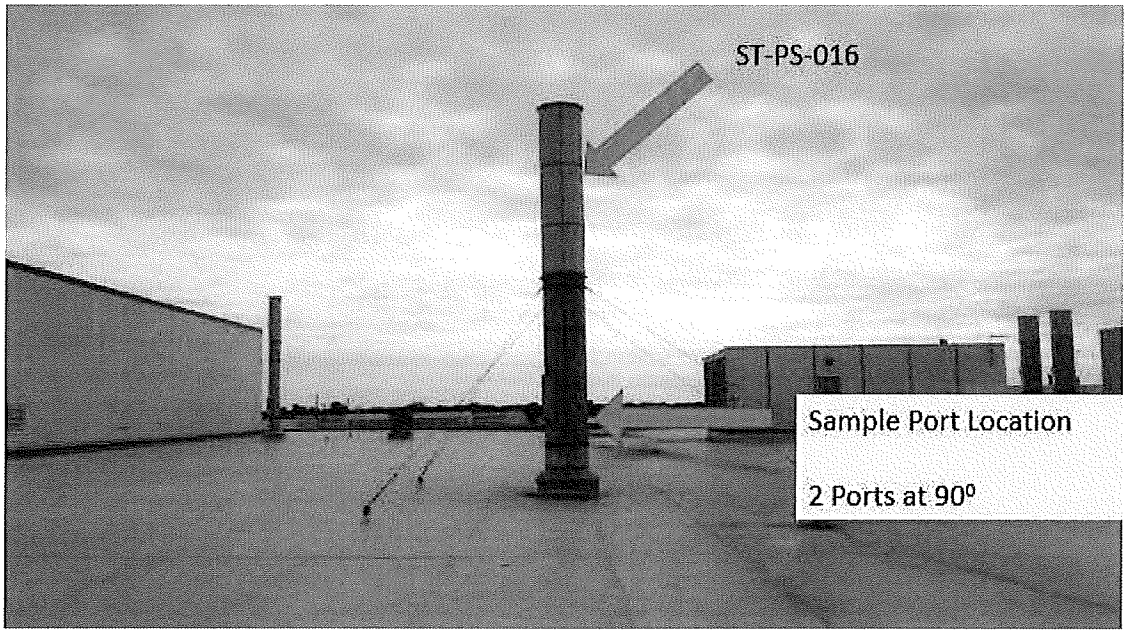


Figure 2: EU-ECOAT ST-P5-018 – Stage 5 Exhaust (Dip Tank)

