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, Warren, Michigan. The Source Testing Program focused on the West Paint Shop (WPS). WTAP WPS operates an automobile assembly plant that produces the Jeep Wagoneer. Per Permit to Install (PTI) 13-19B, this Source Testing Program covered the required testing of the following five (5) sources:

- EUPRIMERWEST - PM/PM_{10}/$PM_{2.5}$ emissions from EUPRIMERWEST observation zone. Testing was completed on source SVPRMOBSWEST
- EUTOPCOATWEST - PM/PM_{10}/$PM_{2.5}$ emissions from Basecoat and Clearcoat observation zones. Testing was completed on source SVBCOBSWEST (Basecoat) and SVCCOBSWEST (Clearcoat).
- EUSPOTREPAIRWEST- PM/PM_{10}/$PM_{2.5}$ emissions from EUSPOTREPAIRWEST. Testing was completed on source SVRPDRPCS.
- FGSPOTPRIMERWEST- PM/PM_{10}/$PM_{2.5}$ emissions from sources SVSPOTPRMWEST1 (Stack 34). Since the two (2) processes are similar, only one (1) was tested.

In addition, the Source Testing Program also included testing of the EUECOATWEST E-Coat Dip Tank and Oven capture efficiency. Since the emissions from both the E-Coat Dip Tank and the Oven are directed to the RTO (SVRTOWEST), the testing for validation of capture efficiency included a modified method, whereby a visualization test (smoke test) was completed at the entrance and exit of the E-Coat Dip Tank and entrance and exit of the E-Coat Oven to demonstrate inward flow into the systems for capture and control to the RTO. If the smoke tests demonstrate inward flow (into the process and therefore into the RTO), the capture efficiency was considered 100%.

In addition, as discussed with EGLE, for EUSPOTREPAIRWEST and FGSPOTRPIMERWEST the original testing was completed using Method 5. Additional testing was later completed April 5th to 7th that included both noted sources also be tested for PM using Method 201A. Correspondence is included in **Appendix A**.

WTAP recorded the production rate of vehicles processed during each particulate test from each of the sources. Testing was completed during from February 14th to 21st and April 5th to 8th, 2022.

A summary of the results can be found in the **Tables** section of this report.

Table i: Average Emission Data – Particulate Testing ($PM/PM_{10}/PM_{2.5}$)

Source	Parameter	Emission Rate			
		Run 1	Run 2	Run 3	Average
SVPRMOBSWEST (Tutone Observation)	PM	0.0025 lb/1000 lb $gas_{(wet)}$	0.0013 lb/1000 lb $gas_{(wet)}$	0.0025 lb/1000 lb $gas_{(wet)}$	0.0021 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.325 lb/hr	0.170 lb/hr	0.250 lb/hr	0.248 lb/hr
	$PM_{2.5}$	0.298 lb/hr	0.156 lb/hr	0.150 lb/hr	0.201 lb/hr
SVBCOBSWEST (Basecoat Observation)	PM	0.0018 lb/1000 lb $gas_{(wet)}$	0.0005 lb/1000 lb $gas_{(wet)}$	0.0032 lb/1000 lb $gas_{(wet)}$	0.0018 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.165 lb/hr	0.033 lb/hr	0.341 lb/hr	0.180 lb/hr
	$PM_{2.5}$	0.117 lb/hr	0.008 lb/hr	0.328 lb/hr	0.151 lb/hr
SVCCOBSWEST (Clearcoat Observation)	PM	0.0008 lb/1000 lb $gas_{(wet)}$	0.0006 lb/1000 lb $gas_{(wet)}$	0.0010 lb/1000 lb $gas_{(wet)}$	0.0008 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.064 lb/hr	0.029 lb/hr	0.031 lb/hr	0.041 lb/hr
	$PM_{2.5}$	0.007 lb/hr	0.001 lb/hr	0.005 lb/hr	0.005 lb/hr
SVRPDRPCS (Spot Repair)	PM (Method 5)	0.00004 lb/1000 lb $gas_{(wet)}$ 0.003 lb/hr	0.0005 lb/1000 lb $gas_{(wet)}$ 0.040 lb/hr	0.0004 lb/1000 lb $gas_{(wet)}$ 0.031 lb/hr	0.0003 lb/1000 lb $gas_{(wet)}$ 0.025 lb/hr
	PM (Method 201A)	0.0004 lb/1000 lb $gas_{(wet)}$	0.0004 lb/1000 lb $gas_{(wet)}$	0.0005 lb/1000 lb $gas_{(wet)}$	0.0004 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.022 lb/hr	0.020 lb/hr	0.022 lb/hr	0.022 lb/hr
	$PM_{2.5}$	0.010 lb/hr	0.010 lb/hr	0.012 lb/hr	0.011 lb/hr
SVSPOTPRMWEST1 (Spot Primer)	PM (Method 5)	0.0011 lb/1000 lb $gas_{(wet)}$ 0.040 lb/hr	0.0015 lb/1000 lb $gas_{(wet)}$ 0.058 lb/hr	0.0002 lb/1000 lb $gas_{(wet)}$ 0.007 lb/hr	0.0010 lb/1000 lb $gas_{(wet)}$ 0.035 lb/hr
	PM (Method 201A)	0.0009 lb/1000 lb $gas_{(wet)}$	0.0007 lb/1000 lb $gas_{(wet)}$	0.0006 lb/1000 lb $gas_{(wet)}$	0.0007 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.029 lb/hr	0.023 lb/hr	0.018 lb/hr	0.023 lb/hr
	$PM_{2.5}$	0.021 lb/hr	0.013 lb/hr	0.008 lb/hr	0.014 lb/hr

