FINAL REPORT

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AIR QUALITY DIVISION

FCA US LLC

DETROIT, MICHIGAN

WARRAN TRUCK ASSEMBLY PLANT
TRANSFER EFFICIENCY AND OVEN SOLVENT LOADING TESTING

RWDI #1803229

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SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI AIR Inc. (RWDI) and JLB Industries, LLC (JLB) were retained by FCA US LLC (FCA) Warren Truck Assembly Plant (WTAP) to complete a compliance environmental testing program at the facility located in Detroit, Michigan. WTAP operates two (2) topcoat paint booths identified as "EU-COLOR_ONE" and "EU-COLOR-TWO" as noted under Renewable Operating Permit No. MI-ROP-B2767-2016. The testing program consisted of Transfer Efficiency (TE) testing and Oven Capture Efficiency (CE) testing. Determination of TE and CE were conducted in accordance with all applicable procedures contained in USEPA document "Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Topcoat Operations". The testing was completed during the week of September 24th, 2018. The testing consisted of the following:

- Paint solids transfer efficiency (TE) – the percent of paint solids sprayed that deposit on the painted part that was measured when applying White solid basecoat, Black metallic basecoat and standard clearcoat in "EU-COLOR_TWO" line and are considered to be representative for all Topcoat Operations.
- Volatile Organic Compound (VOC) capture efficiency (CE) was completed on the bake oven for the "EU-COLOR_TWO" line. This includes the percent of VOC captured from the curing of the coating in the bake oven. The bake oven VOC CE is used to calculate the mass of VOC captured per gallon of applied coating solids (lb VOC/gacs) and is also referred to as oven solvent loading. Oven VOC CE was measured at "EU-COLOR-TWO" Spraybooth when applying solid White basecoat, Black metallic basecoat and standard clearcoat and are considered to be representative for all Topcoat Operations.

Transfer Efficiency values were derived using the RAM 1500 model 4-door which accounts for the largest surface area of the RAM Truck models made at the facility. Personnel from the paint shop, FCA environmental staff and RWDI/JLB conducted the testing. These groups worked together at each stage of testing to ensure that the results were representative of production conditions.

RWDI/JLB Industries used highly accurate weighing systems to determine the vehicle and panel weights before and after coating application. Calibrated volumetric flow meters, located on each applicator, were used to measure paint usage.

Material samples were collected from the paint circulation tanks directly after vehicle spray out. Determination of percent solids by weight and density was performed by Advanced Technologies of Materials laboratories, located in Waverly, Ohio.

Transfer Efficiency (TE) Results Summary

Tested Coating	Solids Transfer Efficiency (%)
Basecoat (White Solid Basecoat)	75.2%
Basecoat (Black Metallic)	70.1%
Clearcoat	74.3%

Capture Efficiency (CE) Results Summary

		Loading (Lb/GACS)	Capture Efficiency	Capture Efficiency @ 100% TE
		EU-COLOR-TWO	EU-COLOR-TWO	EU-COLOR-TWO
Solid Basecoat (White)	Oven	1.28	11.3%	15.0%
Metallic Basecoat (Black)	Oven	1.91	14.3%	20.5%
Clearcoat	Oven	3.48	35.6%	48.0%

1 INTRODUCTION

RWDI AIR Inc. (RWDI) and JLB Industries, LLC (JLB) were retained by FCA US LLC (FCA) Warren Truck Assembly Plant (WTAP) to complete a compliance environmental testing program at the facility located in Detroit, Michigan. WTAP operates two (2) topcoat paint booths identified as "EU-COLOR_ONE" and "EU-COLOR-TWO" as noted under Renewable Operating Permit No. MI-ROP-B2767-2016. The testing program consisted of Transfer Efficiency (TE) testing and Oven Capture Efficiency (CE) testing. Determination of TE and CE were conducted in accordance with all applicable procedures contained in USEPA document "Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Topcoat Operations". The testing was completed during the week of September 24th, 2018. The testing consisted of the following:

- Paint solids transfer efficiency (TE) – the percent of paint solids sprayed that deposit on the painted part that was measured when applying White solid basecoat, Black metallic basecoat and standard clearcoat in "EU-COLOR_TWO" line and are considered to be representative for all Topcoat Operations.