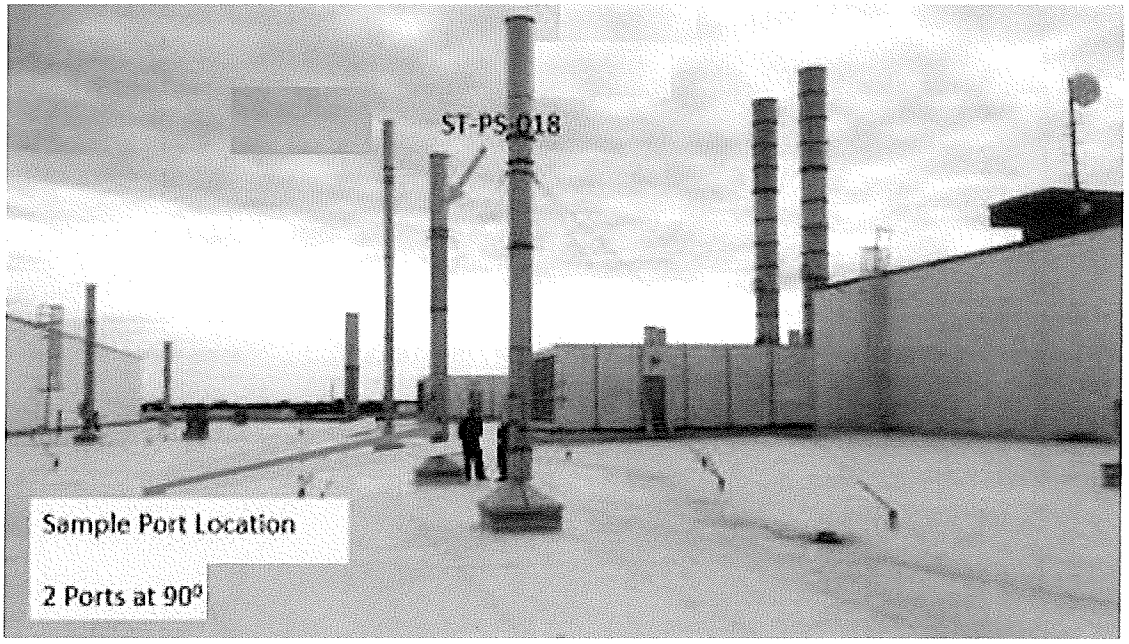


Figure 3: EU-ECOAT Oven Inlet A

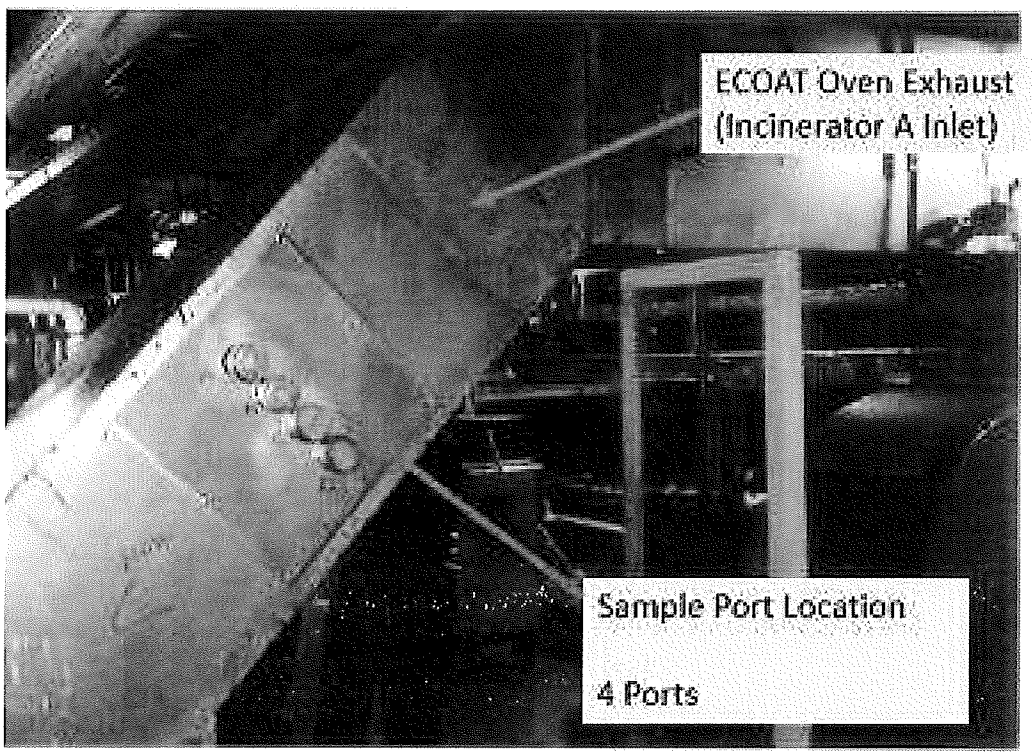
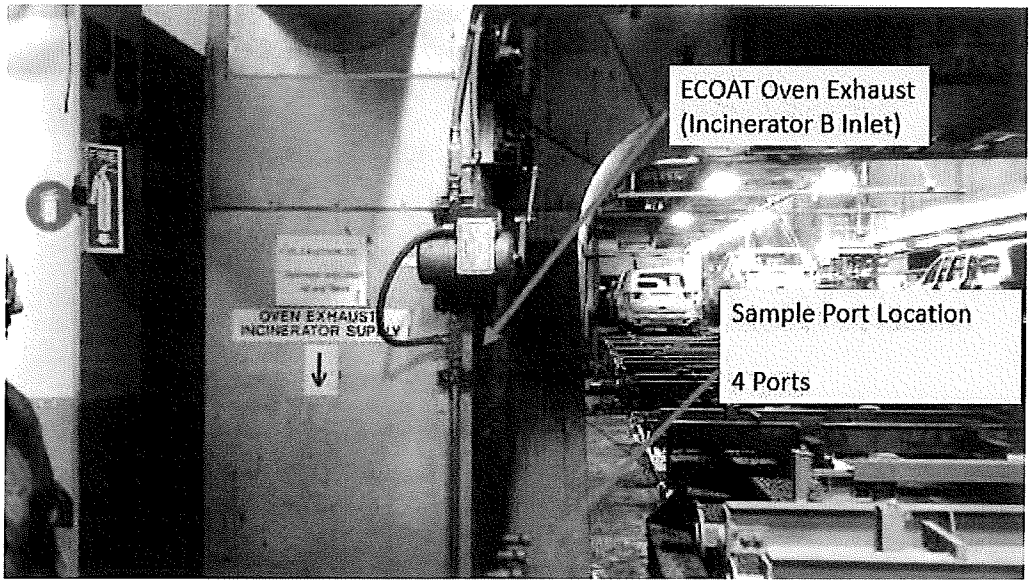


