

CATEGORY:

PRINTING PROCESS

BACT Size: Minor Source BACT

PRINTING PRESS

BACT Determination Number: 138	BACT Determination Date: 1/13/2017
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Equipment Information

Permit Number: N/A -- Generic BACT Determination
Equipment Description: PRINTING PRESS
Unit Size/Rating/Capacity: Non-Heatset Lithographic Offset
Equipment Location:

BACT Determination Information

ROCs	Standard:	See Comments Section Below
	Technology Description:	VOC control device that has an overall system efficiency (collection and destruction) of at least 98.5% for VOC and/or Materials in compliance with SMAQMD Rule 450 (see Comments below).
	Basis:	Achieved in Practice
NOx	Standard:	N/A
	Technology Description:	
	Basis:	
SOx	Standard:	N/A
	Technology Description:	
	Basis:	
PM10	Standard:	N/A
	Technology Description:	
	Basis:	
PM2.5	Standard:	N/A
	Technology Description:	
	Basis:	
CO	Standard:	N/A
	Technology Description:	
	Basis:	
LEAD	Standard:	N/A
	Technology Description:	
	Basis:	

Comments: Sources emitting < 4,697 lbs uncontrolled VOC per year -- Use of materials compliant with SMAQMD Rule 450 - Graphic Arts.
 Sources emitting ≥ 4,697 lbs uncontrolled VOC per year -- Use of materials compliant with SMAQMD Rule 450 - Graphic Arts and a VOC control device that has an overall system efficiency (collection and destruction) of at least 98.5% for VOC.

District Contact: Joe Carle Phone No.: (916) 874 - 4838 email: jcarle@airquality.org



BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

DETERMINATION NO.: 138

DATE: December 14, 2016

ENGINEER: Joe Carle

Category/General Equip Description: Printing Process

Equipment Specific Description: Printing Press Non-Heatset Lithographic Offset

Equipment Size/Rating: Minor Source BACT

Previous BACT Det. No.: 76

This BACT determination will update Determination #76 for lithographic offset printing presses that are non-heatset.

BACT ANALYSIS

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

The following control technologies are currently employed as BACT for lithographic offset printing presses that are non-heatset by the following air pollution control districts:

District/Agency	Best Available Control Technology (BACT)/Requirements												
US EPA	<p><u>BACT</u> Source: EPA RACT/BACT/LAER Clearinghouse</p>												
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<p><u>T-BACT</u> There are no T-BACT standards published in the clearinghouse for this category</p>													
<p><u>RULE REQUIREMENTS:</u> None</p>													

