**UNDER PUBLIC REVIEW** SMAQMD BACT CLEARINGHOUSE

CATEGORY: **COATING - PLEASURE CRAFT**

BACT Size: Minor Source BACT **COATING OPERATION**

| **BACT Determination Number:** 204 | **BACT Determination Date:** |
|---|---|

## Equipment Information

**Permit Number:** 24925
**Equipment Description:** COATING OPERATION
**Unit Size/Rating/Capacity:** ≤ 4,700 lbs VOC/year
**Equipment Location:** DELTA BOAT WORKS
106 W BRANNAN ISLAND RD
ISLETON, CA

## BACT Determination Information

| | | |
|---|---|---|
| **ROCs** | **Standard:** | |
| | **Technology Description:** | Compliance with the pleasure craft requirements of SJVUAPCD Rule 4603, except where noted in footnote (A) |
| | **Basis:** | Achieved in Practice |
| **NOx** | **Standard:** | |
| | **Technology Description:** | |
| | **Basis:** | |
| **SOx** | **Standard:** | |
| | **Technology Description:** | |
| | **Basis:** | |
| **PM10** | **Standard:** | |
| | **Technology Description:** | Enclosed paint booth with dry filters or water wash and use of HVLP spray guns or equivalent |
| | **Basis:** | Achieved in Practice |
| **PM2.5** | **Standard:** | |
| | **Technology Description:** | Enclosed paint booth with dry filters or water wash and use of HVLP spray guns or equivalent |
| | **Basis:** | Achieved in Practice |
| **CO** | **Standard:** | |
| | **Technology Description:** | |
| | **Basis:** | |
| **LEAD** | **Standard:** | |
| | **Technology Description:** | |
| | **Basis:** | |

**Comments:** (A)The following coating category listed in SJVUAPCD Rule 4603 must meet the following standard: antifoulant coatings: aluminum substrate: 440 g/l, other substrates: 330 g/l, - high gloss coatings: 340 g/l - extreme high gloss coatings: 490 g/l - pretreatment wash primers: 420 g/l - primers: 340 g/l - general coatings: 340 g/l.

**District Contact:** Matt Baldwin Phone No.: (916) 874 - 4858 email: mbaldwin@airquality.org

CATEGORY: **COATING - PLEASURE CRAFT**

BACT Size: Minor Source BACT **COATING OPERATION**

| **BACT Determination Number:** 205 | **BACT Determination Date:** |
|---|---|

## Equipment Information

**Permit Number:** N/A -- Generic BACT Determination
**Equipment Description:** COATING OPERATION
**Unit Size/Rating/Capacity:** > 4,700 pounds per year
**Equipment Location:**

## BACT Determination Information

| | | |
|---|---|---|
| **ROCs** | **Standard:** | |
| | **Technology Description:** | 1.Compliance with the pleasure craft requirements of SJVUAPCD Rule 4603, except where noted in footnote (A), and VOC control system with ≥ 90% overall efficiency, or<br>2.Use of low-VOC materials resulting in an equivalent emission reduction. |
| | **Basis:** | Cost Effective |
| **NOx** | **Standard:** | |
| | **Technology Description:** | |
| | **Basis:** | |
| **SOx** | **Standard:** | |
| | **Technology Description:** | |
| | **Basis:** | |
| **PM10** | **Standard:** | |
| | **Technology Description:** | Enclosed paint booth with dry filters or water wash and use of HVLP spray guns |
| | **Basis:** | Achieved in Practice |
| **PM2.5** | **Standard:** | |
| | **Technology Description:** | Enclosed paint booth with dry filters or water wash and use of HVLP spray guns |
| | **Basis:** | Achieved in Practice |
| **CO** | **Standard:** | |
| | **Technology Description:** | |
| | **Basis:** | |
| **LEAD** | **Standard:** | |
| | **Technology Description:** | |
| | **Basis:** | |

**Comments:** (A)The following coating category listed in SJVUAPCD Rule 4603 must meet the following standard: antifoulant coatings: aluminum substrate: 440 g/l, other substrates: 330 g/l, - high gloss coatings: 340 g/l - extreme high gloss coatings: 490 g/l - pretreatment wash primers: 420 g/l - primers: 340 g/l - general coatings: 340 g/l.

