APPENDIX D

PAINT USAGE AND VOLATILE ORGANIC COMPOUNDS EMISSIONS CALCULATIONS

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This appendix contains the Air Resources Board (ARB) staff evaluation of the test results submitted by the Iowa Waste Reduction Center (IWRC) to assess the effectiveness of the Laser Touch model LT-B512 assistive targeting device in reducing air pollutant emissions from coating operations. The ARB staff used the provided field data for the analysis.

Background

In October 1999, testing was conducted to evaluate the environmental benefits of the Laser Touch model LT-B512. The test was performed under specific conditions at the IWRC's Painting and Coating Compliance Enhancement (PAC2E) facility in accordance with ASTM Method D 5286-95 "Standard Test Methods for Determination of Transfer Efficiency Under General Production Conditions for Spray Application of Paints." Several painters with varying degrees of experience were asked to coat test parts as they normally would to establish their unassisted baseline. The painters were then trained on the use of the Laser Touch model LT-B512 and asked to coat the same type of parts assisted by the targeting device.

The Laser Touch model LT-B512 was tested under conditions recommended by Laser Touch and Technologies, LLC, the equipment manufacturer. The test parts painted were a uniform, solid material. The parts were 121.9 centimeters (48 inches) long, 101.6 centimeters (40 inches) wide and 1.5 to 1.7 millimeters (0.060 to 0.066 inches) thick. The manual spray gun used by all painters was an Accuspray model 19 high-volume low pressure (HVLP) pressure feed gun equipped with a 0.9 millimeter (0.036 inch) fluid tip, a 0.9 millimeter (0.036 inch) fluid needle and a #7 air cap.

Volatile Organic Compound Emissions Calculations

Laser Touch and Technologies, LLC selected Sherwin-Williams Polane HS Plus white single stage polyurethane enamel as the test coating. The coating was mixed per manufacturer's recommendation at a ratio of 3:1:0.48 with Sherwin-Williams Catalyst V66V55 and Sherwin-Williams Reducer MAKR6K30. The volatile organic compound (VOC) contents of the aforementioned mix are 2.8, 0.93, and 6.79 lbs/gallon respectfully. The pounds of VOC as applied per gallon were calculated as shown in Table D-1.

Table D-1. VOC "As Applied" Emissions Calculations

	VOC Content [lbs/gallon]	x	Mix Ratio	=	Lbs VOC/gallon
Enamel Coat	2.8	x	3	=	8.4
Catalyst	0.93	x	1	=	0.93
Reducer	6.76	x	0.48	=	3.24
Total			4.48		12.57
	Total VOC	¸	**Total Mix Ratio**	**=**	**Lbs VOC as applied/gallon**
	12.57	¸	4.48	=	2.8

The test consisted of twelve painters recruited from local industries, who had varying degrees of experience (see Table D-2) and training, but none of the participating painters had any previous experience with the Laser Touch model LT-B512. Although twelve painters participated in the test, only ten produced sufficient valid test parts for data analysis.

There were two runs for each painter; one run performed without the targeting device (unassisted), and one run using the Laser Touch model LT-B512 (assisted). Each run consisted of seven parts. A total of fourteen parts were coated.

Table D-2. Painters' Experience Levels

Painter ID #	Years Work Experience	Training
1	2	Technical school
2	2	No formal training
3	3	No formal training
4	1	No formal training
5	1	No formal training
6	20	No formal training
8	20	Vendor paint school
9	3	No formal training
10	20	No formal training
11	18	Electrostatic – Airless
AVG	9	

Transfer Efficiency Calculations

Transfer efficiency (TE) was calculated using the initial and final weights of the paint cup, as well as the initial and final weights of the parts. Data analysis was verified by the ARB Monitoring and Laboratory Division and Precertification staff. The TE (%) for each painter was calculated using the equation shown below:

$$\text{TE (\%)} = \frac{\text{(weight gain of each part) x 100}}{\text{(weight of paint solids sprayed)}}$$

The values for percent change between the unassisted and assisted TE were calculated using the equation shown below:

TE Change (%) = Assisted – Unassisted

The summary of the TE results for each painter is shown in Table D-3. Numbers annotated in "()" are negative values.

