SMAQMD BACT CLEARINGHOUSE

ACTIVE

CATEGORY Type: **COATING - GENERAL**

BACT Category: ≤ 6,198 pounds VOC per year and faciliti

BACT Determination Number: 338	**BACT Determination Date:** 1/16/2024

Equipment Information

Permit Number: N/A -- Generic BACT Determination
Equipment Description: PAINT SPRAY BOOTH
Unit Size/Rating/Capacity: Minor Source BACT
Equipment Location:

BACT Determination Information

District Contact: Jeff Quok Phone No.: (279) 207-1145 email: jquok@airquality.org

ROCs	**Standard:**	See Technology Description
	Technology Description:	1.Compliance with SMAQMD Rule 441 – Organic Solvents 2.Compliance with SMAQMD Rule 466 – Solvent Cleaning 3.Compliance with SDAPCD Rule 66.1 – Misc. Surface Coating Operations and Other Processes
	Basis:	Achieved in Practice
NOx	**Standard:**	See Technology Description
	Technology Description:	For booth heater: < 1200 °F: 30 ppm or 0.036 lb/MMBtu corrected to 3% O2 ≥ 1200 °F: 60 ppm or 0.073 lb/MMBtu corrected to 3% O2
	Basis:	Achieved in Practice
SOx	**Standard:**	No Standard
	Technology Description:	
	Basis:	
PM10	**Standard:**	Dry filters or waterwash
	Technology Description:	
	Basis:	Achieved in Practice
PM2.5	**Standard:**	No Standard
	Technology Description:	
	Basis:	
CO	**Standard:**	For heaters: 400 ppm corrected to 3% O2
	Technology Description:	
	Basis:	Achieved in Practice
LEAD	**Standard:**	No Standard
	Technology Description:	
	Basis:	

Comments: See BACT and T-BACT Determination for full details.

T-BACT for Organic HAP/VHAP is BACT for VOC.
T-BACT for Inorganic HAP is the following: Compliance with 40 CFR 63 Subpart HHHHHH for metals – Spray booth filter system with 98% capture efficiency of paint overspray, HVLP spray equipment, electrostatic application, airless spray gun,

SMAQMD BACT CLEARINGHOUSE

ACTIVE

CATEGORY Type: **COATING - GENERAL**

BACT Category: > 6,198 pounds VOC per year and faciliti

BACT Determination Number: 339	**BACT Determination Date:** 1/16/2024

Equipment Information

Permit Number: N/A -- Generic BACT Determination
Equipment Description: PAINT SPRAY BOOTH
Unit Size/Rating/Capacity: Minor Source BACT
Equipment Location:

BACT Determination Information

District Contact: Jeff Quok Phone No.: (279) 207-1145 email: jquok@airquality.org

ROCs	**Standard:**	See Technology Description
	Technology Description:	1.Compliance with SMAQMD Rule 441 – Organic Solvents 2.Compliance with SMAQMD Rule 466 – Solvent Cleaning 3.VOC Emission Control System that has a combined capture and control device efficiency if at
	Basis:	Cost Effective
NOx	**Standard:**	See Technology Description
	Technology Description:	For booth heater: < 1200 °F: 30 ppm or 0.036 lb/MMBtu corrected to 3% O2 ≥ 1200 °F: 60 ppm or 0.073 lb/MMBtu corrected to 3% O2
	Basis:	Achieved in Practice
SOx	**Standard:**	No Standard
	Technology Description:	
	Basis:	
PM10	**Standard:**	Dry filters or waterwash
	Technology Description:	
	Basis:	Achieved in Practice
PM2.5	**Standard:**	No Standard
	Technology Description:	
	Basis:	
CO	**Standard:**	For heaters: 400 ppm corrected to 3% O2
	Technology Description:	
	Basis:	Achieved in Practice
LEAD	**Standard:**	No Standard
	Technology Description:	
	Basis:	

Comments: See BACT and T-BACT Determination for full details.

T-BACT for Organic HAP/VHAP is BACT for VOC.
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777 12th Street, Ste. 300

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Sacramento, CA 95814

BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

DETERMINATION NOs.: 338 & 339

DATE: 1/16/2024

ENGINEER: Jeffrey Quok

Category/General Equip Description: Coating, Stripping, and Solvent Cleaning – General

Equipment Specific Description: Paint Spray Booth

Equipment Size/Rating: ≤ 6,198 pounds VOC per year and facilities ≤ 9,996 lbs VOC/year (BACT #338)

> 6,198 pounds VOC per year and facilities > 9,996 lbs VOC/year (BACT #339)

Previous BACT Det. No.: N/A

This Best Available Control Technology (BACT) determination is for coating, stripping, and solvent cleaning - general. This General Coatings BACT does **not** apply to coatings, strippers, or solvents that are subject to the following SMAQMD Rules:

Rule 442 – Architectural Coatings
Rule 450 – Graphics Arts Operations
Rule 451 – Surface Coating of Miscellaneous Metal Parts and Products
Rule 452 – Can Coating
Rule 456 – Aerospace Assembly and Component Coating Operations
Rule 459 – Automotive, Truck and Heavy Equipment Refinishing Operations
Rule 460 – Adhesive and Sealants
Rule 463 – Wood Products Coatings
Rule 465 – Polyester Resin Operations
Rule 468 – Surface Coating of Plastic Parts and Products

BACT/T-BACT ANALYSIS

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

The following control technologies are currently employed as BACT for general coating, stripping, and solvent cleaning by the following agencies and air pollution control districts:

US EPA

BACT
Source: EPA RACT/BACT/LAER Clearinghouse

No determinations were found for general coating in the RACT/BACT/LAER Clearinghouse under the process type 41.000 – Surface Coating/Printing/Graphic Arts.

RULE REQUIREMENTS: None

40 CFR 63 Subpart HHHHHH – National Emission Standards for Hazardous Air Pollutants for Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources

This subpart applies to spray application of coatings containing compounds of chromium (Cr), lead (Pb), manganese (Mn), nickel (Ni), or cadmium (Cd), collectively referred to as the target HAP to any part or product made of plastic. This subpart also applies to operations using MeCl for the removal of dried paint.

General Requirements

For paint stripping operations using MeCl:

A. Implement management practice to minimize the evaporative emissions of MeCl. The management practices must address practices in paragraphs 1 through 5, as applicable.
   1. Evaluate each application to ensure there is a need for paint stripping.
   2. Evaluate each application where a paint stripper containing MeCl is used to ensure that there is no alternative paint stripping technology that can be used.
   3. Reduce exposure of all paint strippers containing MeCl to the air.
   4. Optimize application conditions when using paint strippers containing MeCl to reduce MeCl evaporation.
   5. Practice proper storage and disposal of paint strippers containing MeCl.

For coatings that may potentially contain the target HAP compounds of chromium, lead, manganese, nickel, or cadmium:

A. All spray-applied coatings must be performed in a spray booth, preparation station, or mobile enclosures that are fully enclosed with a full roof with four walls or complete side curtains. The enclosure must be ventilated at a negative pressure and equipped with a filter system that can achieve at least 98% capture efficiency.
B. Coatings must be applied with HVLP spray equipment, electrostatic application, airless spray gun, air-assisted airless spray gun, or an equivalent technology for which written approval has been obtained from the U.S. EPA.
C. Spray gun cleaning must be conducted such that an atomized mist or spray of gun cleaning solvent and paint residue is not created outside of a container that collects used cleaning solvent.

D. All new and existing personnel who spray-apply surface coatings must be trained in the proper application of surface coatings.
E. For new affected sources, submit an initial notification to EPA no later than 180 days after initial startup or July 7, 2008, whichever is later. For an existing affected source, submit the initial notification no later than January 11, 2010.

California Air Resource Board (CARB)

BACT
Source: CARB BACT Determination Tool
CARB BACT Guidelines Search

SCAQMD Permit #358727 BACT for Roller Coater for Mirror Manufacture	
VOC	Compliance with SCAQMD Rule 1145 and Rule 1171. Coaters and oven vented to a VOC control device with 90% overall (collection and destruction/removal) efficiency.
NOx	Low NOx burner for oxidizer
SOx	No standard
PM10	No standard
PM2.5	No standard
CO	No standard

The CARB BACT Determination tool only contained the above BACT that would be subject to the SMAQMD's General Coating BACT. The other BACT Determinations found would apply to SMAQMD's Misc. Metal Parts Coating, Automotive Coatings, or Resin Application BACT categories. See Attachment B for details.

RULE REQUIREMENTS:

There are no statewide rule requirements for general coatings.

Sacramento Metropolitan AQMD

BACT
Source: SMAQMD BACT Clearinghouse

No determinations were found for general coating in the SMAQMD BACT Clearinghouse. The coating categories that were found would be subject to the SMAQMD Rules that would exempt them from the General Coating BACT.

T-BACT
There are no T-BACT standards published in the clearinghouse for this category.

RULE REQIREMENTS:

Rule 441 – Organic Solvents (12/6/1978)

This rule limits the emissions of organic solvents/materials into the atmosphere that may result in the use of organic solvents.

This standards of Section 301, 302, 303, & 305 do not apply to materials which the organic solvent content of such material does not exceed 20% by volume of said material, and the volatile content is not photochemically reactive, and the organic solvent does not come into contact with a flame.

This rule has standards for organic materials, photochemically reactive solvents, and non-photochemically reactive solvents as follows:

Organic Materials: A person shall not discharge into the atmosphere more than **6.8 kilograms (15 pounds) of organic materials in any one day**, nor more than **1.4 kilograms (3.1 pounds) in any one hour**, from any article, machine, equipment or other contrivance, in which any organic solvent or any material containing organic solvent comes into contact with flame or is baked, heat-cured or heat-polymerized, in the presence of oxygen, unless said discharge has been reduced by at least 85%. Those portions of any series of articles, machines, equipment or other contrivances designed for processing a continuous web, strip or wire which emit organic materials and using operations described in this section shall be collectively subject to compliance with this section.

Photochemically Reactive Solvents: A person shall not discharge into the atmosphere more than **18 kilograms (39.7 pounds) of organic materials in any one day**, nor more than **3.6 kilograms (7.9 pounds) in any one hour**, from any article, machine, equipment or other contrivance used under conditions other than described in Section 301 for employing, or applying, any photochemically reactive solvent, as defined in Section 203, or material containing such photochemically reactive solvent, unless said discharge has been reduced by at least 85%. Emissions of organic materials into the atmosphere resulting from air or heated drying of products for the first 12 hours after their removal from any article, machine, equipment, or other contrivance described in this section shall be included in determining compliance with this section. Emissions resulting from baking, heat-curing, or heat-polymerizing as described in Section 301 shall be excluded from determination of compliance with this section. Those portions of any series of articles, machines, equipment or other contrivances designed for processing for a continuous web, strip, or wire which emit organic materials and using operations described in this section shall be collectively subject to compliance with this section.