Table ii: Summary of the EUCOATWEST Capture Efficiency Testing Results:

Source Group	Source	Results
E-Coat Dip Tank	Entrance	PASS/ Inward Flow
	Exit	PASS/ Inward Flow
E-Coat Oven	Entrance	PASS / Inward Flow
	Exit	PASS / Inward Flow

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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 at 21500 Mound Road, Warren, Michigan. The Source Testing Program focused on the West Paint Shop (WPS). WTAP WPS operates an automobile assembly plant that produces the Jeep Wagoneer. Per Permit to Install (PTI) 13-19B, this Source Testing Program covered the required testing of the following five (5) sources:

- EUPRIMERWEST - PM/PM_{10}/$PM_{2.5}$ emissions from EUPRIMERWEST observation zone. Testing was completed on source SVPRMOBSWEST
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- EUSPOTREPAIRWEST- PM/PM_{10}/$PM_{2.5}$ emissions from EUSPOTREPAIRWEST. Testing was completed on source SVRPDRPCS.
- FGSPOTPRIMERWEST- PM/PM_{10}/$PM_{2.5}$ emissions from sources SVSPOTPRMWEST1 (Stack 34). Since the two (2) processes are similar, only one (1) was tested.

In addition, the Source Testing Program also included testing of the EUECOATWEST E-Coat Dip Tank and Oven capture efficiency. Since the emissions from both the E-Coat Dip Tank and the Oven are directed to the RTO (SVRTOWEST), the testing for validation of capture efficiency included a modified method, whereby a visualization test (smoke test) was completed at the entrance and exit of the E-Coat Dip Tank and entrance and exit of the E-Coat Oven to demonstrate inward flow into the systems for capture and control to the RTO. If the smoke tests demonstrate inward flow (into the process and therefore into the RTO), the capture efficiency was considered 100%.

In addition, as discussed with EGLE, for EUSPOTREPAIRWEST and FGSPOTRPIMERWEST the original testing was completed using Method 5. Additional testing was completed April 5th to 7th that included both noted sources also be tested for PM using Method 201A. Correspondence is included in **Appendix A**.

WTAP recorded the production rate of vehicles processed during each particulate test from each of the sources. Testing was successfully completed while all process equipment was operating under normal operating conditions.

Testing was completed during the week of February 14th to 21st of 2022. Re-Testing of Spot Prime and Spot Repair with Method 201A was completed April 5th to 7th, 2022. Testing of emissions was conducted by Mr. Mason Sakshaug, Mr. Steve Smith, Mr. Juan Vargas, Mr. Ben Durham, Mr. Mukund Venkitachalam, Mr. Kyle Lyons, Mr. Mitchell Southwell, Mr. Brad Bergeron, and Mr. Zach Huber of RWDI. Mr. Thomas Caltrider and Mr. Brad Wargnier were on-site to monitor the process operation and witness the testing on behalf of FCA US LLC. Ms. Regina Angellotti and Mr. Iranna Konanachalli from the State of Michigan Department of Environment, Great Lakes, and Energy (EGLE) were on-site to witness the testing at WTAP.

