



## BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

**DETERMINATION****NO.:**134 & 139**DATE:**December 22, 2016**ENGINEER:**Felix Trujillo, Jr.

**Category/General Equip  
Description:**

Adhesive Application Operations

**Equipment Specific Description:**

Counter Top Manufacturing

<1,170 lbs VOC/month and ≤ 4,019 lbs VOC/year  
(BACT #134)

≥1,170 lbs VOC/month or > 4,019 lbs VOC/year  
(BACT #139); Minor Source

**Equipment Size/Rating:**

**Previous BACT Det. No.:**

N/A

This BACT was determined under the project for A/C 24317 (VSS Counter Tops, Inc.).

### **BACT ANALYSIS**

#### **A: ACHIEVED IN PRACTICE (Rule 202, §205.1a)**

The following control technologies are currently employed as BACT for adhesive application operations by the following air pollution control districts:

District/Agency	Best Available Control Technology (BACT)/Requirements
US EPA	<b><u>BACT</u></b>
	<a href="#"><u>Source: EPA RACT/BACT/LAER Clearinghouse</u></a>
	Adhesives Application Operation
	<b>VOC</b> No standard
	<b>NOx</b> No standard
	<b>SOx</b> No standard
	<b>PM10</b> No standard
	<b>PM2.5</b> No standard
	<b>CO</b> No standard
	<b><u>RULE REQUIREMENTS:</u></b>
	<u>40 CFR 63 Subpart JJ – National Emission Standards for Wood Furniture Manufacturing Operations</u>
	This regulation applies for facilities that are engaged, either in part or in whole, in the manufacture of wood furniture or wood furniture components and that are located at a plant site that is a major source as defined in 40 CFR subpart A, §63.2 Since this BACT determination is only for minor sources, this NESHAP is not applicable.

Subpart JJ limits volatile hazardous air pollutants (VHAP) of finishing operations and contact adhesives and also limits the VOC strippable spray booth material. Only the limits that are applicable to adhesives will be shown. The limits can be seen in the table below.

**Table 3 to Subpart JJ of Part 63—Summary of Emission Limits**

Emission point	Existing source	New source
Contact Adhesives:		
(a) Use compliant contact adhesives (maximum kg VHAP/kg solids [lb VHAP/lb solids], as applied) based on following criteria:		
i. For aerosol adhesives, and for contact adhesives applied to nonporous substrates	<sup>a</sup> NA	<sup>a</sup> NA
ii. For foam adhesives used in products that meet flammability requirements	1.8	0.2
iii. For all other contact adhesives (including foam adhesives used in products that do not meet flammability requirements); or	1.0	0.2
(b) Use a control device	<sup>b</sup> 1.0	<sup>b</sup> 0.2
All Contact Adhesives:		
(a) Achieve total free formaldehyde emissions across all finishing operations and contact adhesives, lb per rolling 12 month period, as applied	400	400
(b) Use coatings and contact adhesives only if they are low-formaldehyde coatings and contact adhesives	<sup>c</sup> 1.0	<sup>c</sup> 1.0

<sup>a</sup>There is no limit on the VHAP content of these adhesives.

<sup>b</sup>The control device must operate at an efficiency that is equivalent to no greater than 1.0 kilogram (or 0.2 kilogram) of VHAP being emitted from the affected emission source per kilogram of solids used.

<sup>c</sup>The limits refer to the formaldehyde content by weight of the coating or contact adhesive, as specified on certified product data sheets.

ARB	<p><b><u>BACT</u></b>  <b><u>Source: ARB BACT Clearinghouse</u></b></p> <table border="1"> <tr><td colspan="2">Adhesive Application Operation</td></tr> <tr><td><b>VOC</b></td><td>No standard</td></tr> <tr><td><b>NOx</b></td><td>No standard</td></tr> <tr><td><b>SOx</b></td><td>No standard</td></tr> <tr><td><b>PM10</b></td><td>No standard</td></tr> <tr><td><b>PM2.5</b></td><td>No standard</td></tr> <tr><td><b>CO</b></td><td>No standard</td></tr> </table> <p><b><u>RULE REQUIREMENTS:</u></b>  None</p>	Adhesive Application Operation		<b>VOC</b>	No standard	<b>NOx</b>	No standard	<b>SOx</b>	No standard	<b>PM10</b>	No standard	<b>PM2.5</b>	No standard	<b>CO</b>	No standard																										
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	Single-Ply Roof Membrane Installation/Repair Adhesive	250 (2.0)
	Structural Glazing Adhesive	100 (0.8)
	Thin Metal Laminating Adhesive	780 (6.4)
	Tire Retread Adhesive	100 (0.8)
	Perimeter Bonded Sheet Vinyl Flooring Installation Adhesive	660 (5.4)
	Waterproof Resorcinol Glue	170 (1.4)
	Other Plastic Cement Welding Adhesive	450 (3.7)
	Table 2 VOC Content For Adhesive Primers	
	Type of Adhesive Primer	VOC Limits g/l(lbs/gal)
	Automotive Glass	700 (5.7)
	Plastic Cement Welding	400 (3.3)
	Single-Ply Roof Membrane	250 (2.0)
	Traffic Marking Tape	150 (1.2)
	Other	250 (2.0)
	Table 3 VOC Content For Contact Adhesives	
	Type of Contact Adhesive	VOC Limits g/l(lbs/gal)
	Contact Adhesive	250 (2.0)
	Contact Adhesive – Specialty Substrate	250 (2.0)
	Table 4 VOC Content For Sealants	
	Type of Sealant	VOC Limits g/l(lbs/gal)
	Architectural	250 (2.0)
	Marine Deck	760 (6.2)
	Nonmembrane Roof Installation/Repair	300 (2.5)
	Roadway Sealant	250 (2.0)
	Single-Ply Roof Membrane Sealant	250 (2.0)
	Other	420 (3.4)

<p align="center"><b>Table 5</b>  <b>VOC Content For Sealant Primers</b></p>		
Type of Sealant Primer		VOC g/l(lbs/gal)
Architectural		
Nonporous		250 (2.0)
Porous		775 (6.3)
Marine Deck		760 (6.2)
Other		750 (6.1)
<p align="center"><b>Table 6</b>  <b>VOC Content For Adhesives Applications Onto Substrates</b></p>		
Adhesive Applications Onto Substrates		VOC Limits g/l(lbs/gal)
Flexible Vinyl		250 (2.0)
Fiberglass		200 (1.6)
Metal		30 (0.2)
Porous Material		120 (1.0)
Rubber		250 (2.0)
Other Substrates		250 (2.0)
<p align="center"><b>Table 8</b>  <b>VOC Content of Solvents for Surface Preparation, Cleanup, and Stripping</b></p>		
Adhesive Applications Onto Substrates	VOC Limits g/l(lbs/gal) Including water and exempt compounds	VOC Composite Partial Pressure Millimeters of Mercury at 20 °C (68 °F)
SUBSTRATE PREPARATION: Single-Ply Roof Membrane Installation/Repair	--	≤45
SUBSTRATE PREPARATION: Electronic Components	≤900 (≤7.3)	≤33
SUBSTRATE PREPARATION: Medical Devices	≤900 (≤7.3)	≤33
SUBSTRATE PREPARATION: Other Substrates	≤70 (≤0.6)	--
CLEANUP: Cleaning a Spray Gun in an Enclosed Gun Cleaner	--	<45
CLEANUP: Soaking of Application Equipment in a Closed Container	--	≤9.5
CLEANUP: Cleaning of Application Equipment —No Closed Container, No Enclosed Gun Cleaner	≤70 (≤0.6)	---

	CLEANUP: Cleaning of Equipment Other Than Adhesive or Sealant Product Application Equipment	--	<45
	STRIPPING: Adhesive or Sealant Products on Wood	<350	≤2
	STRIPPING: Adhesive or Sealant Products on Substrates	--	≤9.5
South Coast AQMD	<b>BACT</b> Source: <u>SCAQMD BACT Guidelines for Non-Major Polluting Facilities, page 112</u> (Last Revised 10/3/2008)		
	Adhesive Application Operation Spray Booth		
	<b>VOC</b>	<u>For non-automotive booths with &lt;1170 lbs/month VOC Emissions</u> 1. Compliance with applicable AQMD Regulation XI Rules  <u>For non-automotive booths with ≥1170 lbs/month VOC Emissions</u> 1. Compliance with applicable AQMD Regulation XI Rules, and VOC control system with ≥90% collection efficiency and ≥ 95% destruction efficiency; OR 2. Use of Super Clean Materials (<5% VOC by weight); OR Use of low-VOC materials resulting in an equivalent emission reduction	
	<b>NOx</b>	No standard	
	<b>SOx</b>	No standard	
	<b>PM10</b>	Dry filters or waterwash	
	<b>PM2.5</b>	No standard	
	<b>CO</b>	No standard	

**RULE REQUIREMENTS:**

**Rule 1168 Adhesive and Sealant Applications (1/7/05)**

The use of cleaning solvents are addressed under Rule 1171 Solvent Cleaning Operations.