Non-Photochemically Reactive Solvents: A person shall not discharge into the atmosphere more than **1350 kilograms (2,970 pounds) of organic materials in any one day**, nor more than **200 kilograms (441 pounds) in any one hour**, from any article, machine, equipment or other contrivance in which any non-photochemically reactive organic solvent or any material containing such solvent is employed or applied, unless said discharge has been reduced by at least **85%**. Emissions of organic materials into the atmosphere resulting from air or heated drying of products for the first 12 hours after their removal from any article, machine, equipment, or other contrivance described in this section shall be included in determining compliance with this section. Emissions resulting from baking, heat-curing, or heat-polymerizing as described in Section 301 shall be excluded from determination of compliance with this section. Those portions of any series of articles, machines, equipment, or other contrivance designed for processing a continuous web, strip or wire which emit organic materials and using operations described in this section shall be collectively subject to compliance with this section.

Solvent Disposal: A person shall not, during any one day, **dispose of a total of more than 5 liters (1.3 gallons) of any photochemically reactive solvent**, as defined in section 203 or of any material containing more than **5 liters (1.3 gallons) of any such photochemically reactive solvent by any means which will permit the evaporation of such solvent into the atmosphere.**

Rule 466 – Solvent Cleaning (10/28/10)
This rule applies to all persons who use VOC-containing materials in solvent cleaning operations during the production, repair, maintenance or servicing of parts, products, tools, machinery, or equipment, or in general work areas, and to all persons who store and dispose of VOC-containing materials used in solvent cleaning.
VOC Standards
A person shall not perform solvent cleaning unless the solvent has a VOC content, as applied equal to or less than the applicable VOC limit in the table below.

Solvent Cleaning Activity	VOC Content g/l (lb/gal)	
	Prior to 9/25/2009	Effective 9/25/2009
General (wipe cleaning, maintenance cleaning)	50 (0.42)	25 (0.21)
Product Cleaning During Manufacturing Process or Surface Preparation for Coating, Adhesive, Sealants, or Ink Application		
General	50 (0.42)	25 (0.21)
Electrical Apparatus Components and Electronic Components	500 (4.2)	100 (0.83)
Medical Devices and Pharmaceuticals	800 (6.7)	800 (6.7)
Platelets	800 (6.7)	800 (6.7)
Repair and Maintenance Cleaning		
General	50 (0.42)	25 (0.21)
Electrical Apparatus Components and Electronic Components	900 (7.5)	100 (0.83)
Medical Devices and Pharmaceuticals		
General Work Surfaces	600 (5.0)	600 (5.0)
Tools, Equipment, and Machinery	800 (6.7)	800 (6.7)
Platelets	800 (6.7)	800 (6.7)
Architectural Coating Application Equipment		
Water based Coatings		
Enclosed Gun Cleaner	No limit	25 (0.21)
No Enclosed Gun Cleaner	50 (0.42)	25 (0.21)
Solvent based Coatings		
Enclosed Gun Cleaner	No limit	25 (0.21)
No Enclosed Gun Cleaner, cleaning at jobsite	300 (2.5)	25 (0.21)
No Enclosed Gun Cleaner, cleaning not at jobsite	50 (0.42)	25 (0.21)
Sterilization of food manufacturing and processing equipment	No limit	200 (1.68)

Cleaning Devices and Methods Requirements: A person shall not perform solvent cleaning unless one of the following cleaning devices or methods is used:
1. Wipe cleaning
2. Cleaning within closed containers or by using handheld spray bottles from which solvents are applied without a propellant-induced force
3. Using cleaning equipment which has a solvent container that is closed during cleaning operations, except when depositing and removing objects to be cleaned, and is closed during non-operation with the exception of maintenance and repair to the cleaning equipment itself;
4. Using a remote reservoir degreaser, non-vapor degreaser, or vapor degreaser used pursuant to the provisions of Rule 454, DEGREASING OPERATIONS;

5. Using solvent flushing methods where the cleaning solvent is discharged into a container which is closed except for solvent collection openings and, if necessary, openings to avoid excessive pressure buildup inside the container. The discharged solvent from the equipment must be collected into containers without atomizing into the open air. The solvent may be flushed through the system by air or hydraulic pressure, or by pumping.

Storage and Disposal Requirements

1. All solvents shall be stored in closed containers when not in use. The container shall be: a. Nonleaking, and b. Nonabsorbent.
2. All spent solvents shall be disposed of properly. Spent cleanup solvents may be classified as hazardous waste. The owner or operator shall obtain approval from applicable local, state, or federal water pollution control agency prior to disposing of spent solvents into the sewer or storm drain systems.

Rule 419 – NOx from Miscellaneous Combustion Units (10/25/18)

This Rule applies to any miscellaneous combustion unit or cooking unit with a total rated heat input capacity of 2 MMBtu/hr or greater that is located at a major stationary source of NOx and to any miscellaneous combustion unit or cooking unit with a total rated heat input capacity of 5 MMBtu/hr or greater that is not located at a major stationary source of NOx.

The requirements of this rule do not apply to combustion equipment where its primary function is to operate as an air pollution control device including, but not limited to, afterburners, catalytic oxidizers, flares, thermal oxidizers, or vapor incinerators.

TABLE 1: Miscellaneous Combustion Units
Emission Limits Expressed as PPMV, Corrected to 3% O_2

Equipment Category	**NOx Limit ppmv, corrected to 3% O_2 (lb/MMBtu)**		**CO Limit ppmv, corrected to 3% O_2 (lb/MMBtu)**
Gaseous Fuel-Fired Equipment	**Process Temperature**		**All Temperatures**
	< 1,200 °F	≥ 1,200 °F	
Other Miscellaneous Combustion Unit	30 (0.036)	60 (0.073)	400 (0.30)

South Coast AQMD

BACT
Source: SCAQMD BACT Guidelines (Part D) for Non-Major Polluting Facilities, page 117 & 118 (9/2/2022)

Spray Booth – Other Types	
VOC	For booths with < 1,170 lbs/month VOC Emissions (14,040 lb/year) 1. Compliance with applicable AQMD Regulation XI Rules For booths with ≥ 1,170 lbs/month VOC Emissions (14,040 lb/year) 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 Compliant Materials (< 50 grams of VOC per liter of material); OR 3. Use of low-VOC materials resulting in an equivalent emission reduction
VOC	For fully enclosed down-draft type booths, with < 667 lbs/month (8,004 lb/year) VOC Emissions 1. Compliance with applicable AQMD Regulation XI Rules For fully enclosed down-draft type booths, with ≥ 22 lbs/day (8,030 lb/year) VOC Emissions 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 Compliant Materials (< 50 grams of VOC per liter of material); OR Use of low-VOC materials resulting in an equivalent emission reduction
NOx	For booths with make-up air unit or a heater Compliance with Rule 1147 (2-5-2021)
SOx	No standard
PM10	Dry filters or water wash
PM2.5	No Standard
CO	No standard

For BACT comparison purposes, daily and monthly thresholds have been converted to annual equivalents based on 365 days/year and 12 months/year.

T-BACT
There are no T-BACT standards published in the clearinghouse for this category.

RULE REQUIREMENTS:

High Viscosity Coating Application Equipment Discussion
SCAQMD does not have a general coating rule but has coating rules for specific operations. One thing to note about SCAQMD's Rule 1106 Marine and Pleasure Craft Coatings, Rule 1107 Coating of Metal Parts and Products, and Rule 1168 for Adhesive and Sealant is that they provide application equipment standard exemptions for coatings with high viscosity. SCAQMD provided the following explanation for the exemption on page 2-24 of the Staff Report for Rule 1106:

> "Staff proposes to include an exemption in the proposed amendment for certain coatings that are too thick to be sprayed by conventional spray equipment. The proposal will exempt coatings that have a viscosity greater than 650 centipoise, which have poor flow characteristics, from the proposed transfer efficiency requirements in paragraph (d)(8), Application Equipment Transfer Efficiency, including HVLP. The spraying equipment required to spray such thick fluids includes spraying equipment such as plural type application equipment or spraying equipment that must use very high pressure (greater than 1,000 psi) and heated elements to apply coatings. Without the proposed exemption, shops forced to use HVLP equipment would otherwise have to thin high solids coatings with VOC solvents to allow them to be sprayed, thus eliminating the benefit of the low-VOC high solids coatings. Staff proposes the following rule language to exempt coatings that have a viscosity of 650 centipoise or greater from the requirements in paragraph (d)(8):
>
> The provisions of paragraph (d)(8) shall not apply to Marine or Pleasure Craft coatings with a viscosity of 650 centipoise or greater, as applied."

SCAQMD's Rule 1107 Coating of Metal Parts and Products and Rule 1168 Adhesive and Sealant have similar exemptions at 650 centipoise and 200 centipoise, respectively. SMAQMD agrees that due to HVLP not being technological feasibility with high viscosity coatings, an application equipment exemption is needed. Therefore, this BACT Determination will include a 650 centipoise or greater application equipment exemption.

Reg XI, Rule 1132 – Further Control of VOC Emissions from High-Emitting Spray Booth Facilities (Last amended 5/5/2006)

This rule applies to any spray booth facility, except petroleum industry facilities, that uses VOC-containing materials that amount to more than 40,000 pounds (20 tons) per year of VOC emissions in any emission inventory year beginning in 1999.

Standards

A person shall not operate any spray booth facility subject to this rule, unless the VOC emissions from any equipment, activity or operation that applies, or is required by any District rule, regulation or permit to apply, VOC-containing materials in a spray booth are reduced through the use of the following:

(1) An emission control system that has an overall efficiency of at least 65 percent by weight; or
(2) VOC-containing materials that have a VOC content at least 65 percent lower than any applicable rule limit in effect as of January 19, 2001; or
(3) A combination of methods specified in paragraphs (c)(1) and (c)(2), which when individually applied do not meet the specified reduction

Reg XI, Rule 1171 – Solvent Cleaning Operations (Last amended 5/1/2009)

This rule applies to all persons who use these solvent materials in solvent cleaning operations during production, repair, maintenance, or servicing of parts, products, tools, machinery, equipment, or general work areas; all persons who store and dispose of these materials used in solvent cleaning operations; and all solvent suppliers who supply, sell, or offer for sale solvent cleaning materials for use in solvent cleaning operations.