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ARB	<p><u>BACT</u> Source: ARB BACT Clearinghouse</p> <p>Note: All BACT determinations published in the ARB BACT Clearinghouse are at least 10 years old.</p> <table border="1"> <thead> <tr> <th colspan="2">ARB BACT Clearinghouse*</th> </tr> </thead> <tbody> <tr> <td>VOC</td> <td>VOC of fountain solution not to exceed 0.17 lb/gal and Ink VOC ≤ 300 g/L.</td> </tr> <tr> <td>NOx</td> <td>No standard</td> </tr> <tr> <td>SOx</td> <td>No standard</td> </tr> <tr> <td>PM10</td> <td>No standard</td> </tr> <tr> <td>PM2.5</td> <td>No standard</td> </tr> <tr> <td>CO</td> <td>No standard</td> </tr> </tbody> </table> <p>* This BACT determination was found to be the most stringent Achieved in Practice BACT determination published in the ARB clearinghouse based on the control description. The VOC limits seem to be specific to the unit which the BACT determination was created considering higher limits were allowed at later dates than others.</p> <p><u>T-BACT</u> There are no T-BACT standards published in the clearinghouse for this category.</p> <p><u>RULE REQUIREMENTS:</u> None</p>	ARB BACT Clearinghouse*		VOC	VOC of fountain solution not to exceed 0.17 lb/gal and Ink VOC ≤ 300 g/L.	NOx	No standard	SOx	No standard	PM10	No standard	PM2.5	No standard	CO	No standard								
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SMAQMD	<p><u>BACT</u></p> <table border="1"> <thead> <tr> <th colspan="2">Lithographic printing press; all sizes</th> </tr> </thead> <tbody> <tr> <td>VOC</td> <td>Low VOC inks, coatings, fountain solutions compliant with Rule 450</td> </tr> <tr> <td>NOx</td> <td>No standard</td> </tr> <tr> <td>SOx</td> <td>No standard</td> </tr> <tr> <td>PM10</td> <td>No standard</td> </tr> <tr> <td>PM2.5</td> <td>No standard</td> </tr> <tr> <td>CO</td> <td>No standard</td> </tr> </tbody> </table> <p><u>T-BACT</u> There are no T-BACT standards published in the clearinghouse for this category.</p> <p><u>RULE REQUIREMENTS:</u></p> <p><u>Rule 450 – Graphic Arts Operations (10/23/2008)</u></p> <table border="1"> <thead> <tr> <th>MATERIAL TYPE</th> <th>VOC CONTENT g/l (lb/gal) Less water and exempt compounds</th> </tr> </thead> <tbody> <tr> <td>Printing Ink</td> <td>300 (2.5)</td> </tr> <tr> <td>Adhesive</td> <td>150 (1.25)</td> </tr> <tr> <td>Coating</td> <td>300 (2.5)</td> </tr> </tbody> </table>	Lithographic printing press; all sizes		VOC	Low VOC inks, coatings, fountain solutions compliant with Rule 450	NOx	No standard	SOx	No standard	PM10	No standard	PM2.5	No standard	CO	No standard	MATERIAL TYPE	VOC CONTENT g/l (lb/gal) Less water and exempt compounds	Printing Ink	300 (2.5)	Adhesive	150 (1.25)	Coating	300 (2.5)
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South Coast AQMD	<p><u>BACT</u> Source: SCAQMD BACT Guidelines for Non-Major Polluting Facilities, page 98.</p> <table border="1"> <thead> <tr> <th colspan="2">Lithograph or Offset, Non-heatset</th> </tr> </thead> <tbody> <tr> <td>VOC</td> <td>Low VOC fountain solution ($\leq 8\%$ by volume VOC); Low vapor pressure (≤ 10 mm Hg VOC composite partial pressure) or low VOC (≤ 100 g/l) blanket and roller washes; oil-based or UV-curable inks; and compliance with AQMD rules 1130 and 1171 (7-14-2006)</td> </tr> <tr> <td>NOx</td> <td>No standard</td> </tr> <tr> <td>SOx</td> <td>No standard</td> </tr> <tr> <td>PM10</td> <td>No standard</td> </tr> <tr> <td>PM2.5</td> <td>No standard</td> </tr> <tr> <td>CO</td> <td>No standard</td> </tr> </tbody> </table> <p><u>T-BACT</u> There are no T-BACT standards published in the clearinghouse for this category.</p> <p><u>RULE REQUIREMENTS:</u> Reg XI, Rule 1130 – Graphic Arts (5/2/2014)</p> <table border="1"> <thead> <tr> <th>Graphic Art Material</th> <th>VOC CONTENT g/l Less water and exempt compounds</th> </tr> </thead> <tbody> <tr> <td>Adhesive</td> <td>150</td> </tr> <tr> <td>Coating</td> <td>300</td> </tr> <tr> <td>Offset Lithographic Ink</td> <td>300</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Fountain Solution</th> <th>VOC Content Limits Grams of VOC Per Liter of Material</th> </tr> </thead> <tbody> <tr> <td colspan="2">Sheet-Fed</td> </tr> <tr> <td>Using Alcohol without Refrigerated Chiller</td> <td>50</td> </tr> <tr> <td>Using Alcohol with Refrigerated Chiller</td> <td>85</td> </tr> <tr> <td>Using Alcohol Substitute</td> <td>50</td> </tr> <tr> <td colspan="2">Non-Heatset Web-Fed</td> </tr> <tr> <td>Using Alcohol Substitute without Refrigerated Chiller</td> <td rowspan="2">50</td> </tr> <tr> <td>Using Alcohol Substitute with Refrigerated Chiller</td> </tr> </tbody> </table> <p>An emission control device must have a control efficiency of at least 95% and the emission collection system must have a collection efficiency of at least 90%.