<b>Architectural Applications</b>	<b>VOC Limits g/l</b>
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Outdoor Carpet Adhesives	150
Wood Flooring Adhesive	100
Rubber Floor Adhesives	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
VCT and Asphalt Tile Adhesives	50
Dry Wall and Panel Adhesives	50
Cove Base Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100
Single Ply Roof Membrane Adhesives	250

<b>Specialty Applications</b>	<b>VOC Limits g/l</b>
PVC Welding	510
CPVC Welding	490
ABS Welding	325
Plastic Cement Welding	250
Adhesive Primer for Plastic	550
Computer Diskette Manufacturing Contact Adhesive	350
Contact Adhesive	80
Special Purpose Contact Adhesive	250
Tire Retread	100
Adhesive Primer for Traffic Marking Tape	150
Structural Wood Member Adhesive	140
Sheet Applied Rubber Lining Operations	850
Top and Trim Adhesive	250

	<b>Substrate Specific Applications</b>		VOC Limits g/l
	Metal to Metal		30
	Plastic Foams		50
	Porous Material (except wood)		50
	Wood		30
	Fiberglass		80
	** These limits apply to any adhesive, bonding primer or any other primer not Regulated by the previous table.		
	<b>Sealants</b>		VOC Limits g/l
	Architectural		250
	Marine Deck		760
	Nonmembrane Roof		300
	Roadway		250
	Single-Ply Roof Membrane		450
	Other		420
	<b>Sealant Primers</b>		VOC Limits g/l
	Architectural		250
	Nonporous		
	Porous		775
	Modified Bituminous		500
	Marine Deck		760
	Other		750
San Diego County APCD	<b>BACT</b>		
	Source: <a href="#">NSR Requirements for BACT Guidance Document (6/11), page 3-2.</a>		
	Adhesive Application Operations (< 10 gal/day)		
	<b>VOC</b>	Compliance with Rule 67.21, Adhesive Material Application Operations	
	<b>NOx</b>	No standard	
	<b>SOx</b>	No standard	
	<b>PM10</b>	Spray booth if used, shall be equipped with over spray filters.	
	<b>PM2.5</b>		
	<b>CO</b>	No standard	
	** The applicant has the option to limit the potential to emit (PE) to less than 10 lb/day for each pollutant in lieu of meeting the BACT requirements.		

**RULE REQUIREMENTS:**

**Regulation 4, Rule 67.21 Adhesive Material Application Operations (11/14/08)**

Architectural Products	VOC Limits (grams/liter)
Architectural sealant	250
Architectural sealant primer for:	
- Non-porous materials	250
- Porous materials	775
Ceramic tile installation adhesive	65
Cove base installation adhesive	50
Flooring adhesives:	
Indoor carpet or carpet pad adhesive	50
Rubber flooring adhesive	60
Subfloor adhesive	50
VCT and asphalt tile adhesive	50
Wood flooring adhesive	100
Other floor covering adhesive	150
Multipurpose construction installation/repair adhesive	70
Non-membrane roof installation/repair adhesive/sealant	300
Perimeter bonding adhesive	660
Roadway sealant	250
Single-ply roof membrane installation/repair adhesive/primer	250
Single-ply roof membrane sealant	450
Structural glazing adhesive	100
Structural wood member adhesive	140
Traffic marking tape adhesive primer	150

Plastic Welding Products	VOC Limits (grams/liter)
ABS welding adhesive	400
CPVC welding adhesive	490
PVC welding adhesive	510
Plastic cement welding adhesive primer	650
Other plastic cement welding adhesives	510

	Specialty Adhesive Materials		VOC Limits (grams/liter)
	Automotive glass adhesive primer		700
	Adhesive primers		850
	Computer diskette jacket manufacturing adhesive		
	Contact adhesive		
	General		80
	Special		250
	Elastomeric adhesive		750
	Marine deck sealant/primer		760
	Metal to elastomer molding or casting adhesive		850
	Natural gas pipeline tape adhesive primer		600
	Sheet rubber lining installation adhesive		850
	Thin metal laminating adhesive		780
	Tire retread adhesive		100
	Top and Trim adhesive		540
	Waterproof resorcinol glue		170
	Substrate Specific Adhesives		VOC Limits (grams/liter)
	Adhesives applied onto:		
	Fiberglass		80
	Metal		30
	Porous material (except wood)		50
	Wood		30
	Other substrates		250
	All Other Adhesive Materials		VOC Limits (grams/liter)
	Adhesive primer		250
	Sealants		420
	Sealant primers		750
	Surface preparation, stripping and cleanup materials are subject to the following:		
	(i) The material contains 70 grams or less of VOC per liter of material; or		
	(ii) The material has an initial boiling point of 190°C (374°F) or greater; or		
	(iii) The material has a total VOC vapor pressure of 45 mm Hg or less, at 20°C (68°F).		

	<p>Cleaning of application equipment is subject to the following:</p> <ul style="list-style-type: none"><li>(i) The material contains 70 grams or less of VOC per liter of material; or</li><li>(ii) The material has an initial boiling point of 190°C (374°F) or greater; or</li><li>(iii) The material has a total VOC vapor pressure of 45 mm Hg or less, at 20°C (68°F); or</li><li>(iv) The cleaning material is flushed or rinsed through the application equipment in a contained manner that will minimize evaporation into the atmosphere; or</li><li>(v) The application equipment or equipment parts are cleaned in a container, which is open only when being accessed for adding, cleaning, or removing application equipment or when cleaning material is being added, provided the cleaned equipment or equipment parts are drained to the container until dripping ceases; or</li><li>(vi) A system is used that totally encloses the component parts being cleaned during the washing, rinsing, and draining processes; or</li><li>(vii) Other application equipment cleaning methods are used that are demonstrated to be as effective as any of the equipment described above in minimizing the VOC emissions to the atmosphere, provided that the method has been tested and approved in writing by the Air Pollution Control Officer prior to use.</li></ul>
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Bay Area AQMD

**BACT**  
Source: [BAAQMD BACT Guideline](#)

Adhesive Application Operation	
<b>VOC</b>	No standard
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

**RULE REQUIREMENTS:**  
  
**Reg 8, Rule 51 Adhesive and Sealant Products (7/17/02)**  
  
This rule does not include VOC limits for cleaning solvent usage.

Architectural	VOC Limits (grams/liter)
Indoor Floor Covering Installation	150
Multipurpose Construction	200
Nonmembrane Roof Installation/Repair	300
Outdoor Floor Covering Installation	250
Single-Ply Roof Material Installation/Repair	250
Structural Glazing	100
Ceramic Tile Installation	130
Cove Base Installation	150
Perimeter Bonded Sheet Vinyl Flooring Installation	660

  

Specialty	VOC Limits (grams/liter)
Computer Diskette Jacket Manufacturing	850
ABS Welding	400
CPVC Welding	490
PVC Welding	510
Other Plastic Welding	500
Thin Metal Laminating	780
Tire Retread	100
Rubber Vulcanization Bonding	850
Waterproof Resorcinol Glue	170
Immersible Product Manufacturing	650
Top and Trim Installation	540

	<table><tr><th colspan="2">Adhesive Primers</th><th>VOC Limits (grams/liter)</th></tr><tr><td colspan="2">Automotive Glass Primer</td><td>700</td></tr><tr><td colspan="2">Pavement Marking Tape Primer</td><td>150</td></tr><tr><td colspan="2">Plastic Welding Primer</td><td>650</td></tr><tr><td colspan="2">Other</td><td>250</td></tr></table>		Adhesive Primers		VOC Limits (grams/liter)	Automotive Glass Primer		700	Pavement Marking Tape Primer		150	Plastic Welding Primer		650	Other		250						
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San Joaquin Valley APCD	<b>BACT</b> Source: SJVAPCD BACT Guideline 4.9.1 (7/10/96)																						
	Adhesive Application Operation – Tire Retreading																						
	<b>VOC</b>	Use of adhesives with a VOC content of 5.2 lb/gal (less water and exempt compounds) or less																					
	<b>NOx</b>	No standard																					
	<b>SOx</b>	No standard																					
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	Note: Current Rule 4653 limit is more restrictive.																						

Source: SJVAPCD BACT Guideline 4.9.2 (9/11/97)

Adhesive Application Operation – Rubber Parts and Products, Brush Applied	
<b>VOC</b>	Using adhesives with a VOC content of 7.0 lb/gal or less (less water and exempt compounds)
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Note: Current Rule 4653 limit is more restrictive.

Source: SJVAPCD BACT Guideline 4.9.3 (5/27/97)

Adhesive Application Process – Foam Products	
<b>VOC</b>	Adhesives with a VOC content of $\leq 1.0$ lb/gal (less water and exempt compounds)
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Note: Current Rule 4653 limit is more restrictive.

Source: SJVAPCD BACT Guideline 4.9.4 (4/3/00)

Adhesive Application Process – Non-Porous Materials, Specialty Contact Adhesives, Spray Application	
<b>VOC</b>	Using adhesives with a VOC content of 540 g/l or less (less water and exempt compounds) until July 1, 2000. Using adhesives with a VOC content of 400 g/l or less (less water and exempt compounds) after July 1, 2000.
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Note: Current Rule 4653 limit is more restrictive.

