FINAL REPORT

FCA US LLC

DETROIT, MICHIGAN

JEFFERSON NORTH ASSEMBLY PLANT (JNAP)
EU-COAT THERMAL OXIDIZERS (TAR-A & TAR-B)

RWDI #1900746

March 11, 2019

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI AIR Inc. (RWDI) was retained by Fiat Chrysler Automobiles US LLC (FCA) to complete destruction efficiency (DE) testing for volatile organic compounds (VOCs) on the two (2) thermal oxidizers (TOs) controlling the emissions from the E-Coat Oven (EU-ECOAT) at the Jefferson North Assembly Plant (JNAP) located in Detroit, Michigan. As outlined in Title V Renewable Operating Permit (ROP) MI ROP-N2155-2017, the testing was required to validate the destruction efficiency (DE) for the thermal oxidizers (TOs) serving the EU-ECOAT line (TAR-A and TAR-B) under source group EU-ECOAT.

Testing was completed on TAR-A and TAR-B between January 23rd and January 24th, 2019 while all process equipment was operating under normal operating conditions. Since both TOs had a DE of greater than 99% at operating temperatures of 1330°F or greater, it was discussed with Michigan Department of Environmental Quality (MDEQ) to complete a second round of testing at a reduced temperature. FCA discussed this change with both Ms. Regina Angelloti and Mr. Bob Brynes of the MDEQ. As such, On January 24th and 25th, 2019, RWDI completed a 2nd set of destruction efficiency tests at a reduced temperature and determined that TAR-A reached a destruction efficiency of >99% at 1260 °F and determined a destruction efficiency of >96% at 1275 °F for TAR-B.

For the DE testing, 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 TO's simultaneously. Sampling was conducted at permitted operating temperatures and at the MDEQ agreed upon reduced temperatures for both TAR-A and TAR-B TOs.

Three one-hour tests were completed concurrently at the inlet and outlet of each TO (TAR-A and TAR-B) to determine the average DE of each TO (TAR-A and TAR-B) respectively. Stack gas velocity and moisture tests were also taken during each of the three one-hour DE tests at the outlet only (as noted in the Source Testing Plan – Jefferson North Assembly Plant: Intent-To-Test Plan (ITT) November 12, 2018).

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

JEFFERSON NORTH ASSEMBLY PLANT (JNAP)
E-COAT THERMAL OXIDIZERS (TAR-A & TAR-B) DESTRUCTION EFFICIENCY TESTING
FCA US LLC
RWDI#1900746
March 11, 2019

Summary of Results -ECOAT TAR-A

Parameter	Permitted Operating Temperature			Reduced Temperature		
	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
Date	**2019-01-23**	**2019-01-24**	**2019-01-24**	**2019-01-24**	**2019-01-24**	**2019-01-25**
Start Time	**13:25**	**06:25**	**07:45**	**15:12**	**17:26**	**08:40**
End Time	**14:24**	**07:24**	**08:44**	**16:11**	**18:25**	**09:39**
Average TO Combustion Temperature (°F)	1330	1332	1330	1264	1261	1261
Vehicles Per Hour	40	43	32	38	45	41
Inlet THC (ppmv) (as Propane)	281	338	325	324	311	297
Outlet THC (ppmv) (as Propane)	0.15	0.13	0.15	2.4	2.0	2.8
Destruction Efficiency (%)	99.95%	99.96%	99.95%	99.3%	99.3%	99.0%
Inlet THC as Mass lb/hr (propane)	3.4	4.4	4.2	4.6	4.2	3.9
Outlet THC as Mass (lb/hr) (propane)	0.002	0.002	0.002	0.03	0.03	0.04
Destruction Efficiency (%)	99.95%	99.96%	99.95%	99.3%	99.3%	99.0%
Residence Time (sec)	0.88	0.80	0.80	0.79	0.83	0.85

Notes: [1] Destruction Efficiency is calculated based on Total Hydrocarbon concentration ppmv- parts per million by volume

