FINAL REPORT

FCA US LLC

WARREN, MICHIGAN

WARREN TRUCK ASSEMBLY PLANT (WTAP) EAST PAINT SHOP: RTO PARTICULATE MATTER COMPLIANCE TEST

RWDI #2201515

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SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) was retained by FCA US LLC (FCA) to complete the emission sampling program at their Warren Truck Assembly Plant (WTAP) located at 21500 Mound Road in Warren, Michigan. WTAP operates an automobile assembly plant that includes the West Paint Shop which produces the Jeep Wagoneer and an East Paint Shop which produces the Classic Ram 1500 series truck. Testing was executed as required by Permit to Install (PTI) 13-19B (copy of Source Testing Plan and Michigan Department of Environment, Great Lakes, and Energy (EGLE) response letter is attached in **Appendix A**).

Under Permit to Install (PTI) 13-19B, to satisfy the following conditions under FGRTOEAST the following repeat testing was completed:

- Particulate emissions from the SVRTOEAST (RTO exhaust). This testing was a repeat of the program completed in May of 2022.

Ms. Regina Angellotti witnessed the testing on November 22nd, 2022.

Executive Table I: SVRTOEAST – PM Results

Parameter	Emission Rate			
	Test 1	Test 2	Test 3	Average
Particulate Matter ($PM/PM_{10}/PM_{2.5}$) (lb/hr)	0.415	0.308	0.287	0.337
Particulate Matter ($PM/PM_{10}/PM_{2.5}$) (lb/1000 lb of exhaust air (wet))	0.0019	0.0014	0.0013	0.0015

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1 INTRODUCTION

RWDI USA LLC (RWDI) was retained by FCA US LLC (FCA) to complete the emission sampling program at their Warren Truck Assembly Plant (WTAP) located 21500 Mound Road in Warren, Michigan. WTAP operates an automobile assembly plant that includes the West Paint Shop which produces the Jeep Wagoneer and an East Paint Shop which produces the Classic Ram 1500 series truck. Testing was executed as required by Permit to Install (PTI) 13-19B. A copy of the Source Testing Plan and EGLE Approval Letter is provided in **Appendix A**.

Under Permit to Install (PTI) 13-19B, to satisfy the following conditions under EUECOATEAST and FGTOPCOATEAST for EU-COLOR-ONE the following repeat testing was completed:

- Particulate emissions from the SVRTOEAST (RTO exhaust). This testing was a repeat of the program completed in May of 2022.

WTAP recorded the production rate of vehicles processed and RTO combustion chamber temperature during each particulate test for SVRTOEAST. Production data can be found in **Appendix G.**

Results of individual tests are presented in **Appendix C**. SVRTOEAST testing was completed on November 21st and 22nd, 2022.

1.1 Testing Personnel

The following table presents personnel that were involved with the testing program.

Table 1.1.1: Summary of Testing Personnel

Name	Title & Affiliation	Address	Contact Number
Mr. Brad Wargnier	Environmental Specialist FCA US LLC Warren Truck Assembly Plant	21500 Mound Road Warren, MI 48091	248.944.5263
Mr. Tom Caltrider	Corporate Environmental Programs EHS FCA US LLC	38111 Van Dyke Avenue Sterling Heights, MI 48312	248.882.7169
Ms. Regina Angellotti	Environmental Quality Analyst EGLE Air Quality Division	27700 Donald Court Warren, MI 48092	586.854.1611
Mr. Brad Bergeron	Senior Project Manager RWDI USA LLC	2239 Star Court Rochester Hills, MI 48309	519.817.9888
Mr. Mike Nummer	Senior Field Technician RWDI USA LLC	2239 Star Court Rochester Hills, MI 48309	586-863-8237
Mr. Austin Kingsley	Scientist RWDI USA LLC	2239 Star Court Rochester Hills, MI 48309	248-841-8442

2 SOURCE DESCRIPTION

2.1 Plant and Sources Overview

WTAP operates an automobile assembly plant that produces the Jeep Wagoneer models in the West Paint Shop and the Classic Ram 1500 series trucks in the East Paint Shop for FCA US LLC. This Source Testing Plan focusses solely on the East Paint Shop and the testing required of the RTO (SVRTOEAST). Additional, separate testing programs address the other testing requirements as outlined in the PTI. The following table outlines the sampling program.