2 PROCESS DESCRIPTION

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 program focused only on the West Paint Shop. This Source Testing Program included the required compliance testing for particulate matter of the observation zones (Primer, Basecoat and Clearcoat), Spot Prime Booths and Spot Repair Booth and capture efficiency of EUECOATWEST. Additional information for process emissions can be found in **Appendix A**.

3 SAMPLING LOCATIONS AND METHODS

3.1 Sampling Location

This following table summarizes the sampling locations.

Table 3.1.1: Summary of the Stack Characteristics

Source	Parameter	Diameter	Approximate Duct Diameters from Flow Disturbance	Number of Ports	Points per Traverse	Total Points per Test	Anticipated Stack Temperature
SVPRMOBSWEST	PM/PM_{10}/$PM_{2.5}$	44"	~7 downstream and >8 upstream	2	6	12 PM/Flow	~80°F
SVBCOBSWEST	PM/PM_{10}/$PM_{2.5}$	36"	~8 downstream and >8 upstream	2	6	12 PM/Flow	~80°F
SVCCOBSWEST	PM/PM_{10}/$PM_{2.5}$	41"	~8 downstream and >8 upstream	2	6	12 PM/Flow	~80°F
SVRPDRPCS	PM/PM_{10}/$PM_{2.5}$	55"	~5 downstream and >8 upstream	2	6	12 PM/Flow	~80°F
SVSPOTPRMWEST1[1]	PM/PM_{10}/$PM_{2.5}$	27"	~8 downstream and >8 upstream	2	6	12 PM/Flow	~80°F

Notes: Upstream and downstream distances were verified on-site and adjusted accordingly.
[1] SVSPOTPRMWEST 1 was measured as they are from similar processes as SVSPOTPRMWEST 2.

Example photos of sources are provided on the following page.