Source: SJVAPCD BACT Guideline 4.9.5 (11/5/98)

Adhesive Application Process – Wooden Case Manufacturing	
<b>VOC</b>	Use of adhesives with a VOC content compliant with Rule 4653 (Adhesives).
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Source: SJVAPCD BACT Guideline 4.9.6 (11/28/00)

Paper Carton Manufacturing – Printing and Adhesive Application	
<b>VOC</b>	Adhesive with a VOC content of = or < 5.7 lb/gal (excluding water and exempt compounds) and inks with a VOC content of = or < 2.55 lb/gal (excluding water and exempt compounds)
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Note: This BACT is not applicable, since the adhesive's limit is addressed under the District Graphic Arts Rule (Rule 4607).

Source: SJVAPCD BACT Guideline 4.9.7 (8/3/01)

Corrugated PVC Sheet Products – Special Contact Adhesive, Roller Applied	
<b>VOC</b>	PVC welding adhesive compliant with District Rule 4653
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Source: SJVAPCD BACT Guideline 4.9.8 (11/20/01)

Adhesive Application Process – Wooden Door Assembly, Roller Applied	
<b>VOC</b>	Use of an adhesive with a VOC content of 5.0 grams/liter (less water and exempt compounds), or less
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Note: This limit is more restrictive than Rule 4653.

Source: SJVAPCD BACT Guideline 4.9.9 (9/26/03)

Adhesive Application Process – Vinyl Door and Window Assembly, Non-Spray Applied	
<b>VOC</b>	<ol style="list-style-type: none"> <li>1) Use of adhesive with a VOC content of 3.0 g/l (less water and exempt compounds), or less for automated adhesive application and assembly processes</li> <li>2) Use of adhesive with VOC content of 76.5 g/l (less water and exempt compounds), or less for manually applied adhesive operation when assembling</li> </ol>
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Note: These limits are more restrictive than Rule 4653.

Source: SJVAPCD BACT Guideline 4.9.10 (11/18/04)

Adhesive Application for Multi-Wall Packaging Manufacturing	
<b>VOC</b>	Adhesives with a VOC content of $\leq 0.2$ lb/gal (excluding water and exempt compounds) for the adhesion of plastic film to porous material  Adhesives with a VOC content of $\leq 0.13$ lb/gal (excluding water and exempt compounds) for the adhesion of porous materials
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Note: These limits are more restrictive than Rule 4653.

Source: SJVAPCD BACT Guideline 4.9.11 (11/3/05)

Adhesive Application Operation – Bonding of Fiberglass Boat Hulls and Decks, Non-Atomizing Application	
<b>VOC</b>	Use of adhesives with VOC content of 80 grams/liter or less (less water and exempt compounds)
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Note: This limit is equivalent to the current Rule 4653 limit.

Source: SJVAPCD BACT Guideline 4.9.12 (9/22/06)

Corrugated Box Gluer	
<b>VOC</b>	Use of adhesives with a VOC content (less water and exempt compounds) not exceeding 0.044 lb/gal
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Note: This limit is more restrictive than Rule 4653.

Source: SJVAPCD BACT Guideline 4.9.13 (1/30/15)

Corrugated Cardboard Manufacturing (Corrugator)	
<b>VOC</b>	Adhesives – 0.015 lb/VOC/gal (less water and exempt compounds)
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

Note: This limit is more restrictive than Rule 4653.

**RULE REQUIREMENTS:**

Rule 4653 Adhesives and Sealants (9/16/10)

Table 2 - VOC Content Limits for Adhesive Products (Effective on and after January 1, 2012)	
Applications	VOC limit (Grams Per Liter)
	Architectural Adhesive Products:
Multipurpose Construction	70
Ceramic Tile Adhesive	65
Cove Base Installation	50
Dry Wall and/or Panel Adhesive	50
Flooring Adhesives:	
Floor Covering Installation	150
Ceramic Floor Tile Installation	65
Indoor Carpet Adhesive	50
Carpet Pad Adhesive	50
Outdoor Carpet Adhesive	150
Rubber Flooring Adhesive	60
Perimeter Bonded Sheet Flooring Installation	660
Subfloor Adhesive	50
VCT and Asphalt Tile Adhesive	50
Wood Flooring Adhesive	100
Roofing Adhesives:	
Single-Ply Roof Material Installation	250
Non-Membrane Roof Adhesive	300
Structural Glazing	100
Structural Wood Member Adhesive	140
Miscellaneous Adhesives:	
Contact Adhesive	80
Contact Adhesive – Specialty	250
Rubber Vulcanization Adhesive/Primer	850
Tire Retread	100
Motor Vehicle Adhesive	250
Motor Vehicle Weather-strip Adhesive	750
Traffic Marking Tape Adhesive/ Primer	150
Top and Trim Adhesive	540
Waterproof Resorcinol Glue	170
Staple and Nail Manufacturing	640

Thin Metal Laminating Adhesive	780
Elastomeric Adhesive	750
Flexible Vinyl Adhesive	250

Table 2 - VOC Content Limits for Adhesive Products continued (Effective on and after January 1, 2012)	
Applications	VOC Limit (Grams per Liter)
Plastic Welding Products	
ABS Welding Adhesive	325
Cellulosic Plastic Welding Adhesive	100
CPVC Welding Adhesive	490
PVC Welding Adhesive	510
Styrene-Acrylonitrile Welding Adhesive	100
Plastic Cement Welding Adhesive Primer	400
Other Plastic Cement Welding Adhesive	250
Adhesive Primers:	
Automotive Glass Primer	700
Adhesive Primer	250

Table 3 - VOC Content Limits for Adhesive Products			
Material Bonded	VOC Limit Effective through December 31, 2010. (Grams Per Liter)	VOC Limit Effective on and after January 1, 2011. (Grams Per Liter)	VOC Limit Effective on and after January 1, 2012. (Grams Per Liter)
Metal to Metal	30	30	30
Porous Materials	120	120	50
Plastic Foam	120	120	50
Wood	30	30	30
Pre-formed Rubber Products	250	250	250
Reinforced Plastic Composite	250	200	200
Fiberglass	-	-	80
All other Substrates	250	250	250

Table 4 - VOC Content Limits for Sealants	
Sealant	VOC Limit Effective on and after January 1, 2012. (Grams Per Liter)
Architectural	250
Marine Deck	760
Non-membrane Roof	300
Roadway	250
Single-Ply Roof Membrane	450
Other Sealants	420

	Table 5 - VOC Content Limits for Sealant Primers	
	Sealant Primer	VOC Limit Effective on and after January 1, 2012. (Grams Per Liter)
	Architectural Non Porous	250
	Architectural Porous	775
	Modified Bituminous	500
	Marine Deck	760
	Other Sealant Primers	750
	Table 6 – VOC Limits for Organic Solvents Used in Cleaning Operations	
	Type of Solvent Cleaning Operation	VOC Content Limit Grams of VOC/liter of material (lb/gal)
	A. Products Cleaning During Manufacturing Process or Surface Preparation for Adhesive Application	
	1. General	25 (0.21)
	2. Surface Preparation Prior to Rubber Vulcanization Process	850 (7.1)
	B. Repair and Maintenance Cleaning	25 (0.21)
	C. Cleaning of Adhesive Application Equipment	25 (0.21)

The following control technologies have been identified and are ranked based on stringency:

<b>SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES</b>	
<b>VOC</b>	1. See adhesive limit tables from each district and BACT guidelines from the SCAQMD, SDCAPCD and SJVAPCD listed above – [SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD]
<b>NOx</b>	1. No standard – [SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD]
<b>SOx</b>	1. No standard – [SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD]
<b>PM10</b>	1. Dry filters or waterwash – [SCAQMD] 2. Spray booth if used, shall be equipped with over spray filters – [SDCAPCD] (A) 3. No standard – [SMAQMD, SJVAPCD, BAAQMD]
<b>PM2.5</b>	1.No Standard [SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD]
<b>CO</b>	1. No standard – [SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD]

(A) SDCAPCD allows the facility the option of limiting the PE to emit to less than 10 lb/day in lieu of meeting the BACT requirements. Achieved in Practice BACT is the use of over spray filters.

On 2/2/16, the District sent the SJVAPCD, SDCAPCD and SCAQMD an email and asked them if the limits established in their adhesives rules were being enforced in order to determine if the limits were considered to be achieved in practice.

Angela Ortega (SDCAPCD, Supervisor – Rule Development, (858)586-2753) called the District on 2/4/16 and stated they are enforcing their rule limits. She stated their inspectors have been to hardware stores to ensure the adhesives that are being sold are compliant. They also have a point of sale in their rule.

Bradley McClung (SCAQMD, AQ Inspector III, (909)396-2446) called the District on 2/17/16 and stated they are enforcing their rule limits. He also stated they will be amending their adhesives rule, but didn't know the timeline for adoption of the new rule. The rule was supposed to be amended in 2014, but it was put on hold.

Chay Thao (SJVAPCD, Program Manager – Strategies and Incentives Department, (559)230-5895) emailed the District with a response on 4/4/16. He stated they are enforcing their adhesives rule limits.