- Volatile Organic Compound (VOC) capture efficiency (CE) was completed on the bake oven for the "EU-COLOR_TWO" line. This includes the percent of VOC captured from the curing of the coating in the bake oven. The bake oven VOC CE is used to calculate the mass of VOC captured per gallon of applied coating solids (lb VOC/gacs) and is also referred to as oven solvent loading. Oven VOC CE was measured at "EU-COLOR-TWO" Spraybooth when applying solid White basecoat, Black metallic basecoat and standard clearcoat and are considered to be representative for all Topcoat Operations.

A Source Testing Plan, for the testing, was submitted to the Michigan Department of Environmental Quality (MDEQ) on August 3, 2018. Testing was successfully completed while all process equipment was operating under normal maximum operating conditions during the week of September 24th, 2018. A copy of the Source Testing Plan is provided in **Appendix A**.

Testing of emissions was conducted by Mr. Jim Belanger and Mr. Jeff Monache of JLB, and Mr. Brad Bergeron of RWDI. Mr. Matthew Smith and Mr. Rohit Patel were on-site to monitor the process operation and witness the testing on behalf of FCA US LLC.

2 SOURCE AND SAMPLING LOCATIONS

2.1 Process Description

WTAP is located at 21500 Mound Road in Warren, Michigan. The facility completes assembly and paint operations for FCA US LLC. Vehicle body panels are stamped and assembled on site from sheet metal components. The bodies are cleaned, treated, and prepared for painting in the phosphate system. Drawing compounds, mill oils, and dirt are removed from the vehicle bodies utilizing both high pressure spray and immersion cleaning/rinsing techniques. Vehicle bodies then are dip coated in electro deposition corrosion primer paint for protection. The electro primer (E-coat) is heat-cured to the vehicle body in a high-temperature bake oven. After completing the E-coat operation, vehicle bodies are conveyed to the sealer area for application of various sealants to body seams and joints. Vehicle bodies are then conveyed to an oven to cure the sealers.

After the sealer oven, the vehicles are routed to the powder prime system and then topcoat operations. In the topcoat system, the bodies receive solvent borne coatings: basecoat and clearcoat coatings. After topcoat is applied, the vehicle is baked in the topcoat oven. After exiting the topcoat oven, the vehicles are routed to inspection.

An overview of the process to be sampled and associated sampling sites is provided below.