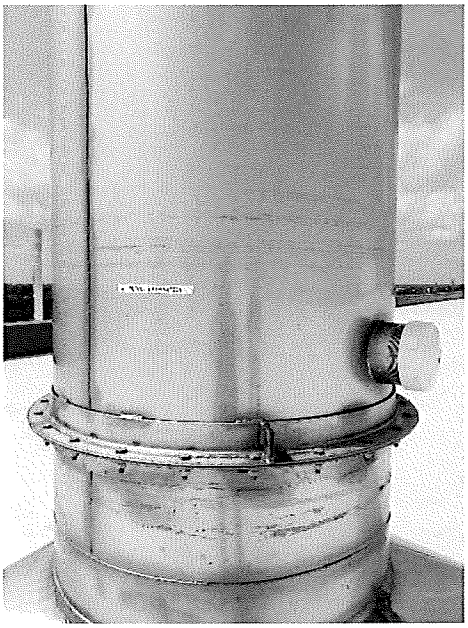

Figure 3.1.1.1:
Primer Observation Zone Exhaust

Figure 3.1.1.2:
Basecoat Observation Zone Exhaust

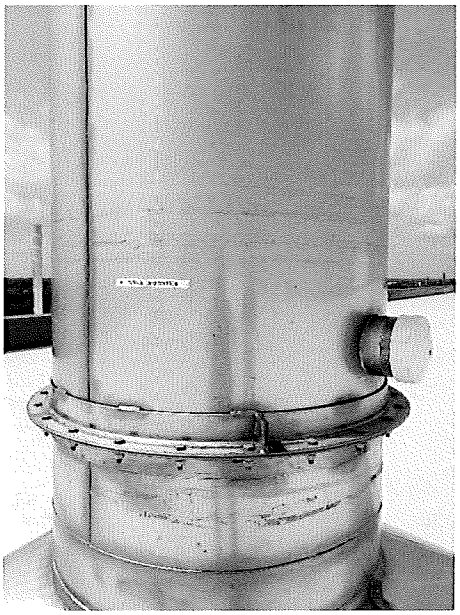

Figure 3.1.1.3:
Clearcoat Observation Zone Exhaust

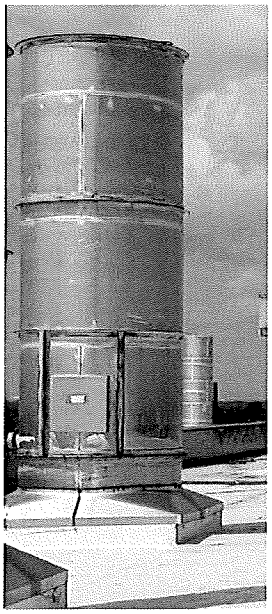

Figure 3.1.1.4:
Spot Repair Exhaust

Figure 3.1.1.5:
SVSPOTPRMWEST1 Exhaust

3.1.1 E-Coat Dip Tank and Oven Capture Efficiency Testing Locations

To determine the direction of the air moving at the E-Coat Dip Tank and E-Coat Oven, the openings to the entrance and exit of each of the Dip Tank and Oven were reviewed.

3.2 Test Methodology

3.2.1 Velocity, Temperature and Volumetric Flow Rate Determination

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". The stack was assumed to be at ambient conditions 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".

3.2.2 Sampling for Particulate Matter (PM, PM_{10} and $PM_{2.5}$)

Particulate matter ($PM/PM_{10}/PM_{2.5}$) was sampled following procedures outlined in U.S. EPA Method 201A and Method 5. Since the filter temperature did not exceed 85°F, Method 202 was not used for the analysis.

As stated in Method 202, "***If the gas filtration temperature exceeds 30°C (85°F) and you must measure both the filterable and condensable (material that condenses after passing through a filter) components of total primary (direct) PM emissions to the atmosphere, then you must combine the procedures in this method with the procedures in Method 201A of appendix M to this part for measuring filterable PM. However, if the gas filtration temperature never exceeds 30°C (85°F), then use of this method is not required to measure total primary PM***".

For the observation zone exhausts (Primer, Basecoat and Clearcoat), the tests were 120 minutes in duration using Method 201A. For the Spot Repair and Spot Prime exhausts, the tests were 240 minutes and originally completed following U.S. EPA Method 5. After discussions with EGLE, both Spot Prime and Spot Repair were re-tested in April following U.S. EPA Method 201A.

3.3 Sampling for Capture Efficiency

Sampling of capture efficiency is intrusive to the production as the testing obstructs the flow of vehicles into the E-Coat area. Therefore, for the capture efficiency testing, no vehicles were entering the system during the testing, however all ventilation systems and oven were confirmed to be operating normally (simulating normal production conditions).

Sampling for capture efficiency included a visualization test (smoke test). Smoke was applied to the entrance and exit of the Dip Tank and Oven. Each location was tested separately under the normal ventilation scenario. The visualization testing demonstrated that the smoke (or air flow) was flowing into the Dip Tank/Oven and therefore the in the control system (RTO). As a result, the capture efficiency was observed to be 100%.

3.4 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, equipment calibrations for all measured parameters, completion of Chain of Custody forms when submitting laboratory samples, and submission of field blank samples to the laboratories.

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.

4 RESULTS

The average emission results are presented in this section of this report. **Table 1** presents a summary of the parameters and methodology used in this sampling program. Detailed information regarding each particulate test can be found in **Appendices B through H**.

Laboratory results are included in **Appendix I**. All calibration information for the equipment used for this study is included in **Appendix J**. Sample calculations are included in **Appendix K**. Production data is summarized in **Appendix L**.

4.1 Discussion of Results

Sampling was completed during the week of February 14th to 21st and April 5th to 7th, 2022. PM/PM_{10}/$PM_{2.5}$ was measured (U.S. EPA Method 201A and Method 5). The results have been summarized below in **Table 4.1.1 and 4.1.2**. Concentrations were corrected to reference conditions of 68 °F, and 29.92 in.Hg. Operating conditions during the sampling were monitored by FCA personnel. All equipment was operated under normal representative operating conditions.