Table D-3. Summary TE Data

Painter ID #	Unassisted TE	SD	Assisted TE	SD	% TE Change
1	70.1	2.5	78.9	1.2	8.8
2	72.9	0.7	76.8	0.8	3.9
3	71.1	2.4	73.1	0.7	2.0
4	62.2	1.9	71.6	1.1	9.4
5	71.3	0.6	75.5	0.9	4.2
6	80.5	1.2	80.0	0.7	(0.5)
8	75.7	0.9	80.9	1.2	5.2
9	76.1	1.4	75.2	1.5	(0.9)
10	69.6	1.2	76.2	0.9	6.6
11	62.0	1.5	75.7	1.2	13.7
AVG	71.2	1.4	76.4	1.0	5.2

Although ASTM Method D-5286-95 does not include parameters for determining the reduction in VOC emissions from coating operations, the associated VOC decreases for these tests were estimated based on the difference in the amount of applied paint. The paint differences were calculated from the available data provided in the "Full" part results.

Paint Usage and VOC Emissions Calculations

The paint difference and percent change of paint usage were calculated using the equations below:

Paint Usage Difference = (Assisted Total Paint Used – Unassisted Total Paint Used)

$$\text{Percent Change in Paint Usage} = \frac{(\text{Assisted Total Paint Used} - \text{Unassisted Total Paint Used})}{\text{Unassisted Total Paint Used}} \times 100$$

The values for the corresponding VOC emissions from paint usage were derived from the equations below:

Unassisted VOC Emissions (lbs) = Unassisted Total Paint Used x lbs VOC as applied/gallon*

* = Value derived from Table D-1, VOC "As Applied" Emissions Calculations

Assisted VOC Emissions (lbs) = Assisted Total Paint Used x lbs VOC as applied/gallon*

* = Value derived from Table D-1, VOC "As Applied" Emissions Calculations

$$\text{Percent Change in VOC Emissions} = \frac{(\text{Assisted VOC Emissions} - \text{Unassisted VOC Emissions})}{\text{Unassisted VOC Emissions}} \times 100$$

The summary of the aforementioned calculations derived from the "Full" part is shown in Table D-4. Numbers annotated in "()" are negative values.

Table D-4. Summary Paint Usage and VOC Reduction Evaluation From "Full" Data

Painter ID#	Unassisted TE (%)	Assisted TE (%)	TE Change (%)	Unassisted total paint used (gallons)	Assisted total paint used (gallons)	Paint usage difference (gallons)	Change in paint usage (%)	Unassisted VOC emissions (lbs)	Assisted VOC Emissions (lbs)	Change in VOC emissions (lbs)	Change VOC emissions (%)
1	70.1	78.9	8.8	0.224	0.244	0.020	9	0.63	0.68	0.06	9
2	72.9	76.8	3.9	0.183	0.175	(0.008)	(4)	0.51	0.49	(0.02)	(4)
3	71.1	73.1	2.0	0.216	0.161	(0.055)	(25)	0.60	0.45	(0.15)	(25)
4	62.2	71.6	9.4	0.284	0.242	(0.042)	(15)	0.80	0.68	(0.12)	(15)
5	71.3	75.5	4.2	0.232	0.178	(0.054)	(23)	0.65	0.50	(0.15)	(23)
6	80.5	80.0	(0.5)	0.212	0.182	(0.030)	(14)	0.59	0.51	(0.08)	(14)
8	75.7	80.9	5.2	0.247	0.200	(0.047)	(19)	0.69	0.56	(0.13)	(19)
9	76.1	75.2	(0.9)	0.252	0.197	(0.055)	(22)	0.71	0.55	(0.15)	(22)
10	69.6	76.2	6.6	0.193	0.166	(0.027)	(14)	0.54	0.46	(0.08)	(14)
11	62.0	75.7	13.7	NA	NA	NA	NA	NA	NA	NA	NA
AVG	71.2	76.4	5.2	0.227	0.194	(0.033)	(15)	0.64	0.54	(0.09)	(15)

NA – Data not available

Summary

The ARB evaluation of the Laser Touch model LT-B512 suggests a general improvement of TE. Test results revealed an average 5.7 percent increase in TE over the unassisted TE. Data from the evaluation yielded corresponding average reduction of 15% of paint usage and VOC emissions.

It should be noted that this device is effective at reducing VOC emissions only to the extent to which the painter provides corrective action in response to the assistive feedback of the Laser Touch model LT-B512.