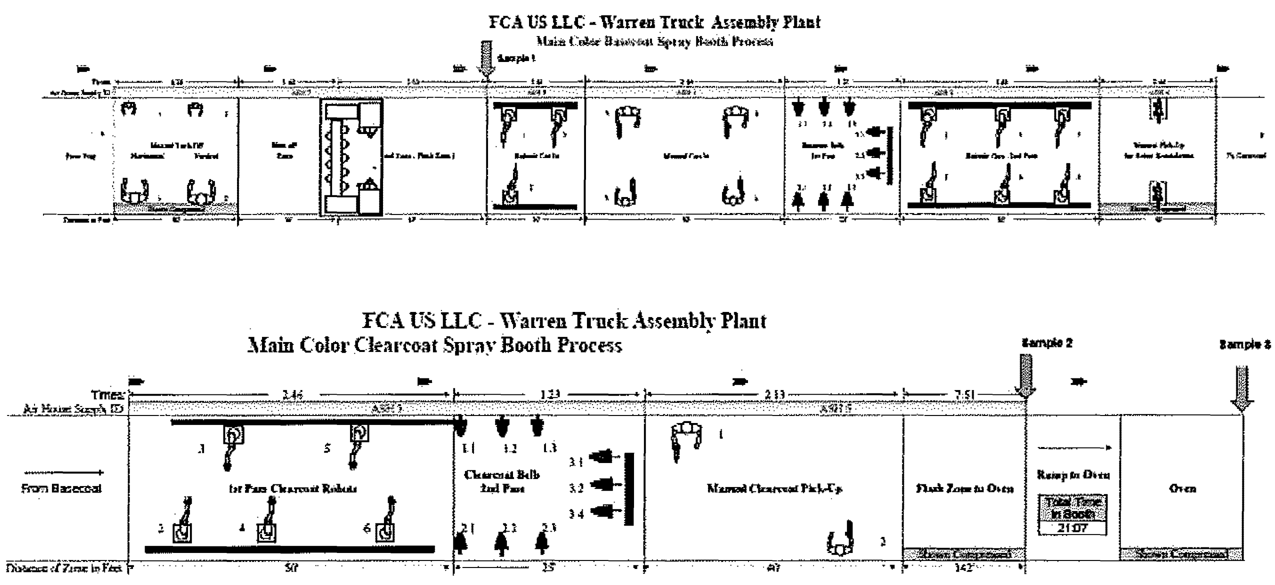


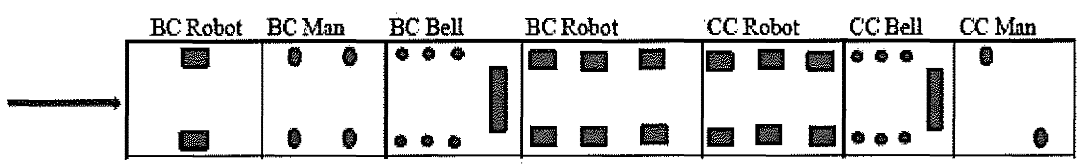
Figure 1: Process and Sampling Location Overview

Table 2.1-1: Summary of "EU-COLOR-TWO" Applicator Parameters

Operation	Manufacturer	Applicator	Fluid Tip/ Bell Size	Air Cap	Gun Voltage (kV)	RPM	Gun-to-Target Distance (inch)	Remarks
Basecoat Robot Engine	ABB	Eco2 HX 1	1.1 mm	N/A	N/A	25,000	6-10 inches	
Basecoat Bell	Behr	EcoBell	1.1 mm	N/A	60-80 kV	50k Black / 55k White	10 inches	
Basecoat Robot	ABB	Eco HX	0.7 side / 0.9 OH	N/A	50 kV	65k Black / 55k White	10 inches	
Clearcoat Robot	ABB	EFC-2	3 mm	A71L	80 kV	N/A	10 inches	
Clearcoat Bell	Behr	EcoBell	1.1 mm	N/A	60-80 kV	55,000	10 inches	

Notes: mm – millimetres
kV – kilovolts
RPM – revolutions per minute

Line Speed: 16.4 fpm



2.2 Control Equipment

Topcoat Spray Booths are controlled using a downdraft ventilation system and water wash system below the booth grate to control paint overspray. Captured basecoat and clearcoat bake oven VOC emission are directed to thermal oxidizer (TO) for VOC abatement. All controls were functioning during the testing period.

2.3 Operating Parameters

The following process control measures were recorded during the testing:

- Coating usage;
- Application information;
- Bake Oven Temperature;
- Spray booth relative humidity; and
- Spray booth temperature.

The following summarizes the Spray booth and Bake Oven process conditions.