Solvent Requirements

SOLVENT CLEANING ACTIVITY	CURRENT LIMITS* VOC g/l (lb/gal)	EFFECTIVE 1/1/2010 VOC g/l (lb/gal)
(A) Product Cleaning During Manufacturing Process Or Surface Preparation For Coating, Adhesive, Or Ink Application		
(i) General	25 (0.21)	
(ii) Electrical Apparatus Components & Electronic Components	100 (0.83)	
(iii) Medical Devices & Pharmaceuticals	800 (6.7)	
(B) Repair and Maintenance Cleaning		
(i) General	25 (0.21)	
(ii) Electrical Apparatus Components & Electronic Components	100 (0.83)	
(iii) Medical Devices & Pharmaceuticals		
(A) Tools, Equipment, & Machinery	800 (6.7)	
(B) General Work Surfaces	600 (5.0)	
(C) Cleaning of Coatings or Adhesives Application Equipment	25 (0.21)	
(D) Cleaning of Ink Application Equipment		
(i) General	25 (0.21)	
(ii) Flexographic Printing	25 (0.21)	
(iii) Gravure Printing		
(A) Publication	100 (0.83)	
(B) Packaging	25 (0.21)	
(iv) Lithographic (Offset) or Letter Press Printing		
(A) Roller Wash, Blanket Wash, & On-Press Components	100 (0.83)	
(B) Removable Press Components	25 (0.21)	
(v) Screen Printing	100 (0.83)	
(vi) Ultraviolet Ink/ Electron Beam Ink Application Equipment (except screen printing)	650 (5.4)	100 (0.83)
(vii) Specialty Flexographic Printing	100 (0.83)	

SOLVENT CLEANING ACTIVITY	CURRENT LIMITS* VOC g/l (lb/gal)	EFFECTIVE 1/1/2010 VOC g/l (lb/gal)
(E) Cleaning of Polyester Resin Application Equipment	25 (0.21)	

* The specified limits remain in effect unless revised limits are listed in subsequent columns.

Reg XI, Rule 1147 – NOx Reductions from Miscellaneous Sources
(Last amended 5/6/2022)
This rule applies to ovens, dryers, dehydrators, heaters, kilns, calciners, furnaces, crematories, incinerators, heated pots, cookers, roasters, fryers, closed and open heated tanks and evaporators, distillation units, afterburners, degassing units, vapor incinerators, catalytic or thermal oxidizers, soil and water remediation units and other combustion equipment with nitrogen oxide emissions that require a District permit and are not specifically required to comply with a nitrogen oxide emission limit by other District Regulation XI rules.

However, Reg II, Rule 219 exempts combustion equipment firing natural gas, for which the maximum heat input is 2,000,000 Btu/hr or less. Therefore, in practice, the below standards only apply to booth heaters with a heat input greater than 2,000,000 Btu/hr.

Equipment Category	**NOx Emission Limit PPM @ 3% O_2, dry or pound/MMBtu heat input for ≤ 2.0 MMBtu/hr**	
	Process Temperature	
	< 1,200 °F	**≥ 1,200 °F**
Other Unit or Process Temperature	30 ppm or 0.036 lb/MMBtu	60 ppm or 0.073 lb/MMBtu

CO limit for all units is 1,000 ppmv at 3% O_2.

San Joaquin Valley Unified APCD

Source: SJVAPCD BACT Clearinghouse

BACT
No determinations were found for general coating in the SJVAPCD BACT Clearinghouse. The coating categories that were found would be subject to the SMAQMD Rules that would exempt them from the General Coating BACT.

T-BACT
There are no T-BACT standards published in the clearinghouse for this category.

RULE REQUIREMENTS:

SJVAPCD Rule 4661 – Organic Solvents (Amended 9/20/2007)

This rule applies to any source operation that uses organic solvents unless the source operation is subject to any of the following rules:

1. Rule 4601 (Architectural Coatings),
2. Rule 4603 (Surface Coating of Metal Parts and Products),
3. Rule 4604 (Can and Coil Coating Operations),
4. Rule 4605 (Aerospace Assembly and Component Coating Operations),
5. Rule 4606 (Wood Products Coating Operations),
6. Rule 4607 (Graphic Arts),
7. Rule 4610 (Glass Coating Operations),
8. Rule 4612 (Motor Vehicle and Mobile Equipment Coating Operations – Phase II),
9. Rule 4653 (Adhesives),
10. Rule 4662 (Organic Solvent Degreasing Operations),
11. Rule 4684 (Polyester Resin Operations), or
12. Rule 4691 (Vegetable Oil Processing Operations).

Standards

1. An operator shall not emit to the atmosphere VOCs in excess of **833 pounds VOC per calendar month per facility (9,996 lb/year equivalence)**.
2. In lieu of meeting the VOC emission limit above, an operator may install and operate a VOC emission control system that meets the following requirements.
   a. The VOC emission control system shall be approved by the APCO.
   b. The VOC emission control system shall have a capture efficiency of at least 90 percent by weight (90 wt%) and a control efficiency of at least 95 wt%.
3. Organic Solvent Cleaning, Storage, and Disposal Requirements
   a. Operators shall comply with the requirements of Rule 4663 (Organic Solvent Cleaning, Storage, and Disposal) when performing organic solvent cleaning, storage and disposal of organic solvents and waste solvent materials, coatings, adhesives, catalysts, and thinners.

RULE REQUIREMENTS:

SJVAPCD Rule 4663 – Organic Solvent Cleaning, Storage, and Disposal (Amended 9/20/2007)

This rule applies to any organic solvent cleaning performed outside a degreaser during the production, repair, maintenance, or servicing of parts, products, tools, machinery, equipment, or in general work areas at stationary sources. The rule shall also apply to the storage and disposal of all solvents and waste solvent materials at stationary sources.

Organic Solvent VOC Content Limits

Type of Solvent Cleaning Operation	Effective November 15, 2003 through September 20, 2008 VOC Content Limit Grams of VOC/liter of material (lb/gal)	Effective on and after September 21, 2008 VOC Content Limit Grams of VOC/liter of material (lb/gal)
A. Product Cleaning During Manufacturing Process or Surface Preparation for Coating, Adhesive, or Ink Application		
1. General	50 (0.42)	25 (0.21)
2. Electrical Apparatus Components and Electronic Components	500 (4.2)	100 (0.84)
3. Medical Devices and Pharmaceuticals	800 (6.7)	800 (6.7)
B. Repair and Maintenance Cleaning		
1. General	50 (0.42)	25 (0.21)
2. Electrical Apparatus Components and Electronic Components	900 (7.5)	100 (0.84)
3. Medical Devices and Pharmaceuticals	800 (6.7)	800 (6.7)
3.1 Tools, Equipment, and Machinery		
3.2 General Work Surfaces	600 (5.0)	600 (5.0)
C. Cleaning of Coating or Adhesive Application Equipment	550 (4.6)	25 (0.21)

San Diego County APCD

BACT
Source: SDAPCD BACT Guidance Document (June 2011)

General Surface Coating (< 10 gallons of coating/day) (No specific Coating Category Rule Applies)	
VOC	Compliance with Rule 66.1, Miscellaneous Surface Coating Operation and Other Processes Emitting Volatile Organic Compounds
NOx	No standard
SOx	No standard
PM10	Spray booth equipped with overspray filters
PM2.5	No standard
CO	No standard

T-BACT
There are no T-BACT standards published in the clearinghouse for this category.

RULE REQUIREMENTS:

SDAPCD Rule 66.1 – Miscellaneous Surface Coating Operations and Other Processes Emitting Volatile Organic Compounds (Amended 5/11/2016)

This rule is applicable to all surface coating, solvent cleaning or other operations or processes that may result in emissions of VOCs and are not subject to or exempt from the following rules:

67.0.1 - Architectural Coatings;
67.2 - Dry Cleaning Equipment Using Petroleum Based Solvents;
67.3 - Metal Parts and Products Coating Operations;
67.4 - Metal Container, Metal Closure and Metal Coil Coating Operations;
67.5 - Paper, Film and Fabric Coating Operations;
67.6.1 - Cold Solvent Cleaning and Stripping Operations;
67.6.2 - Vapor Degreasing Operations;
67.9 - Aerospace Coating Operations;
67.10 - Kelp Processing and Bio-Polymer Manufacturing Operations;
67.11 - Wood Products Coating Operations;
67.12.1 - Polyester Resin Operations;
67.15 - Pharmaceutical and Cosmetic Manufacturing Operations;
67.16 - Graphic Arts Operations;
67.18 - Marine Coating Operations;
67.19 - Coatings and Printing Inks Manufacturing Operations;
67.20.1 - Motor Vehicle and Mobile Equipment Coating Operations;
67.21 - Adhesive Materials Application Operations;
67.24 - Bakery Ovens;
61.1 through 61.8 – Vapor Recovery Rules;
68 through 69.4.1 – Rules Regulating Combustion Sources.

Standards

Surface Coating and other Operations

1. A person shall not conduct any surface coating or other operation, excluding surface preparation and solvent cleaning operations, that may result in emissions of volatile organic compounds unless one of the following requirements is satisfied.
   a. VOC emissions from such operation are less than 5 tons per calendar year, excluding emissions from cleaning operations; or
   b. VOC emissions are reduced by air pollution control equipment in compliance with all the applicable requirements of Section (e); or
   c. a surface coating operation is conducted by using air-dried coatings with a VOC content not higher than 420 grams/liter (3.5 lbs/gal) of coating, less water and exempt compounds, as applied, or by using baked coatings with a VOC content not higher than 360 grams/liter (3.0 lbs/gal) of coating, less water and exempt compounds, as applied.

Surface Preparation and Solvent Cleaning Operations

2. A person shall not conduct a surface preparation or solvent cleaning operation, including wipe cleaning but excluding cleaning of coating application equipment, unless:
   a. the total VOC vapor pressure of cleaning material is 8 mm Hg at 20°C (68°F) or less, or
   b. for Aerospace Components, not associated with a surface coating operation, 45 mm Hg at 20°C (68°F) or less; or
   c. the VOC content of cleaning material complies with the following limits expressed as either grams of VOC per liter of material (g/L) or pounds of VOC per gallon of material (lb/gal), as used:

Category	VOC Limits	
	g/l	Lb/gal
General	50	0.42
Aerospace Components	200	1.7
Ultra-high Purity Chemical Manufacturing	840	7.0

Application Equipment for Surface Coating Operations

3. Coating Application Methods
   No surface coatings shall be applied unless one of the following application methods is used:
   a. Hand application method
   b. Dip Coat
   c. Roll Coat
   d. Flow Coat
   e. Electrostatic Spray
   f. HVLP, Facilities using HVLP spray shall have available on site pressure gauges in proper operating conditions to measure air pressure at the air cup, or have manufacturer's information regarding the correlation between the air cap pressure and the handle inlet pressure, or
   g. Other coating application methods that are demonstrated to have a transfer efficiency equal at a minimum to one of the above application methods, and which are used in such a manner that the parameters under which they were tested are permanent features of the method. Such coating application methods shall be approved in writing by the Air Pollution Control Officer prior to use.
4. Cleaning of Coating Application Equipment
   A person shall not use VOC containing materials for the cleaning of coating application equipment used in operations subject to this rule unless:
   a. The cleaning material contains 50 grams or less of VOC per liter of material; or
   b. The cleaning material is flushed or rinsed through the application equipment in a contained manner that will minimize evaporation into the atmosphere; or
   c. 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 its parts and provided that the cleaned equipment or its parts are drained to the container until dripping ceases; or
   d. A system is used that totally encloses the component parts being cleaned during the washing, rinsing, and draining processes.

