EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) and JLB Industries, LLC (JLB) were retained by FCA US LLC (FCA) Warren Truck Assembly Plant (WTAP) to complete source testing of the Topcoat operations in the East Paint Shop at their Warren Truck Assembly Plant (WTAP) located at 21500 Mound Road, Warren, Michigan. The test program included the completion of paint solids transfer efficiency (TE) and Oven Capture Efficiency (OCE) testing of the Topcoat operations (FGTOPCOATEAST), for one (1) line (EU-COLOR-ONE) as this booth was the only booth that has changed with the implementation of the concentrator system since the last TE/OCE testing in 2018. This is also the only line in operation at the time of testing. The following coatings were tested in this program:

- Metallic Basecoat;
- Solid Basecoat; and
- Clearcoat.

Results of the testing are considered representative of plant production. The results are used to support on-going VOC monthly emission calculations. WTAP East Paint Shop currently operates under Permit to Operate (PTI) Permit # 13-19B dated June 23, 2021.

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 JLB.

Transfer Efficiency (TE) Results Summary

Tested Coating	Solids Transfer Efficiency (%)
Basecoat (White Solid Basecoat)	78.5%
Basecoat (Black Metallic)	75.3%
Clearcoat	71.6%

Capture Efficiency (CE) Results Summary

		Loading (Lb/GACS)	Capture Efficiency
		EU-COLOR-ONE	EU-COLOR-ONE
Solid Basecoat (White)	Booth[1]	8.90	83.6%
	Oven	1.18	11.1%
	Totals	***10.08***	***94.7%***
Metallic Basecoat (Black)	Booth[1]	10.06	81.7%
	Oven	1.38	11.7%
	Totals	***11.44***	***93.4%***
Clearcoat	Booth	5.24	50.4%
	Oven	2.98	28.8%
	Totals	***8.22***	***79.2%***

Note: [1] Basecoat CE and Loading values in carryover to the Clearcoat controlled booth.

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1 INTRODUCTION

RWDI USA LLC (RWDI) and JLB Industries, LLC (JLB) were retained by FCA US LLC (FCA) Warren Truck Assembly Plant (WTAP) to complete source testing of the Topcoat operations in the East Paint Shop at their Warren Truck Assembly Plant (WTAP) located at 21500 Mound Road, Warren, Michigan. The test program included the completion of paint solids transfer efficiency (TE) and Oven Capture Efficiency (OCE) testing of the Topcoat operations (FGTOPCOATEAST), for one (1) line (EU-COLOR-ONE) as this booth was the only booth that has changed with the implementation of the concentrator system since the last TE/OCE testing in 2018. This is also the only line in operation at the time of testing. The following coatings were tested in this program:

- Metallic Basecoat;
- Solid Basecoat; and
- Clearcoat.

Results of the testing are considered representative of plant production. The results are used to support on-going VOC monthly emission calculations. WTAP East Paint Shop currently operates under Permit to Operate (PTI) Permit # 13-19B dated June 23, 2021.

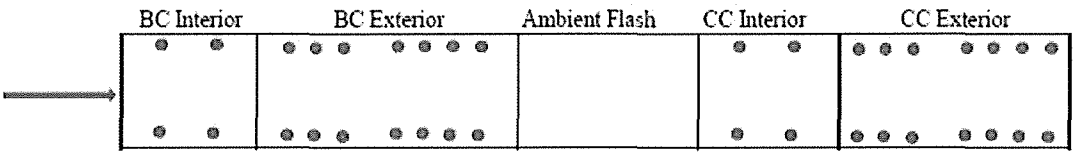
A Source Testing Plan, for the testing, was submitted to the State of Michigan Department of Environment, Great Lakes and Energy (EGLE) on October 6, 2021. Testing was successfully completed while all process equipment was operating under representative operating conditions during the week of December 6th, 2021 with testing completed on December 7th to 10th, 2021. A copy of the Source Testing Plan is provided in **Appendix A.**

Testing of emissions was conducted by Mr. Jim Belanger, Mr. Jeff Monache, and Mr. Kyle Lyons of JLB, and Mr. Steve Smith and Mr. Brad Bergeron of RWDI. Mr. Bradley Wargnier and Mr. Thomas Caltrider were on-site to monitor the process operation and witness the testing on behalf of FCA US LLC. Testing was witnessed by EGLE by Mr. Remilando Pinga, Ms. Regina Angellotti and Mr. Sebastian Kallumkal.