Table 2.3-1: Summary of Operating Conditions

Source	Spray Booth Temperature	Spray Booth Relative Humidity	Bake Oven Temperature
EU-COLOR-TWO Spray Booth	ASH1 - 76°F ASH2 - 74°F ASH3 - 86°F ASH4 - 80°F ASH5 - 80°F ASH6 - 69°F ASH7 - 69°F	ASH1 - 38% ASH2 - 40% ASH3 - 26% ASH4 - 32% ASH5 - 35% ASH6 - 47% ASH7 - 47%	Zone 1 - 324°F Zone 2 - 330°F Zone 3 - 294°F Zone 3a - 289°F Zone 4 - 294°F Zone 5 - 289°F Fresh Air - 285°F Incinerator - 1369°F Sill Heat - 319°F Cooling - 98°F

2.4 Process Sampling Locations

A process sample of each coating applied during the testing were collected for analysis. The coatings were collected following procedures in USEPA's "Standard Procedure for Collection of Coating and Ink Samples for Analysis by Method 24 and 24A".

Coating samples were collected at the application point into four (4) ounce glass sampling jars with minimal headspace. The coating-as-applied samples were analyzed using USEPA Method 24 to measure percent VOC, percent water and density. The results are summarized below in **Table 2.4-1** and in **Appendix B.**

Table 2.4-1: Summary of Method 24 Coating Analysis

Sample	Parameter									
	Date	% Non-Volatile	% Volatile	Density		% Water	VOC		VOC-Water	
				g/ml	lb/gal		g/L	lb/gal	g/L	lb/gal
Black Metallic Basecoat	9/25/18	48.64	51.36	0.985	8.218	0	505.81	4.221	--	--
White Basecoat	9/26/18	61.48	38.52	1.243	10.369	0	478.66	3.994	--	--
Clearcoat	9/28/18	55.45	44.55	1.033	8.622	0	460.27	3.841	--	--

3 SAMPLING AND ANALYTICAL PROCEDURES

3.1 Summary of Test Program

The topcoat process at WTAP is comprised of two (2) topcoat paint lines consisting of the "EU-COLOR-ONE" and "EU-COLOR-TWO" lines. The topcoat system consists of several spray sections followed by an associated curing oven. The spray booth operations are defined as follows:

- Basecoat Robots – Basecoat was applied to the exterior and interior surfaces; and
- Clearcoat Robots - Clearcoat was applied to the exterior and interior surfaces.

Skidded vehicles are conveyed through the booth and coated with topcoat materials (basecoat and clearcoat). The vehicles are processed through a bake oven where the coating is cured.

Currently, coatings are applied to the RAM Truck production models. Production units on which an electrocoat corrosion inhibiting primer had been applied were used in the test program for the transfer efficiency testing. For the CE testing, scrap vehicles were used for the testing program. The test program is summarized below.

3.2 Transfer Efficiency Test

Transfer Efficiency testing was conducted in the Topcoat Spray Booth where White solid basecoat, Black metallic basecoat and clearcoat were applied. Applicator and environmental conditions were monitored to ensure that the testing accurately reflected production conditions. Measured parameters included: Vehicle weight gain, material usage, material analysis (percent solids by weight and density), applicator settings, film build and oven heat settings.

A total of four vehicle bodies were used in calculating test results. Three vehicles were processed as normal production vehicles, and one vehicle were dedicated as no-paint, control vehicles in conjunction with the testing. All units were production vehicles with sealer.

An off-line vehicle weigh station (VWS) was constructed to measure the weight of the test units before and after each painting process. Test vehicles were routed to a dedicated conveyor spur. A fixed stop was secured to assure repeatable positioning of the vehicles. Test vehicles were lifted free from their carriers by two lift-table mounted scale bases. Ultra-high molecular weight (UHMW) plastic blocks were strategically placed on the scale bases to lift the vehicle at the center of gravity locations. The UHMW blocks minimized friction loading on vehicles and scale bases.

Vehicle weights were measured several times and recorded. All test vehicles were weighed with production fixtures (door hooks and hood props) installed. The vehicle weigh station scales were calibrated using Class-F calibration weights conforming to the National Bureau of Standards handbook 105-1. A one or two-pound avoirdupois, Class F stainless steel weight was added periodically during pre- and post-process weighing to verify scale linearity.

Coating thickness was measured on a representative test vehicle to verify paint film-build was within the production specification. The data was taken with a handheld Elcometer gauge.