</p> <p>Reg XI, Rule 1171 – Solvent Cleaning Operations (5/1/2009)</p>	Lithograph or Offset, Non-heatset		VOC	Low VOC fountain solution ($\leq 8\%$ by volume VOC); Low vapor pressure (≤ 10 mm Hg VOC composite partial pressure) or low VOC (≤ 100 g/l) blanket and roller washes; oil-based or UV-curable inks; and compliance with AQMD rules 1130 and 1171 (7-14-2006)	NOx	No standard	SOx	No standard	PM10	No standard	PM2.5	No standard	CO	No standard	Graphic Art Material	VOC CONTENT g/l Less water and exempt compounds	Adhesive	150	Coating	300	Offset Lithographic Ink	300	Fountain Solution	VOC Content Limits Grams of VOC Per Liter of Material	Sheet-Fed		Using Alcohol without Refrigerated Chiller	50	Using Alcohol with Refrigerated Chiller	85	Using Alcohol Substitute	50	Non-Heatset Web-Fed		Using Alcohol Substitute without Refrigerated Chiller	50	Using Alcohol Substitute with Refrigerated Chiller
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San Diego County APCD	<p>BACT Source: NSR Requirements for BACT, page 3-14.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: left;">Graphic Arts Operations (< 5 tons/year)</th> </tr> </thead> <tbody> <tr> <td style="width: 10%;">VOC</td> <td>1. Use of low VOC fountain solution (< 6% VOC by volume), 2. Capture & recycle blanket and roller tray wash, 3. Use of cleanup solvent which has either less than 200 g VOC/l or vapor pressure of less than 5 mm HG at 20°C, 4. Use of metering roll cleanup solvent which has either less than 100 g VOC/l or vapor pressure less than 10 mm HG at 20°C, and 5. Use of inks which have a VOC content of less than 300 g/l (2.5 lb/gal)</td> </tr> <tr> <td>NOx</td> <td>No standard</td> </tr> <tr> <td>SOx</td> <td>No standard</td> </tr> <tr> <td>PM10</td> <td>No standard</td> </tr> <tr> <td>PM2.5</td> <td>No standard</td> </tr> <tr> <td>CO</td> <td>No standard</td> </tr> </tbody> </table> <p>T-BACT There are no T-BACT standards published in the clearinghouse for this category.</p> <p><u>RULE REQUIREMENTS:</u></p> <p><u>Regulation 4, Rule 67.16 – Graphic Arts Operations (11/9/2011)</u></p> <ul style="list-style-type: none"> - Graphic arts materials, except adhesives, must contain < 300 g VOC/l (2.5 lb/gal) - Adhesives containing not more than 150 grams of VOC per liter (1.25 lb/gal), as applied, less water and less exempt compounds - Fountain solutions must contain no more than 5% VOC by volume - Fountain solutions refrigerated to a temperature below 60 °F must contain no more than 8.5% VOC by volume - Cleaning material must have a VOC content less than 100 g/l or the total VOC vapor pressure of the cleaning material is 5mm of Hg at 20°C or less. 		Graphic Arts Operations (< 5 tons/year)		VOC	1. Use of low VOC fountain solution (< 6% VOC by volume), 2. Capture & recycle blanket and roller tray wash, 3. Use of cleanup solvent which has either less than 200 g VOC/l or vapor pressure of less than 5 mm HG at 20°C, 4. Use of metering roll cleanup solvent which has either less than 100 g VOC/l or vapor pressure less than 10 mm HG at 20°C, and 5. Use of inks which have a VOC content of less than 300 g/l (2.5 lb/gal)	NOx	No standard	SOx	No standard	PM10	No standard	PM2.5	No standard	CO	No standard		
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District/Agency	Best Available Control Technology (BACT)/Requirements		
	- Control devices must have a capture and control efficiency of 85% by mass.		
Bay Area AQMD	<p>BACT Source: BAAQMD BACT Guidelines, Document #110.2.1, Rev. 4, 8/24/98</p>		
	<p>Lithographic or Offset Printing – Non-Heatset</p>		
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	<table border="1"> <tr> <td>SOx</td> <td>No standard</td> </tr> </table>	SOx	No standard
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CO	No standard		