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

Operation	Manufacturer	Applicator	Fluid Tip/ Bell Size	Air Cap	Gun Voltage (kV)	RPM	Gun-to-Target Distance (inch)	Remarks
Basecoat Interior	Fanuc	Versa Bell 3	1.5 mm	N/A	30-50kVA	35,000	8 inches	Solventborne
Basecoat Exterior	Fanuc	Versa Bell 3	1.5 mm	N/A	30-80 kV	50,000	10 inches	Solventborne
Clearcoat Interior	Fanuc	Versa Bell 3	1.8 mm	N/A	30 - 50 kV	45,000	8 inches	Solventborne
Clearcoat Exterior	Fanuc	Versa Bell 3	1.2 mm	N/A	50-80 kV	50,000	10 inches	Solventborne

Notes: mm – millimetres
kV – kilovolts
RPM – revolutions per minute
Line Speed – 16.9 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. Emissions from the Basecoat Interior/Exterior and Clearcoat Interior/Exterior zones are sent to a series of concentrators. The desorb section of the concentrators are sent to a RTO (SVRTOEAST). Captured basecoat and clearcoat bake oven VOC emissions are directed to EU-COLOR-ONE 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 2.4-1: Summary of Method 24 Coating Analysis

Sample	Test	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	TE	12/09/21	50.47	49.528	0.974	8.125	0	482.18	4.024	--	--
	CE	12/10/21	50.38	49.621	0.972	8.114	0	482.42	4.026	--	--
White Basecoat	TE / CE	12/08/21	61.56	38.443	1.243	10.371	0	477.75	3.987	--	--
Clearcoat	TE	12/08/21	55.74	44.263	1.031	8.607	0	456.54	3.810	--	--
	CE	12/09/21	55.75	44.250	1.029	8.590	0	455.46	3.801	--	--

3 SAMPLING AND ANALYTICAL PROCEDURES

3.1 Summary of Test Program

The topcoat process at WTAP is comprised of one (1) topcoat paint line consisting of the "EU-COLOR-ONE" line. 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 was dedicated as a no-paint, control vehicle in conjunction with the testing. All units were production vehicles with cured body shop sealer.

Clearcoat:

1. Test Unit ID TE1
2. Test Unit ID TE2
3. Test Unit ID TE3
4. Test Unit ID TE4 – (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 was 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 B0, B1, B2, B3, B4, B5 and blank for basecoat and marked C0, C1, C2 and blank for the clearcoat and weighed to establish the initial unpainted panel weights (B0 or C0).

For Basecoat, the panels were then attached to a test vehicle prior to being sprayed (B0) and routed through the controlled Basecoat Spray Booth. After basecoat is applied, (B1), the panels were carefully removed from the test vehicle and brought to the balance for weighing immediately upon exit from the basecoat booth zone (controlled) and before entering the uncontrolled basecoat observation zone. The panels were then placed on the test vehicle for travel through the uncontrolled basecoat observation zone and are removed again and weighed (B2) prior to entering the controlled zone for the Clearcoat Spray Booth Section. The vehicles are not coated in the Clearcoat Spraybooth, however, allowed to continue through the system mimicking spray application. The panels (B3) are again carefully removed from the test vehicle and brought to the balance for weighing immediately upon exit from the clearcoat booth zone (controlled) and before entering the uncontrolled clearcoat observation zone. The panels were then placed on the test vehicle for travel through the uncontrolled clearcoat observation zone and are removed again and weighed (B4) prior to entering the controlled zone for the Oven. Upon exiting the oven, the panels were allowed to cool and then weighed a final time (B5).

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-4	-0.15	White Solid Basecoat Batch
TE-4	0.05	Black Metallic Batch
TE-4	-0.08	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.

Table 5.1-2 – Capture Efficiency Results Summary

		Loading (Lb/GACS)	Capture Efficiency
		EU-COLOR-ONE	EU-COLOR-ONE
Solid Basecoat (White)	Booth[1]	8.90	83.6%
	Oven	1.18	11.1%
	Totals	***10.08***	***94.7%***
Metallic Basecoat (Black)	Booth[1]	10.06	81.7%
	Oven	1.38	11.7%
	Totals	***11.44***	***93.4%***
Clearcoat	Booth	5.24	50.4%
	Oven	2.98	28.8%
	Totals	***8.22***	***79.2%***

Note: [1] Basecoat CE and Loading values in carryover to the Clearcoat controlled booth.