Coating material usage was monitored via volumetric flow measurement devices located on each applicator. A verification of each applicator was performed by FCA personnel to ensure accurate usage measurement. Material samples of applied coatings were collected from the respective systems directly after testing. Samples were sent to Advanced Technologies of Materials for analysis to determine density by ASTM D1475 and weight solids content by ASTM D2369 (referenced in EPA Method 24). The laboratory results were used in calculating the Transfer Efficiency and Capture Efficiency values.

Production vehicles with paint shop sealer were prepared with prime and processed through the Topcoat Spray Booth. The test sequence for the Transfer Efficiency test was:

White Solid Basecoat:

1. Test Unit ID TE1
2. Test Unit ID TE2
3. Test Unit ID TE4
4. Test Unit ID TE3 – (no-paint control)

Black Metallic Basecoat:

1. Test Unit ID TE1
2. Test Unit ID TE2
3. Test Unit ID TE4
4. Test Unit ID TE3 – (no-paint control)

Clearcoat:

1. Test Unit ID TE1
2. Test Unit ID TE2
3. Test Unit ID TE4
4. Test Unit ID TE3 – (no-paint control)

Test Vehicles were routed through the bake oven and back to the vehicle weigh station. After cooling, the test vehicles were weighed and released to production.

3.3 Capture Efficiency Tests

A panel weigh station (PWS) was assembled at the Topcoat Spray Booth. A precision balance with measurement capability to 0.001 gram was placed on an isolation platform inside an enclosure to minimize vibration and air movement.

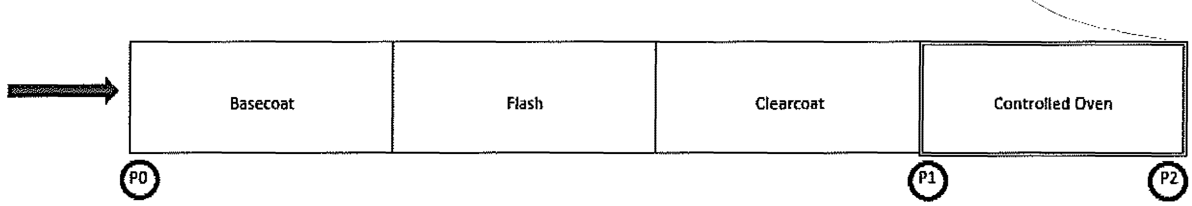
The testing conformed to the methods described in ASTM 5087-02 for solvent borne coatings.

Test panels were placed on a test vehicle and processed with normal production spray programming.

Four electrocoated panels were used for each test. Each group of test panels was weighed in four locations (see panel test diagram) to determine the relative distribution of VOC that is released in the controlled booth zone and bake oven. The panels were attached to test vehicles by magnet, which allowed for removal of the wet panels with minimal disturbance to the coating during handling. Panel mounting locations were chosen to achieve a representative coating film based on the observation of normal vehicle production.

Before the panels were coated, they were marked (P0, P1, P2 and blank) and weighed to establish the initial unpainted panel weights (P0). The panels were then attached to a test vehicle and routed through the Spray Booth. After coating, the panels were carefully removed from the test vehicle and brought to the balance for weighing immediately upon exit from the booth zone before entering the controlled bake oven (P1). The panels were then placed on the test vehicle for travel through the curing oven. Upon exiting the oven, the panels were allowed to cool and then weighed a final time (P2).

Figure 2 - Panel Testing Diagram



4 TEST EQUIPMENT AND QA/QC PROCEDURES

Equipment used in this program passed the Quality Assurance /Quality Control (QA/QC) procedures. **Appendix C** contains the calibration records of the equipment and inspection sheets.

4.1 Pretest QA/QC Activities and Audits

Before testing, the equipment was inspected and calibrated according to the procedures outlined in the applicable procedures outlined in the USEPA document "Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobiles and Light Duty Truck Topcoat Operations", as referenced in 40 CFR 63, Subpart IIII. Refer to **Appendix C** for inspection and calibration sheets.