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777 12th Street, Third Floor

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Sacramento, CA 95814

# BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

| | |
|---|---|
| **DETERMINATION NO.:** | 204 & 205 |
| **DATE:** | August 9, 2018 |
| **ENGINEER:** | Matt Baldwin |

| | |
|---|---|
| **Category/General Equip Description:** | Pleasure Craft Coating Operation |
| **Equipment Specific Description:** | Paint Spray Operation |
| **Equipment Size/Rating:** | ≤ 4,700 lbs VOC/year, Minor Source (BACT #204)<br>>4,700 lbs VOC/year, Minor Source (BACT #205) |
| **Previous BACT Det. No.:** | N/A |

This BACT determination will be made for a pleasure craft coating operation.

This BACT was determined under the project for A/C 24925 (Delta Boat Works).

**BACT/T-BACT ANALYSIS**

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

The following control technologies are currently employed as BACT/T-BACT for pleasure craft coating operations by the following agencies and air pollution control districts:

**US EPA**

**BACT**

Source: EPA RACT/BACT/LAER Clearinghouse (See Attachment A)

| **Ship Building & Repair Surface Coating (Process Code 41.024)** | |
|---|---|
| **VOC** | 90% Overall Control / 2.0 tons per year controlled emissions (per spray booth) achieved using a concentrator and regenerative thermal oxidizer. |
| **NOx** | No standard |
| **SOx** | No standard |
| **PM10** | No standard |
| **PM2.5** | No standard |
| **CO** | No standard |

RBLC ID: CA-1168

**US EPA (continued)**

**T-BACT**

There are no T-BACT standards published in the clearinghouse for this category, but the NESHAP standards (see 40 CFR, Part 63 standards below) represent Maximum Achievable Control Technology (MACT) or Generally Available Control Technology (GACT) for HAPs and can therefore be considered T-BACT.

**RULE REQUIREMENTS**

Control Techniques Guidelines for Miscellaneous Metal Parts and Plastic Parts Coatings (EPA-453/R- 08-003)

Although not a promulgated rule, this guideline identifies Reasonably Available Control Measures and Reasonably Available Control Technology. These guidelines establish achieved in practice control measures that are used by state and local agencies when developing rules for their State Implementation Plans, and are used by U.S. EPA when approving those rules. The guideline recommends implementing the limits established by SCAQMD Rule 1106.1 for pleasure craft coatings.

40 CFR 63 Subpart II – National Emission Standards for Shipbuilding and Ship Repair (Surface Coating)

This subpart applies to shipbuilding or ship repair operations at any facility that is a major source. For the purposes of this NESHAP, the definition of "ship" specifically excludes pleasure craft. As such, this NESHAP is not applicable to this BACT determination.

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:

## US EPA (continued)

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 Resources Board (CARB)

**BACT**
Source: CARB BACT Clearinghouse
There are no applicable BACT determinations posted on CARB's BACT clearinghouse.

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

**RULE REQUIREMENTS**
There are no statewide rule requirements for coating of pleasure craft.

## Sacramento Metropolitan AQMD

**BACT**
Source: SMAQMD BACT Clearinghouse

No BACT determination found for this source category. See Technologically Feasible section regarding BACT #64 for coating of vinyl window frames.

**T-BACT**
The above BACT determination did not address T-BACT.

**RULE REQUIREMENTS**
Rule 468 – Surface Coating of Plastic Parts and Products (Adopted 3/22/2018)

SMAQMD Rule 468, Section 118 exempts pleasure craft coating operations from the requirements of this rule.

## South Coast AQMD

### BACT

Source: SCAQMD BACT Guidelines (Part D) for Non-Major Polluting Facilities, pages 54 & 116

| Spray Booth – Other Types | |
|---|---|
| **VOC** | VOC Emissions < 14,040 lb/year (1,170 lb/month) (A)<br>A. Compliance with SCAMQD Rule 1106.1<br><br>VOC Emissions ≥ 14,040 lb/year (1,170 lb/month) (A)<br>A. Compliance with SCAQMD Rule 1106.1, and VOC Control System with ≥ 90% Collection Efficiency and ≥ 95% Destruction Efficiency, or<br>B. Use of Super Compliant Materials (< 5% VOC by weight): or<br>C. Use of Low-VOC Materials Resulting in an Equivalent Emission Reduction |
| **NOx** | No standard |
| **SOx** | No standard |
| **PM10** | Dry filters or water wash |
| **PM2.5** | No Standard |
| **CO** | No standard |

(A) Monthly emissions have been annualized to be consistent with District methodology for determining cost effectiveness for add-on control (Cost per ton per year of emissions reduced).