Control Equipment

5. In lieu of complying with the provisions of Section (d) of this rule, an owner/operator may use an air pollution control system which:
   a. Has been installed in accordance with an Authority to Construct; and
   b. Has a combined emissions capture and control device efficiency of at least 85% by weight.
6. A person electing to use control equipment pursuant to Subsection (e)(1) shall submit to the Air Pollution Control Officer for approval an Operation and Maintenance plan for the proposed emission control device and emission collection system and receive approval prior to operation of the control equipment. Thereafter, the plan can be modified, with Air Pollution Control Officer approval, as necessary to ensure compliance. Such plan shall:
   a. Identify all key system operating parameters. Key system operating parameters are those necessary to ensure compliance with Subsection (e)(1)(ii), such as temperature, pressure and/or flow rate; and

b. Include proposed inspection schedules, anticipated ongoing maintenance, and proposed record keeping practices regarding the key system operating parameters.

7. Upon approval by the Air Pollution Control Officer, a person subject to the requirements of Section (e) shall implement the Operation and Maintenance plan and shall comply thereafter with the provisions of the approved plan.

Bay Area AQMD

BACT

Source: BAAQMD BACT Guideline 84.1.1 (8/30/91)
BAAQMD BACT Guideline 84.2.1 (8/30/91)

Guideline 84.4.1: Flow Coater, Dip Tank, and Roller Coater < 36 lb/day (uncontrolled)	
VOC	No standard
NOx	No standard
SOx	No standard
PM10	No standard
PM2.5	No Standard
CO	No standard

Guideline 84.4.2: Flow Coater, Dip Tank, and Roller Coater ≥ 36 lb/day (uncontrolled)	
VOC	Coating with VOC content complying with applicable BAAQMD rules, and emissions from coating area, drying area, and oven vented to control device with overall capture/destruction efficiency > 90%
NOx	No standard
SOx	No standard
PM10	No standard
PM2.5	No Standard
CO	No standard

For BACT comparison purposes, the daily thresholds of 36 lbs/day will be converted to an annual equivalent of 13,140 lb/year based on 365 days/year.

RULE REQUIREMENTS:

BAAQMD Regulation 8, Rule 4 – General Solvent and Surface Coating Operations (Amended 11/16/2002)

This rule applies to, but are not limited to, model making, printed circuit board manufacturing and assembly, electrical and electronic component manufacturing, surface coating of test panels, training facilities where the application of coating is for training purposes, stencil coatings, low usage coating activities exempt from other Regulation 8 Rules, coatings specifically exempt from other Regulation 8 Rules or solvent usage not specified by other Regulation 8 Rules.

The surface preparation standards shall not apply to surface preparation of material subject to the following Regulation 8 surface coating rules or made subject to Rule 4 by specific exemption or reference in any of the following rules:

Rule 3: Architectural Coating
Rule 11: Metal Container, Closure and Coil Coating
Rule 12: Paper, Fabric and Film Coating
Rule 13: Light and Medium Duty Motor Vehicle Assembly Plants
Rule 14: Surface Coating of Metal Furniture and Large Appliances
Rule 19: Surface Coating of Miscellaneous Metal Parts and Products
Rule 20: Graphic Arts Printing and Coating Operations
Rule 23: Coating of Flat Wood Paneling and Wood Flat Stock
Rule 26: Magnet Wire Coating Operations
Rule 29: Aerospace Assembly and Component Coating Operations
Rule 30: Semiconductor Wafer Fabrication Operations
Rule 31: Surface Coating of Plastic Parts and Product
Rule 32: Wood Products Coating
Rule 35: Coating, Ink and Adhesive Manufacturing
Rule 38: Flexible and Rigid Disc Manufacturing
Rule 43: Marine Vessel Coating
Rule 45: Motor Vehicle and Mobile Equipment Coating Operations
Rule 50: Polyester Resin Operations

Standards

Solvent and Surface Coating Requirements:

1. A person shall not emit more than 4,553 kg (5 tons) of VOC from any source during any calendar year; or
2. Emissions are controlled by an approved emission control system with an overall abatement efficiency of 85% on a mass basis. If reduction is achieved by incineration, at least 90% by weight of the organic compound emissions shall be oxidized to carbon dioxide; or
3. The coating operation uses a coating with a VOC content less than or equal to 420 grams per liter (3.5 lb/gal) of coating as applied.

Solvent evaporative loss minimization:

Unless emissions to the atmosphere are controlled by an approved emission control system with an overall abatement efficiency of at least 85%, any person using organic solvent for surface preparation and cleanup or any person mixing, using or disposing of organic solvent:

1. Shall use closed containers for the storage or disposal of cloth or paper used for solvent surface preparation and cleanup.
2. Shall not use organic solvent for the cleanup of spray equipment, including paint lines, with a VOC content in excess of 50 g/l (0.42 lb/gal) unless either, (i) solvent is pressurized though spray equipment with atomizing air off or dispensed from a small non-atomizing container, and collected and stored in a closed container until recycled or properly disposed of offsite, or (ii) a spray gun washer subject to and in compliance with the requirements of Regulation 8, Rule 16 is used.
3. Shall close containers of solvent or coating when not in use.

Surface Preparation Standards:

No person shall use a solvent with a VOC content that exceeds 50 g/l (0.42 lbs/gal), as applied, for surface preparation in any operation subject to this Rule unless emissions to the atmosphere are controlled to an equivalent level by an approved emission control system with an overall abatement efficiency of at least 85 percent.

Summary of Achieved in Practice Control Technologies

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

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
VOC **VOC**	<u>General Solvent Operations (see Organic Materials, Photochemically Reactive, and Non-Photochemically Reactive Solvent Sections for details)</u> 1. Compliance with SMAQMD Rule 441 Organic Solvents and SJVAPCD Rule 4661 Organic Solvents 2. Compliance with BAAQMD Regulation 8, Rule 4 – General Solvent and Surface Coating Operations 3. Compliance with SDAPCD Rule 66.1 Misc. Surface Coating Operation and Other Processes Emitting Volatile Organic Compounds <u>Organic Materials</u> 1. A person shall not discharge into the atmosphere more than **6.8 kilograms (15 pounds) of organic materials in any one day (5,475 lbs/year equivalent)**, nor more than **1.4 kilograms (3.1 pounds) in any one hour**, from any article, machine, equipment or other contrivance, in which any organic solvent or any material containing organic solvent comes into contact with flame or is baked, heat-cured or heat-polymerized, in the presence of oxygen, **unless said discharge has been reduced by at least 85%**. [SMAQMD] 2. An operator shall not emit to the atmosphere VOCs in excess **of 833 pounds VOC per calendar month per facility (9,996 lb/year equivalence)**. In lieu of meeting the VOC emission limit, an operator may install and operate a VOC emission Control system that has a **capture efficiency of at least 90% by weight and a control efficiency of at least 95% wt%**. [SJVAPCD] 3. VOC emissions from operations must be less than **5 tons per calendar year**, excluding cleaning operations; or VOC emissions are reduced by air pollution control equipment with a **combined emissions capture and control device efficiency of at least 85% by weight**; or using air-dried coatings with a VOC content not higher than **420 g/l (3.5 lbs/gal)** of coating, less water and exempt compounds, as applied, or by using baked coatings with a VOC content not higher than **360 grams/liter (3.0 lbs/gal)** of coating, less water and exempt compounds, as applied [SDAPCD] 4. VOC emissions from operations must be less than **5 tons per calendar year**, excluding cleaning operations; or VOC emissions are reduced by air pollution control system with an **overall abatement efficiency of 85% on a mass basis**; or using coatings with a VOC content not higher than **420 g/l (3.5 lbs/gal)** of coating, as applied [BAAQMD] <u>Photochemically Reactive Solvents</u> 1. An operator shall not emit to the atmosphere VOCs in excess of **833 pounds VOC per calendar month per facility (9,996 lb/year equivalent)**. In lieu of meeting the VOC emission limit, an operator may install and operate a VOC emission Control system that has a capture efficiency of at least 90% by eight and a control efficiency of at least 95% wt%. [SJVAPCD] 2. VOC emissions from operations must be less than **5 tons per calendar year**, excluding cleaning operations; or VOC emissions are reduced by air pollution control equipment with a **combined emissions capture and control device efficiency of at least 85% by weight**; or using air-dried coatings with a VOC content not higher than **420 g/l (3.5 lbs/gal)** of coating, less water and exempt compounds, as applied, or by using baked coatings with a VOC content not higher

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
VOC	than **360 grams/liter (3.0 lbs/gal)** of coating, less water and exempt compounds, as applied [SDAPCD] 3. VOC emissions from operations must be less than **5 tons per calendar year**, excluding cleaning operations; or VOC emissions are reduced by air pollution control system with an **overall abatement efficiency of 85% on a mass basis**; or using coatings with a VOC content not higher than **420 g/l (3.5 lbs/gal)** of coating, as applied [BAAQMD] 4. A person shall not discharge into the atmosphere more than **18 kilograms (39.7 pounds) of organic materials in any one day (14,490.5 lb/year equivalent)**, nor more than **3.6 kilograms (7.9 pounds) in any one hour**, from any article, machine, equipment or other contrivance used under conditions other than described in Section 301 for employing, or applying, any photochemically reactive solvent, as defined in Section 203, or material containing such photochemically reactive solvent, unless said **discharge has been reduced by at least 85%**. Emissions of organic materials into the atmosphere resulting from air or heated drying of products for the first 12 hours after their removal from any article, machine, equipment, or other contrivance described in this section shall be included in determining compliance with this section. Emissions resulting from baking, heat-curing, or heat-polymerizing as described in Section 301 shall be excluded from determination of compliance with this section. Those portions of any series of articles, machines, equipment or other contrivances designed for processing for a continuous web, strip, or wire which emit organic materials and using operations described in this section shall be collectively subject to compliance with this section. [SMAQMD] <u>Non-Photochemically Reactive Solvents</u> 1. An operator shall not emit to the atmosphere VOCs in excess of **833 pounds VOC per calendar month per facility (9,996 lb/year equivalent)**. In lieu of meeting the VOC emission limit, an operator may install and operate a VOC emission Control system that has a **capture efficiency of at least 90% by weight and a control efficiency of at least 95% wt%**. [SJVAPCD] 2. VOC emissions from operations must be less than **5 tons per calendar year**, excluding cleaning operations; or VOC emissions are reduced by air pollution control equipment with a **combined emissions capture and control device efficiency of at least 85% by weight**; or using air-dried coatings with a VOC content not higher than **420 g/l (3.5 lbs/gal)** of coating, less water and exempt compounds, as applied, or by using baked coatings with a VOC content not higher than **360 grams/liter (3.0 lbs/gal)** of coating, less water and exempt compounds, as applied [SDAPCD] 3. VOC emissions from operations must be less than **5 tons per calendar year**, excluding cleaning operations; or VOC emissions are reduced by air pollution control system with an **overall abatement efficiency of 85% on a mass basis**; or using coatings with a VOC content not higher than **420 g/l (3.5 lbs/gal)** of coating, as applied [BAAQMD] 4. A person shall not discharge into the atmosphere more than **1,350 kilograms (2,970 pounds) of organic materials in any one day (542 ton/year equivalent)**, nor more than **200 kilograms (441 pounds) in any one hour**, from any article, machine, equipment or other contrivance in which any non-photochemically reactive organic solvent or any material containing such solvent is employed or applied, unless said **discharge has been reduced by at least 85%.** Emissions of organic materials into the atmosphere resulting from air or heated drying of products for the first 12 hours after their removal from any article, machine, equipment, or other contrivance described in this section shall be included in determining compliance with this section. Emissions resulting from baking, heat-curing, or heat-polymerizing as described in Section 301 shall be excluded from