Table 2.1.1: Summary of Sampling Program – EUECOATEAST & EU-COLOR-ONE / SVRTOEAST

FGRTOEAST (with EUECOATEAST & EU-COLOR-ONE)	
Emission Unit Description [Including Process Equipment & Control Device(s)]	An electrodeposition (E-Coat) coating process consists of a series dip tanks, rinses, a curing oven, a cooling tunnel. Emissions from the E-coat tanks and the curing oven are controlled by the East RTO (SVRTOEAST). EU-COLOR-ONE coating booth (basecoat and clearcoat) emissions are exhausted through a downdraft water wash system, the east concentrators, and the east RTO (SVRTOEAST). EU-COLOR-ONE is part of FGTOPCOATEAST. Testing program included the required compliance testing for SVRTOEAST. **Source:** SVRTOEAST
Parameter Tested	SVRTOEAST particulate matter emissions, in addition to Stack Gas Velocity, Stack gas composition, and Moisture
Testing Monitoring Methods	• USEPA Methods: 1, 2, 3, 4, 5, and 202. • The Ecoat Oven and Tank and EU-COLOR-ONE Concentrator desorb stream all exhaust to the new East RTO. • The outlet sampling location for the RTO meets the USEPA Method 1 criteria. The outlet sampling locations were used for stack gas velocity, flow rate, stack gas composition and moisture. Outlet was used for PM/PM10/PM2.5 emissions. • The sampling train for PM/PM10/PM2.5 consisted of filterable and condensable particulate capture during three (3) 240-minute runs as described in USEPA Method 5/202, from the outlet of the RTO.
Modifications (Included in Test Plan)	• Compliance testing was completed using USEPA Method 5/202. All particulate matter collected was assumed to be equivalent to PM10 and PM2.5. • Due to safety concerns in relation to the guardrail impeding a full train system, an independent system with a flex line running from the filter hot box to the first impinger was used for the particulate matter testing. • Nitrogen purge was not completed post sample to remove sulphates for any of the sampling. Sulfur dioxide exposure is not expected to be an issue at this source location.

2.2 Sampling Locations Overview

This following table summarizes the sampling locations.

Table 2.2.1: : Summary of the Stack Characteristics – SVRTOEAST

Source	Parameter	Diameter	Approximate Duct Diameters from Flow Disturbance	Number of Ports	Points per Traverse	Total Points per Test	Anticipated Stack Temperature
SVRTOEAST Outlet	PM/PM_{10}/ $PM_{2.5}$	72"	~7 upstream and ~3.5 downstream	2	12 Flow/PM	24 PM/Flow	~275°F

3 TESTING METHODOLOGIES

3.1 Description of Testing Methodologies

The following section provides brief descriptions of the sampling methods and discusses any modifications to the reference test methods that were completed with the testing.

3.1.1 USEPA Method 1 - "Sample and Velocity Traverses for Stationary Sources"

USEPA Method 1 is used in the selection of sampling ports and traverse points at which sampling for air pollutants will be performed. Based on diameter, upstream, and downstream disturbances. The stack is divided into a determined number of equally size areas, and sampling points are located within each area.

3.1.2 USEPA Method 2 – *"Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"*

USEPA Method 2 is used for the determination of the average velocity and the volumetric flow rate of a gas stream. Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a digital temperature indicator at each point as determined by USEPA Method 1.

A cyclonic verification check is done prior to testing to verify cyclicity is absent from the flow. The average absolute value of all points measure must be at or below 20 degrees for the flow measurements to be valid at the designated sampling point. The average absolute value of the angle of flow for all sampling points was at or below 20 degrees, so the sampling location is not considered cyclonic.

3.1.3 USEPA Method 3 – *"Gas Analysis for the Determination of Dry Molecular Weight"*

USEPA Method 3 is used for the determination of CO_2 and O_2 concentrations and dry molecular weight of a sample of effluent gas stream of a fossil-fuel combustion process or other process. A Fyrite analyzer was used in the analysis by introducing sample gas to each the CO_2 and O_2 during each test. Each Fyrite has a specific indicating chemical for either CO_2 or O_2 and introducing sample gas creates a reaction which indicates the percentage of the respected gas. Sample gas is introduced to the Fyrite using a one-way squeeze bulb, and then mixed multiple times with the specified chemical. The results are then used to calculate the dry molecular weight of the sample gas.

3.1.4 USEPA Method 4 – *"Determination of Moisture Content in Stack Gases"*

USEPA Method 4 is used to determine the moisture content of stack gas. Moisture is determined via direct condensation. In the case of determining moisture content during an isokinetic test, a gas sample is drawn through a probe and filter, then through a series of impingers (impinger type and contents vary depending on the isokinetic method) and dropped to a temperature below 68° Fahrenheit to ensure all moisture is removed from the sample. The impingers are analyzed gravimetrically pre and post test to determine total moisture gain. Moisture content is then calculated based on moisture gain and total sample volume passed through the impingers.