RULE REQUIREMENTS:

Reg 8, Rule 20 – Graphic Arts Printing and Coating Operations (11/19/2008)

Product	Product Limit grams VOC per liter of product as applied, less water and exempt solvent (lbs/gal) Less than:
Ink	300 (2.5)
Coating	300 (2.5)
Adhesive	150 (1.25)
Web Splicing Adhesive	300 (2.5)

Fountain Solution must be 8% VOC by volume

Cleaning Product Limits:

Equipment	VOC g/l (lb/gal) including water
For Press Equipment, except Other Press Parts	
Specialty Lithographic Press	100 (0.83)
Lithographic Press, by either Manual or Automatic Washing	100 (0.83)
Adhesive Application Equipment	25 (0.21)
Ultraviolet Ink Removal, Any Press Type	100 (0.83)
Other Press Parts	25 (0.21)

Emission control systems must have an overall efficiency of 75% on a mass basis.

District/Agency	Best Available Control Technology (BACT)/Requirements																																				
San Joaquin Valley APCD	<p>BACT Source: SJVUAPCD BACT Guideline</p> <table border="1"> <thead> <tr> <th colspan="2">Lithographic or Offset Printing – Non-Heatset</th> </tr> </thead> <tbody> <tr> <td>VOC</td> <td>Using materials with the following VOC contents: Inks: less than 5% VOC by weight (less water and exempt compounds) or less than 30% VOC by weight (less water and exempt compounds) for high end graphics Fountain Solutions: less than 5% by volume for coldest web offset lithographic, less than 5% by volume for sheet-fed offset lithographic with maximum sheet size greater than 11x17 inches, and less than 8% by volume for high end graphics</td> </tr> <tr> <td>NOx</td> <td>No standard</td> </tr> <tr> <td>SOx</td> <td>No standard</td> </tr> <tr> <td>PM10</td> <td>No standard</td> </tr> <tr> <td>PM2.5</td> <td>No standard</td> </tr> <tr> <td>CO</td> <td>No standard</td> </tr> </tbody> </table> <p><u>RULE REQUIREMENTS:</u></p> <p><u>Rule 4607 – Graphic Arts and Paper, Film, Foil and Fabric Coatings (12/18/2008)</u></p> <p>VOC content limits for inks, coatings, and adhesives</p> <table border="1"> <thead> <tr> <th>Material</th> <th>Grams of VOC per liter (lb/gal), less water and exempt compounds, as applied</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> </tr> <tr> <td>Inks</td> <td>300 (2.5)</td> </tr> <tr> <td>Coatings</td> <td>300 (2.5)</td> </tr> <tr> <td>Adhesives</td> <td>150 (1.25)</td> </tr> </tbody> </table> <p>VOC content limits for fountain solution</p> <table border="1"> <thead> <tr> <th>Fountain Solution</th> <th>Percent VOC by Volume</th> </tr> </thead> <tbody> <tr> <td>Coldset Web Offset Lithographic</td> <td>5.0</td> </tr> <tr> <td>Sheet-fed Offset Lithographic with Maximum Sheet Size greater than 11 X 17 Inches</td> <td>5.0</td> </tr> <tr> <td>All Other Presses</td> <td>8.0</td> </tr> </tbody> </table> <p>VOC content limits for solvent cleaning</p> <table border="1"> <thead> <tr> <th>Type of Solvent Cleaning Operation</th> <th>Limit Grams of VOC/Liter of Material (lb/gal)</th> </tr> </thead> <tbody> <tr> <td>Product Cleaning During Manufacturing Process; or Surface Preparation for Coating, Ink, on Adhesive Application</td> <td>25 (0.21)</td> </tr> </tbody> </table>	Lithographic or Offset Printing – Non-Heatset		VOC	Using materials with the following VOC contents: Inks: less than 5% VOC by weight (less water and exempt compounds) or less than 30% VOC by weight (less water and exempt compounds) for high end graphics Fountain Solutions: less than 5% by volume for coldest web offset lithographic, less than 5% by volume for sheet-fed offset lithographic with maximum sheet size greater than 11x17 inches, and less than 8% by volume for high end graphics	NOx	No standard	SOx	No standard	PM10	No standard	PM2.5	No standard	CO	No standard	Material	Grams of VOC per liter (lb/gal), less water and exempt compounds, as applied			Inks	300 (2.5)	Coatings	300 (2.5)	Adhesives	150 (1.25)	Fountain Solution	Percent VOC by Volume	Coldset Web Offset Lithographic	5.0	Sheet-fed Offset Lithographic with Maximum Sheet Size greater than 11 X 17 Inches	5.0	All Other Presses	8.0	Type of Solvent Cleaning Operation	Limit Grams of VOC/Liter of Material (lb/gal)	Product Cleaning During Manufacturing Process; or Surface Preparation for Coating, Ink, on Adhesive Application	25 (0.21)
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District/Agency	Best Available Control Technology (BACT)/Requirements	
	Repair and Maintenance Cleaning	25 (0.21)
	Cleaning of Coating or Adhesive Application Equipment	25 (0.21)
	<i>Cleaning of Ink Application Equipment</i>	
	General	25 (0.21)
	Lithographic (Offset) or Letterpress Printing	
	Roller Wash – Step 1	100 (0.83)
	Roller Wash – Step 2; Roller Wash – not specified; Blanket Wash, and On-Press Components	100 (0.83)
	Removable Press Components	25 (0.21)
	Ultraviolet Ink/Electron Beam Ink Application Equipment (except screen printing)	100 (0.83)
<p>Lithographic offset non-heatset printing presses venting to a control device must have an overall capture and control efficiency of 75% on a mass basis.</p>		