### T-BACT

The above BACT determination did not address T-BACT.

### RULE REQUIREMENTS

Regulation IX, Rule 1106.1 – Pleasure Craft Coating Operations (last amended 02/12/1999)

SJVAPCD Rule 4603 and SCAQMD Rule 1106.1 are related to coating of pleasure craft and are either based on or provide the basis for the pleasure craft portion of EPA-453/R-08-003 "*Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings*," US EPA, September 2008, which is the basis for Reasonably Available Control Technologies (RACT). These rules were adopted to comply with each District's respective portion of the State Implementation Plan (SIP). Since these rules are based on similar guidelines, a rule comparison has been added under Section A.2.

## San Joaquin Valley APCD

**BACT**
Source: SJVAPCD BACT Guideline 4.2.8

| Recreational Marine Vessel (Pleasure Craft) Coating | |
|---|---|
| **VOC** | Use of materials with VOC contents (less water and exempt compounds) as indicated, or lower: - antifoulant coatings: aluminum substrate: 440 g/l, other substrates: 330 g/l, - high gloss coatings: 340 g/l - extreme high gloss coatings: 490 g/l - pretreatment wash primers: 420 g/l - primers: 340 g/l - all other coatings (A): 340 g/l |
| **NOx** | No standard |
| **SOx** | No standard |
| **PM10** | Enclosed paint spray booth with particulate filters and HVLP application equipment (or equivalent) |
| **PM2.5** | No standard |
| **CO** | No standard |

(A) All other coatings is considered to be the category for general coatings, since this determination was made prior to the inclusion of pleasure craft coatings into Rule 4603 in 2009.

**T-BACT**
The above BACT determination did not address T-BACT

**RULE REQUIREMENTS:**
Rule 4603 – Surface Coating of Metal Parts and Products, Plastic Parts and Products, And Pleasure Crafts (Last amended 09/17/2009)

SJVAPCD Rule 4603 and SCAQMD Rule 1106.1 are related to coating of pleasure craft and are either based on or provide the basis for the pleasure craft portion of EPA-453/R-08-003 "*Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings*," US EPA, September 2008, which is the basis for Reasonably Available Control Technologies (RACT). These rules were adopted to comply with each District's respective portion of the State Implementation Plan (SIP). Since these rules are based on similar guidelines, a rule comparison has been added under Section A.2.

## San Diego County APCD

**BACT**
Source: NSR Requirements for BACT

| Marine Coating Operation < 10 gallons of coating/day and feasible to apply coatings in a spray booth | |
|---|---|
| **VOC** | Compliance with SDAPCD Rule 67.18 – Marine Coating Operations |
| **NOx** | No standard |
| **SOx** | No standard |

## San Diego County APCD (continued)

| Marine Coating Operation < 10 gallons of coating/day and feasible to apply coatings in a spray booth | |
|---|---|
| **PM10** | Spray booth equipped with overspray filters |
| **PM2.5** | No standard |
| **CO** | No standard |

| Marine Coating Operation < 140 lb of VOC per day and not feasible to apply coatings in a spray booth | |
|---|---|
| **VOC** | Compliance with SDAPCD Rule 67.18 – Marine Coating Operations, except that High Temperature Coatings must meet a VOC limit of 420 g/L and Low Activation Interior Coatings must meet a VOC limit of 340 g/L |
| **NOx** | No standard |
| **SOx** | No standard |
| **PM10** | High transfer efficiency application equipment where feasible and shrouding. |
| **PM2.5** | No standard |
| **CO** | No standard |

**T-BACT**

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

**RULE REQUIREMENTS**

Regulation 4, Rule 67.18 – Marine Coating Operations (Last Amended 05/15/1996)

This rule is applicable to all surface coating and solvent cleaning at Marine Coating Operations.

