FINAL REPORT

FCA US LLC

WARREN, MICHIGAN

WARREN TRUCK ASSEMBLY PLANT (WTAP) EAST PAINT SHOP: OBSERVATION ZONE (BASECOAT, CLEARCOAT) AND SPOT PRIME PARTICULATE MATTER COMPLIANCE TEST

RWDI #2201515

August 14, 2022

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 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 PTI is provided in **Appendix A**).

The approved Source Testing Plan covered the following seven (7) sources:

- EUSPOTREPAIREAST - PM emissions from SVDS_SPOTEAST observation zone.
- The balance of the sources are in the FGFACILITY Flexible Group:
    - EU-COLOR-ONE Basecoat Observation 1 - PM/PM_{10}/$PM_{2.5}$ emissions from SVBC1OBEAST1.
    - EU-COLOR-ONE Basecoat Observation 2 - PM/PM_{10}/$PM_{2.5}$ emissions from SVBC1OBEAST2.
    - EU-COLOR-ONE Basecoat Observation 3 - PM/PM_{10}/$PM_{2.5}$ emissions from SVBC1OBEAST3.
    - EU-COLOR-ONE Clearcoat Observation 1 - PM/PM_{10}/$PM_{2.5}$ emissions from SVCC1OBEAST1.
    - EU-COLOR-ONE Clearcoat Observation 2 - PM/PM_{10}/$PM_{2.5}$ emissions from SVCC1OBEAST2.
    - EU-COLOR-ONE Topcoat Oven Thermal Oxidizer - PM emissions from SVEXC1INC.

As communicated between FCA and the State of Michigan Environment, Great Lakes, and Energy (EGLE), the program was split and this report does not include EU-COLOR-ONE Topcoat Oven Thermal Oxidizer - PM emissions from SVEXC1INC. SVEXC1INC was addressed in a separate report.

EUSPOTREPAIR was testing twice for this program. The original measured values were suspected to be too high in comparison to expected concentration. Therefore, on August 8th and 9th, 2022 RWDI re-test EUSPOTREPAIR to confirm the particulate levels for PM/PM_{10}/$PM_{2.5}$. Both sets of results are provided in this report.

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

Source	Parameter	Emission Rate
		Average
SVDS_SPOTEAST (Spot Repair) June Testing	PM (Method 201A)	0.0017 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.135 lb/hr
	$PM_{2.5}$	0.067 lb/hr
SVDS_SPOTEAST (Spot Repair) August Testing	PM (Method 201A)	0.0005 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.037 lb/hr
	$PM_{2.5}$	0.028 lb/hr
SVBC1OBEAST1 (Basecoat Observation 1)	PM (Method 201A)	0.0003 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.019 lb/hr
	$PM_{2.5}$	0.016 lb/hr
SVBC1OBEAST2 (Basecoat Observation 2)	PM (Method 201A)	0.0021 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.114 lb/hr
	$PM_{2.5}$	0.066 lb/hr
SVBC1OBEAST3 (Basecoat Observation 3)	PM (Method 201A)	0.0024 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.174 lb/hr
	$PM_{2.5}$	0.075 lb/hr
SVCC1OBEAST1 (Clearcoat Observation 1)	PM (Method 201A)	0.0017 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.095 lb/hr
	$PM_{2.5}$	0.062 lb/hr
SVCC1OBEAST2 (Clearcoat Observation 2)	PM (Method 201A)	0.0028 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.065 lb/hr
	$PM_{2.5}$	0.041 lb/hr

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2 SOURCE DESCRIPTION

2.1 Plant and Sources Overview

WTAP operates an automobile assembly plant that produces the RAM 1500 Classic model in the East Paint Shop for FCA US LLC. This program focuses only on the East Paint Shop. This Source Testing Plan includes the required compliance testing for particulate matter of the Topcoat observation zones (Basecoat and Clearcoat), Topcoat Oven Thermal Oxidizer, and Spot Repair Booth. This report does not cover the emissions from EU-COLOR-ONE Topcoat Oven Thermal Oxidizer. The following table outlines the sampling program.