5.2 Discussion of Results

There were no significant disruptions to the testing program.

6 PROCESS CONDITIONS

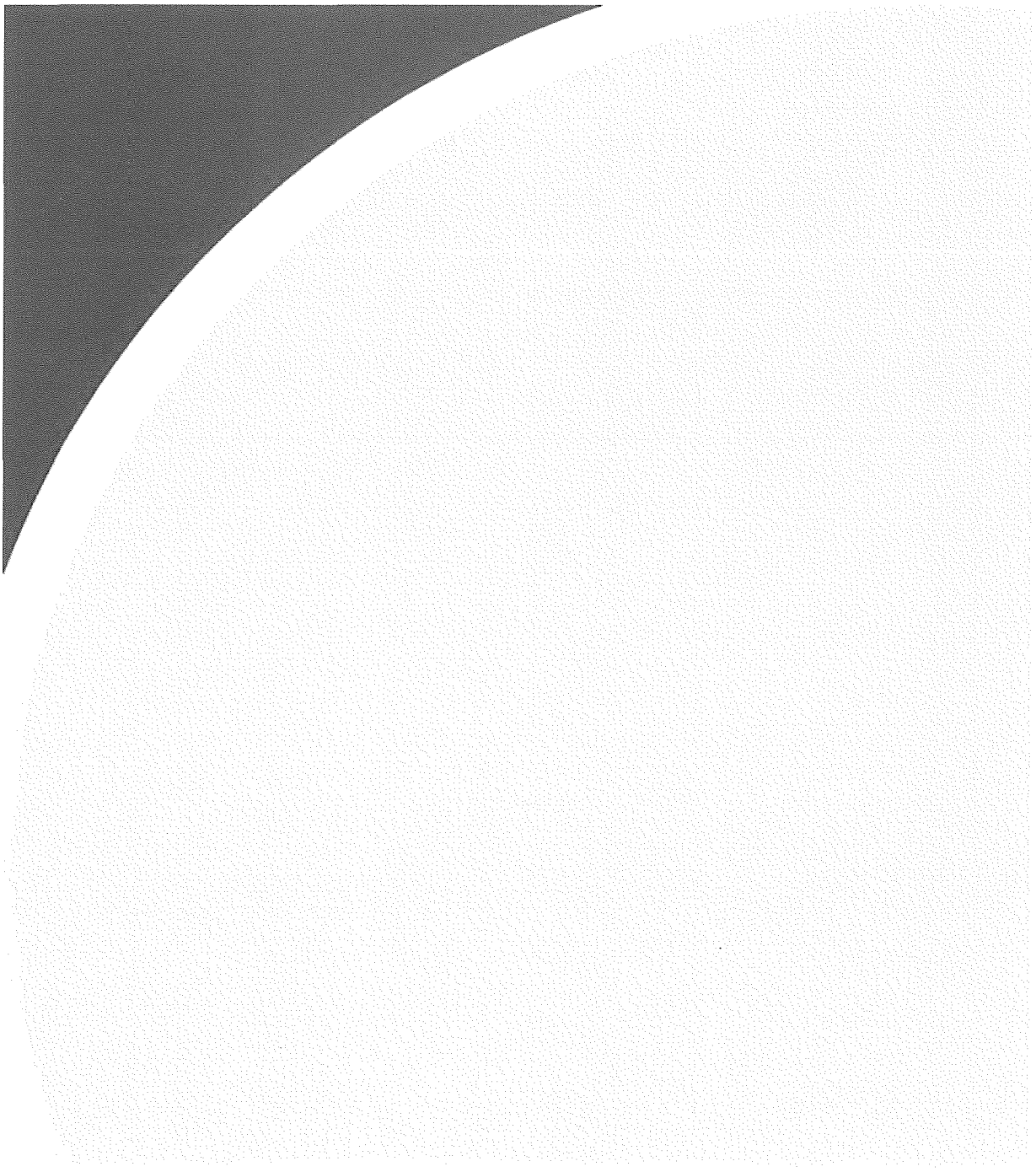
Operating conditions during the sampling were monitored by FCA personnel. All equipment was operated under normal maximum operating conditions. Process Data is provided in **Appendix G**.