This rule requires the following for Marine Coating Operations:

1. VOC emissions from the operation must be less than 5 tons per year, or
2. VOC emissions are reduce by air pollution control device that meets a capture and control efficiency of at least 85% by weight, or
3. Coatings that meet the following limits:

| Coating | VOC Content less water and exempt compounds grams/liter, (lb/gal) | |
|---|---|---|
| | **Air-dried** | **Baked** |
| General | 340 (2.8) | 275 (2.3) |
| Air Flask | 340 (2.8) | |
| Antenna Coating | 340 (2.8) | |
| Anitfoulant Coating (except for pleasure craft) | 400 (3.3) | |
| Anitfoulant Coating (for pleasure craft) | 330 (2.8) | |

## San Diego County APCD (continued)

| Coating | VOC Content less water and exempt compounds grams/liter, (lb/gal) | |
|---|---|---|
| | Air-dried | Baked |
| Finish Primer | 600 (5.0) | |
| Heat Resistant Coating | 420 (3.5) | 360 (3.0) |
| High Gloss Coating | 420 (3.5) | 360 (3.0) |
| High Solids Epoxy Coating | 280 (2.3) | |
| High Temperature Coating | 500 (4.2) | |
| Impregnating Sealer | 700 (5.8) | |
| Inorganic Zinc Coating | 340 (2.8) | |
| Low Activation Interior Coating | 420 (3.5) | |
| Military Exterior Topcoat | 340 (2.8) | |
| Mist Coating | 610 (5.1) | |
| Navigational Aids Specialty Coating | 550 (4.6) | |
| Organic Zinc Coating | 340 (2.8) | |
| Pleasure Craft Topcoat | 650 (5.4) | |
| Preconstruction Zinc Primer | 650 (5.4) | |
| Pretreatment Wash Primer | 420 (3.5) | |
| Primer Surfacer | 340 (2.8) | |
| Radar Exterior Topcoat | 340 (2.8) | |
| Rubber Camouflage Coating | 340 (2.8) | |
| Sealing Coat for Thermal Spray Aluminum | 610 (5.1) | |
| Special Marking Coating | 420 (3.5) | |
| Specialty Interior Coating | 340 (2.8) | |
| Tack Coat | 610 (5.1) | |
| Thermoplastic Coatings used in a Repair and Maintenance Coating Operation | 550 (4.6) | |
| Underwater Weapons System Coating | 340 (2.8) | 275 (2.3) |
| Wood Sealer | 340 (2.8) | |

## San Diego County APCD (continued)

This rule requires the following for Surface Preparation and Solvent Cleaning Operations:

A. the total VOC vapor pressure of cleaning material is 45 mm Hg at 20°C (68°F) or less, or
B. the material has an initial boiling point of 190°C (374°F) or greater; 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:

| Surface Preparation and Cleaning Solvent | VOC Content as applied grams/liter, (lb/gal) |
|---|---|
| General | 200 (1.7) |

## Bay Area AQMD

**BACT**

Source: BAAQMD BACT Guideline 84.1.1

| Flow Coater, Dip Tank and Roller Coater | |
|---|---|
| **VOC** | VOC Emissions < 13,140 lb/year (36 lb/day uncontrolled) (A)<br>Not determined<br><br>VOC Emissions ≥ 13,140 lb/year (36 lb/day uncontrolled) (A)<br>Coating with Lower VOC Content than Required by Applicable Rules, and Emissions from Coating Area, Flash Off Area, Drying Area, and Oven Vented to Control Device Achieving ≥ 90% Overall Efficiency |
| **NOx** | No standard |
| **SOx** | No standard |
| **PM10** | No standard |
| **PM2.5** | No standard |
| **CO** | No standard |

(A) Daily emissions have been annualized to be consistent with District methodology for determining cost effectiveness for add-on control (Cost per ton per year of emissions reduced).

**T-BACT**

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

**Bay Area AQMD (continued)**

**RULE REQUIREMENTS**

Regulation 8, Rule 43 – Surface Preparation and Coating of Marine Vessels (last amended 10/16/2002)

This rule does not apply to the coating of pleasure craft or commercial fishing vessels using coating purchased in containers of one gallon or less.