Figure: 4: EU-ECOAT Oven Inlet B



4 SAMPLING METHODOLOGY

4.1 Testing Methodology

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

Table 4.1: Summary of Test Methodology

Source Location	No. of Tests per Stack	Sampling Parameter	Sampling Method
Dip Tank & Oven (4 Sources)	3	Volumetric Flow Rate	U.S. EPA [1] Methods 1 & 2
	3	Molecular Weight (O_2, CO_2)	U.S. EPA [1] Method 3
	1	Moisture	U.S. EPA [1] Method 4
	3	Total Hydrocarbons	U.S. EPA [1] Method 18/25A
	3	Methane	U.S. EPA [1] Method 18/25A

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. 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. Flow measurements were completed once during each test at all four sources.

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". One moisture test was completed at each of the four sources. All information pertaining to stack gas flow rate can be found in **Appendix D.**

4.2.2 Continuous Emissions Monitoring for VOCs

Testing for VOCs was accomplished simultaneously at all four emission sources using lung sampling and continuous emission monitors (CEM). VOC testing followed USEPA Method 25A "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer" and USEPA Method 18 "Measurement of Gaseous Organic Compound by Gas Chromatography". A lung and pump sampling apparatus was set up at each source, and the exhaust gas sample was withdrawn at a constant rate from a single point at the center of each duct/stack using a stainless steel probe. The pump was used to evacuate the lung and pull exhaust gas from the stack into a Tedlar bag. The Tedlar bag containing exhaust gas was then connected to a calibrated analyzer for analysis.

Prior to testing, instrument linearity checks and calibration error checks were conducted on the FID analyzers. USEPA protocol gases were used for all span values. The FIDs 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 and mid ranges 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. One analyzer was prepared in the 0-100 ppm range, and another in the 0-1000 ppm range to capture all values. The highest one-minute average of each bag sample was used in reporting the results.

Appendix C contains detailed data for the sampling program including summary of results, the span value data, averages, and max value from each bag. All field notes are provided in **Appendix E**.

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.

4.3 Process Data

JNAP representatives provided the production rate for each process during the testing program. Mr. Thomas Caltrider and Mr. Steven Szura from FCA US LLC recorded and monitored the process during the testing to ensure the production rate was within typical normal production rates. Prior to commencing with the testing, Mr. Caltrider and/or Mr. Szura confirmed that the process was operating normally. Further details are provided in **Appendix G**.

5 MODIFICATIONS

During test 3, one bag did not fill so an extra bag was taken at all four sources for an extra 30 minutes. These bags were used in the data analysis to account for analysis on the full 60 minute test run.

6 RESULTS

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

Table 6.1: EU-ECOAT – Run Times (June 29, 2021)

Test #	Sampling Date	Start Time	End Time
Test #1	29-Jun-21	7:37 AM	8:36 AM
Test #2	29-Jun-21	9:52 AM	10:51 AM
Test #3*	29-Jun-21	11:42 AM	1:15 PM

*For Test 3, sample bag collected during 2nd half of test leaked. As per on-site discussions with EGLE, a 3rd set has collected and used for the analysis

Table 6.2: EU-ECOAT – VOC Emissions Summary (June 29, 2021)

Test	E-Coat #1 - Dip Tank THC (lb/hr)	E-Coat #2 - Dip Tank THC (lb/hr)	E-Coat TAR A Inlet- Oven THC (lb/hr)	E-Coat TAR B Inlet - Oven THC (lb/hr)	Total THC (lb/hr)
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3	0.886	0.674	2.834	3.814	8.207
Average	1.027	0.652	2.666	3.473	7.819

Table 6.3: EU-ECOAT – VOC Emission Split Summary (June 29, 2021)

Test	E-Coat #1 - Dip Tank THC (%)	E-Coat #2 - Dip Tank THC (%)	E-Coat TAR A Inlet - Oven THC (%)	E-Coat TAR B Inlet - Oven THC (%)	Total E-Coat Dip Tank Split (%)	Total E-Coat Oven Split (%)
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3	10.80%	8.21%	34.53%	46.47%	19.01%	80.99%
Average	13.20%	8.35%	34.07%	44.38%	21.55%	78.45%

The results were incorporated in emission reporting beginning July 1, 2021.

7 CONCLUSIONS

Testing was successfully completed on June 29, 2021. All parameters were tested in accordance with USEPA referenced methodologies. The results were incorporated in emission reporting beginning July 1, 2021.