Table 2.1.1: Summary of Sampling Program – EU-COLOR-ONE Basecoat Observation 1, 2, and 3

FGNEWNGEAST	
Emission Unit Description [Including Process Equipment & Control Device(s)]	Emissions from the observation zones for basecoat are controlled by particulate control system and exhausted to the ambient air. **Sources:** SVBC1OBEAST1, SVBC1OBEAST2, and SVBC1OBEAST3
Parameter Tested	Particulate matter ($PM/PM_{10}/PM_{2.5}$) in addition to Stack Gas Velocity, Stack gas composition, and Moisture
Testing Monitoring Methods	• USEPA Methods: 1, 2, 3, 4, and 201A • Each test was 120-minutes

Table 2.1.2: Summary of Sampling Program – EU-COLOR-ONE Clearcoat Observation 1 and 2

FGNEWNGEAST	
Emission Unit Description [Including Process Equipment & Control Device(s)]	Emissions from the observation zones for clearcoat are controlled by particulate control system and exhausted to the ambient air. **Sources:** SVCC1OBEAST1 and SVCC1OBEAST2
Parameter Tested	Particulate matter ($PM/PM_{10}/PM_{2.5}$) in addition to Stack Gas Velocity, Stack gas composition, and Moisture
Testing Monitoring Methods	• USEPA Methods: 1, 2, 3, 4, and 201A • Each test was 120-minutes

Table 2.1.3: Summary of Sampling Program – EUSPOTREPAIREAST

EUSPOTREPAIREAST	
Emission Unit Description [Including Process Equipment & Control Device(s)]	Dry filter particulate controls on the east spot repair are exhausted to the atmosphere **Sources:** SVDS_SPOTEAST
Parameter Tested	Particulate matter (PM) in addition to Stack Gas Velocity, Stack gas composition, and Moisture
Testing Monitoring Methods	• USEPA Methods: 1, 2, 3, 4, and 201A • Each test was 240-minutes

2.2 Sampling Locations Overview

This following table summarizes the sampling locations.

Table 2.2.1: Summary of the Stack Characteristics

Source	Parameter	Diameter	Approximate Duct Diameters from Flow Disturbance	Number of Ports	Points per Traverse	Total Points per Test	Average Stack Temperature
SVDS_SPOTEAST	PM/PM_{10}/$PM_{2.5}$	41"	8 downstream and 9 upstream	2	6	12 PM/Flow	78.1°F
SVCCOBEAST1	PM/PM_{10}/$PM_{2.5}$	41"	8 downstream and 8 upstream	2	6	12 PM/Flow	79.5°F
SVCCOBEAST2	PM/PM_{10}/$PM_{2.5}$	27"	9 downstream and 10 upstream	2	6	12 PM/Flow	77.7°F
SVBCOBEAST1	PM/PM_{10}/$PM_{2.5}$	41.5"	8 downstream and 8 upstream	2	6	12 PM/Flow	76.3°F
SVBCOBEAST2	PM/PM_{10}/$PM_{2.5}$	41.5"	8 downstream and 8 upstream	2	6	12 PM/Flow	75.3°F
SVBCOBEAST3	PM/PM_{10}/$PM_{2.5}$	41.5"	8 downstream and 8 upstream	2	6	12 PM/Flow	76.9°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 sized 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 Sampling for Particulate Matter (PM, PM_{10} and $PM_{2.5}$)

To measure PM_{10} and $PM_{2.5}$, a sample of gas is extracted at a predetermined constant flow rate through an in-stack sizing device. The particle-sizing device separates particles with nominal aerodynamic diameters of 10 micrometers and 2.5 micrometers. To minimize variations in the isokinetic sampling conditions, well-defined limits must be established. After a sample is obtained, uncombined water is removed from the particulate. Gravimetric analysis is then used to determine the particulate mass for each size fraction. The method allows the use of a $PM_{2.5}$ cyclone downstream of the PM_{10} cyclone. Both cyclones were developed and evaluated as part of a conventional five-stage cascade cyclone train. The addition of a $PM_{2.5}$ cyclone between the PM_{10} cyclone and the stack temperature filter in the sampling train supplements the measurement of PM_{10} with the measurement of $PM_{2.5}$.