Table 4.1.1: Average Emission Data – Particulate Testing (PM/PM_{10}/$PM_{2.5}$)

Source	Parameter	Emission Rate			
		Run 1	Run 2	Run 3	Average
SVPRMOBSWEST (Tutone Observation)	PM	0.0025 lb/1000 lb $gas_{(wet)}$	0.0013 lb/1000 lb $gas_{(wet)}$	0.0025 lb/1000 lb $gas_{(wet)}$	0.0021 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.325 lb/hr	0.170 lb/hr	0.250 lb/hr	0.248 lb/hr
	$PM_{2.5}$	0.298 lb/hr	0.156 lb/hr	0.150 lb/hr	0.201 lb/hr
SVBCOBSWEST (Basecoat Observation)	PM	0.0018 lb/1000 lb $gas_{(wet)}$	0.0005 lb/1000 lb $gas_{(wet)}$	0.0032 lb/1000 lb $gas_{(wet)}$	0.0018 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.165 lb/hr	0.033 lb/hr	0.341 lb/hr	0.180 lb/hr
	$PM_{2.5}$	0.117 lb/hr	0.008 lb/hr	0.328 lb/hr	0.151 lb/hr
SVCCOBSWEST (Clearcoat Observation)	PM	0.0008 lb/1000 lb $gas_{(wet)}$	0.0006 lb/1000 lb $gas_{(wet)}$	0.0010 lb/1000 lb $gas_{(wet)}$	0.0008 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.064 lb/hr	0.029 lb/hr	0.031 lb/hr	0.041 lb/hr
	$PM_{2.5}$	0.007 lb/hr	0.001 lb/hr	0.005 lb/hr	0.005 lb/hr
SVRPDRPCS (Spot Repair)	PM (Method 5)	0.00004 lb/1000 lb $gas_{(wet)}$ 0.003 lb/hr	0.0005 lb/1000 lb $gas_{(wet)}$ 0.040 lb/hr	0.0004 lb/1000 lb $gas_{(wet)}$ 0.031 lb/hr	0.0003 lb/1000 lb $gas_{(wet)}$ 0.025 lb/hr
	PM (Method 201A)	0.0004 lb/1000 lb $gas_{(wet)}$	0.0004 lb/1000 lb $gas_{(wet)}$	0.0005 lb/1000 lb $gas_{(wet)}$	0.0004 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.022 lb/hr	0.020 lb/hr	0.022 lb/hr	0.022 lb/hr
	$PM_{2.5}$	0.010 lb/hr	0.010 lb/hr	0.012 lb/hr	0.011 lb/hr
SVSPOTPRMWEST1 (Spot Primer)	PM (Method 5)	0.0011 lb/1000 lb $gas_{(wet)}$ 0.040 lb/hr	0.0015 lb/1000 lb $gas_{(wet)}$ 0.058 lb/hr	0.0002 lb/1000 lb $gas_{(wet)}$ 0.007 lb/hr	0.0010 lb/1000 lb $gas_{(wet)}$ 0.035 lb/hr
	PM (Method 201A)	0.0009 lb/1000 lb $gas_{(wet)}$	0.0007 lb/1000 lb $gas_{(wet)}$	0.0006 lb/1000 lb $gas_{(wet)}$	0.0007 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.029 lb/hr	0.023 lb/hr	0.018 lb/hr	0.023 lb/hr
	$PM_{2.5}$	0.021 lb/hr	0.013 lb/hr	0.008 lb/hr	0.014 lb/hr

The following table outlines the results from the capture efficiency from E-Coat Dip Tank and E-Coat Oven system.

Table 4.1.2: Summary of the EUCOATWEST Capture Efficiency Testing Results:

Source Group	Source	Results
E-Coat Dip Tank	Entrance	PASS/ Inward Flow
	Exit	PASS/ Inward Flow
E-Coat Oven	Entrance	PASS / Inward Flow
	Exit	PASS / Inward Flow

5 OPERATING CONDITIONS

Operating conditions during sampling were monitored by WTAP personnel. 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 representative operating conditions.

6 CONCLUSIONS

Testing was successfully completed during the week of February 14th to 21st and April 5th to 7th, 2022. All parameters were tested in accordance with referenced methodologies.

TABLE

Table 1: Summary of Sampling Parameters and Methodology

Source	No. of Tests per Stack	Sampling Parameter	Sampling Method
Spot Prime	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 5
Spot Prime	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 201A
Spot Repair	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 5
Spot Repair	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 201A
Basecoat Observation	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 201A
Clearcoat Observation	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 201A
Tutone Observation	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 201A

Notes:

[1] U.S. EPA - United States Environmental Protection Agency