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
VOC	1. Use of materials compliant with SCAQMD Rule 1130 and 1171, SMAQMD Rule 450, or SJVUAPCD Rule 4607. – [SCAQMD, SMAQMD, SJVUAPCD] 2. Use of materials compliant with SDCAPCD Rule 67.16. – [SDCAPCD] 3. Use of materials compliant with BAAQMD Regulation 8 Rule 20. – [BAAQMD]
NOx	1. No standard – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVUAPCD]
SOx	1. No standard – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVUAPCD]
PM10	1. No standard – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVUAPCD]
PM2.5	1. No standard – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVUAPCD]
CO	1. No standard – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVUAPCD]

Emission limits for inks, coatings, and solvent cleaning are consistent across SCAQMD Rule 1130 and 1171, SMAQMD Rule 450, and SJVUAPCD Rule 4607. Emission limits for fountain solutions vary from rule to rule mostly based on how the emission limit is expressed. SCAQMD lists emission limits for fountain solutions in grams per liter while SMAQMD expresses the limit in percent VOC by mass, and SJVUAPCD expresses the limits in percent VOC by volume. It is difficult to compare these limits because percent by mass and volume can vary from solution to solution depending upon its physical properties.

The EPA Control Techniques Guidelines for Offset Lithographic Printing and Letter Press Printing (CTG) lists recommends emission standards as percent mass. The SMAQMD Rule also lists these identical standards as a percent mass. SCAQMD updated their emission limits for fountain solutions in 2014. In their staff report for these amendments they state that their emission limits are equivalent to those of the CTG except they have converted the limits to grams per liter to remain consistent with the previous emission limits for fountain solutions. Additionally, in 2008 amendments were made to SJVUAPCD Rule 4607, according to the associated staff report, to align the emission standards to that of other districts and the CTG.

Even though the emission limits for fountain solutions differ in the way they are expressed between the SCAQMD, SMAQMD, and SJVUAPCD all districts claim to be equivalent to the recommendations in the CTG. In order to remain consistent with the CTG and SMAQMD Rule 450 for fountain solutions will be expressed on a percent mass basis.

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

BEST CONTROL TECHNOLOGIES ACHIEVED		
Pollutant	Standard	Source
VOC	Use of materials compliant with SMAQMD Rule 450 – Graphic Arts.	SMAQMD (Rule 450)
NOx	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD
SOx	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD
PM10	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD
PM2.5	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD
CO	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD

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.

VOC	1. VOC control device with 98.5% Overall System Efficiency
NOx	N/A
SOx	N/A
PM10	N/A
PM2.5	N/A
CO	N/A

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 _x	24,500
PM ₁₀	11,400
SO _x	18,300
CO	TBD if BACT triggered

Cost Effectiveness Analysis Summary

Background: Current District BACT analysis for lithographic printing operations assumed pressroom emissions similar to that of VOC emissions in spray coating operations. Top down BACT analyses performed by the District recently for control technologies using VOC incineration and carbon adsorption in coating operations resulted in a cost effectiveness level of 4,663 lb or less per year. This was reported in the District's BACT Determinations No. 118 & 119.

The objective of this BACT determination is to verify the assumption that VOC emissions in graphic arts printing operation is similar to spray coating operation. Lithographic printing operation will be reviewed by using the pressroom as the emission source and updating the cost inputs in accordance with the EPA OAQPS Air Pollution Control Cost Manual (Third Edition).

- Basic assumptions:
- 1) Single 4-color lithographic printing press operation.
 - 2) Press room dimensions: 40'W x 60'L x 20'H (because the press room is relatively small a hood is not necessary)
 - 3) The press room is assumed to be the enclosure with an overall system efficiency of 98.5% and venting to the control device through a general ventilation system.
 - 4) General ventilation with an 8,000 CFM blower (10 air changes per hour).
 - 5) Cost calculations and assumptions are based on the EPA Air Pollution Control Cost Manual.