Summary of Results -ECOAT TAR-B

Parameter	Permitted Operating Temperature			Reduced Temperature		
	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
Date	**2019-01-23**	**2019-01-23**	**2019-01-23**	**2019-01-25**	**2019-01-25**	**2019-01-25**
Start Time	**07:22**	**08:43**	**10:05**	**12:24**	**13:42**	**14:55**
End Time	**08:21**	**09:42**	**11:04**	**13:23**	**14:41**	**15:54**
Average TO Combustion Temperature (°F)	1329	1332	1332	1274	1278	1276
Vehicles Per Hour	37	39	41	45	34	35
Inlet THC (ppmv) (as Propane)	128.2	130.7	135.5	145.6	106.9	126.1
Outlet THC (ppmv) (as Propane)	0.87	0.65	0.52	4.75	4.37	4.42
Destruction Efficiency (%)	99.3%	99.5%	99.6%	96.7%	95.9%	96.5%
Inlet THC as Mass lb/hr (propane)	8.4	8.1	8.3	8.8	6.6	7.5
Outlet THC as Mass (lb/hr) (propane)	0.06	0.04	0.03	0.29	0.27	0.26
Destruction Efficiency (%)	99.3%	99.5%	99.6%	96.7%	95.9%	96.5%
Residence Time (sec)	0.54	0.56	0.57	0.58	0.59	0.61

Notes: [1] Destruction Efficiency is calculated based on Total Hydrocarbon concentration ppmv- parts per million by volume

Based on the results, TAR-A is able to operate at a combustion chamber setpoint temperature of 1260°F and maintain a destruction efficiency of >99% and TAR-B is able to operate at a combustion chamber setpoint temperature of 1275°F and maintain a destruction efficiency of >95.9%.

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1 INTRODUCTION

RWDI was retained by FCA to complete DE testing for VOCs on the two (2) TOs controlling the emissions from the EU-ECOAT at the JNAP located in Detroit, Michigan. As outlined in Title V ROP MI ROP-N2155-2017, the testing was required to validate the DE for the TOs serving the EU-ECOAT lines (TAR-A and TAR-B) under source group EU-ECOAT.

Testing was completed on TAR-A and TAR-B between January 23rd and January 24th, 2019 while all process equipment was operating under normal operating conditions. Since both TOs had a DE of greater than 99% at operating temperatures of 1330°F or greater, it was discussed with MDEQ to complete a second round of testing at a reduced temperature. FCA discussed this change prior to commence with both Ms. Regina Angelloti and Mr. Bob Brynes of MDEQ. As such, On January 24th and 25th, 2019, RWDI completed a 2nd set of destruction efficiency tests at a reduced temperature and determined that TAR-A reached a destruction efficiency of >99% at 1260°F and reached a destruction efficiency of >96% at 1275°F for TAR-B.

Testing of emissions were conducted by Mr. Thomas Langille, Mr. Derek Ottens, Mr. Alec Smith, Mr. Kirk Easto and Mr. Brad Bergeron of RWDI. Mr. Steve Szura from JNAP and Mr. Rohit Patel (FCA) were on-site to monitor the process operation and witness the testing on behalf of FCA US LLC. Testing was witness by Ms. Regina Angelloti from MDEQ on January 23rd, 2019.

2 PROCESS DESCRIPTION

JNAP is located at 2101 Connor Road in Detroit, Michigan. JNAP operates an automobile assembly plant that produces Jeep Grand Cherokee and Dodge Durango models for FCA US LLC in regard to this DE testing under ROP-N2155-2017 Emission Units: EU-ECOAT, FG-Facility, FG-Controls, and FG-Auto-MACT. Auto bodies are primed in an enclosed electrocoat dip tank system followed by a curing oven. VOC emissions from the curing oven are controlled by two thermal oxidizers (TAR-A and TAR-B).

The vehicles are processed through a multi-stage phosphate coating process that includes baths in which the vehicle is completely immersed. The vehicles then go through the electrocoat (E-Coat) system. The vehicles are immersed in an E-Coat bath and an electric current is applied to uniformly coat the vehicle. The E-Coat is then cured in curing oven. Emissions from the E-Coat oven are controlled with the two (2) TOs. At the exit of the oven, the vehicles are cooled with air. After E-Coat process, the vehicles continue through the remainder of the painting process.