3.1.6 Sampling Modifications

During the test program, the plant production on June 15th, 2022 abruptly ended in the middle of testing on BC 1, BC 2, and BC 3. RWDI discussed this with Ms. Gina Angellotti and this pause was approved. RWDI continued testing on June 16th, 2022 and finished on each source.

Since each source was under 85°F, USEPA Method 202 was not conducted.

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 EUSPOTREPAIREAST, EU-COLOR-ONE Basecoat Observation 1, EU-COLOR-ONE Basecoat Observation 2, EU-COLOR-ONE Basecoat Observation 3, EU-COLOR-ONE Clearcoat Observation 1, EU-COLOR-ONE Clearcoat Observation 2.

Table 5.1: Emission Data – Particulate Testing ($PM/PM_{10}/PM_{2.5}$)

Source	Parameter	Emission Rate
		Average
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	$PM_{2.5}$	0.062 lb/hr
SVCC1OBEAST2 (Clearcoat Observation 2)	PM (Method 201A)	0.0028 lb/1000 lb $gas_{(wet)}$
	PM_{10}	0.065 lb/hr
	$PM_{2.5}$	0.041 lb/hr

6 CONCLUSIONS

Testing for particulate matter ($PM/PM_{10}/PM_{2.5}$) was completed June 15th - 17th, 2022 and August 8th to 9th, 2022 and was completed in accordance with the Source Testing Plan for EUSPOTREPAIREAST, EU-COLOR-ONE Basecoat Observation 1, EU-COLOR-ONE Basecoat Observation 2, EU-COLOR-ONE Basecoat Observation 3, EU-COLOR-ONE Clearcoat Observation 1, EU-COLOR-ONE Clearcoat Observation 2. The results for EU-COLOR-ONE Topcoat Oven Thermal Oxidizer were included in a separate report which preceded this one.