Carbon Adsorption System

Equipment Life = 10 years
Total Capital Investment = \$114,290
Annualized Total Capital Investment = \$17,417 per year
Direct Annual Cost = \$15,696 per year
Indirect Annual Cost = \$7,377 per year
Total Annual Cost = \$23,073 per year
VOC Removed = 2.31 tons per year

Cost of VOC Removal = \$17,505.18 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 4,697 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 = \$401,329
- Annualized Total Capital Investment = \$76,839 per year
- Direct Annual Cost = \$173,047 per year
- Indirect Annual Cost = \$24,228 per year
- Total Annual Cost = \$274,114 per year
- VOC Removed = 15.66 tons per year

Cost of VOC Removal = \$17,500.00 per ton reduced

A detailed calculation of the cost effectiveness for VOC removal with a thermal oxidizer is shown in Appendix C. Uncontrolled VOC emissions of 31,797 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 4,697 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 31,797 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:

BACT FOR LITHOGRAPHIC OFFSET PRINTING PRESSES THAT ARE NON-HEATSET EMITTING < 4,697 LBS UNCONTROLLED VOC PER YEAR		
Pollutant	Standard	Source
VOC	Use of materials compliant with SMAQMD Rule 450 – Graphic Arts.	SMAQMD (Rule 450)
NOx	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD
SOx	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD
PM10	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD

BACT FOR LITHOGRAPHIC OFFSET PRINTING PRESSES THAT ARE NON-HEATSET EMITTING < 4,697 LBS UNCONTROLLED VOC PER YEAR		
Pollutant	Standard	Source
PM2.5	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD
CO	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD

BACT FOR LITHOGRAPHIC OFFSET PRINTING PRESSES THAT ARE NON-HEATSET EMITTING ≥ 4,697 LBS UNCONTROLLED VOC PER YEAR		
Pollutant	Standard	Source
VOC	Use of materials compliant with SMAQMD Rule 450 – Graphic Arts and a VOC control device that has an overall system efficiency (collection and destruction) of at least 98.5% for VOC.	SMAQMD (Rule 450) BAAQMD (BACT Guideline)
NOx	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD
SOx	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD
PM10	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD
PM2.5	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD
CO	No standard	SMAQMD, SCAQMD, SJVUAPCD, SDCAPCD, BAAQMD

D. SELECTION OF T-BACT

For this category of equipment T-BACT will be determined on a case by case basis.

REVIEWED BY: _____ DATE: _____

APPROVED BY:  DATE: 1/13/17

Attachment A

Review of BACT Determinations published by ARB

List of BACT determinations published in ARB's BACT Clearinghouse for lithographic offset printing-non-heatset

Source	Date	Equipment Description/ Capacity	VOC Limit	Control Description
SCAQMD	3/16/2000	Air dry; 12 printing units, 2,000 hp total press drive	309 lb/day	VOC of fountain solution not to exceed 0.17 lb/gal and Ink VOC ≤ 300 g/L.
SCAQMD	12/1/2000	Sheet fed, IR dried; 6-color, 40" sheet width, 21 IR lamps; 127 hp total press drive, 15,000 sheets/hr max	2730 lb/month	Fountain solution < 0.2 lb/gal
SCAQMD	8/19/1999	Sheet fed, single color; 40" sheet width	667 lb/month	Fountain solution < 8% by volume
SCAQMD (A)	2/2/2000	Offset lid printer (dry lithographic); 6 color printing units, 15 inch sheet width w/a.3 kw UV	240 lb/month	UV curable inks and wash solutions in compliance with SCAQMD Rule 1171

(A) Noted in the clearinghouse as "Not yet a BACT Determination-Considered as AIP"

= Selected as the most stringent BACT determination achieved in practice.

Attachment B

Cost Effectiveness Analysis for Carbon Adsorption

COST EFFECTIVENESS ANALYSIS FOR CARBON ADSORPTION

This cost effectiveness analysis was performed using EPA's OAQPS Control Cost Manual
EPA publication no. 452/B-02-001

EQUIPMENT DESCRIPTION: Lithographic Offset Non-Heatset
Printing Press

VOC Parameters

VOC of concern (using the physical properties of toluene)	Various
Cost of pure VOC (\$/ton)	100
Molecular weight of VOC	92.13
Emission rate (lbs/hr - inlet)	1.13
Inlet concentration (ppm)	10
k factor	0.551
m factor	0.11
Partial pressure (psi)	0.00014936