Therefore, the limits established in the SJVAPCD, SDCAPCD and SCAQMD adhesives rules are considered to be achieved in practice.

The following control technologies have been identified as the most stringent, achieved in practice control technologies:

<b>BEST CONTROL TECHNOLOGIES ACHIEVED</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
VOC	<u>For booths with &lt;1,170 lbs/month VOC Emissions</u> 1. Compliance with Tables 1 – 9 under Section C of this document.	SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD
	<u>For booths with ≥1,170 lbs/month VOC Emissions</u> 1. Compliance with Tables 1 – 9 under Section C of this document and VOC control system	

<b>BEST CONTROL TECHNOLOGIES ACHIEVED</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
	with ≥90% collection efficiency and ≥ 95% destruction efficiency; OR 2. Use of Super Clean Materials (<5% VOC by weight); OR 3. Use of low-VOC materials resulting in an equivalent emission reduction	
NO <sub>x</sub>	No standard	
SO <sub>x</sub>	No standard	
PM <sub>10</sub>	1. Dry filters or waterwash – [SCAQMD] 2. Spray booth if used, shall be equipped with over spray filters – [SDCAPCD] (A)	SCAQMD (BACT) SDCAPCD (BACT)
PM <sub>2.5</sub>	No standard	
CO	No standard	

(A) SDCAPCD allows the facility the option of limiting the PE to emit to less than 10 lb/day in lieu of meeting the BACT requirements. Achieved in Practice is the use of over spray filters as the use of the booth is an option.

## **B. TECHNOLOGICALLY FEASIBLE AND COST EFFECTIVE (Rule 202, §205.1.b.):**

### **Technologically Feasible Alternatives:**

Any alternative basic equipment, fuel, process, emission control device or technique, singly or in combination, determined to be technologically feasible by the Air Pollution Control Officer.

The table below shows the technologically feasible alternatives identified as capable of reducing emissions beyond the levels determined to be “Achieved in Practice” as per Rule 202, §205.1.a.

<b>VOC</b>	1. Carbon Adsorber 2. Thermal Oxidizer
<b>NO<sub>x</sub></b>	No other technologically feasible option identified
<b>SO<sub>x</sub></b>	No other technologically feasible option identified
<b>PM<sub>10</sub></b>	No other technologically feasible option identified
<b>PM<sub>2.5</sub></b>	No other technologically feasible option identified
<b>CO</b>	No other technologically feasible option identified

### **Cost Effective Determination:**

After identifying the technologically feasible control options, a cost analysis is performed to take into consideration economic impacts for all technologically feasible controls identified.

#### **Maximum Cost per Ton of Air Pollutants Controlled**

1. A control technology is considered to be cost-effective if the cost of controlling one ton of that air pollutant is less than the limits specified below (except coating operations):

<u>Pollutant</u>	<u>Maximum Cost (\$/ton)</u>
ROG	17,500
NO <sub>x</sub>	24,500
PM <sub>10</sub>	11,400
SO <sub>x</sub>	18,300
CO	TBD if BACT triggered

#### Cost Effectiveness Analysis Summary

The cost analysis was processed in accordance with the EPA OAQPS Air Pollution Control Cost Manual (Third Edition). The sales tax rate was based on the District's standard rate of 8.5% as approved on 10/17/16. The electricity (11.24 cents/kWh) and natural gas (6.41 dollars/1,000 cubic feet) rates were based on an industrial application as approved by the District on 10/17/16. The life of the equipment was based on the EPA cost manual recommendation. The interest rate was based on the previous 6-month average interest rate on United States Treasury Securities (based on the life of the equipment) and addition of two percentage points and rounding up to the next higher integer rate. The labor (Occupation Code 51-9191: Adhesive bonding machine operators and tenders) and maintenance (Occupation Code 49-9099: Installation, maintenance, and repair workers, all other) rates were based on data from the Bureau of Labor Statistics.

#### Carbon Adsorption System

Equipment Life = 10 years

Total Capital Investment = \$10,210.98

Annualized Total Capital Investment = \$1,481.46 per year

Direct Annual Cost = \$4,209.43 per year

Indirect Annual Cost = \$4,257.98 per year

Cost of Carbon per year = \$21,702.60

Total Annual Cost = \$31,651.47 per year

VOC Removed = 1.8 tons per year

**Cost of VOC Removal = \$17,501.02 per ton reduced**

A detailed calculation of the cost effectiveness for VOC removal with a carbon absorber is shown in Appendix B. Uncontrolled VOC emissions of 4,019 lb/year or greater is the cost-effective threshold for control equipment using carbon absorption control technology

#### Thermal Oxidizer:

Equipment Life = 10 years

Total Capital Investment = \$218,719

Annualized Total Capital Investment = \$18,943.24 per year

Direct Annual Cost = \$90,774.16 per year

Indirect Annual Cost = \$17,018.07 per year

Total Annual Cost = \$126,735.47 per year

VOC Removed = 7.24 tons per year

**Cost of VOC Removal = \$17,504.90 per ton reduced**

A detailed calculation of the cost effectiveness for VOC removal with a thermal oxidizer is shown in Appendix B. Uncontrolled VOC emissions of 14,480 lb/year or greater is the cost-effective threshold for control equipment using thermal oxidation control technology.

Conclusion: In this analysis, different emission operating levels are presented with the corresponding total cost per ton of VOC controlled using either a carbon adsorption control or a thermal oxidizer. Uncontrolled VOC emission level of 4,019 lb per year or greater must be reached in order for the carbon absorption control option to be cost effective. Uncontrolled VOC emission level of 14,480 lb per year or greater must be reached in order for a thermal oxidizer to be cost effective. The emissions levels for the cost effectiveness of controls is based on the District cost effective limit for ROC of \$17,500 per ton controlled.

### C. SELECTION OF BACT:

<b>BACT FOR ADHESIVES APPLICATION OPERATIONS (#134)</b> <b>&lt; 1,170 lbs/month and ≤ 4,019 lbs VOC/year</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
VOC	1. Compliance with adhesive BACT VOC limits (see Tables 1-9 below)	SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD
NOx	No standard	
SOx	No standard	
PM10	1. Spray booth with dry filters or waterwash.	SCAQMD SDCAPCD
PM2.5	1. Spray booth with dry filters or waterwash.	SCAQMD SDCAPCD
CO	No Standard	

<b>BACT FOR ADHESIVES APPLICATION OPERATIONS (#139)</b> <b>&gt;1,170 lbs /month or &gt; 4,019 lb VOC/year</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
VOC	1. Compliance with adhesive BACT VOC limits (see Tables 1-9 below) and VOC control system with ≥90% collection efficiency and ≥ 95% destruction efficiency.	SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD
NOx	No standard	
SOx	No standard	
PM10	1. Spray booth with dry filters or waterwash.	SCAQMD SDCAPCD

<b>BACT FOR ADHESIVES APPLICATION OPERATIONS (#139)</b> <b>&gt;1,170 lbs /month or &gt; 4,019 lb VOC/year</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
PM2.5	1. Spray booth with dry filters or waterwash.	SCAQMD SDCAPCD
CO	No Standard	

<b>Table 1</b> <b>Adhesives</b>		
<b>Adhesive</b>	<b>VOC Limits g/l (lbs/gal)</b>	<b>Source</b>
<b>Architectural Adhesive Applications:</b>		
Multipurpose Construction Adhesive	70 (0.6)	SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Ceramic Tile Installation Adhesive	65 (0.54)	SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Cove Base Installation Adhesive	50 (0.4)	SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Dry Wall and/or Panel Adhesive	50 (0.4)	SJVAPCD Rule 4653, SCAQMD Rule 1168
<b>Flooring Adhesives:</b>		
Indoor Floor Covering Installation Adhesive (A)	150 (1.2)	SMAQMD Rule 460, SJVAPCD Rule 4653, SDCAPCD Rule 67.21, BAAQMD Rule 51
Ceramic Floor Tile Installation	65 (0.5)	SJVAPCD Rule 4653
Indoor Carpet Adhesive	50 (0.4)	SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Carpet Pad Adhesive	50 (0.4)	SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Outdoor Carpet Adhesive	150 (1.2)	SJVAPCD Rule 4653, SCAQMD Rule 1168
Rubber Flooring Adhesive	60 (0.5)	SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Perimeter Bonded Sheet Vinyl Flooring Installation Adhesive	660 (5.4)	SMAQMD Rule 460, SJVAPCD Rule 4653, SDCAPCD Rule 67.21, BAAQMD Rule 51

<b>Table 1 (continued)</b> <b>Adhesives</b>		
<b>Adhesive</b>	<b>VOC Limits g/l (lbs/gal)</b>	<b>Source</b>
Subfloor Adhesive	50 (0.4)	SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
VCT and Asphalt	50 (0.4)	SJVAPCD Rule 4653, SCAQMD