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 December 6th, 2021. All parameters were tested in accordance with referenced methodologies.

TABLES



FCA US LLC WTAP DS, December 2021

Table 1: Transfer Efficiency Summary

Tested Coating	Solids Transfer Efficiency (%)
Solid Basecoat	78.5%
Metallic Basecoat	75.3%
Clearcoat	71.6%

Table 2: Capture Efficiency Summary

Tested Coating	Booth Capture Efficiency (%)	Oven Capture Efficiency (%)	Total Capture Efficiency (%)
Solid Basecoat	83.6%	11.1%	94.7%
Metallic Basecoat	81.7%	11.7%	93.4%
Clearcoat	50.4%	28.8%	79.2%

Table 3: Weight of VOC available for control per gallon of applied coating solids

Tested Coating	Booth Loading (Lb/GACS)	Oven Loading (Lb/GACS)	Total Loading (Lb/GACS)
Solid Basecoat	8.90	1.18	10.08
Metallic Basecoat	10.06	1.38	11.44
Clearcoat	5.24	2.98	8.22

Note: Basecoat booth CE and Loading values include carryover to the Clearcoat controlled booth.

Table 4: Solid Basecoat Transfer Efficiency Summary
WTAP DS, December 2021

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	4.03	4.35	0.867	10.371	0.6156	5.54	**78.5%**
TE 2	4.36						
TE 3	4.19						

Control Vehicle Sealer Weight Loss

Vehicle ID	Vehicle Weight Gain (lb.)
Variable:	SWL
Calculation:	(W2-W1)
TE 4	-0.15

Table 6: Clearcoat Transfer Efficiency Summary
WTAP DS, December 2021

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	3.49	3.39	0.987	8.607	0.5574	4.74	**71.6%**
TE 2	3.06						
TE 3	3.38						

Control Vehicle Sealer Weight Loss

Vehicle ID	Vehicle Weight Gain (lb.)
Variable:	SWL
Calculation:	(W2-W1)
TE 4	-0.08

Table 7a: Solid Basecoat Booth VOC Capture Efficiency
WTAP DS, December 2021

Sample	Blank Panel Weights (g)	Wet Panel Weights - Control Zone Exit	Panel Weights - after bake (g)	Weight of Coating Solids Deposited (g)	Weight of VOC remaining after zone (g)	Weight of VOC remaining per Weight Solids Deposited (g)	Mass Fraction Solids	Mass Fraction VOC in Coating	VOC fraction remaining on Panel after Zone	Section Capture Efficiency (%)
Variable	P0	P1	P5	Wsdep	Wrem	P_m	W_S	W_{VOC}	P_{VOC}	CE
Formula				P5-P0	P1-P5	W_{rem}/W_{sdep}			$(P_m)(W_S)/(W_{VOC})$	$1-P_{VOC}$
B1	187.063	187.951	187.864	0.801	0.087	0.109				
B2	187.048	187.923	187.838	0.790	0.085	0.108				
B3	187.546	188.424	188.334	0.788	0.090	0.114				
B4	187.407	188.267	188.179	0.772	0.088	0.114				
Average						0.111	0.6156	0.3844	0.178	**82.2%**

Booth Loading Calculation

	VOC Content (lb VOC/gal)	Volume Solids Fraction	Transfer Efficiency (%)	Weight of VOC generated per volume of solids deposited (lb/GACS)	Capture Efficiency	Weight of VOC captured per volume of applied solids deposited (lb/GACS)
Variable	VOC	V_S	TE	VOC_G	CE	VOC_A
Formula				VOC/(V_S* TE)		CE*VOC_G
Lab	3.994	0.4780	78.5%	10.65	0.822	8.75

Table 7b: Solid Basecoat Booth VOC Capture Efficiency (Basecoat carryover to Abated Clearcoat Booth)
WTAP DS, December 2021