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
VOC	determination of compliance with this section. Those portions of any series of articles, machines, equipment, or other contrivance designed for processing a continuous web, strip or wire which emit organic materials and using operations described in this section shall be collectively subject to compliance with this section. [SMAQMD] Solvent Cleaning 1. Compliance with SMAQMD Rule 466. **General Solvent Cleaning VOC Content limit: 25 g/l** 2. Compliance with SCAQMD Rule 1171. **General Solvent Cleaning VOC Content limit: 25 g/l** 3. Compliance with SJVAPCD Rule 4663. **General Solvent Cleaning VOC Content limit: 25 g/l** 4. Compliance with SDAPCD Rule 66.1. **General Solvent Cleaning VOC Content limit: 50 g/l** 5. Compliance with BAAQMD Regulation 8, Rule 4 – General Solvent and Surface Coating Operations. **General Solvent Cleaning VOC Content limit: 50 g/l** Application Equipment(A) 1. One of the following application methods must be used: a. Hand application method b. Dip Coat c. Roll Coat d. Flow Coat e. Electrostatic Spray f. HVLP, Facilities using HVLP spray shall have available on-site pressure gauges in proper operating conditions to measure air pressure at the air cup, or have manufacturer's information regarding the correlation between the air cap pressure and the handle inlet pressure, or g. Other coating application methods that are demonstrated to have a transfer efficiency equal at a minimum to one of the above application methods, and which are used in such a manner that the parameters under which they were tested are permanent features of the method. Such coating application methods shall be approved in writing by the Air Pollution Control Officer prior to use. [SDAPCD] For Flow Coater, Dip Tank, Roller Coater ≥ 36 lb/day (13,140 lb/year equivalent) 1. Coating with VOC content complying with applicable BAAQMD rules, and emissions from coating area, drying area, and oven vented to control device with overall capture/destruction efficiency > 90% [BAAQMD] 2. Compliance with SCAQMD Rule 1145 and 1171. Coaters and oven vented to a VOC control device with 90% overall (collection and destruction/removal) efficiency. [SCAQMD Permit #358727] For booths with ≥ 1,170 lb/month VOC Emissions (14,040 lb/year equivalent) and > 20 tons per year per facility 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 Compliant Materials (< 50 grams of VOC per liter of material); OR 3. Use of low-VOC materials resulting in an equivalent emission reduction [SCAQMD]

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
	<u>For fully enclosed down-draft type booths, with ≥ 22 lb/day VOC Emissions (8,030 lb/year equivalent) and > 20 tons per year per facility</u> 1. Compliance with applicable SCAQMD Regulation XI Rules, and VOC control system with ≥ 90% collection efficiency and ≥ 95% destruction efficiency; OR 2. Use of Super Compliant Materials (< 50 grams of VOC per liter of material); OR 3. Use of low-VOC materials resulting in an equivalent emission reduction [SCAQMD]
NOx	1. For booth heaters: < 1,200 °F: 30 ppm or 0.036 lb/MMBtu ≥ 1,200 °F: 60 ppm or 0.073 lb/MMBtu. [SCAQMD, SMAQMD] 2. No Standard – [SDCAPCD, BAAQMD, SJVAPCD, US EPA]
SOx	1. No Standard – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD]
PM10	1. Dry filters or waterwash [SCAQMD] 2. Spray booth equipped with overspray filters [SDAPCD]
PM2.5	1. No Standard – [SMAQMD, SCAQMD, SDAPCD, BAAQMD, SJVAPCD]
CO	1. For heaters: 400 ppm corrected to 3% O_2 – [SMAQMD] 2. For heaters: 1,000 ppm corrected to 3% O_2 – [SCAQMD]
HAP/VHAP (T-BACT)	3. Compliance with SMAQMD Rule 441, SMAQMD Rule 466, SJVAPCD Rule 4661, and SDAPCD Rule 66.1. 4. VOC control system with overall capture efficiency ≥ 85% by weight
Inorganic HAP (T-BACT)	Compliance with 40 CFR 63 Subpart HHHHHH for metals – Spray booth filter system with 98% capture efficiency of paint overspray, HVLP spray equipment, electrostatic application, airless spray gun, air-assisted airless spray gun, or an equivalent technology [US EPA]

(A) Due to HVLP not being technological feasibility with high viscosity coatings, an application equipment exemption for coatings with a 650 centipoise or greater application will be included in the BACT Determination, similar to SCAQMD coating rules.

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

BEST CONTROL TECHNOLOGIES ACHIEVED		
Pollutant	**Standard**	**Source**
VOC	<u>For booths without add-on Control < 22 lb/day (8,030 lb/year equivalent) VOC Emissions</u> 1. Compliance with SMAQMD Rule 441 – Organic Solvents 2. Compliance with SMAQMD Rule 466 – Solvent Cleaning 3. Compliance with SDAPCD Rule 66.1 – Misc. Surface Coating Operations and Other Processes Emitting Volatile Organic Compounds Section (d)(3): Application Equipment for Surface Coating Operations(A) <u>For booths with add-on Control ≥ 22 lb/day (8,030 lb/year equivalent) VOC Emissions</u> 1. Compliance with SMAQMD Rule 441 – Organic Solvents 2. Compliance with SMAQMD Rule 466 – Solvent Cleaning 3. VOC Emission Control System that has a combined capture and control device efficiency if at least 85% by weight.	SMAQMD, SCAQMD, SJVAPCD
NOx	<u>For booth heater:</u> < 1200 °F: 30 ppm or 0.036 lb/MMBtu corrected to 3% O_2 ≥ 1200 °F: 60 ppm or 0.073 lb/MMBtu corrected to 3% O_2	SCAQMD
SOx	No standard	SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD
PM10	Dry filters or waterwash	SCAQMD, SDAPCD
PM2.5	No Standard	SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD
CO	For heaters: 400 ppm corrected to 3% O_2	SMAQMD
Organic HAP/VHAP	<u>For booths without add-on Control</u> 1. Compliance with SMAQMD Rule 441 – Organic Solvents 2. Compliance with SMAQMD Rule 466 – Solvent Cleaning 3. Compliance with SDAPCD Rule 66.1 – Misc. Surface Coating Operations and Other Processes Emitting Volatile Organic Compounds Section (d)(3): Application Equipment for Surface Coating Operations(A)	SMAQMD SCAQMD SJVAPCD

BEST CONTROL TECHNOLOGIES ACHIEVED		
Pollutant	**Standard**	**Source**
Organic HAP/VHAP	For booths with add-on Control 1. Compliance with SMAQMD Rule 441 – Organic Solvents 2. Compliance with SMAQMD Rule 466 – Solvent Cleaning 3. VOC Emission Control System that has a combined capture and control device efficiency if at least 85% by weight.	SMAQMD SCAQMD SJVAPCD
Inorganic HAP	Compliance with 40 CFR 63 Subpart HHHHHH for metals – Spray booth filter system with 98% capture efficiency of paint overspray, HVLP spray equipment, electrostatic application, airless spray gun, air-assisted airless spray gun, or an equivalent technology	USEPA

(A) Due to HVLP not being technological feasibility with high viscosity coatings, an application equipment exemption for coatings with a 650 centipoise or greater application will be included in the BACT Determination, similar to SCAQMD coating rules.

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.

Pollutant	Technologically Feasible Alternatives
VOC	1. Carbon Adsorber 2. Thermal Oxidizer
NOx	No other technologically feasible option identified
SOx	No other technologically feasible option identified
PM10	No other technologically feasible option identified
PM2.5	No other technologically feasible option identified
CO	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:

Pollutant	Maximum Cost ($/ton)
VOC	25,300
NO_X	35,300
PM10	11,400
SO_X	18,300
CO	300

Cost Effectiveness Analysis Summary

This BACT determination will perform a cost effectiveness analysis in accordance with the updated EPA OAQPS Air Pollution Control Cost Manual. The electricity (11.24 cents/kWh) and natural gas (9.75 dollars/1,000 cubic feet) rates were based on an industrial application as approved by the District. 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 51-8099: Plant and System Operators - Other) and maintenance (Occupation Code 49-2094: electrical and electronics commercial and industrial equipment repairers) rates were based on data from the Bureau of Labor Statistics.

Carbon Adsorber:
As shown in Attachment A, the cost effectiveness for the add on carbon adsorber system to control VOC was calculated to be **$25,392.94/ton** (see attached Paint Spray Booth for General Coating Cost Effectiveness Analysis). The following basic parameters were used in the analysis.

Equipment Life = 15 years

Total Capital Investment = $366,297

Direct Annual Cost = $13,274 per year

Indirect Annual Cost = $59,395 per year

Total Annual Cost = $70,828 per year

VOC Removed = 2.789 tons per year

Cost of VOC Removal = $25,392.94 per ton reduced

A detailed calculation of the cost effectiveness for VOC removal with a carbon absorber is shown in Attachment A. **Uncontrolled** VOC emissions of **6,198 lb/year** or greater is the cost-effective threshold for control equipment using carbon absorption control technology.

Thermal Oxidizer:

Equipment Life = 20 years

Direct Cost = $1,034,666

Direct Annual Cost = $77,753 per year

Indirect Annual Cost = $183,111 per year

Total Annual Cost = $260,864 per year

VOC Removed = 10.256 tons per year

Cost of VOC Removal = $25,436 per ton reduced

A detailed calculation of the cost effectiveness for VOC removal with a thermal oxidizer is shown in Attachment A. **Uncontrolled** VOC emissions of **20,824 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 6,198 lb per year or greater must be reached in order for the carbon adsorption control option to be cost effective. Uncontrolled VOC emission level of 20,824 lb per year or greater must be reached in order for a thermal oxidizer to be cost effective. The emissions level for the cost effectiveness of controls is based on the District cost effective limit for VOC of $25,300 per ton controlled.