<b>Table 1 (continued)</b>		
<b>Adhesives</b>		
<b>Adhesive</b>	<b>VOC Limits g/l (lbs/gal)</b>	<b>Source</b>
Tile Adhesive		Rule 1168, SDCAPCD Rule 67.21
Wood Flooring Adhesive	100 (0.8)	SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Other Floor Covering Installation Adhesive (A)	150 (1.2)	SJVAPCD Rule 4653, SDCAPCD Rule 67.21
<b>Roofing Adhesives:</b>		
Single-Ply Roof Membrane Installation/Repair Adhesive (A)	250 (2.0)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Non-Membrane Roof Installation/Repair Adhesive	300 (2.5)	SMAQMD Rule 460, SJVAPCD Rule 4653, SDCAPCD Rule 67.21, BAAQMD Rule 51
Structural Glazing Adhesive (A)	100 (0.8)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
Structural Wood Member Adhesive	140 (1.1)	SJVAPCD Rule 4653, SDCAPCD Rule 67.21
<b>Plastic Welding Products:</b>		
ABS Welding Adhesive	325 (2.7)	SJVAPCD Rule 4653, SCAQMD Rule 1168
Cellulosic Plastic Welding Adhesive	100 (0.8)	SDCAPCD Rule 67.21
CPVC Welding Adhesive	490 (4.0)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
PVC Welding Adhesive	510 (4.2)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
Styrene-Acrylonitrile Welding Adhesive	100 (0.8)	SJVAPCD Rule 4653
Other Plastic Cement Welding Adhesive	250 (2.0)	SJVAPCD Rule 4653, SCAQMD Rule 1168
<b>Miscellaneous Adhesives:</b>		
Metal to	250 (2.0)	SMAQMD Rule 460

<b>Table 1 (continued)</b> <b>Adhesives</b>		
<b>Adhesive</b>	<b>VOC Limits g/l (lbs/gal)</b>	<b>Source</b>
Urethane/Rubber Molding or Casting Adhesive		
Thin Metal Laminating Adhesive (A)	780 (6.4)	SMAQMD Rule 460, SJVAPCD Rule 4653, SDCAPCD Rule 67.21, BAAQMD Rule 51
Tire Retread Adhesive (A)	100 (0.8)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
Waterproof Resorcinol Glue (A)	170 (1.4)	SMAQMD Rule 460, SJVAPCD Rule 4653, SDCAPCD Rule 67.21, BAAQMD Rule 51
Computer Diskette Jacket Manufacturing Adhesive	350 (2.92)	SCAQMD Rule 1168
Adhesive Application Process – Wooden Door Assembly, Roller Applied	Use of an adhesive with a VOC content of 5.0 grams/liter (0.04 lb/gal) (less water and exempt compounds), or less	SJVAPCD BACT Guideline 4.9.8 (11/20/01)
Adhesive Application Process – Vinyl Door and Window Assembly, Non-Spray Applied	1) Use of adhesive with a VOC content of 3.0 g/l (0.02 lb/gal)(less water and exempt compounds), or less for automated adhesive application and assembly processes 2) Use of adhesive with VOC content of 76.5 g/l (0.6 lb/gal) (less water and exempt compounds), or less for manually applied adhesive operation when assembling	SJVAPCD BACT Guideline 4.9.9 (9/26/03)
Adhesive Application for Multi-Wall Packaging Manufacturing	1. Adhesives with a VOC content of $\leq 0.2$ lb/gal (24.0 g/l) (excluding water and exempt compounds) for the adhesion of plastic film to porous material  2. Adhesives with a VOC content of $\leq 0.13$ lb/gal (15.6 g/l) (excluding water	SJVAPCD BACT Guideline 4.9.10 (11/18/04)

<b>Table 1 (continued)</b> <b>Adhesives</b>		
<b>Adhesive</b>	<b>VOC Limits g/l (lbs/gal)</b>	<b>Source</b>
	and exempt compounds) for the adhesion of porous materials	
Corrugated Box Gluer	Use of adhesives with a VOC content (less water and exempt compounds) not exceeding 0.044 lb/gal (5.3 g/l)	SJVAPCD BACT Guideline 4.9.12 (9/22/06)
Corrugated Cardboard Manufacturing (Corrugator)	Adhesives – 0.015 lb/VOC/gal (1.8 g/l) (less water and exempt compounds)	SJVAPCD BACT Guideline 4.9.13 (1/30/15)

(A) Also listed in EPA's s Control Techniques Guidelines for Miscellaneous Industrial Adhesives (EPA-453/R-08-005 (9/08)).

<b>Table 2</b> <b>VOC Content For Adhesive Primers</b>		
<b>Type of Adhesive Primer</b>	<b>VOC Limits g/l (lbs/gal) (A)</b>	<b>Source</b>
Automotive Glass	700 (5.7)	SMAQMD Rule 460, SJVAPCD Rule 4653, SDCAPCD Rule 67.21, BAAQMD Rule 51
Plastic Cement Welding	400 (3.3)	SMAQMD Rule 460, SJVAPCD Rule 4653,
Single-Ply Roof Membrane	250 (2.0)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Traffic Marking Tape	150 (1.2)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
Other	250 (2.0) (A)	SMAQMD Rule 460, SDCAPCD Rule 67.21, BAAQMD Rule 51

(A) Also listed in EPA's s Control Techniques Guidelines for Miscellaneous Industrial Adhesives (EPA-453/R-08-005 (9/08)).

<b>Table 3</b> <b>VOC Content For Contact Adhesives</b>		
<b>Type of Contact Adhesive</b>	<b>VOC Limits g/l (lbs/gal)</b>	<b>Source</b>
Contact Adhesive	80 (0.7)	SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Contact Adhesive – Specialty Substrate	250 (2.0)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168,

		SDCAPCD Rule 67.21
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<b>Table 4</b> <b>VOC Content For Sealants</b>		
<b>Type of Sealant</b>	<b>VOC Limits g/l (lbs/gal)</b>	<b>Source</b>
Architectural	250 (2.0)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
Marine Deck	760 (6.2)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
Nonmembrane Roof Installation/Repair	300 (2.5)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, BAAQMD Rule 51
Roadway Sealant	250 (2.0)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
Single-Ply Roof Membrane Sealant	450 (3.7)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
Other	420 (3.4)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51

<b>Table 5</b> <b>VOC Content For Sealant Primers</b>		
<b>Type of Sealant Primer</b>	<b>VOC g/l (lbs/gal)</b>	<b>Source</b>
Architectural Nonporous Porous	250 (2.0) 775 (6.3)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
Marine Deck	760 (6.2)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Modified Bituminous	500 (4.2)	SJVAPCD Rule 4653, SCAQMD Rule 1168
Other	750 (6.1)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51

<b>Table 6</b> <b>VOC Content For Adhesives Applications Onto Substrates</b>		
<b>Adhesive Applications Onto Substrates</b>	<b>VOC Limits g/l (lbs/gal)</b>	<b>Source</b>
Flexible Vinyl (A)	250 (2.0)	SMAQMD Rule 460

<b>Table 6</b> <b>VOC Content For Adhesives Applications Onto Substrates</b>		
<b>Adhesive Applications Onto Substrates</b>	<b>VOC Limits g/l (lbs/gal)</b>	<b>Source</b>
Fiberglass	80 (0.7)	SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Metal (A)	30 (0.2)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
Porous Material	50 (0.4)	SMAQMD Rule 460, SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51
Rubber (A)	250 (2.0)	SMAQMD Rule 460
Wood (A)	30 (0.2)	SJVAPCD Rule 4653, SCAQMD Rule 1168, SDCAPCD Rule 67.21
Plastic Foam	50 (0.4)	SJVAPCD Rule 4653, SCAQMD Rule 1168
Reinforced Plastic Composite	200 (1.7)	SJVAPCD Rule 4653
Other Substrates (A)	250 (2.0)	SMAQMD Rule 460, SCAQMD Rule 1168, SDCAPCD Rule 67.21, BAAQMD Rule 51

(A) All of the listed substrates and limits, except fiberglass, are listed in EPA/s Control Techniques Guidelines for Miscellaneous Industrial Adhesives (EPA-453/R-08-005 (9/08)).

<b>Table 7</b> <b>Maximum VOC Content Percentages for Aerosol Adhesives</b> <b>(Percent by VOC by Weight)</b>		
<b>Type of Solvent Cleaning Operation</b>	<b>VOC Content Limit grams of VOC/liter of material (lb/gal)</b>	<b>Source</b>
Adhesives – Aerosol Mist Spray Adhesives Web Spray Adhesives	65% 55%	SMAQMD Rule 460
Special Purpose Spray Adhesives Mounting, Automotive Engine Compartment, and Flexible Vinyl Adhesives Polystyrene Foam and Automobile Headliner Adhesives Polyolefin and Laminate Repair/Edge banding Adhesives	70 % 65% 60%	SMAQMD Rule 460

<b>Table 8 Solvent Cleaning VOC Limits</b>		
<b>Type of Solvent Cleaning Operation</b>	<b>VOC Content Limit grams of VOC/liter of material (lb/gal)</b>	<b>Source</b>
Product cleaning during manufacturing process or surface preparation for adhesive application		
1. General	25 (0.21)	SJVAPCD Rule 4653
Repair and maintenance cleaning	25 (0.21)	SJVAPCD Rule 4653
Cleaning of adhesive application equipment	25 (0.21)	SJVAPCD Rule 4653

<b>Table 9 Stripper VOC Limits</b>		
	<b>VOC Content g/l (lbs/gal) including water and exempt compounds</b>	<b>VOC Composite Partial Pressure Millimeters of Mercury at 20 °C (68 °F)</b>
Adhesive or Sealant Products on Wood	≤ 70 (≤ 0.6) (A)	≤ 2 (B)
Adhesive or Sealant Products on Substrates	--	≤ 9.5 (B)

(A) VOC limit is based on SDCAPCD Regulation IV, Rule 67.21.