Sample	Blank Panel Weights (g)	Wet Panel Weights - Enter Zone (g)	Wet Panel Weights - Exit Zone (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	P5	Wcos	Wa	CL
Formula					P5-P0	P2-P3	(Wa/Wcos)*Dcos
B1	187.063	187.948	187.943	187.864	0.801	0.005	0.08
B2	187.048	187.913	187.906	187.838	0.790	0.007	0.12
B3	187.546	188.416	188.403	188.334	0.788	0.013	0.22
B4	187.407	188.259	188.249	188.179	0.772	0.010	0.17
Average					0.788	0.009	**0.15**

Material Properties

Sample	Coating Density (lb/gal)	Mass Fraction Solids	Volume Fraction Solids	Average Film Build Thickness (mil)	VOC mass fraction	Solids Density (lb/gal)
Variable	W_c	W_s	V_s	mil	W_{voc}	D_{cos}
Formula						$(W_s*W_c)/V_s$
Basecoat	10.37	0.6156	0.4780	0.70	0.3844	13.36

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 (%)
W_{voc}	D_c	VOC	TE	V_s	V_{sdep}	P	CE
		$(D_c)(W_{voc})$			$(V_s)(TE)$		$(P)(V_{sdep})(100)/(VOC)$
0.3844	10.37	3.987	78.5%	0.4780	0.375	0.15	**1.4%**

Table 7c: Solid Basecoat Oven VOC Capture Efficiency
WTAP DS, December 2021

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	$(W_a/W_{cos})*D_{cos}$
W1	187.063	187.937	187.864	0.801	0.073	1.22
W2	187.048	187.907	187.838	0.790	0.069	1.17
W3	187.546	188.399	188.334	0.788	0.065	1.10
W4	187.407	188.250	188.179	0.772	0.071	1.23
Average						**1.18**

Material Properties

Sample	Coating Density (lb/gal)	Mass Fraction Solids	Volume Fraction Solids	Average 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
Solid BC	10.37	0.6156	0.4780	0.70	0.3844	13.36

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)			$(V_s)(TE)$		$(P)(V_{sdep})(100)/(VOC)$
0.3844	10.37	3.987	78.5%	0.4780	0.375	1.18	**11.1%**

Table 8a: Metallic Basecoat Booth VOC Capture Efficiency
WTAP DS, December 2021

Sample	Blank Panel Weights (g)	Wet Panel Weights - Control Zone Exit	Panel Weights - after bake (g)	Weight of Coating Solids Deposited (g)	Weight of VOC remaining after zone (g)	Weight of VOC remaining per Weight Solids Deposited (g)	Mass Fraction Solids	Mass Fraction VOC in Coating	VOC fraction remaining on Panel after Zone	Section Capture Efficiency (%)
Variable	P0	P1	P5	Wsdep	Wrem	P_m	W_s	W_{VOC}	P_{VOC}	CE
Formula				P5-P0	P1-P5	W_{rem}/W_{sdep}			$(P_m)(W_s)/(W_{VOC})$	$1-P_{VOC}$
B1	186.767	187.239	187.165	0.398	0.074	0.186				
B2	186.803	187.289	187.203	0.400	0.086	0.215				
B3	186.881	187.387	187.318	0.437	0.069	0.158				
B4	187.007	187.503	187.431	0.424	0.072	0.170				
Average						0.182	0.5047	0.4953	0.186	**81.4%**

Booth Loading Calculation

	VOC Content (lb VOC/gal)	Volume Solids Fraction	Transfer Efficiency (%)	Weight of VOC generated per volume of solids deposited (lb/GACS)	Capture Efficiency	Weight of VOC captured per volume of applied solids deposited (lb/GACS)
Variable	VOC	V_S	TE	VOC_G	CE	VOC_A
Formula				$VOC/(V_S * TE)$		$CE*VOC_G$
Lab	4.221	0.4549	75.3%	12.32	0.814	10.03

Table 8b: Metallic Basecoat Booth VOC Capture Efficiency (Basecoat carryover to Abated Clearcoat Booth)
WTAP DS, December 2021

Sample	Blank Panel Weights (g)	Wet Panel Weights - Enter Zone (g)	Wet Panel Weights - Exit Zone (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	P5	Wcos	Wa	CL
Formula					P5-P0	P2-P3	(Wa/Wcos)*Dcos
B1	186.767	187.229	187.232	187.165	0.398	-0.003	-0.07
B2	186.803	187.282	187.281	187.203	0.400	0.001	0.02
B3	186.881	187.381	187.377	187.318	0.437	0.004	0.08
B4	187.007	187.495	187.492	187.431	0.424	0.003	0.06
Average					0.415	0.001	**0.03**