TABLE

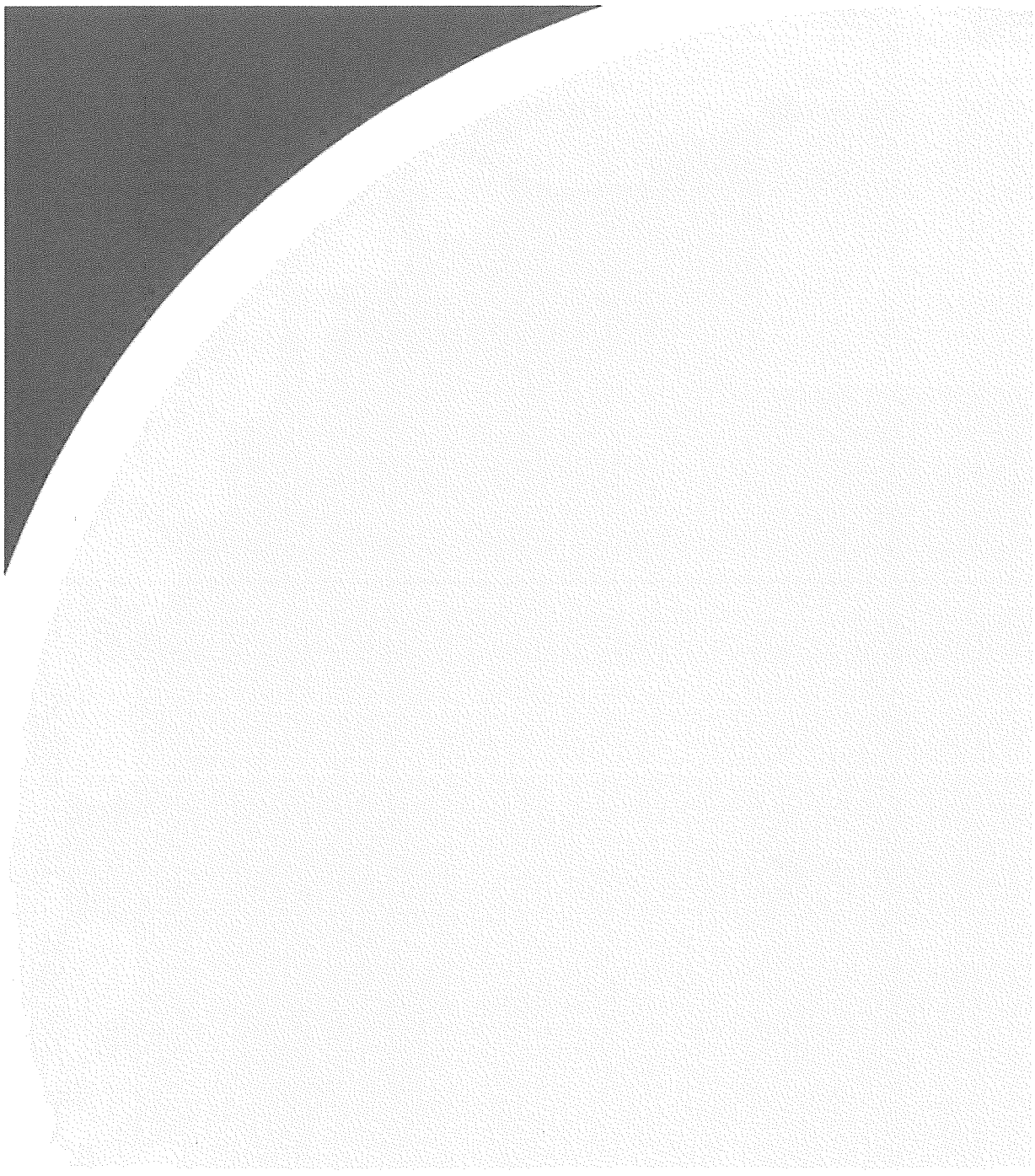


Table 1: Summary of Sampling Parameters and Methodology

Source	No. of Tests per Stack	Sampling Parameter	Sampling Method
Spot Repair	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 201A
Basecoat Observaton 1	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 201A
Basecoat Observation 2	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 201A
Basecoat Observation 3	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 201A
Clearcoat Observation 1	3	Stack Parameters	U.S. EPA [1] Methods 1-4
	3	PM/PM10/PM2.5	U.S. EPA [1] Method 201A
Clearcoat Observation 2	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