(B) VOC vapor pressure limit is based on SMAQMD Regulation IV, Rule 460.

#### **D: SELECTION OF T-BACT:**

Toxics are in the form of VOCs and may also be exempt compounds. T-BACT for adhesives application was determined to be the following:

<b>T-BACT FOR ADHESIVES APPLICATION OPERATIONS (#134) &lt; 1,170 lbs/month and ≤ 4,019 lbs VOC/year</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
Organic HAP/VHAP (T-BACT)	1. Compliance with adhesive BACT VOC limits (see Tables 1-9 above) and emission limits of Table 3 to Subpart JJ of Part 63.	SCAQMD NESHAP 40 CFR 63 Subpart JJ

<b>T-BACT FOR ADHESIVES APPLICATION OPERATIONS (#139) ≥ 1,170 lbs VOC/month or &gt; 4,019 lb VOC/year</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
Organic HAP/VHAP (T-BACT)	1. Compliance with adhesives BACT VOC limits (see Tables 1-9 above), emission limits of Table 3 to Subpart JJ of Part 63 and VOC control system with ≥90% collection efficiency and ≥ 95% destruction efficiency.	SCAQMD NESHAP 40 CFR 63 Subpart JJ

**REVIEWED BY:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

**APPROVED BY:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

# **Appendix A**

## **Review of BACT Determinations Published by Other Air Districts**

**SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT**  
**Best Available Control Technology (BACT) Guidelines for Non-Major Polluting Facilities\***

10-20-2000 Rev. 0

Equipment or Process:    Spray Booth

Subcategory/ Rating/Size	Criteria Pollutants					Inorganic
	VOC	NOx	SOx	CO	PM <sub>10</sub>	
Automotive, Down-Draft Type, < 660 Lbs/Month of VOC Emissions	Compliance with Applicable AQMD Regulation XI Rules (10-20-2000)				Dry Filters or Waterwash (1990)	
Other Types, < 1170 Lbs/Month of VOC Emissions	Compliance with Applicable AQMD Regulation XI Rules (10-20-2000)				Same as Above (1990)	
Automotive, Down-Draft Type, ≥ 22 Lbs/Day of VOC Emissions	- Compliance with Applicable AQMD Regulation XI Rules, and VOC Control System with ≥ 90% Collection Efficiency and ≥ 95% Destruction Efficiency, or - Use of Super Clean Materials (< 5% VOC by weight); or - Use of Low-VOC Materials Resulting in an Equivalent Emission Reduction (10-20-2000)				Same as Above (1990)	
Other Types, ≥ 1170 Lbs/Month of VOC Emissions	Same as Above (10-20-2000)				Same as Above (1990)	

Note: The sum of all VOC emissions from all spray booths within the same subcategory applied for in the previous two years at the same facility are considered toward the emission threshold.

\* Means those facilities that are not major polluting facilities as defined by Rule 1302 - Definitions

BACT Guidelines - Part D

112

Spray Booth

**ADHESIVE MATERIAL APPLICATION OPERATIONS (<10 gal/day)**  
**Fee Schedules 27 U, V, & W**

Review the BACT Control Option listed below. The applicant must propose the Control Option listed or perform a Top-down BACT Analysis as described in Section 4 to justify the selection of another Control Option. The applicant will be required to provide documentation that the Control Option selected meets the requirements listed in the table.

	VOC	NO <sub>x</sub>	SO <sub>x</sub>	PM
<b>BACT Emission Rate Limit</b>	Not Determined	(N/A)	(N/A)	Not Determined
<b>BACT Control Option</b>	Compliance with Rule 67.21, Adhesive Material Application Operations (A/P)	(N/A)	(N/A)	Spray booth if used, shall be equipped with over spray filters. (A/P)

The applicant may choose to limit the Potential to Emit (PTE) from the equipment to less than 10 pounds per day for each pollutant in lieu of meeting the stated BACT requirement

*(This table does not apply to operations applying, on average, 10 or more gallons of adhesive application materials per day.)*

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.1\***

Last Update: 7/10/1996

**Adhesives Application Operation - Tire Retreading**

<b>Pollutant</b>	<b>Achieved in Practice or contained in the SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	Use of adhesives with a VOC content of 5.2 lb/gal (less water and exempt compounds) or less	1. VOC capture and control with thermal/catalytic incineration utilizing adhesives with a VOC content of 5.2 lb/gal (less water and exempt compounds) or less 2. VOC capture and control with thermal/catalytic incineration utilizing adhesives with a VOC content of 7.1 lb/gal (less water and exempt compounds) or less 3. VOC capture and control with carbon adsorption utilizing adhesives with a VOC content of 5.2 lb/gal (less water and exempt compounds) or less 4. VOC capture and control with carbon adsorption utilizing adhesives with a VOC content of 7.1 lb/gal (less water and exempt compounds) or less	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**\*This is a Summary Page for this Class of Source**

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.2\***

Last Update: 9/11/1997

**Adhesive Application Operation - Rubber Parts and Products,  
Brush Applied**

<b>Pollutant</b>	<b>Achieved in Practice or contained in the SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	Using adhesives with a VOC content of 7.0 lb/gal or less (less water and exempt compounds)	1. VOC capture and control with thermal incineration 2. VOC capture and control with catalytic incineration 3. VOC capture and control with carbon adsorption	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**\*This is a Summary Page for this Class of Source**

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.3\***

Last Update: 5/27/1997

**Adhesive Application Process - Foam Products**

<b>Pollutant</b>	<b>Achieved in Practice or contained in the SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	Adhesives with a VOC content of $\leq 1.0$ lb/gallon (less water and exempt compounds)	1. Capture and control with a thermal incineration device 2. Capture and control with a catalytic incineration device 3. Capture and control with a carbon adsorption device 4. Adhesives with a VOC content of $\leq$ 0.49 lb/gallon (less water and exempt compounds)	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**\*This is a Summary Page for this Class of Source**

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.4\***

Last Update: 4/3/2000

**Adhesive Application Process - Non-Porous Materials,  
Specialty Contact Adhesives, Spray Application**

<b>Pollutant</b>	<b>Achieved in Practice or contained in the SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	Using adhesives with a VOC content of 540 grams/liter or less (less water and exempt compounds) until July 1, 2000. Using adhesives with a VOC content of 400 grams/liter or less (less water and exempt compounds) after July 1, 2000.	1. VOC capture and control with thermal or catalytic incineration 2. VOC capture and control with carbon adsorption	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**\*This is a Summary Page for this Class of Source**

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.5\***

Last Update: 11/5/1998

**Adhesive Application Process - Wooden case manufacturing**

<b>Pollutant</b>	<b>Achieved in Practice or contained in the SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	Use of adhesives with a VOC content compliant with Rule 4653 (Adhesives) [This is achieved in practice only for those facilities subject to District Rule 4653.]	1. VOC capture and incineration using adhesives with a VOC content compliant with Rule 4653 (Adhesives). 2. VOC capture and carbon adsorption using adhesives with a VOC content compliant with Rule 4653 (Adhesives).	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**\*This is a Summary Page for this Class of Source**

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.6\***

Last Update: 11/28/2000

**Paper Carton Manufacturing - Printing and Adhesive  
Application**

<b>Pollutant</b>	<b>Achieved in Practice or contained in the SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	1. Adhesive with a VOC content of = or < 5.7 lb/gal (excluding water and exempt compounds) and Inks with a VOC content of = or < 2.5 lb/gal (excluding water and exempt compounds)	1. Capture and thermal incineration. 2. Capture and carbon adsorption. 3. Adhesive with a VOC content of = or < 4.04 lb/gal (excluding water and exempt compounds) and Inks with a VOC content of = or < 2.4 lb/gal (excluding water and exempt compounds)	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**\*This is a Summary Page for this Class of Source**

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.7\***

Last Update: 8/3/2001

**Corrugated PVC Sheet Products - Special Contact  
Adhesive, Roller Applied**

<b>Pollutant</b>	<b>Achieved in Practice or contained in the SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	PVC welding adhesive compliant with District Rule 4653	1. Thermal / catalytic incinerator. 2. Carbon adsorption system. 3. Low VOC adhesive (= or < 0.3 lb/gal, less water and exempt compounds).	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**\*This is a Summary Page for this Class of Source**

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.8\***

Last Update: 11/20/2001

**Adhesive Application Process – Wooden Door  
Assembly, Roller applied**

<b>Pollutant</b>	<b>Achieved in Practice or contained in the SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	Use of an adhesive with a VOC content of 5.0 grams/liter (less water and exempt compounds), or less.	1. Thermal incineration 2. Carbon Adsorption or Use of an adhesive with a VOC content of 1.0 grams/liter (less water or exempt compounds), or less.	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**\*This is a Summary Page for this Class of Source**

[Back](#)**Best Available Control Technology (BACT) Guideline 4.9.8 A**

<b>Emissions Unit:</b>	Wooden Door Assembly, roller-applied adhesive.	<b>Equipment Rating:</b>	All
<b>Facility:</b>	American Door Manufacturing	<b>References:</b>	ATC #: N-1084-6-0 Project #: N-1010318
<b>Location:</b>	Stockton	<b>Date of Determination:</b>	11/20/2001
<b>Pollutant</b>	<b>BACT</b>		
CO	BACT NOT TRIGGERED		
NOx	BACT NOT TRIGGERED		
PM10	BACT NOT TRIGGERED		
SOx	BACT NOT TRIGGERED		
VOC	Use of an adhesive with 1.0 gram/liter (less water and exempt compounds).		