With EPA's cost data, the highest allowable uncontrolled emission rate to not require add-on control devices will be updated to 6,198 lb/year based on the cost of carbon adsorption.

C. SELECTION OF BACT and T-BACT:

Based on the above analysis, BACT and T-BACT for VOC, NOx, SOx, PM10, PM2.5 and CO will be the following:

BACT #338 for VOC will require compliance with SMAQMD Rule 441 Organic Solvents, SMAQMD Rule 466 for Solvent Cleaning, SDAPCD's Rule 66.1 application equipment standards, and SJVAPCD's Rule 4661 facility threshold of less than 833 lbs VOC/month.

SDAPCD's Rule 66.1 is the only District Rule for General Coatings that has application equipment standards. This application equipment standards will be included in BACT Determination #338. However, an additional exemption to these standards will be included for high viscosity coatings similar to SCAQMD's Rule 1106. Both SCAQMD and SMAQMD have found that HVLP is not technologically feasible for thick fluids with poor flow characteristics. Therefore, an application exemption for coatings with a viscosity of 650 centipoise or greater, as applied, will be included in BACT Determination #338. Application equipment standards are not required for BACT Determination #339 due to the add-on control requirements. When add-on control is applied, the operation is exempt from the application equipment standards per SDAPCD Rule 66.1 Section (e)(1).

Although SMAQMD's Rule 441 has the lowest "Organic Material" hourly and daily limits, SJVAPCD's Rule 4661 has the lowest "VOC" facility monthly limit of 833 lbs per month. Therefore, SJVAPCD's facility monthly limit of 833 lbs VOC/month will be converted to an annual facility limit of 9,996 lb VOC/year and be used as an additional threshold for add-on control.

BACT #338 for Coatings, Stripping, and Solvent Cleaning – General, ≤ 6,198 pounds VOC per year or facilities ≤ 9,996 lbs VOC/year		
Pollutant	**Standard**	**Source**
VOC	1. Compliance with SMAQMD Rule 441 – Organic Solvents 2. Compliance with SMAQMD Rule 466 – Solvent Cleaning 3. Compliance with SDAPCD Rule 66.1 – Misc. Surface Coating Operations and Other Processes Emitting Volatile Organic Compounds Section (d)(3): Application Equipment for Surface Coating Operations(A)	SMAQMD, SCAQMD, SJVAPCD
NOx	For booth heater: < 1200 °F: 30 ppm or 0.036 lb/MMBtu corrected to 3% O_2 ≥ 1200 °F: 60 ppm or 0.073 lb/MMBtu corrected to 3% O_2	SMAQMD, SCAQMD
SOx	No Standard	SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD
PM10	Dry filters or waterwash	SCAQMD, SDAPCD
PM2.5	No Standard	SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD
CO	For heaters: 400 ppm corrected to 3% O_2	SMAQMD

(A) The application equipment requirements include the exemptions of SDAPCD Rule 66.1 and includes an exemption for any coatings with a viscosity of 650 centipoise or greater, as applied.

T-BACT #338 for Coatings, Stripping, and Solvent Cleaning – General, ≤ 6,198 pounds VOC per year or facilities ≤ 9,996 lbs VOC/year		
Pollutant	**Standard**	**Source**
Organic HAP/VHAP	1. Compliance with SMAQMD Rule 441 – Organic Solvents 2. Compliance with SMAQMD Rule 466 – Solvent Cleaning 3. Compliance with SDAPCD Rule 66.1 – Misc. Surface Coating Operations and Other Processes Emitting Volatile Organic Compounds Section (d)(3): Application Equipment for Surface Coating Operations(A)	SMAQMD SCAQMD SJVAPCD
Inorganic HAP	Compliance with 40 CFR 63 Subpart HHHHHH for metals – Spray booth filter system with 98% capture efficiency of paint overspray, HVLP spray equipment, electrostatic application, airless spray gun, air-assisted airless spray gun, or an equivalent technology	USEPA

(A) The application equipment requirements include the exemptions of SDAPCD Rule 66.1 and includes an exemption for any coatings with a viscosity of 650 centipoise or greater, as applied.

BACT #339 for Coatings, Stripping, and Solvent Cleaning – General, > 6,198 pounds VOC per year or facilities > 9,996 lbs VOC/year		
Pollutant	**Standard**	**Source**
VOC	1. Compliance with SMAQMD Rule 441 – Organic Solvents 2. Compliance with SMAQMD Rule 466 – Solvent Cleaning 3. VOC Emission Control System that has a combined capture and control device efficiency if at least 85% by weight.	SMAQMD, SCAQMD
NOx	For booth heater: < 1,200 °F: 30 ppm or 0.036 lb/MMBtu corrected to 3% O_2 ≥ 1,200 °F: 60 ppm or 0.073 lb/MMBtu corrected to 3% O_2	SMAQMD, SCAQMD
SOx	No Standard	SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD
PM10	Dry filters or waterwash	SCAQMD, SDAPCD
PM2.5	No Standard	SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD
CO	For heaters: 400 ppm corrected to 3% O_2	SMAQMD

T-BACT #339 for Coatings, Stripping, and Solvent Cleaning – General, > 6,198 pounds VOC per year or facilities > 9,996 lbs VOC/year		
Pollutant	**Standard**	**Source**
Organic HAP/VHAP	1. Compliance with SMAQMD Rule 441 – Organic Solvents 2. Compliance with SMAQMD Rule 466 – Solvent Cleaning 3. VOC Emission Control System that has a combined capture and control device efficiency if at least 85% by weight.	SMAQMD
Inorganic HAP	Compliance with 40 CFR 63 Subpart HHHHHH for metals – Spray booth filter system with 98% capture efficiency of paint overspray, HVLP spray equipment, electrostatic application, airless spray gun, air-assisted airless spray gun, or an equivalent technology.	USEPA

APPROVED BY: *Brian F Krebs* **DATE:** 01-16-2024

Attachment A

Cost Effectiveness Determination for Carbon Adsorbers and Thermal Oxidizer

BACT Template Version 032118

Carbon Adsorber Cost Effectiveness Calculations

Data Inputs

Select the type of carbon adsorber system:	Fixed-Bed Carbon Adsorber with Steam Regeneration

For fixed-bed carbon adsorbers, provide the following information:

Select the type of operation:	Continuous Operation
Select the type of material used to fabricate the carbon adsorber vessels:	Stainless Steel, 304
Select the orientation for the adsorber vessels:	Horizontal

Enter the design data for the proposed Fixed-Bed Carbon Adsorber with Steam Regeneration

Number of operating hours per year (Θ_s)	2,080	hours/year	
Waste Gas Flow Rate (Q)	10,000	acfm (at atmospheric pressure and 77^{o}F)	
VOC Emission Rate (m_{voc})	2.980	lbs/hour	
Required VOC removal efficiency (E)	90	percent	
Superficial Bed Velocity (v_b)	75.00	ft/min	
Estimated equipment life of adsorber vessels and auxiliary Equipment (n)	15	Years*	* 15 years is a default equipment life. User should enter actual value, if known.
Estimated Carbon life (n)	5	Years	
Total Number of carbon beds (N_{total})	3	Beds*	* 3 beds is the default. User should enter actual number of beds, if known.
Number of carbon beds adsorbing VOC when system is operating (N_A)	2	Beds*	* 2 beds is the default. User should enter actual number of beds, if known.
Total time for adsorption (Θ_A)	12	hours*	* 12 hours is a default value. User should enter actual value, if known.
Total time for desorption (Θ_D)	5	hours*	* 5 hours is a default value. User should enter actual value, if known.
Estimated Carbon Replacement Rate (CRR)	379	lbs/hour*	* 379 lbs./hour is a default value. User should enter actual value, if known.

Enter the Characteristics of the VOC/HAP:

Name of VOC/HAP	Toluene	
Partial Pressure of Toluene in waste gas stream	0.0104	psia
Parameter "k" for Toluene	0.551	**Note:**
Parameter "m" for Toluene	0.110	Typical values of "k" and "m" for some common VOCs are shown in Table A.

Enter the cost data for the carbon adsorber:

Desired dollar-year	2023			
CPI for 2023	305.69	CPI value for Jul. 2023	168.9	1999
Annual Interest Rate (i)	6	percent (Current bank prime rate)		

Electricity (P_{elec})	$0.1124	per kWh	
Steam (P_s)	$5.00	per 1,000 lbs*	* $5.00/1,000 lbs is a default value. User should enter actual value, if known.
Cooling Water (P_{cw})	$3.55	per 1,000 gallons of water*	* $3.55/1,000 gallons is a default value. User should enter actual value, if known.
Operator Labor Rate	$27.48	per hour*	* $27.48/hour is a default value. User should enter actual value, if known.
Maintenance Labor Rate	$30.23	per hour*	* $30.23/hour is a default value. User should enter actual value, if known. If the rate is not kno
Carbon Cost (CC)	$4.20	per lb	* $4.20/lb is a default value based on 2018 market price. User should enter actual value, if kno
Re-Sale Value of Recovered VOC (P_{voc})	$0.33	per lb*	* $0.33/lb is a default value for recovered toluene based on 2018 data. User should enter actua
Disposal/Treatment Cost for Recovered VOC (D_{voc})	$0.00	per lb*	* $0/lb is a default value for disposal and/or treatment of recovered VOC/HAP. User should ent

If known, enter any additional costs for site preparation and building construction/modification:

Site Preparation (SP) =	$0	* Default value. User should enter actual value, if known.
Buildings (Bldg) =	$0	* Default value. User should enter actual value, if known.
Equipment Costs for auxiliary equipment (e.g., ductwork, dampers, and stack) (EC_{aux}) =	$32,000	* Default value. User should enter actual value, if known.
Contingency Factor (CF)	10.0	percent* * 10 percent is a default value. The contingency factor should be between 5 and 15 percent.

Design Parameters

The following design parameters for the carbon adsorber were calculated based on the values entered on the *Data Inputs* tab. These values were used to prepare the costs shown on the *Cost Estimate* tab.