FIGURES

Figure No. 1

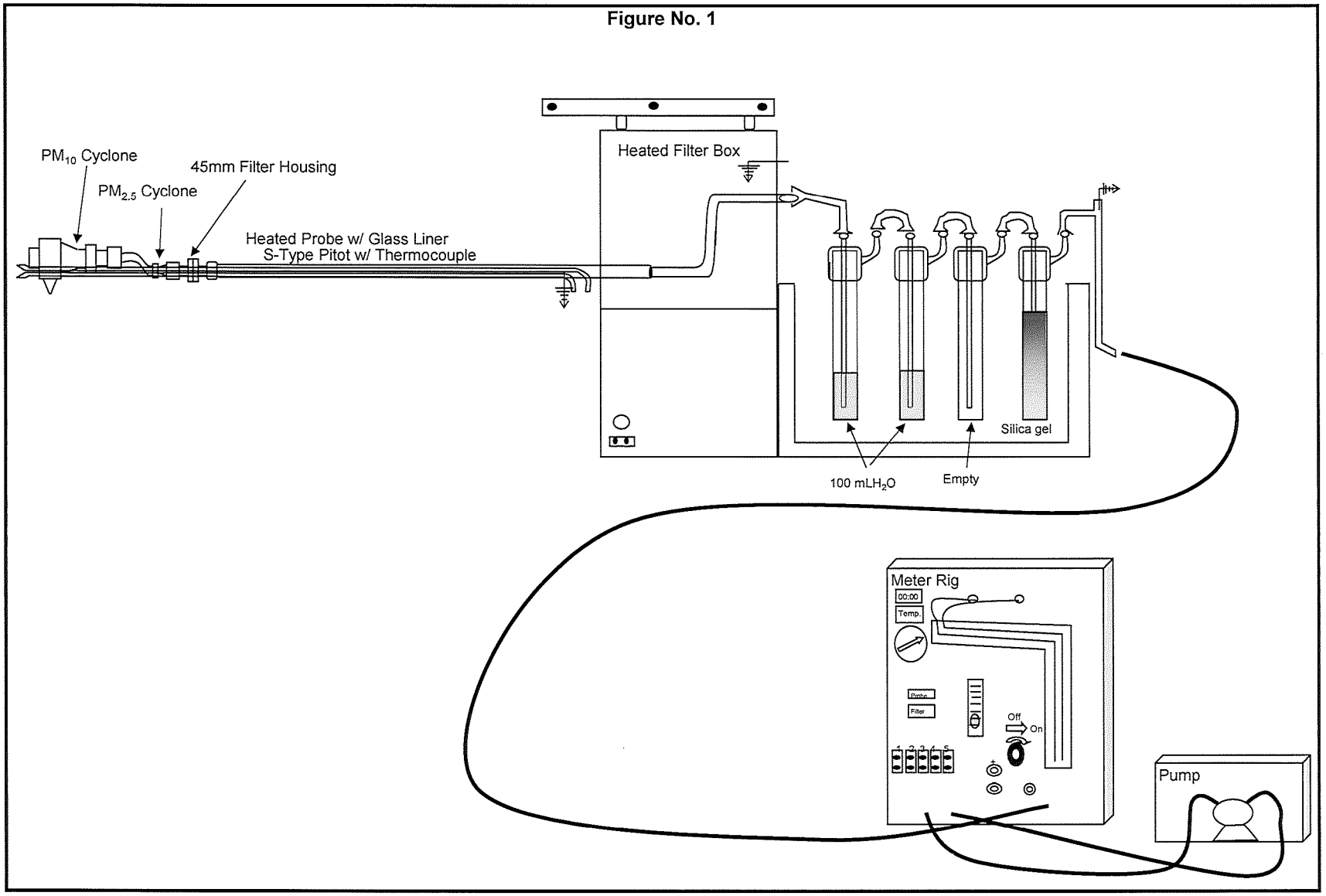
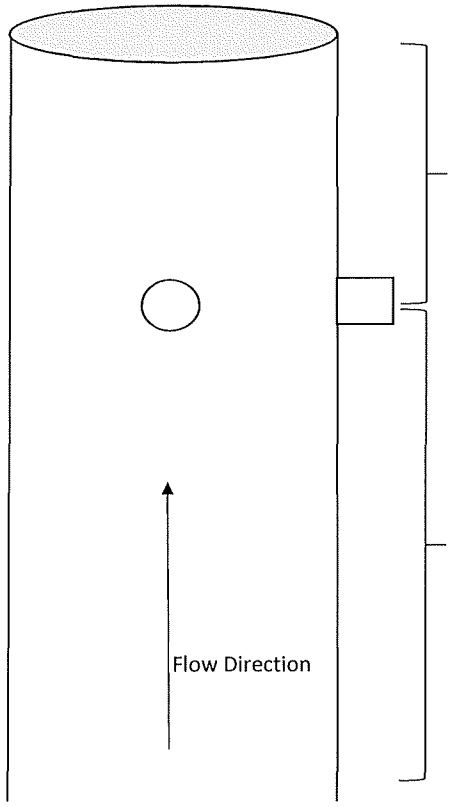
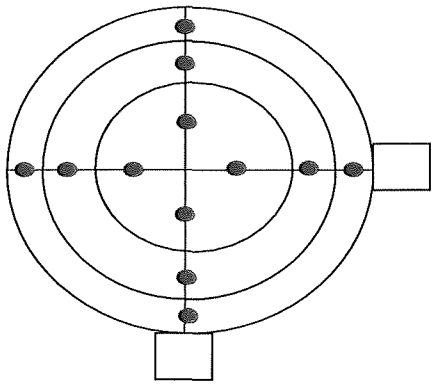