	<b>BACT Status</b>	<b>Comment</b>
Technologically Feasible BACT		
The following technologically feasible options were not cost effective		1. Thermal or catalytic oxidation.

[Back](#)**Best Available Control Technology (BACT) Guideline 4.9.9 A**

<b>Emissions Unit:</b>	Adhesive Application	<b>Equipment Rating:</b>	All
<b>Facility:</b>	Jeld-Wen, Inc.	<b>References:</b>	ATC # N-4943-4-0 and -5-0; Project # 1030691
<b>Location:</b>	Stockton	<b>Date of Determination:</b>	9/26/2003

Pollutant	BACT
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CO	BACT NOT TRIGGERED
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NOx	BACT NOT TRIGGERED
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PM10	BACT NOT TRIGGERED
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SOx	BACT NOT TRIGGERED
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VOC	1) Use of adhesive with VOC content of 3.0 g/l (less water and exempt compounds), or less for automated adhesive application and assembly processes 2) Use of adhesive with VOC content of 76.5 g/l (less water and exempt compounds), or less for manually applied adhesive operations when assembling custom window assemblies
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**BACT Status****Comment**

Achieved in Practice

The following technologically feasible options were not cost effective

Thermal Oxidizer, Carbon Adsorption

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.10\***

Last Update: 11/18/2004

**Adhesive Application for Multi-Wall Packaging Manufacturing**

Pollutant	Achieved in Practice or contained in the SIP	Technologically Feasible	Alternate Basic Equipment
VOC	adhesives with a VOC content of $\leq 0.2$ lb/gal (excluding water and exempt compounds) for the adhesion of plastic film to porous material  adhesives with a VOC content of $\leq 0.13$ lb/gal (excluding water and exempt compounds) for the adhesion of porous materials	1. Capture and thermal incineration 2. Capture and carbon adsorption	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

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[Back](#)**Best Available Control Technology (BACT) Guideline 4.9.10 A**

<b>Emissions Unit:</b>	Adhesive Application for Multi-Wall Packaging	<b>Equipment Rating:</b>	6,231 lb-adhesive/day
<b>Facility:</b>	Exopack, LLC	<b>References:</b>	ATC #C-264-14-0; # 1040496
<b>Location:</b>	Hanford	<b>Date of Determination:</b>	11/18/2004

**Pollutant****BACT**

CO BACT NOT TRIGGERED

NO<sub>x</sub> BACT NOT TRIGGEREDPM<sub>10</sub> BACT NOT TRIGGEREDSO<sub>x</sub> BACT NOT TRIGGEREDVOC Adhesives with a VOC content of  $\leq 0.2$  lb/gal (excluding water and exempt compounds) for the adhesion of plastic film to paper material Adhesives with a VOC content of  $\leq 0.13$  lb/gal (excluding water and exempt compounds) for the adhesion of paper materials**BACT Status****Comment**

Achieved in Practice

The following alternate basic equipment was not cost effective capture and thermal incineration; capture and carbon adsorption

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.11\***

Last Update: 11/3/2005

**Adhesive Application Operation - Bonding of Fiberglass Boat Hulls and Decks,  
Non-Atomizing Application**

<b>Pollutant</b>	<b>Achieved in Practice or contained in the SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	use of adhesives with VOC content of 80 grams/liter or less (less water and exempt compounds)	1. VOC capture and incineration  2. VOC capture and carbon adsorption  3. use of low VOC content adhesives with VOC content of 50 grams/liter or less (less water and exempt compounds)	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**\*This is a Summary Page for this Class of Source**

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.12\***

Last Update: 9/22/2006

**Corrugated Box Gluer**

<b>Pollutant</b>	<b>Achieved in Practice or contained in the SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	use of adhesives with a VOC content (less water and exempt compounds) not exceeding 0.044 lb/gal	1) capture of VOCs and thermal or catalytic oxidation  2) capture of VOCs and carbon absorption  3) capture of VOCs and regenerative thermal oxidizer  4) use of adhesives with a VOC content (less water and exempt compounds) not exceeding 0.021 lb/gal	

Replaces BACT 4.7.3

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**\*This is a Summary Page for this Class of Source**

[Back](#)**Best Available Control Technology (BACT) Guideline 4.9.12 A**

<b>Emissions Unit:</b>	Corrugated Box Gluer	<b>Equipment Rating:</b>	< or = 54.7 lb-VOC/day
<b>Facility:</b>	International Paper Corporation	<b>References:</b>	C-2610-12-1, '-15-0
<b>Location:</b>	Hanford	<b>Date of Determination:</b>	9/22/2006
<b>Pollutant</b>	<b>BACT</b>		

CO BACT NOT TRIGGERED

NOx BACT NOT TRIGGERED

PM10 BACT NOT TRIGGERED

SOx BACT NOT TRIGGERED

VOC Use of adhesives with a VOC content (less water and exempt compounds) not exceeding 0.021 lb/gal

**BACT Status****Comment**

Technologically Feasible BACT

The following technologically feasible options were not cost effective

1) capture of VOCs and thermal or catalytic oxidation; 2) capture of VOCs and carbon absorption; and 3) capture of VOCs and regenerative thermal oxidizer

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 4.9.13\***

Last Update: 1/30/2015

**Corrugated Cardboard Manufacturing (Corrugator)**

<b>Pollutant</b>	<b>Achieved in Practice or contained in the SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	Steam Conditioning of Paper - 8 lb-VOC/10 <sup>6</sup> sq ft	1. VOC Capture and Thermal/Catalytic Incineration	
	Adhesives - 0.015 lb- VOC/gal (less water and exempt compounds)	2. VOC Capture and Carbon Adsorption	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

**\*This is a Summary Page for this Class of Source**

[Back](#)**Best Available Control Technology (BACT) Guideline 4.9.13 A**

<b>Emissions Unit:</b>	Corrugator	<b>Equipment Rating:</b>	none
<b>Facility:</b>	Pacific Southwest Container	<b>References:</b>	ATC # N-3606-31-0; Project # 1130130
<b>Location:</b>	4530 Leckron Road in Modesto, CA	<b>Date of Determination:</b>	4/16/2013

**Pollutant****BACT**

VOC	Steam conditioning of paper - 8 lb-VOC/10 <sup>6</sup> square feet; Adhesives - 0.015 lb-VOC/gal (less water and exempt compounds)
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**BACT Status****Comment**

Achieved in Practice

# **Appendix B**

## **Cost Analysis**

## **COST EFFECTIVENESS ANALYSIS FOR THERMAL INCINERATION**

This cost effectiveness analysis was performed using EPA's OAQPS Control Cost Manual  
EPA publication no. 450/3-90-006

**FACILITY NAME:** VSS Counter Tops  
**LOCATION:** 7640 Wilbuer Way  
**PERMIT NO.:** 24317  
**EQUIPMENT DESCRIPTION:** Adhesives Application Operation

### **VOC Parameters**

VOC of concern	Toluene
Molecular weight of VOC (see Control Cost Manual, p 3-63)	92.13
Heat of combustion (Btu/lb - see Control Cost Manual, p 3-63)	17,601
Heating value of VOC (Btu/scf)	4,074
Emission rate (lbs/hr - inlet)	1.93
Inlet concentration (ppm)	17

### **Gas Parameters**

Total gas flow rate (scfm - inlet)	8000
Total gas pressure (psi - inlet)	14.7
Inlet gas temperature (deg F)	71

### **Equipment Parameters**

Level of energy recovery (0%, 35%, 50% or 70%)	70%
Control efficiency (%)	90.0%
Equipment life (years)	10

### **Operating Parameters**

Hours per day	8
Days per week	5
Weeks per year	52
Shifts per day	2

### **Incinerator Parameters**

Volumetric heat of combustion of effluent (Btu/scf)	0.07
Heat of combustion per pound of effluent (Btu/lb)	0.93
Temperature Required for incineration (deg F)	1,500.00
Gas temperature at exit of pre-heater (deg F)	1,071.30
Effluent gas temperature (deg F)	499.7

### **Electricity Usage**

Price of electricity (\$/kWh)	\$0.1124
System fan (kWh/yr)	61,651.20
Total Power Used (kWh/yr)	61,651.20