Type of Carbon Adsorber:	**Fixed-Bed Carbon Adsorber with Steam Regeneration**
Name of VOC Controlled:	**Toluene**

Parameter	Equation	Calculated Value	Units
Quantity of Toluene Recovered:			
Quantity of Toluene Recovered (Wvoc) =	$W_{voc} = m_{voc} \times \Theta_s \times E$ =	2.789	tons/year
Time required for Desorption (Θ_D) =		5	hours
Time for Adsorption (Θ_A) =		12	hours
Time Available for Desorption =	$\Theta_A (N_D/N_A)$ =	6	hours
Adsorber Parameters:			
Equilibrium Capacity at the Inlet ($W_{e(max)}$) =	$k \times P^m$ =	0.333	lb. VOC/lb. Carbon
Working Capacity (w_c) =	0.5 x $w_{e(max)}$ =	0.167	lb. VOC/lb. Carbon
Adjustment Factor for Adorber Vessel Material (F_m) =		1.0	(* Stainless Steel, 304)
Number of Bed Desorbing (N_D) =	$N_{total} - N_A$ =	1	Bed
Number of Bed Adsorbing (N_A) =		2	Bed
Volumetric Flow Rate for each Vessel (Q') =	Q/N_A =	5,000	acfm/Bed
Carbon Bed Thickness (t_b) =	$(M_c'/\rho_b)/(Q'/v_b)$, where the density of carbon (ρb) = 30 lb/sq.ft	0.05	ft.
Pressure Drop (ΔP_s) =	$t_b \times (0.03679 v_b + 1.107 \times 10^{-4} v_b^2) + 1$ =	1.18	inches
Cooling Fan Operating Time (Θ_{cf}) =	0.4 x Θ_D x $(N_A \times \Theta_s)/\Theta_A$ =	693	hours
Estimated Carbon Required:			
Estimated Carbon Consumption (M_c) for a continuously operated system =	$(m_{voc}/w_c) \times \Theta_A (1 + N_D/N_A)$ =	322	lbs.
Carbon Required for each Vessel (M_c') =	$M_c/(N_A + N_D)$ =	107	lbs./Bed
Estimated Adsorber Vessel Dimensions and Surface Area:			
Vessel Orientation =		Horizontal	
Vessel Diameter (D) =	$(0.127 \times M_c' \times v_b)/Q'$ =	0.20	ft.
Vessel Length (L) =	$(7.87/Mc') \times (Q'/v_b)^2$ =	326.15	ft.
Surface Area of Adsorber Vessel (S) =	$\pi \times D \times (L+D/2)$ =	209	sq.ft
Electricity Consumption:			
Electricity Consumed by the system fan (Q_{sf}) =	$(0.746 kW/hp) \times 2.5 \times 10^{-4} \times Q \times \Delta P_s \times \Theta_s$ =	4,583	kWh/year
Electricity Consumed by the cooling fan (Q_{cf}) =	$(0.746 kW/hp) \times 2.5 \times 10^{-4} \times Q_{cf} \times \Delta P_s \times \Theta_{cf}$ =	458	kWh/year
Electricity Consumed by the Cooling Water Fan (Q_{cwf}) =	$(0.746 kW/hp) \times [2.52 \times 10^{-4} \times 100/\eta] \times [\Theta_{cwp}/(0.6 \times \Theta_D \times N_A \times \Theta_D/\Theta_A) \times 60 mins/hour]$ =	128	kWh/year
Total Estimated Electricity Consumption (Q_{Elec}) =	Qsf + Qcf + Qcsf =	5,169	kWh/year
Steam Consumption:			
Total Steam Consumption (Q_{Steam}) =	= 3.5 x M_{voc} x Θ_s =	21,694	lbs./year
Cooling Water Consumption:			
Total Cooling Water Consumption (Q_{cw}) =	= 3.43 x C_s/P_s =	74,412	gallons/year
Capital Recovery Factor:			
Capital Recovery Factor for adsorber vessels and auxiliary equipment (CFRAbsorber)=	$[i \times (1 + i)^n] / [(1 + i)^n - 1]$ = Where n = Equipment Life and i = Interest Rate	0.1030	
Capital Recovery Factor for carbon (CRF_{Carbon}) =	$[i \times (1 + i)^n] / [(1 + i)^n - 1]$ = Where n = Carbon Life and i = Interest Rate	0.2374	

Cost Estimate

Capital Costs

Estimated capital costs for a Fixed-Bed Carbon Adsorber with Steam Regeneration with the following characteristics:

VOC Controlled/Recovered = Toluene
Adsorber Vessel Orientation = Horizontal
Operating Schedule = Continuous Operation

Total Capital Investment (TCI) (in 2023 dollars)

Parameter	Equation	Cost
Costs for Each Carbon Adsorber Vessel (C_v) =	$271 \times F_m \times S^{0.778}$ =	$31,357
Total Cost for All Carbon Adsorber Vessels and Carbon(EC_{Adsorb}) =	$5.82 \times Q^{-0.133} \times [C_c + (N_A + N_D) \times C_v]$ =	$163,146
Auxiliary Equipment (EC_{aux}) =	(Based on design costs or estimated using methods provided in Section 2)	$32,000
Total Purchased Equipment Costs for Carbon Adsorber (A) =	= $EC_{Adsorb} + EC_{aux}$ =	$195,146
Instrumentation =	0.10 × A =	Included in A
Sales taxes =	0.03 × A =	$5,854
Freight =	0.05 × A =	$9,757
	Total Purchased Equipment Costs (B) =	$210,758

Direct Installation Costs (in 2023 dollars)

Parameter	Equation	Cost
Foundations and Supports =	0.08 × B =	$16,861
Handling and Erection =	0.14 × B =	$29,506
Electrical =	0.04 × B =	$8,430
Piping =	0.02 × B =	$4,215
Insulation =	0.01 × B =	$2,108
Painting =	0.01 × B =	$2,108
Site Preparation (SP) =		$0
Buildings (Bldg) =		$0
	Total Direct Costs (DC) = B + (0.3 × B) + SP + Bldg =	$273,985

Total Indirect Installation Costs (in 2023 dollars)

Parameter	Equation	Cost
Engineering =	0.10 × B =	$21,076
Construction and field expenses =	0.05 × B =	$10,538
Contractor fees =	0.10 × B =	$21,076
Start-up =	0.02 × B =	$4,215
Performance test =	0.01 × B =	$2,108
	Total Indirect Costs (IC) =	$59,012
Contingency Cost (C) =	CF(IC+DC)=	$33,300

Total Capital Investment (TCI) =	**DC + IC + C = (1.28 × B) + SP + Bldg. + C =**	**$366,297**	**in 2023 dollars**

Annual Costs

Direct Annual Costs

Parameter	Equation	Cost	
Annual Electricity Cost =	$Q_{Elec} \times P_{elec}$ =	$581	
Annual Steam Cost (C_s) =	$3.50 \times m_{voc} \times \Theta_s \times P_s$ =	$108	
Annual Cooling Water Cost (C_{cs}) =	$3.43 \times C_s/P_s \times P_{wc}$ =	$264	
Operating Labor Costs:	Operator = 0.5 hours/shift × Labor Rate × (Operating hours/8 hours/shift)	$3,572	
	Supervisor = 15% of Operator	$536	
Maintenance Costs:	Labor = 0.5 hours/shift × Labor Rate × (Operating Hours/8 hours/shift)	$3,930	
	Materials = 100% of maintenance labor	$3,930	
Carbon Replacement Costs:	Labor = CRF_{carbon} x (Labor Rate × M_c)/CRR =	$6	
	Carbon = CRF_{carbon} x CC x M_c x 1.08 =	$346	

Direct Annual Costs (DAC) =		**$13,274**	**in 2023 dollars**

Indirect Annual Costs

Parameter	Equation	Cost
Overhead	= 60% of sum of operator, supervisor, maintenance labor Plus maintenance materials	$7,181
Administrative Charges	= 2% of TCI	$7,326
Property Taxes	= 1% of TCI	$3,663
Insurance	= 1% of TCI	$3,663
Capital Recovery	= $CRF_{Adsorber}$ × (TCI - [(1.08 x CC x M_c) + (LR x M_c/CRR)] =	$37,562

Indirect Annual Costs (IAC) =		**$59,395**	**in 2023 dollars**

Recovered Solvent Credit/Disposal Costs

Disposal Cost

Parameter	Equation	Cost
VOC Disposal/Treatment Costs ($Disposal_{cost}$)	$= m_{voc} \times \Theta_s \times D_{voc} \times E$ =	$0

VOC Recovery Credit

Parameter	Equation	Cost
Annual Recovery Credit for Condensate (RC)	$= m_{voc} \times \Theta_s \times P_{voc} \times E$ =	$1,841

Total Annual Cost (TAC) =	**DAC + IAC + C + $Disposal_{Cost}$ - RC =**	**$70,828**	**in 2023 dollars**

Cost Effectiveness

Cost Effectiveness

Parameter	Equation	Cost	
Total Annual Cost =	TAC =	$70,828	per year in 2023 dollars
Annual Quantity of VOC Removed/Recovered =	$W_{voc} = m_{voc} \times \Theta_s \times E$ =	2.789	tons/year
Cost Effectiveness =	Total Annual Cost (TAC) / Annual Quantity of VOC Removed/Recovered =	$25,392.94	per ton of pollutants removed/recovered in 2023 dollars

Oxidizer Cost Effectiveness Calculations

Data Inputs

Select the type of oxidizer: Regenerative Thermal Oxidizer

Enter the following information for your emission source:

Composition of Inlet Gas Stream

Pollutant Name	Concentration (ppmv)	Lower Explosive Limit (LEL) (ppmv)*	Heat of Combustion (Btu/scf)	Molecular Weight
Toluene	35	11,000	4,274	92.13

Note: The lower explosion limit (LEL), heat of combustion and molecular weight for some commonly used VOC/HAP are provided in the table below.

Enter the design data for the proposed oxidizer:

Number of operating hours/year	2,080	hours/year	
Inlet volumetric flow rate(Q_{wi}) at 77°F and 1 atm.	20,000	scfm*	* 20,000 scfm is a default volumetric flow rate. User should enter actual value, if known.
Inlet volumetric flow rate(Q_{wi}) (actual conditions)	20,900	acfm*	* 20,900 acfm is a default volumetric flow rate. User should enter actual value, if known.
Pressure drop (ΔP)	19	inches of water	* 23 inches of water is the default pressure drop for thermal oxidizers; 19 inches of water is the default pressure drop for catalytic oxidizers. Enter actual value, if known.
Motor/Fan Efficiency (ε)	60	percent*	* 60% is a default fan efficiency. User should enter actual value, if known.
Inlet Waste Gas Temperature (T_{wi})	77	°F	
Operating Temperature (T_{fi})	1,900	°F	* Note: Default value for Tfi is 2000°F for thermal regenerative oxidizers. Use actual value if known. Tfi for regenerative oxidizers typically between 1800 and 2000°F.
Destruction and Removal Efficiency (DRE)	98.5	percent	
Estimated Equipment Life	20	Years*	* 20 years is the typical equipment life. User should enter actual value, if known.
Heat Loss (η)	1	percent*	* 1 percent is a default value for the heat loss. User should enter actual value, if known. Heat loss is typically between 0.2 and 1.5%.