VOC Content of Coatings for Marine Vessels

| Coating | VOC Content less water and exempt compounds grams/liter, (lb/gal) | |
|---|---|---|
| | Air-dried | Baked |
| General | 340 (2.8) | 275 (2.3) |
| Anitfoulant Coating | 400 (3.3) | |
| Heat Resistant Coating | 420 (3.5) | 360 (3.0) |
| High Gloss Coating | 340 (2.8) | 275 (2.3) |
| High Temperature Coating | 500 (4.2) | |
| Extreme High Gloss Coating | 490 (4.1) | 420 (3.5) |
| Inorganic Zinc Coating | 340 (2.8) | |
| Low Activation Interior Coating | 420 (3.5) | |
| Military Exterior Topcoat | 340 (2.8) | |
| Navigational Aids Specialty Coating | 550 (4.6) | |
| Pretreatment Wash Primer | 420 (3.5) | |
| Sealant Coat for Wire Spray Aluminum | 610 (5.1) | |
| Special Marking Coating | 490 (4.1) | |
| Tack Coat | 610 (5.1) | |
| Thermoplastic Coatings used in a Repair and Maintenance Coating Operation | 340 (2.8) | |
| Underwater Weapons System Coating | 490 (4.1) | 420 (3.5) |

| Surface Preparation and Cleaning Solvent | VOC Content as applied grams/liter, (lb/gal) |
|---|---|
| General | 50 (0.42) |

## A.2: COMPARISON OF DISTRICT RULE REQUIREMENTS FOR PLEASURE CRAFT COATING OPERATIONS:

| Coating Category [(A)] | VOC Content less water and exempt compounds, grams/liter | | | |
|---|---|---|---|---|
| | SCAQMD Rule 1106.1 | SJVAPCD Rule 4603 (Facility ≥ 2.7 TPY VOC) | SDAPCD Rule 67.18 | BAAQMD Rule 8-43 (in > 1 gallon containers) |
| Extreme High Gloss Topcoat | 490 | 490 | 650 | 490 |
| High Gloss Topcoat | 420 | 420 | 650 | 340 |
| Pretreatment Wash Primer | 780 | 780 | 420 | 420 |
| Finish Primer Surfacer | 420 | 420 | 600 | N/A |
| High Build Primer Surfacer | 340 | 340 | 600 | N/A |
| Teak Primer | 775 | N/A | N/A | N/A |
| Aluminum Substrate Anitfoulant Coating | 560 | 560 | N/A | N/A |
| Other Substrate Anitfoulant Coating | 330 | 330 | 400 | 400 |
| Clear Wood Sealer | 550 | N/A | 340 | N/A |
| Clear Wood Varnish | 490 | N/A | N/A | N/A |
| All other pleasure craft surface coatings | 420 | 420 (metal or plastic) | 340 | 340 |

(A) SDAPCD Rule 67.18 and BAAQMD Rule 8-43 are for Marine Coating Operations and are applicable to large marine vessels and ship building operations as well as pleasure craft. SCAQMD Rule 1106 applies to Marine Coating Operations, but excludes pleasure craft, since Rule 1106.1 covers this category. Thus, only the coatings common to 1106.1 are included in this table.

## Exemptions:

The above rules include various exemptions for sources specific to each District. For example:

- SJVAPCD allows up to 55 gallons per year of non-compliant coatings.
- SJVAPCD exempts facilities that emit less than 2.7 tons per year of VOC from the pleasure craft standards.
- SCAMQD generally exempts coatings operations that emit less than 3 pounds per day or 66 pounds per month of VOC.
- Touch-up and repair, clear/translucent coatings, and performance testing on coatings at paint manufacturing facilities are exempted by SCAQMD and SJVAPCD.
- BAAQMD exempts pleasure craft coatings that are purchased in containers of one gallon or less.