The results of select sampling and equipment QA/QC audits are presented in the following sections. Refer to **Appendix C** for inspection and calibration sheets.

4.2 Transfer Efficiency QA/QC Blanks

One (1) no-paint control vehicles were run through the process with each test batch to account for weight-loss attributable to sealers. The results of the control vehicles are presented in **Table 4.2-1**.

Table 4.2-1: Summary of Transfer Efficiency QA/QC Control Vehicles

Vehicle Identification	Vehicle Weight Gain (lb)	Vehicle Batch
TE-1	-0.20	White Solid Basecoat Batch
TE-1	-0.06	Black Metallic Batch
TE-1	0.03	Clearcoat Batch

4.3 Test Equipment and QA/QC Procedures

4.3.1 Vehicle Weigh Station (VWS)

A dedicated vehicle weigh station (VWS) equipped with two 1,000 lb. capacity scale bases was used to obtain pre- and post-process vehicle weights. The VWS is accurate to better than 0.05 pounds.

The scales were calibrated as directed by the operating instruction manual. Scales were powered up and exercised by placing 250 pounds of Class F calibration weights on each scale platform. Then, the VWS was calibrated with 500 pounds of Class F calibration weights. VWS linearity was checked using a one-pound, Class F stainless steel calibration weight. The one-pound weight was also added to each test vehicle during pre- and post-process weighing to verify scale linearity.

4.3.2 Material Usage

Coating material usage was monitored via volumetric flow measurement devices located on each applicator. A verification of the applicators was performed by FCA personnel before testing to ensure accurate usage data. Paint usage was measured at each applicator in a graduated cylinder and compared to the expected volume.

A sample of each material was taken after each test and analyzed by Advanced Technologies of Materials, located in Waverly, Ohio. These values were used in calculating the paint solids sprayed and the transfer efficiency. ASTM Method D-2369 was used to determine paint solids. ASTM Method D-1475 was used to determine paint density.

4.3.3 Panel Weigh Station

A panel weigh station (PWS) with measurement capability to 0.001 gram was used to measure panel weights. The balance was warmed up and then calibrated with a 300-gram test weight. The balance was tested with 100, 50, 10 and 1-gram weights before commencing weighing operations. A blank panel weight was measured at the beginning of the testing program and again at the time of each subsequent panel weight measurement. The balance was placed on an isolation platform and inside an enclosure to minimize vibration and airflow at the measurement point.

5 RESULTS

The testing program consisted of Transfer Efficiency (TE) testing and Oven Capture Efficiency (CE) testing. Determination of TE and CE were conducted in accordance with all applicable procedures contained in USEPA document "Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Topcoat Operations".

5.1 Results

Results are summarized in Tables 5.1-1 and 5.1-2 for TE and CE. Detailed VOC CE and paint solids TE results are presented in Table Section. All sampling field notes are provided in **Appendix E**. Sample Calculations are provided in **Appendix F**. All laboratory results are included in **Appendix B**. Process Data is provided in **Appendix G**.

Table 5.1-1 – Transfer Efficiency Results Summary

Tested Coating	Transfer Efficiency (%)
White Solid (Basecoat)	75.2%
Black Metallic (Basecoat)	70.1%
Clearcoat	74.3%

Table 5.1-2 – Capture Efficiency Results Summary

		Loading (Lb/GACS)	Capture Efficiency	Capture Efficiency @ 100% TE
		EU-COLOR-TWO	EU-COLOR-TWO	EU-COLOR-TWO
Solid Basecoat (White)	Oven	1.28	11.3%	15.0%
Metallic Basecoat (Black)	Oven	1.91	14.3%	20.5%
Clearcoat	Oven	3.48	35.6%	48.0%

5.2 Discussion of Results

There were no significant disruptions to the testing program.