Material Properties

Sample	Coating Density (lb/gal)	Mass Fraction Solids	Volume Fraction Solids	Average Film Build Thickness (mil)	VOC mass fraction	Solids Density (lb/gal)
Variable	W_c	W_s	V_s	mil	W_{voc}	D_{cos}
Formula						$(W_s*W_c)/V_s$
Basecoat	8.13	0.5047	0.4549	0.54	0.4953	9.01

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 (%)
W_{voc}	D_c	VOC	TE	V_s	V_{sdep}	P	CE
		$(D_c)(W_{voc})$			$(V_s)(TE)$		$(P)(V_{sdep})(100)/(VOC)$
0.4953	8.13	4.024	75.3%	0.4549	0.343	0.03	**0.2%**

Table 8c: Metallic Basecoat Oven VOC Capture Efficiency
WTAP DS, December 2021

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	186.767	187.228	187.165	0.398	0.063	1.43
B2	186.803	187.280	187.203	0.400	0.077	1.74
B3	186.881	187.373	187.318	0.437	0.055	1.13
B4	187.007	187.488	187.431	0.424	0.057	1.21
Average						**1.38**

Material Properties

Sample	Coating Density (lb/gal)	Mass Fraction Solids	Volume Fraction Solids	Average 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	8.13	0.5047	0.4549	0.54	0.4953	9.01

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)			$(V_s)(TE)$		$(P)(V_{sdep})(100)/(VOC)$
0.4953	8.13	4.024	75.3%	0.4549	0.343	1.38	**11.7%**

Table 9a: Clearcoat Booth VOC Capture Efficiency
WTAP DS, December 2021

Sample	Blank Panel Weights (g)	Wet Panel Weights - Control Zone Exit	Panel Weights - after bake (g)	Weight of Coating Solids Deposited (g)	Weight of VOC remaining after zone (g)	Weight of VOC remaining per Weight Solids Deposited (g)	Mass Fraction Solids	Mass Fraction VOC in Coating	VOC fraction remaining on Panel after Zone	Section Capture Efficiency (%)
Variable	P0	P1	P5	Wsdep	Wrem	P_m	W_s	W_{VOC}	P_{VOC}	CE
Formula				P5-P0	P1-P5	W_{rem}/W_{sdep}			$(P_m)(W_s)/(W_{VOC})$	$1-P_{VOC}$
C1	186.962	188.653	188.170	1.208	0.483	0.400				
C2	186.651	188.344	187.861	1.210	0.483	0.399				
C3	186.733	188.297	187.859	1.126	0.438	0.389				
C4	187.180	188.741	188.304	1.124	0.437	0.389				
Average						0.394	0.5574	0.4426	0.496	**50.4%**

Booth Loading Calculation

	VOC Content (lb VOC/gal)	Volume Solids Fraction	Transfer Efficiency (%)	Weight of VOC generated per volume of solids deposited (lb/GACS)	Capture Efficiency	Weight of VOC captured per volume of applied solids deposited (lb/GACS)
Variable	VOC	V_S	TE	VOC_G	CE	VOC_A
Formula				$VOC/(V_S * TE)$		$CE*VOC_G$
Lab	3.841	0.5151	71.6%	10.41	0.504	5.24

Table 9b: Clearcoat Oven VOC Capture Efficiency
WTAP DS, December 2021

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	186.962	188.566	188.170	1.208	0.396	3.05
C2	186.651	188.253	187.861	1.210	0.392	3.02
C3	186.733	188.212	187.859	1.126	0.353	2.92
C4	187.180	188.656	188.304	1.124	0.352	2.92
Average						**2.98**

Material Properties

Sample	Coating Density (lb/gal)	Mass Fraction Solids	Volume Fraction Solids	Average 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	8.61	0.5574	0.5151	1.43	0.4426	9.31

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)			$(V_s)(TE)$		$(P)(V_{sdep})(100)/(VOC)$
0.4426	8.61	3.809	71.6%	0.5151	0.369	2.98	**28.8%**