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

| SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES | |
|---|---|
| **Pollutant** | **Standard** |
| **VOC** | **<u>VOCs from Coating Operation Without Add-On Controls</u>**<br>1. Compliance with the pleasure craft requirements of SJVUAPCD Rule 4603 AND use of materials with VOC contents (less water and exempt compounds) as indicated, or lower: - antifoulant coatings: aluminum substrate: 440 g/l, other substrates: 330 g/l, - high gloss coatings: 340 g/l - extreme high gloss coatings: 490 g/l - pretreatment wash primers: 420 g/l - primers: 340 g/l - general coatings: 340 g/l [SJVUAPCD]<br>2. Compliance with SDAPCD Rule 67.18 – Marine Coating Operations, except that High Temperature Coatings must meet a VOC limit of 420 g/L and Low Activation Interior Coatings must meet a VOC limit of 340 g/L [SDAPCD]<br>3. Compliance with District Rules and Regulations (See above discussion and rule comparison) [SCAQMD, BAAQMD]<br><br>**<u>VOCs From Coating Operation and Booths With Add-On Controls</u>**<br>1. VOC Emissions > 13,140 lb/year<br>A. Coating with Lower VOC Content than Required by Applicable BAAQMD Rules, and Emissions from Coating Area, Flash Off Area, Drying Area, and Oven Vented to Control Device Achieving ≥ 90% Overall Efficiency [BAAQMD]<br>2. <u>VOC Emissions ≥ 40,000 lb/year</u><br>A. VOC Control System with ≥ 90% Overall Control Efficiency [USEPA]<br>3. <u>VOC Emissions ≥ 14,040 lb/year</u><br>A. Compliance with SCAQMD Rule 1106.1, and VOC Control System with ≥ 90% Collection Efficiency and ≥ 95% Destruction Efficiency, or<br>B. Use of Super Compliant Materials (< 5% VOC by weight): or<br>C. Use of Low-VOC Materials Resulting in an Equivalent Emission Reduction [SCAQMD] |
| **NOx** | No standard |
| **SOx** | No standard |
| **PM10** | 1. Enclosed paint booth with dry filters or water wash and use of HVLP spray guns (or equivalent) [SJVAPCD, SCAMQD, SDAPCD]<br>2. Use of HVLP spray guns, electrostatics spray guns, and electrostatic rotary atomizers for spray coating operations. Good work practices. [USEPA] |
| **PM2.5** | No standard |
| **CO** | No standard |
| **Organic HAP/VHAP & Inorganic HAP (T-BACT)** | 1. Compliance with NESHAP HHHHHH [USEPA] |

**USE OF PM10 STANDARD FOR PM2.5**

Emissions of PM10 are created during spray application of coatings. Overspray aerosols from these operations are usually controlled by increasing the transfer efficiency of the coating to the substrate and using a spray booth with overspray filters. Since PM2.5 is a subset of PM10, and

the technology used to control PM10 also controls PM2.5, the achieved in practice standard for PM10 will also be used for PM2.5.

**T-BACT**
For pleasure craft coatings, toxic emissions may be from either organic HAPs (ethylbenzene, methylene chloride) found in carrier solvents, strippers, and surface prep or clean-up solvents; or from inorganic HAPs found in pigments (cadmium, chromium, lead). Depending on the organic HAP, VOC control technologies, (oxidizer, carbon adsorption), may not be technologically feasible. Additionally, VOC controls are not effective for inorganic metals. The above NESHAPs address both organic and inorganic HAPs and are therefore considered T-BACT for this source category.

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

| **BEST CONTROL TECHNOLOGIES ACEIVED** | | |
|---|---|---|
| **Pollutant** | **Standard** | **Source** |
| VOC | <u>For booths emitting > 13,140 lb/year (uncontrolled)</u><br>1. Compliance with the pleasure craft requirements of SJVUAPCD Rule 4603, except where noted in footnote (A), **and** VOC control system with ≥ 90% overall efficiency, or<br>2. Use of low-VOC materials resulting in an equivalent emission reduction.<br><br><u>For booths emitting ≤ 13,140 lb/year (uncontrolled)</u><br>1. Compliance with the pleasure craft requirements of SJVUAPCD Rule 4603, except where noted in footnote (A) | BAAQMD, SCAQMD, SJVUAPCD |
| NOx | No standard | |
| SOx | No standard | |
| PM10 | Enclosed paint booth with dry filters or water wash and use of HVLP spray guns | SJVAPCD, SCAMQD, SDAPCD |
| PM2.5 | Enclosed paint booth with dry filters or water wash and use of HVLP spray guns | SJVAPCD, SCAMQD, SDAPCD |
| CO | No standard | |
| Organic HAP/VHAP & Inorganic HAP (T-BACT) | Compliance with NESHAP HHHHHH where applicable | USEPA |

(A) The following coating category listed in SJVUAPCD Rule 4603 must meet the following standard: antifoulant coatings: aluminum substrate: 440 g/l, other substrates: 330 g/l, - high gloss coatings: 340 g/l - extreme high gloss coatings: 490 g/l - pretreatment wash primers: 420 g/l - primers: 340 g/l - general coatings: 340 g/l.