Percent Energy Recovery (HR) = 70 percent

Enter the cost data:

Desired dollar-year	2023			
CPI for 2023	305.69	Enter the CPI value for Jul. 2023	247.705	2016 CPI
Annual Interest Rate (i)	6	Percent		
Electricity ($Cost_{elect}$)	0.1124	$/kWh		
Natural Gas Fuel Cost ($Cost_{fuel}$)	0.00975	$/scf		
Operator Labor Rate	$27.48	per hour		
Maintenance Labor rate	$30.23	per hour		
Contingency Factor (CF)	10.0	Percent		

* 10 percent is a default value for construction contingencies. User may enter values between 5 and 15 percent.

Design Parameters

The following design parameters for the oxidizer were calculated based on the values entered on the *Data Inputs* tab. These values were used to prepare the costs shown on the *Cost Estimate* tab.

Composition of Inlet Gas Stream		
Pollutant Name	Concentration in Waste Stream (ppmv) From Data Inputs Tab	Adjusted Concentration with Dilution Air (ppmv)
Toluene	35	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
Total	35	0

Constants used in calculations:

Temperature of auxiliary fuel (T_{af}) =	Reference Temperature (T_{ref}) =	77.0	°F
Density of auxiliary Fuel at 77 °F (ρ_{af}) =		0.0408	lb/ft^3
Heat Input of auxiliary fuel ($-\Delta h_{caf}$) =		21,502	Btu/lb
Density of waste gas at 77 °F (ρ_{wi}) =		0.0739	lb/ft^3
Mean Heat Capacity of Air (C_{pmair})	(For thermal oxidizers)	0.255	Btu/lb °F

Parameter	Equation	Calculated Value	Units	Value	Units
Sum of volume fraction of combustible components =	= ($\sum x_i$) =	35	ppmv		
Lower Explosive Limit of waste gas (LEL_{mix})	= $[\sum((x_j)/((\sum x_i) \times LEL_j))]^{-1}$ =	11,000	ppmv		
	Where x_j is the volume fraction and LEL_j the lower explosive limit for each combustible component in the waste gas.				
% LEL_{mix}	= (Total Combustible Conc. In Mixture/LEL_{mix}) × 100 =	0.32	percent	* Note: Since the LEL of the waste gas stream is below 25%, no dilution air is needed.	
Dilution Factor	= (LEL_{mix} x 0.249)/($\sum x_i$) =	Not applicable			
Lower Explosive Limit (LEL) of waste gas after addition of dilution air	= (Total Adjusted Conc. With Dilution Air/LEL_{mix}) × 100 =	Not Applicable			
Inlet volumetric flow rate(Qwi) at 77°F and 1 atm.	(From Data Inputs Tab) =	20,000	scfm		
Oxygen Content of gas stream	= 100 - ($\sum x_j \times 100/10^6$) x 0.209 =	20.90	percent		
Fan Power Consumption (FP)	= $[(1.17 \times 10^{-4}) \times Q_{wi} \times \Delta P]/\varepsilon$	77.4	kW		
Q_{wo}	≈ Q_{wi} =	20,000	scfm		
Operating temperature of oxidizer (T_{fi})	(From Data Inputs Tab)	1,900	°F		
Temperature of waste gas at outlet to preheater (T_{wo})	= Heat Recovery × (T_{fi} - T_{wi}) + T_{wi} =	1,353	°F		
Temperature of flue gas exiting the regenerative oxidizer (T_{fo})	= T_{fi} - 0.95(T_{fi} - T_{wi}) =	168	°F		

Heat Input of waste gas ($-\Delta h_{cwi}$)				
	$= \sum (-\Delta h_{ci})\, x_i$			
	Where $(-\Delta h_{ci})$ is the heat of combustion and x_i the fraction of component "i" at 77 °F.	0.15	Btu/scf	2.0 Btu/lb
Estimated Auxiliary Fuel Flow (Q_{af}) at 77 °F and 1 atm.	(Calculated using Equation 2.45 in Appendix B)	13.77	scfm	
Auxiliary fuel Energy Input =		12,077	Btu/min	
Minimum Energy required for combustion stabilization =	$= 5\% \times$ Total Energy Input $= 0.05 \times \rho_{fi} \times Q_{fi} \times C_{pmfi} \times (T_{fi} - T_{ref}) =$	34,377	Btu/min	
Is the calculated auxiliary fuel sufficient to stabilize combustion? (Note: If the auxiliary fuel energy input > 5% of Total Energy Input, then the auxilary fuel is sufficient.)		No		Note: Additional auxiliary fuel equivalent to 5% of total energy input is required to stabilize combustion.
Auxiliary fuel flow (Qaf) (adjusted for fuel required for combustion stabilization)at 77°F and 1 atm. =		39	scfm	
Total Volumetric Throughput (Q_{tot}) at 77 °F and 1 atm.	$= Q_{fi} = Q_{wo} + Q_a + Q_{af} = Q_{wi} + Q_{af} =$	20,039	scfm	

Capital Recovery Factor:

Parameter	Equation	Calculated Value
Capital Recovery Factor (CRF) =	$i\,(1+i)^n/(1+i)^n - 1 =$	0.0872
	Where n = Equipment Life and i= Interest Rate	

Cost Estimate

Direct Costs		
Total Purchased equipment costs (in 2023 dollars)		
Incinerator + auxiliary equipment[a] (A) =		
Equipment Costs (EC) for Regenerative Oxidizer	=[2.664 x 100,000 + (13.98 x Qtot)] x (2023 CEPI/2016 CEPCI) =	$674,489 in 2023 dollars
Instrumentation[b] =	0.10 × A =	$67,449
Sales taxes =	0.03 × A =	$20,235
Freight =	0.05 × A =	$33,724
	Total Purchased equipment costs (B) =	$795,897 in 2023 dollars

Footnotes

a - Auxiliary equipment includes equipment (e.g., duct work) normally not included with unit furnished by incinerator vendor.

b - Includes the instrumentation and controls furnished by the incinerator vendor.

Direct Installation Costs (in 2023 dollars)		
Foundations and Supports =	0.08 × B =	$63,672
Handlong and Errection =	0.14 × B =	$111,426
Electrical =	0.04 × B =	$31,836
Piping =	0.02 × B =	$15,918
Insulation for Ductwork =	0.01 × B =	$7,959
Painting =	0.01 × B =	$7,959
Site Preparation (SP) =		$0
Buildings (Bldg) =		$0
	Total Direct Installaton Costs =	$238,769
Total Direct Costs (DC) =	Total Purchase Equipment Costs (B) + Total Direct Installation Costs =	$1,034,666 in 2023 dollars

Total Indirect Installation Costs (in 2023 dollars)		
Engineering =	0.10 × B =	$79,590
Construction and field expenses =	0.05 × B =	$39,795
Contractor fees =	0.10 × B =	$79,590
Start-up =	0.02 × B =	$15,918
Performance test =	0.01 × B =	$7,959
	Total Indirect Costs (IC) =	$222,851
Continency Cost (C) =	CF(IC+DC)=	$125,752
Total Capital Investment =	**DC + IC +C =**	**$1,383,268 in 2023 dollars**

Direct Annual Costs		
Annual Electricity Cost	= Fan Power Consumption × Operating Hours/year × Electricity Price =	$18,104
Annual Fuel Costs for Natural Gas	= $Cost_{fuel}$ × Fuel Usage Rate × 60 min/hr × Operating hours/year	$47,682
Operating Labor	Operator = 0.5hours/shift × Labor Rate × (Operating hours/8 hours/shift)	$3,572
	Supervisor = 15% of Operator	$536
Maintenance Costs	Labor = 0.5 hours/shift × Labor Rate × (Operating Hours/8 hours/shift)	$3,930
	Materials = 100% of maintenance labor	$3,930
Direct Annual Costs (DC) =		**$77,753 in 2023 dollars**

Indirect Annual Costs		
Overhead	= 60% of sum of operating, supervisor, maintenance labor and maintenance materials	$7,181
Administrative Charges	= 2% of TCI	$27,665
Property Taxes	= 1% of TCI	$13,833
Insurance	= 1% of TCI	$13,833
Capital Recovery	= CRF[TCI-1.08(cat. Cost)]	$120,600
Indirect Annual Costs (IC) =		**$183,111 in 2023 dollars**

Total Annual Cost =	**DC + IC =**	**$260,864 in 2023 dollars**

Cost Effectiveness

Cost Effectiveness = (Total Annual Cost)/(Annual Quantity of VOC/HAP Pollutants Destroyed)

Total Annual Cost (TAC) =	$260,864	per year in 2023 dollars
VOC/HAP Pollutants Destroyed =	10.256	tons/year
Cost Effectiveness =	$25,436	per ton of pollutants removed in 2023 dollars

Attachment B

CARB BACT Determination

List of BACT determinations published in CARB's BACT Clearinghouse for general coating operations:

Permit number	Source	Date	Type[(A)]	VOC	NOx	CO	Filterable PM10	SO_x
358727	SOUTH COAST AQMD	5/2/2002	Roller Coater for mirror manufacture	Compliance with SCAQMD Rule 1145 and Rule 1171. Coaters and oven vented to a VOC control device with 90% overall (collection and destruction/removal) efficiency.	Low NOx burner	NA	NA	NA
328007	SOUTH COAST AQMD	1/6/1999	9 spray booths and 5 ovens for misc. metal parts	Concentrator and a thermal oxidizer	0.27 lb/hr	0.16 lb/hr	NA	NA
320641	SOUTH COAST AQMD	9/17/1997	Misc. metal parts coatings	Direct-flame oxidizer, 420 lb/day facility limit	0.76 lb/hr	0.15 lb/hr	NA	NA
335644	SOUTH COAST AQMD	5/25/1999	Automotive downdraft	Haptite adsorber (concentrator) coupled with catalytic oxidizer. Overall efficiency 83%.	NA	NA	NA	NA
352856	SOUTH COAST AQMD	9/23/2003	Resin application for yacht manufacture	Compliance with SCAQMD Rule 1162. Carbon adsorber/thermal oxidizer system achieving 85% overall VOC control.	NA	NA	NA	NA
402868	SOUTH COAST AQMD	9/23/2003	9 spray booths and two resin tanks for jacuzzi manufacture	Concentrator/catalytic oxidizer system for VOC	NA	NA	Filter system for PM10	NA
322432	SOUTH COAST AQMD	3/18/2004	Powder Coating Booth for Misc. Metal Parts.	Use of powder coating and zero-VOC cleanup materials	NA	NA	NA	NA

(A) Coating operations for misc. metal parts, automotive, and resin application are not applicable to the general coating BACT.

= Selected as the most stringent BACT determination achieved in practice

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