### **Gas Usage**

Price of gas (\$/1000 cu.ft.)	\$6.41
Auxiliary fuel required (scfm)	87.58

## CAPITAL COST

### Direct Costs:

Incinerator	\$110,000
Auxiliary equipment (if not included above)	\$0
Equipment Cost (A)	<u>\$110,000</u>
Instrumentation (0.1A if not included above)	\$11,000
CA Sales taxes (0.085)	\$9,350
Freight (0.05A)	\$5,500
Total Equipment Cost (B)	<u>\$135,850</u>

### Direct Installation Costs:

Foundation & Supports (0.08B)	\$10,868
Handling & erection (0.14B)	\$19,019
Electrical (0.04B)	\$5,434
Piping (0.02B)	\$2,717
Insulation for duct work (0.01B)	\$1,359
Painting (0.01B)	\$1,359
Direct Installation Cost	<u>\$40,755</u>

Site preparation	\$0
Facilities & buildings	\$0

<b>Total Direct Costs</b>	<b>\$176,605</b>
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### Indirect Costs (installation)

Engineering (0.10B)	\$13,585
Construction & field expenses (0.05B)	\$6,793
Contractor fees (0.10B)	\$13,585
Start-up (0.02B)	\$2,717
Performance test (0.01B)	\$1,359
Contingencies (0.03B)	\$4,076

<b>Total Indirect Costs</b>	<b>\$42,114</b>
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<b>TOTAL CAPITAL INVESTMENT</b>	<b>\$218,719</b>
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## ANNUAL COST

### Direct Annual Costs

Operating Cost	
Operator (@ \$15.19/hr & .5 hr per shift )	\$3,949.40
Supervisor (15% of operator)	\$592.41
Operating materials	\$0.00
Maintenance	
Labor (@17.77/hr & .5 hr per shift)	\$4,620.20
Material (same as labor)	\$4,620.20
Utilities	
Price of electricity (\$/kWh)	\$0.11
Price of gas (\$/1000 cu.ft.)	\$6.41
Electricity (\$/yr)	\$6,929.59
Natural Gas (\$/yr)	\$70,062.35
<b>Total Direct Costs</b>	<b>\$90,774.16</b>

### Indirect Annual Costs

Overhead	\$8,269.33
Administrative charges	\$4,374.37
Property taxes	\$2,187.19
Insurance	\$2,187.19
Interest rate (%)	4%
Equipment life (years)	10
CRF	0.0736
Capital recovery	\$16,097.68
Capital Recovery Inflation Adjustment	\$18,943.24
<b>Total Indirect Costs</b>	<b>\$35,961.31</b>

<b>TOTAL ANNUAL COST</b>	<b>\$126,735.47</b>
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Annual Cost (\$/yr)	\$126,735.47
Annual Emissions Reductions (tons/yr)	7.24
(annual emissions based on BACT determination limit for add-	

<b>COST PER TON OF VOCs REDUCED (\$/ton)</b>	<b>\$17,504.90</b>
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# COST EFFECTIVENESS ANALYSIS FOR CARBON ADSORPTION

This cost effectiveness analysis was performed using EPA's OAQPS Control Cost Manual  
EPA publication no. 450/3-90-006

FACILITY NAME: VSS Counter Tops  
LOCATION: 7640 Wilbur Way  
PERMIT NO.: 24317  
EQUIPMENT DESCRIPTION: Adhesives Application Operation

## VOC Parameters

VOC of concern	Toluene
Cost of pure VOC (\$/ton)	100
Molecular weight of VOC (Refer to Control Cost Manual, pg 3-63)	92.13
Emission rate (lbs/hr - inlet)	1.93
Inlet concentration (ppm)	17
k factor (Refer to Control Cost Manual, pg 4-11)	0.551
m factor (Refer to Control Cost Manual, pg 4-11)	0.11
Partial pressure (psi)	0.000255334

## Gas Parameters

Total gas flow rate (acfm - inlet)	8,000
Total gas pressure (psi - inlet)	14.7

## Equipment Parameters

Removal efficiency (%)	90.0%
Adsorption time (hours)	8
Desorption time (hours)	8
Number of adsorbing beds	1
Number of Desorbing beds	1
Equipment life (years)	10

## Operating Parameters

Hours per day	8
Days per week	5
Weeks per year	52

## Carbon Requirements

Controlled VOC Emissions with max operation (tons/year)	$((1.9 \text{ lbs VOC/hr}) * (0.9) * (8 \text{ hours/day}) * (5 \text{ days/week}) * (52 \text{ weeks/year})) / (2000 \text{ lbs/ton})$	1.8
VOC Emissions BACT add on limit (tons/year)		4019
Controlled VOC Emissions BACT add on limit (tons/year)	$(5015 \text{ lbs/year}) * 0.9$	1.8
Carbon working capacity (lb VOC/lb carbon)		0.25
Amount of carbon needed (lbs)	$(5015 \text{ lbs voc}) / (0.25 \text{ lb VOC/lb carbon})$	14,468
Carbon cost	$($1.5/\text{lb carbon}) * (18,054 \text{ lbs carbon})$	\$21,703
Carbon life (years)		5

## Direct Costs:

Purchased Equipment Cost		\$7,800.00
Adsorber and auxiliary equipment		\$780.00
Instrumentation	1% of equipment cost $($7800) * 0.1$	\$663.00
Sales taxes	$(7800) * 0.085 \text{ (CA sales tax)}$	\$390.00
Freight	5% of equipment cost $($7800) * 0.05$	\$963.00
Purchased Equipment Cost	$($7800 + $780 + $663 + $390)$	\$9,633.00

Direct installation costs	Cannister carbon adsorption doesn't require site prep and building costs	\$ -
Foundations & supports		\$ -
Handling & erection		\$ -
Electrical		\$ -
Piping		\$ -
Insulation		\$ -
Painting		\$ -
Direct installation costs		\$ -

## Indirect Costs:

Indirect Costs (Installation)		\$ -
Engineering		\$ -
Construction and field expenses		\$ -
Contractor fees		\$ -
Start-up	2% of equipment cost $($9663) * 0.02$	\$ 192.66
Performance test	1% of equipment cost $($9663) * 0.01$	\$ 96.33
Contingencies	3% of equipment cost $($9663) * 0.03$	\$ 288.99
Total Indirect Costs	$($192.66 + $96.33 + $288.99)$	\$ 577.98

Total Capital Investment	$($9633.00 + $577.98)$	\$10,210.98
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Interest Rate		0.04
Equipment Life (years)		10
Capital Recovery Factor (CRF)		0.1233
Capital recovery cost	$($10210.98 * 0.1233)$	\$1,258.92
Capital Recovery Inflation adjustment	$$1258.92 * [(1 + 0.0275)^6]$	\$1,481.46

## Direct Annual Costs

Labor wage (\$/hr)		15.18
operator hour (hrs/shift)		0.5
shifts per day (shift/day)		1
days of work per year (days/year)		260

Operator labor		
	Bureau of Labor Statistics. Occupation Code: 51-9191	
Operator	(Adhesive Operators)	$($15.18) * (0.5 \text{ hours/shift}) * (1 \text{ shift/day}) * (260 \text{ days/year})$
Supervisor		\$0.00
Material	equal to operator costs	\$1,973.40
Replacement labor		\$0.00

Utilities		
Electrical Cost		
kW/hp		0.746
hp		10
hours/year		2080
	(Based on District's Avg. Electricity Rate for an Industrial Operation as approved on 10/17/16)	
kWh price		0.1124
Electrical	(0.746 kw/hp)*(10 hp)*(1,040 hours/year)*(0.1124/kwh)	\$1,744.09
<b>Total Direct Annual Costs (without carbon costs)</b>		<b>\$5,690.89</b>
<b>Indirect Annual Costs</b>		
Overhead	60% of maintenance labor and materials	\$2,368.08
Administrative Charges	2% of Total Capital Investment	\$ 204.22
Property Tax	1% of Total Capital Investment	\$ 102.11
Insurance	1% of Total Capital Investment	\$ 102.11
<b>Total Indirect Annual Costs (without Capital Recovery)</b>		<b>\$2,776.52</b>
Ton VOC controlled		1.81
Carbon needed		14,468
Cost of Carbon per year	(13,428 lb carbon)*(\$1.50/lb carbon)	\$21,702.60
<b>Total Annual Costs</b>	(\$1,481.46+\$5,690.89+\$2,776.52+\$21,702.60)	<b>\$31,651.47</b>
<b>Cost of VOC Removal</b>	(\$31,651.47)/(1.8 tons voc)	<b>\$17,501.02</b>
<b>Determination of Maximum Annual VOC Limit Not Requiring Add-on Bact</b>		
Annual Direct Operating Cost (without carbon costs)		\$5,690.89
Annual Indirect Operating Cost		\$4,257.98
Carbon working capacity (lb carbon/lb VOC)		0.25
Annual lb VOC PTE		4019
Annual tons Controlled VOC		1.8
Control Efficiency		0.900
Amount of Carbon Needed		14468.4
Cost of Carbon		\$21,702.60
Total Annual Cost		\$31,651.47
Cost per ton VOC Controlled		\$17,501.02