PM10 Cyclone
PM2.5 Cyclone
45mm Filter Housing
Heated Probe w/ Glass Liner
S-Type Pitot w/ Thermocouple
Heated Filter Box
Silica gel
100 mLH2O
Empty
Meter Rig
00:00
Temp.
Filter
Off
On
Pump

Figure No. 2



Diameter: 41.5

Sampling Points (in.)	
1	1.83
2	6.06
3	12.28
4	29.22
5	35.44
6	39.67



Not to scale

Basecoat 1
FCA
WTAP East Paint Shop
Warren, Michigan

Date:
June 15-16, 2022

RWDI USA LLC
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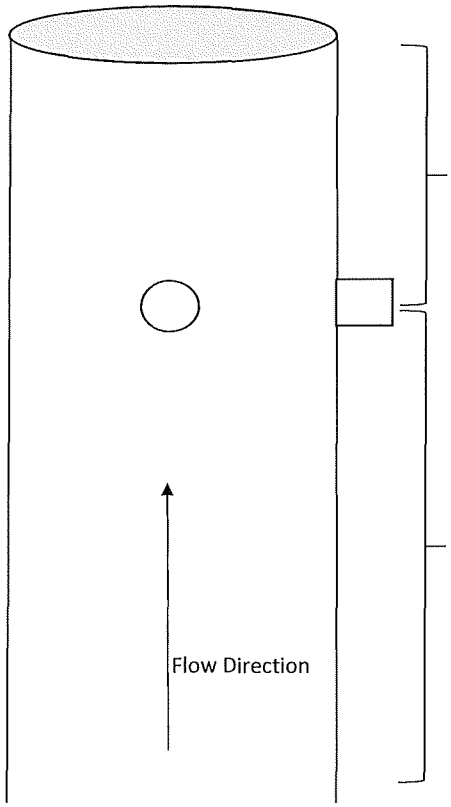
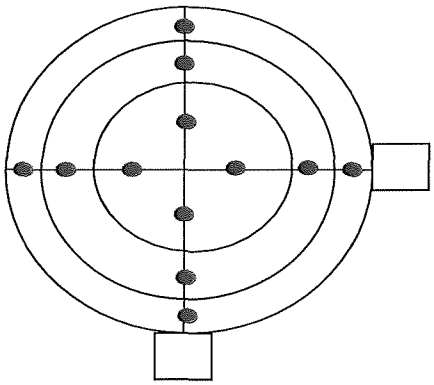
Rochester Hills, MI 48309