6 PROCESS CONDITIONS

Operating conditions during the sampling were monitored by FCA personnel. All equipment was operated under normal maximum operating conditions. Process Data is provided in **Appendix G**.

Contact was maintained between the operator and the sampling team. A member of the RWDI/JLB sampling team was in contact with FCA staff during the entire sampling program.

7 CONCLUSIONS

Testing was successfully completed during the week of September 24th, 2018. All parameters were tested in accordance with referenced methodologies.

September 2018
Summary

Table 1: VOC Loading and Capture Efficiency

Process	Loading (Lb VOC/GACS)	Capture Efficiency (%)	Capture Efficiency @ 100% TE (%)
Metallic Basecoat Oven	1.91	14.3%	20.5%
Solid Basecoat Oven	1.28	11.3%	15.0%
Clearcoat Oven	3.48	35.6%	48.0%

Table 2: Transfer Efficiency

Process	Transfer Efficiency (%)
Metallic Basecoat	70.1%
Solid Basecoat	75.2%
Clearcoat	74.3%

Table 3 - Metallic Basecoat Transfer Efficiency Summary
FCA WTAP Transfer Efficiency Test
September 2018

Vehicle ID	Vehicle Weight Gain (lb.)	Average Vehicle Weight Gain (lb.)	Average Paint Sprayed (gal)	Coating Density (lb/gal)	Weight Solids Fraction	Average Solids Sprayed	Transfer Efficiency (%)
Variable:	VWG	AVWG	APS	CD	WSF	SS	TE
Calculation:	(W2-W1)	(avgVWG-SWL)	(PS)	(Method 24)	(Method 24)	(APS*CD*WSF)	(AVWG/SS)
TE 1	1.90	1.90	0.678	8.218	0.4864	2.71	**70.1%**
TE 2	1.70						
TE 4	1.94						

Control Vehicle Sealer Weight Loss

Vehicle ID	Vehicle Weight Gain (lb.)
Variable:	SWL
Calculation:	(W2-W1)
TE 3	-0.06

Table 4 - Solid Basecoat Transfer Efficiency Summary
FCA WTAP Transfer Efficiency Test
September 2018

Vehicle ID	Vehicle Weight Gain (lb.)	Average Vehicle Weight Gain (lb.)	Average Paint Sprayed (gal)	Coating Density (lb/gal)	Weight Solids Fraction	Average Solids Sprayed	Transfer Efficiency (%)
Variable:	VWG	AVWG	APS	CD	WSF	SS	TE
Calculation:	(W2-W1)	(avgVWG-SWL)	(PS)	(Method 24)	(Method 24)	(APS*CD*WSF)	(AVWG/SS)
TE 1	3.53	3.71	0.773	10.369	0.6148	4.93	**75.2%**
TE 2	3.61						
TE 4	3.38						

Control Vehicle Sealer Weight Loss

Vehicle ID	Vehicle Weight Gain (lb.)
Variable:	SWL
Calculation:	(W2-W1)
TE 3	-0.20

Table 5 - Clearcoat Transfer Efficiency Summary
FCA WTAP Transfer Efficiency Test
September 2018

Vehicle ID	Vehicle Weight Gain (lb.)	Average Vehicle Weight Gain (lb.)	Average Paint Sprayed (gal)	Coating Density (lb/gal)	Weight Solids Fraction	Average Solids Sprayed	Transfer Efficiency (%)
Variable:	VWG	AVWG	APS	CD	WSF	SS	TE
Calculation:	(W2-W1)	(avgVWG-SWL)	(PS)	(Method 24)	(Method 24)	(APS*CD*WSF)	(AVWG/SS)
TE 1	3.22	3.17	0.891	8.622	0.5545	4.26	**74.3%**
TE 2	3.00						
TE 4	3.37						

Control Vehicle Sealer Weight Loss

Vehicle ID	Vehicle Weight Gain (lb.)
Variable:	SWL
Calculation:	(W2-W1)
TE 3	0.03