Gas Parameters

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

Equipment Parameters

Removal efficiency (%)	98.5%
Adsorption time (hours)	16
Desorption time (hours)	8
Carbon Beds	1
Equipment life (years)	10

Operating Parameters

Hours per day	16
Days per week	5
Weeks per year	52

Carbon Requirements

Carbon working capacity (lb VOC/lb carbon)	$(k \text{ factor}) * ((\text{partial pressure})^m / \text{factor}) / 2$	0.105
Amount of carbon needed (lbs)	$(\text{Emission Rate}) * (\text{hrs/day}) / (\text{Carbon Working Capacity})$	173
Carbon cost	$(\$1/\text{lb carbon}) * (\text{lbs of carbon needed})$	\$173
Carbon life (years)		5

Adsorber Vessel Dimension and Cost

Superficial bed velocity (ft/min)	75
Diameter of each vessel (ft)	0.21
Length of each vessel (ft)	518
Surface area (sq. ft)	335
Fm factor (see Control Cost Manual, p 4-24)	1.3
Cost per vessel	\$32,463.63
Adsorber Equipment Cost	\$57,479.71

Direct Costs:

Purchased Equipment Cost

Adsorber and auxiliary equipment	To be conservative assume auxiliary costs = \$0	\$57,479.71
Instrumentation	1% of equipment cost	\$5,747.97
Sales taxes	8.5% of equipment cost	\$4,885.78
Freight	5% of equipment cost	\$2,873.99
Total Purchased Equipment Cost		\$70,987.44

Direct installation costs

Foundations & supports	8% of total equipment cost	\$5,679.00
Handling & erection	14% of total equipment cost	\$9,938.24
Electrical	4% of total equipment cost	\$2,839.50
Piping	2% of total equipment cost	\$1,419.75
Insulation	1% of total equipment cost	\$709.87
Painting	1% of total equipment cost	\$709.87
Direct installation costs		\$21,296.23

Total Direct Cost

Total equipment cost + Direct installation costs

\$92,283.67

Indirect Costs:

Indirect Costs (installation)

Engineering	10% of total equipment cost	\$7,098.74
Construction and field expenses	5% of total equipment cost	\$3,549.37
Contractor fees	10% of total equipment cost	\$7,098.74
Start-up	2% of total equipment cost	\$1,419.75
Performance test	1% of total equipment cost	\$709.87
Contingencies	3% of total equipment cost	\$2,129.62
Total Indirect Costs		\$22,006.11

Total Capital Investment

total direct cost + total indirect costs

\$114,289.78

Interest Rate

0.05

Equipment Life (years)

10

Capital Recovery Factor (CRF)		0.1295
Capital recovery cost	(total capital investment)*(CRF)	\$14,801.05
Capital Recovery Inflation adjustment	(capital recovery cost)*[(1+0.0275)^6]	\$17,417.41
Direct Annual Costs		
Operator wage (\$/hr)		15.64
Maintenance wage (\$/hr)		17.21
operator hour (hrs/shift)		0.5
shifts per day (shift/day)		2
days of work per year (days/year)		260
Operator labor		
Operator	(labor wage)*(hours/shift)*(shifts/day)*(days/year)	\$4,066.40
Supervisor	15% of operator labor	\$609.96
Maintenance		
Maintenance labor	(labor wage)*(hours/shift)*(shifts/day)*(days/year)	\$4,474.60
Materials	100% of maintenance labor	\$4,474.60
Utilities		
System Fan (kWh/yr)	Refer to EPA cost manual	7340
Bed drying/cooling fan (kWh/yr)	Refer to EPA cost manual	4
Cooling water pump (kWh/yr)	Refer to EPA cost manual	28
Total Power Used (kWh/yr)		7372
	0.13 \$/kWh = SMUD Medium General Service Summer On-Peak Rate	
Electricity Cost		\$958.33
Steam Cost		\$957.57
Cooling water		\$109.48
Carbon Replacement		
Interest Rate		0.05
Carbon Life (yrs)		5
Capital Recovery Factor		0.2310
Replacement Labor	CRF*\$0.05/lb*carbon needed	\$2.00
Carbon Cost	CRF*initial carbon cost*1.0875	\$43.40