Figure No. 3



Diameter: 41.5

Sampling Points (in.)	
1	1.83
2	6.06
3	12.28
4	29.22
5	35.44
6	39.67



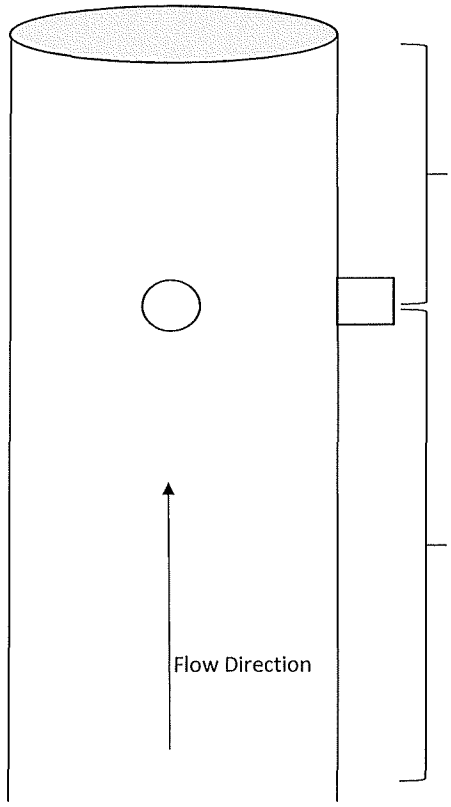
Not to scale

Basecoat 2
FCA
WTAP East Paint Shop
Warren, Michigan

Date:
June 15-16, 2022

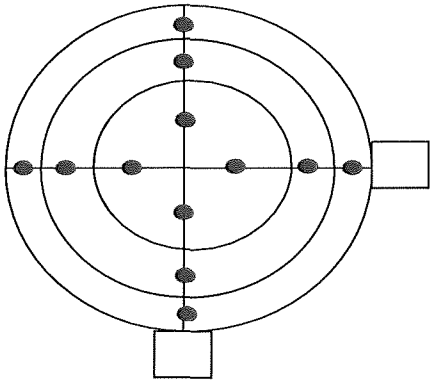
RWDI USA LLC
2239 Star Court
Rochester Hills, MI 48309

Figure No. 4



Diameter: 41.5

Sampling Points (in.)	
1	1.83
2	6.06
3	12.28
4	29.22
5	35.44
6	39.67



Not to scale

Basecoat 3
FCA
WTAP East Paint Shop
Warren, Michigan

Date:
June 15-16, 2022

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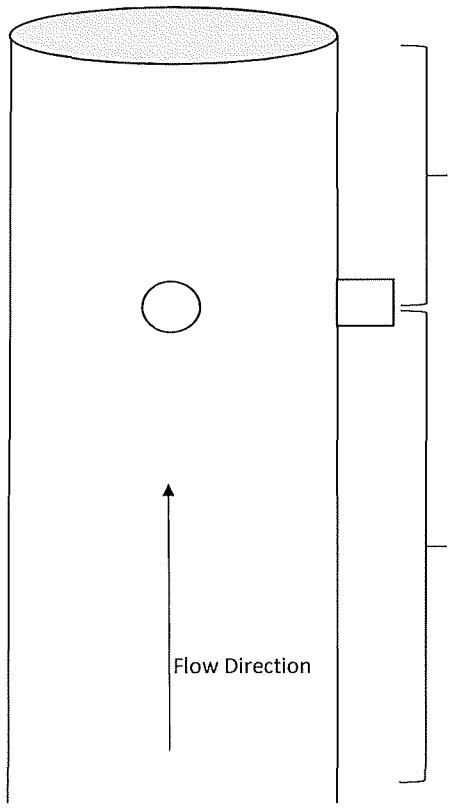
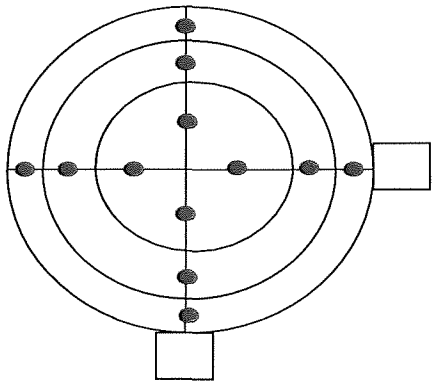
Rochester Hills, MI 48309