3.1.5 USEPA Method 5 – *"Determination of Particulate Matter Emissions from Stationary Sources"*

Particulate matter ($PM/PM_{10}/PM_{2.5}$) was sampled following procedures outlined in USEPA Method 5 and Method 202 (Condensable Particulate Matter).

USEPA Method 5 is used to determine filterable particulate matter from the specified source. The sample gas is sampled isokinetically through a stainless-steel nozzle, then a glass/quartz (stainless-steel may also be used) probe-liner, and through a glass-fiber filter. The probe and filter are designed to keep the sampling temperature at 248 ± 25 °F per the method standards. USEPA Method 5 can be combined with other methods, but everything up to the filter is considered filterable particulate matter.

Prior to testing, a leak check is performed on the sampling train to ensure a leak-free system. The probe nozzle is then set to the first sampling point, and sampling begins once all temperatures and flow rates are established. Sampling occurs for a pre-determined amount of time and at all pre-determined sampling points. Sampling rate is determined based on in-stack conditions including flow rate and stack gas temperature. A valid test must sample at an average rate ±10% of 100% isokinetic sampling. Once testing is complete, a post-test leak check is done to show a leak-proof sampling system. The system is leak checked at a vacuum (Hg") at or just above the maximum vacuum seen during the test.

Once all sampling procedures are complete, recovery begins as soon as possible. The impingers in the train must be weighed prior to recovery for moisture content analysis. For USEPA Method 5, all used sampling equipment up to the filter is rinsed three times with acetone. The probe and nozzle must be rinsed and thoroughly brushed (three times for glass/quartz, six times for stainless-steel). The front half of the filter holder is then rinsed three time with acetone into the same glass sample jar as the probe and nozzle rinse. The filter is then collected and placed in a petri dish. All USEPA Method 5 recovered filter samples are analyzed gravimetrically by RWDI USA LLC and the Method 5 acetone rinses and Method 202 recovered samples were analyzed by Bureau Veritas in Mississauga, Ontario.

3.1.6 USEPA Method 202 – "Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"

USEPA Method 202 is an isokinetic method used to measure condensable particulate (CPM) emissions from a stationary source. CPM is collected after the filterable particulate matter is removed by the filterable particulate matter filter. The test follows all procedures laid out in USEPA Method 5. The impingers for the 202 train are as follows:

- After leaving the filter housing of the filterable particulate matter filter, the gas stream enters a vertical condenser to begin cooling the air sample and dropping out CPM;
- The sample is drawn through a large potbelly impinger that collects moisture;
- The sample is then drawn through a modified Greenburg-Smith impinger to drop out any remaining CPM;
- The CPM filter collects any remaining CPM in the air sample. The gas must be kept at a temperature between 65° and 85° Fahrenheit.

After the filter, the gas is then passed through a modified Greenberg-Smith impinger containing water, and an impinger containing silica gel to capture any remaining moisture.

Recovery of the USEPA Method 202 train begins immediately following sampling. Weights on all impingers are taken to determine moisture content. If necessary, a nitrogen purge is performed for one hour in compliance with section 8.5.3 of the test method (if sulfur dioxide is not suspected to be part of the process, then the nitrogen purge may be skipped). Nitrogen purges were not completed as noted in the Source Testing Plan. Following the filterable particulate filter and up to the CPM filter must be rinsed twice with water, once with acetone, and twice with hexane. Any condensed water in the first two impingers can be poured into the sample jar with the water rinses. The acetone and hexane rinses can be combined into the same jar. The CPM filter is put into either a sample jar on its own, or a petri dish. All samples are carried via courier to Bureau Veritas, in Mississauga, Ontario for analysis.

4 PROCESS DATA

During the emissions testing, plant process data was monitored and collected by WTAP personnel to ensure representative operation of the facility. For this series of tests, the production data consists of the vehicle counts in **Appendix G**.

5 RESULTS

All calibration information for the equipment used for this study is included in **Appendix F**. The following tables summarize the testing results, and more detailed tables can be found in **Appendices C and D** for the SVRTOEAST.

Table 5.1: SVRTOEAST – PM Results

Parameter	Emission Rate			
	Test 1	Test 2	Test 3	Average
Particulate Matter ($PM/PM_{10}/PM_{2.5}$) (lb/hr)	0.415	0.308	0.287	0.337
Particulate Matter ($PM/PM_{10}/PM_{2.5}$) (lb/1000 lb of exhaust air (wet))	0.0019	0.0014	0.0013	0.0015

6 CONCLUSIONS

Testing for particulate matter ($PM/PM_{10}/PM_{2.5}$) was completed on November 21st and 22nd, 2022 and was completed in accordance with the Source Testing Plan for SVRTOEAST.