Total Direct Annual Costs		\$15,696.34
Indirect Annual Costs		
Overhead	60% of maintenance labor and materials	\$2,805.82
Administrative Charges	2% of Total Capital Investment	\$2,285.80
Property Tax	1% of Total Capital Investment	\$1,142.90
Insurance	1% of Total Capital Investment	\$1,142.90
Total Indirect Annual Costs		\$7,377.41
Total Annual Costs	CRC and Inflation Total Capital Investment + Total Direct Annual Costs + Total Indirect Annual Costs	\$40,491.15
Tons VOC reduced	(Emission Rate)*(reduction efficiency)*(hrs/yr)/2000	2.31
Cost of VOC Removal	(Total Annual Costs)/(Tons VOC Controlled)	\$17,505.18

Attachment C

Cost Effectiveness Analysis for Thermal Oxidizers

COST EFFECTIVENESS ANALYSIS FOR THERMAL INCINERATION

This cost effectiveness analysis was performed using EPA's OAQPS Control Cost Manual
EPA publication no. 452/B-02-001

Lithographic Offset Non-Heatset Printing
Press

EQUIPMENT DESCRIPTION:

VOC Parameters

VOC of concern (Using the physical properties of toluene)	Various
Molecular weight of VOC	92.13
Heat of combustion (Btu/lb)	17,601
Heating value of VOC (Btu/scf)	4,074
Emission rate (lbs/hr - inlet)	7.6
Inlet concentration (ppm)	66

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 (%)	98.5%
Equipment life (years)	10

Operating Parameters

Hours per day	16
Days per week	5
Weeks per year	52
Shifts per day	2

Incinerator Parameters

Volumetric heat of combustion of effluent (Btu/scf)	0.27
Heat of combustion per pound of effluent (Btu/lb)	3.67
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)	\$0.13
System fan (kWh/yr)	123,302.40
Total Power Used (kWh/yr)	123,302.40

Gas Usage

Price of gas (\$/1000 cu.ft.)	\$3.30
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Auxiliary fuel required (scfm) 174.01

CAPITAL COST

Direct Costs:

Incinerator	\$201,840
Auxiliary equipment (if not included above)	\$0
Equipment Cost (A)	<u>\$201,840</u>
Instrumentation (0.1A if not included above)	\$20,184
Sales taxes (0.085A)	\$17,156
Freight (0.05A)	\$10,092
Total Equipment Cost (B)	<u>\$249,273</u>

Direct Installation Costs:

Foundation & Supports (0.08B)	\$19,942
Handling & erection (0.14B)	\$34,898
Electrical (0.04B)	\$9,971
Piping (0.02B)	\$4,985
Insulation for duct work (0.01B)	\$2,493
Painting (0.01B)	\$2,493
Direct Installation Cost	<u>\$74,782</u>

Site preparation	\$0
Facilities & buildings	\$0

Total Direct Costs **\$324,054**

Indirect Costs (installation)

Engineering (0.10B)	\$24,927
Construction & field expenses (0.05B)	\$12,464
Contractor fees (0.10B)	\$24,927
Start-up (0.02B)	\$4,985
Performance test (0.01B)	\$2,493
Contingencies (0.03B)	\$7,478

Total Indirect Costs **\$77,275**

TOTAL CAPITAL INVESTMENT **\$401,329**

ANNUAL COST

Direct Annual Costs

Operating Cost	
Operator (@ \$15.64/hr & .5 hr per shift)	\$4,066.40
Supervisor (15% of operator)	\$609.96

	Operating materials	\$0.00
Maintenance		
	Labor (@17.21/hr & .5 hr per shift)	\$4,474.60
	Material (same as labor)	\$4,474.60
Utilities		
	Price of electricity (\$/kWh)	\$0.13
	Price of gas (\$/1000 cu.ft.)	\$3.30
	Electricity (\$/yr)	\$16,029.31
	Natural Gas (\$/yr)	\$143,328.44
	Total Direct Costs	\$172,983.32

Indirect Annual Costs

Overhead	\$8,175.34
Administrative charges	\$8,026.58
Property taxes	\$4,013.29
Insurance	\$4,013.29
Interest rate (%)	5%
Equipment life (years)	10
CRF	0.1627
Capital recovery	\$65,296.21
Capital Recovery Inflation Adjustment	\$76,838.52
Total Indirect Costs	\$101,067.01

TOTAL ANNUAL COST	\$274,050.33
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Annual Cost (\$/yr)	\$274,050.33
Annual Emissions Reductions (tons/yr)	15.66
(annual emissions based on BACT determination limit for add-on controls)	

COST PER TON OF VOCs REDUCED (\$/ton)	\$17,500.00
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