Figure No. 5



Diameter: 41

Sampling Points (in.)	
1	1.80
2	5.99
3	12.14
4	28.86
5	35.01
6	39.20



Not to scale

Clearcoat 1
FCA
WTAP East Paint Shop
Warren, Michigan

Date:
June 16-17, 2022

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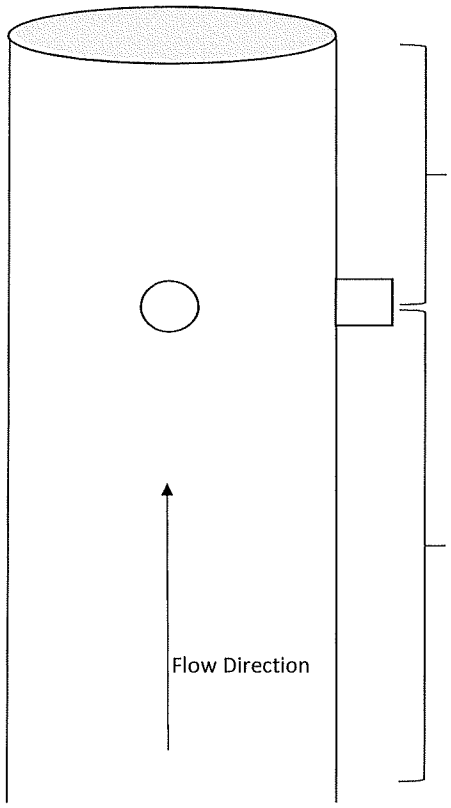
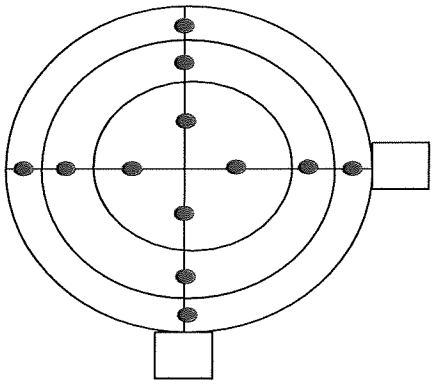
Rochester Hills, MI 48309

Figure No. 6



Diameter: 27

Sampling Points (in.)	
1	1.19
2	3.94
3	7.99
4	19.01
5	23.06
6	25.81



Not to scale

Clearcoat 2
FCA
WTAP East Paint Shop
Warren, Michigan

Date:
June 16-17, 2022

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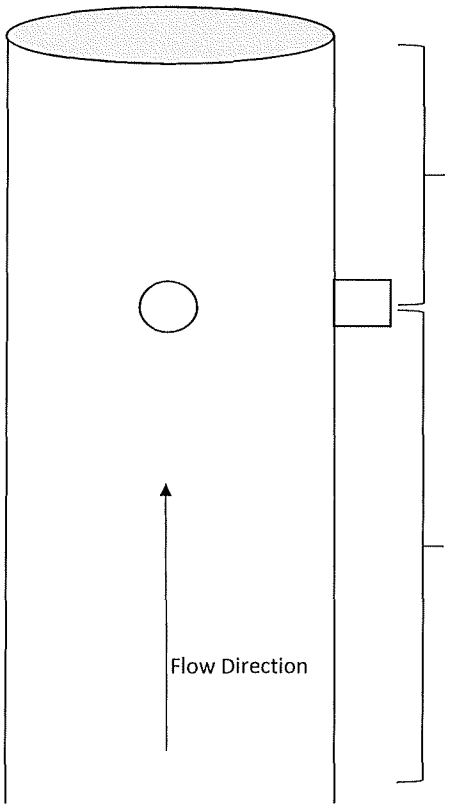
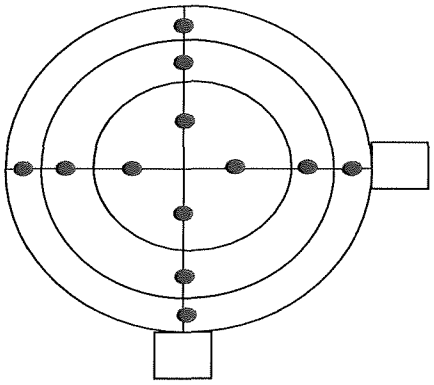
Rochester Hills, MI 48309

Figure No. 7



Diameter: 41

Sampling Points (in.)	
1	1.80
2	5.99
3	12.14
4	28.86
5	35.01
6	39.20



Not to scale

Spot Prime
FCA
WTAP East Paint Shop
Warren, Michigan

Date:
June 16-17, 2022

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