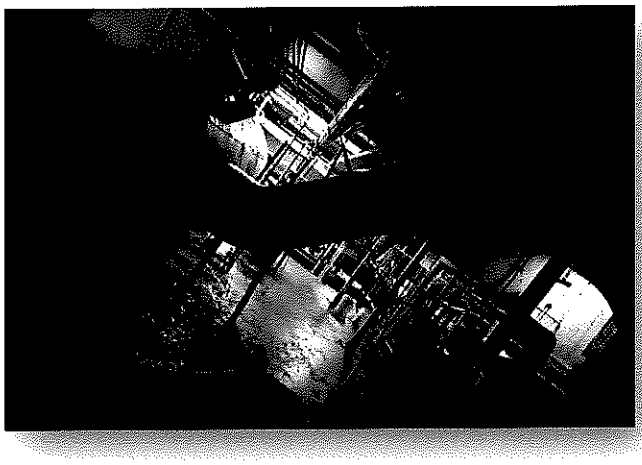
3 SAMPLING LOCATIONS

3.1 Sample Location

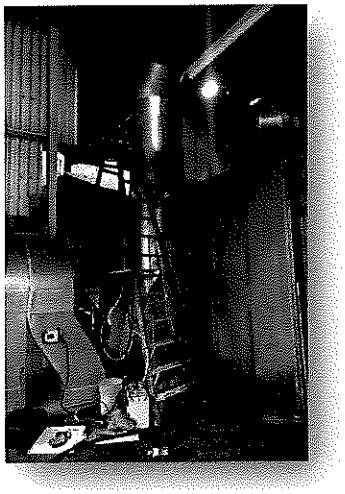
The sampling locations were located inside the building on the inlet and outlet of the TOs.

3.1.1 ECOAT TAR-A Sampling Locations

For ECOAT TAR-A, the inlet location is a 14" x 14" duct with flow disturbances ~2 stack duct diameter up and ~1 downstream from any flow obstructions. This sampling location is not considered ideal according to U.S EPA Method 1.



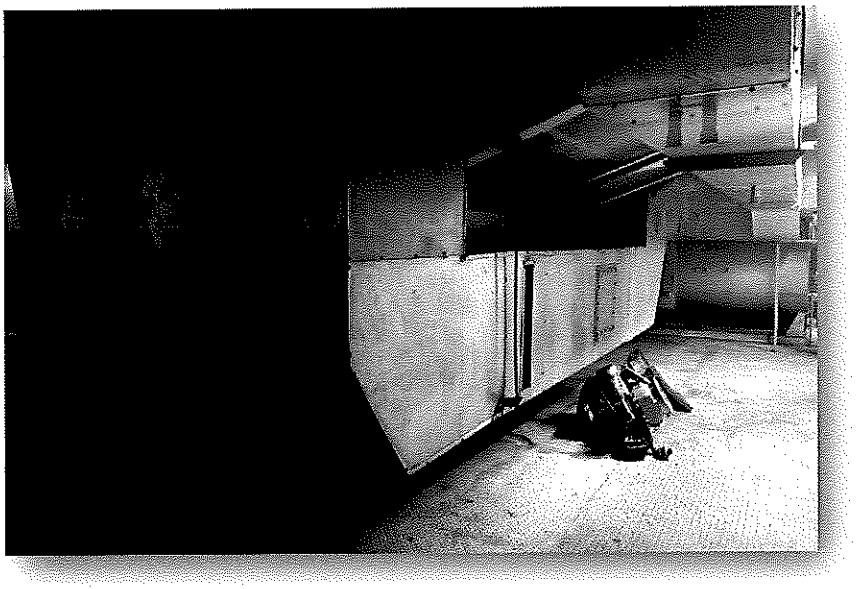
The outlet location is an 18" duct diameter with flow disturbances ~2 stack diameter up and ~3 duct diameters downstream of the TO and any flow disturbances. This sampling location is considered ideal according to U.S EPA Method 1.



3.1.2 ECOAT TAR-B Sampling Locations

For ECOAT-TAR-B, the inlet location is a 33" x 49" duct with flow disturbances ~2 stack duct diameter up and <1 duct diameter downstream from any flow disturbances.

This sampling location is not considered ideal according to U.S EPA Method 1. The outlet location is a 30" x 38" duct with flow disturbances ~4 stack diameter up and ~1 duct diameters downstream of any flow disturbances. This sampling location is considered ideal according to U.S EPA Method 1.