Table 6 -- Black Metallic Basecoat Oven VOC Capture Efficiency
FCA WTAP, September 2018

Solvent Loading

Sample	Blank Panel Weights (g)	Wet Panel Weights - Before Bake (g)	Panel Weights - after bake (g)	Weight of Coating Solids Deposited (g)	Weight of VOC available for abatement (g)	Weight of VOC available per volume of coating solids (lb/GACS)
Variable	P0	P1	P2	W_{cos}	W_a	CL
Formula				P4-P0	P3-P4	$(W_a/W_{cos})*D_{cos}$
B1	185.813	186.375	186.279	0.466	0.096	1.82
B2	184.889	185.399	185.305	0.416	0.094	2.00
B3	185.063	185.613	185.516	0.453	0.097	1.89
B4	184.581	185.073	184.985	0.404	0.088	1.93
Average						**1.91**

Material Properties

Sample	Coating Density (lb/gal)	Mass Fraction Solids	Volume Fraction Solids	Film Build Thickness (mil)	VOC mass fraction	Solids Density (lb/gal)
Variable	W_c	W_s	V_s	mil	W_{voc}	D_{cos}
Formula						(Ws*Wc)/Vs
Metallic BC	8.22	0.4864	0.4521	0.64	0.5136	8.84

Capture Efficiency

Mass Fraction VOC in Coating	Coating Density (lb/gal)	Mass VOC per Volume Coating (lb/gal)	Transfer Efficiency (%)	Volume Fraction Solids	Volume Solids Deposited per Volume Coating Sprayed	Panel Test Result (lb VOC/ gal Solids)	Oven VOC Capture Efficiency @100% TE (%)
W_{voc}	D_c	VOC	TE	V_s	V_{sdep}	P	CE
		(Dc)(Wvoc)			$(V_s)(TE)$		$(P)(V_{sdep})(100)/(VOC)$
0.5136	8.22	4.221	100.0%	0.4521	0.452	1.91	**20.5%**

Table 8 -- Clearcoat Oven VOC Capture Efficiency
FCA WTAP, September 2018

Solvent Loading

Sample	Blank Panel Weights (g)	Wet Panel Weights - Before Bake (g)	Panel Weights - after bake (g)	Weight of Coating Solids Deposited (g)	Weight of VOC available for abatement (g)	Weight of VOC available per volume of coating solids (lb/GACS)
Variable	P0	P2	P3	Wcos	Wa	CL
Formula				P3-P0	P2-P3	$(W_a/W_{cos})*D_{cos}$
C1	185.519	188.585	187.709	2.190	0.876	3.61
C2	185.746	187.483	187.007	1.261	0.476	3.41
C3	185.336	187.041	186.569	1.233	0.472	3.45
C4	185.069	186.907	186.400	1.331	0.507	3.44
Average						**3.48**

Material Properties

Sample	Coating Density (lb/gal)	Mass Fraction Solids	Volume Fraction Solids	Film Build Thickness (mil)	VOC mass fraction	Solids Density (lb/gal)
Variable	W_c	W_s	V_s	mil	W_{voc}	D_{cos}
Formula						(Ws*Wc)/Vs
Clearcoat	8.62	0.5545	0.5300	1.62	0.4455	9.02

Capture Efficiency

Mass Fraction VOC in Coating	Coating Density (lb/gal)	Mass VOC per Volume Coating (lb/gal)	Transfer Efficiency (%)	Volume Fraction Solids	Volume Solids Deposited per Volume Coating Sprayed	Panel Test Result (lb VOC/ gal Solids)	Oven VOC Capture Efficiency @100% TE (%)
W_{voc}	D_c	VOC	TE	V_s	V_{sdep}	P	CE
		(Dc)(Wvoc)			(V_s)(TE)		$(P)(V_{sdep})(100)/(VOC)$
0.4455	8.62	3.841	100.0%	0.5300	0.530	3.48	**48.0%**