4 SAMPLING METHODOLOGY

4.1 Test Methods

4.1.1 Stack Velocity, Temperature, and Volumetric Flow Rate

The exhaust velocities and flow rates were determined following U.S. EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer. Volumetric flow rates were determined following the equal area method as outlined in U.S. EPA Method 2. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a calibrated digital temperature indicator.

The dry molecular weight of the stack gas was determined following calculations outlined in U.S. EPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight". A portable ECOM combustion analyzer was used to measure the temperature and gas composition of the stack for the determination of the dry molecular weight. Stack moisture content was determined through direct condensation and according to U.S. EPA Method 4, "Determination of Moisture Content of Stack Gases".

4.1.2 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 were converted to parts per million (ppmv) as propane. The exhaust gas sample was withdrawn from a single point at the center 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 flame ionization analyzers 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 checked (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.

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.

4.2 Quality Assurance / Quality Control Measures

Applicable quality assurance measures were implemented during the sampling program to ensure the integrity of the results. These measures included detailed documentation of field data and equipment calibrations for all measured parameters.

All samplers were bench tested and calibrated in RWDI's office prior to field deployment. For each sample collected with a Method 5 sampling train, both pre- and post- leak checks were conducted by plugging the inlet and drawing a vacuum of equal to or greater than the vacuum recorded during the test. Dry gas meter reading leakage rates greater than 4 percent of the average sampling rate or 0.00057 m^3/min (0.02 cfm), whichever is less, were considered unacceptable. Similar leak check procedures for pitot tube and pressure lines were also conducted. Daily temperature sensor audits were completed by noting the ambient temperature, as measured by a reference thermometer, and comparing these values to those obtained from the stack sensor. Leak checks for each test were documented on the field data sheets presented in the applicable appendices for each sample parameter.

Quality checks for the CEMS (VOCs) are provided in the methodology section.

5 RESULTS

The emission results for this study are presented in **Appendix C** of this report. **Tables 5.1** through 5.2 outline the summary of the testing results and process data collected during the testing periods

Table 5.1: Summary of Results –TAR-A

Parameter	Permitted Operating Temperature			Reduced Temperature		
	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
Date	**2019-01-23**	**2019-01-24**	**2019-01-24**	**2019-01-24**	**2019-01-24**	**2019-01-25**
Start Time	**13:25**	**06:25**	**07:45**	**15:12**	**17:26**	**08:40**
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Destruction Efficiency (%)	99.95%	99.96%	99.95%	99.3%	99.3%	99.0%
Residence Time (sec)	0.88	0.80	0.80	0.79	0.83	0.85

Notes: [1] Destruction Efficiency is calculated based on Total Hydrocarbon concentration
ppmv- parts per million by volume

Table 5.2: Summary of Results –TAR-B

Parameter	Permitted Operating Temperature			Reduced Temperature		
	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
Date	**2019-01-23**	**2019-01-23**	**2019-01-23**	**2019-01-25**	**2019-01-25**	**2019-01-25**
Start Time	**07:22**	**08:43**	**10:05**	**12:24**	**13:42**	**14:55**
End Time	**08:21**	**09:42**	**11:04**	**13:23**	**14:41**	**15:54**
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Residence Time (sec)	0.54	0.56	0.57	0.58	0.59	0.61

Notes: [1] Destruction Efficiency is calculated based on Total Hydrocarbon concentration
ppmv- parts per million by volume

Field notes are provided in **Appendix D**. All calibration information for the equipment used for this study is included in **Appendix E**.

JNAP representatives provided production information during each of the testing periods including temperature for the TOs and vehicle throughout of the oven during each test. All equipment was operated under normal operating conditions. **Appendix F** includes the production for each testing periods. Sample calculations are provided in **Appendix G**.

6 CONCLUSIONS

For the destruction efficiency, 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 each TO simultaneously.

Contact was maintained between the operator and the sampling team. A member of the RWDI sampling team contacted the operator before each test, to ensure that the process was at normal operating conditions.

Based on the results, TAR-A is able to operate at a combustion chamber setpoint temperature of 1260°F and maintain a destruction efficiency of >99% and TAR-B is able to operate at a combustion chamber setpoint temperature of 1275°F and maintain a destruction efficiency of >95.9%.