## B. TECHNOLOGICALLY FEASIBLE AND COST EFFECTIVE (RULE 202, §205.1.b.)

The District does not have a previously established BACT for coating of pleasure craft. However, in a related category, the District previously determined that for the coating of vinyl (plastic) window frames, BACT for VOC was a coating VOC content of 1.0 pounds per gallon for VOC emissions less than or equal to 4,700 pounds per year. (BACT Determination #64, source specific determination for A/C #23518). For VOC emissions greater than 4,700 pounds per year, add-on control (90% collection & 95% control) was determined to be cost effective. The coating used in that application was a two-component coating applied to vinyl window frames. The BACT limit is a case-specific BACT determination derived from SCAQMD Rule 1145 for a two-component coating and it is not generally applicable to coating of plastic parts on pleasure craft. The application which triggered this BACT determination is for the coating of pleasure craft after the fiberglass resin has cured (post-mold coating). Because the pleasure craft requires an antifoulant coating for the underwater portion of the boat to prevent biological growth, the coating limit for vinyl windows is not considered technologically feasible for this application.

### 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. Thermal/catalytic oxidation with an enclosed booth (100% capture efficiency).<br>2. Carbon adsorption with an enclosed booth (100% capture efficiency). |
| **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

A control technology is considered 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 | 17,500 |
| $NO_X$ | 24,500 |

**TECHNOLOGICALLY FEASIBLE AND COST EFFECTIVE (RULE 202, §205.1.b.) (continued)**

| Pollutant | Maximum Cost ($/ton) |
|---|---|
| PM10 | 11,400 |
| $SO_X$ | 18,300 |
| CO | TBD if BACT triggered |

Cost Effectiveness Analysis Summary

The previous cost analysis for a related category (BACT Determination #64) used the District's generic threshold of 4,700 pounds of VOC per year (BACT Determination #22 for Automotive Coating Operations) for a single spray booth. This is the same threshold used in the current Automotive Coating Operations BACT #153 and #154. This BACT determination will revisit this limit using new cost data. Facilities that coat miscellaneous metal parts, miscellaneous plastic parts, and pleasure craft use generally the same types of equipment to coat their respective substrates (Spray booths, HVLP spray guns). This BACT determination will use updated cost data (sales tax, electricity, natural gas, and labor rates).

The cost analysis was processed in accordance with the EPA OAQPS Air Pollution Control Cost Manual (Sixth Edition, EPA/452/B-02-001). The sales tax rate was based on the District's standard rate of 8.25%. The electricity (13.80 cents/kWh) and natural gas (8.04 dollars/1,000 cubic feet) rates were based on a commercial 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 51-9122: Painters, Transportation Equipment and maintenance (Occupation Code 49-9099: Installation, maintenance, and repair workers, all other) rates were based on data from the Bureau of Labor Statistics.

**Carbon Adsorber:** As shown in Attachment B, the cost effectiveness for the add-on carbon adsorber system to control VOC was calculated to be **$17,515/ton**. The following basic parameters were used in the analysis.

Equipment Life = 10 years

Total Capital Investment = $12,736.85

Direct Annual Cost = $37,513.61 per year

Indirect Annual Cost = $5,637.75 per year

Total Annual Cost = $43,151.36 per year

VOC Removed = 2.5 tons per year

**Cost of VOC Removal = $17,514.51 per ton reduced**

**TECHNOLOGICALLY FEASIBLE AND COST EFFECTIVE (RULE 202, §205.1.b.) (continued)**

A detailed calculation of the cost effectiveness for VOC removal with a carbon adsorber is shown in Attachment B. Uncontrolled VOC emissions of 5,475 pounds per year or greater is the cost-effective threshold for control equipment using carbon adsorption control technology.

**Thermal Oxidizer:** As shown in Attachment B, the cost effectiveness for the add-on thermal oxidizer system to control VOC was calculated to be **$17,501/ton**. The following basic parameters were used in the analysis.

Equipment Life = 10 years

Direct Costs: = $176,248

Direct Annual Cost = $109,119 per year

Indirect Annual Cost = $51,018 per year

Total Annual Cost = $160,137 per year

VOC Removed = 9.15 tons per year

**Cost of VOC Removal = $17,501 per ton reduced**

A detailed calculation of the cost effectiveness for VOC removal with a carbon adsorber is shown in Attachment B. Uncontrolled VOC emissions of 18,300 pounds per 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 5,475 pounds per year or greater must be reached in order for the carbon adsorption control option to be cost effective. Uncontrolled VOC emission level of 18,300 pounds 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 VOC of $17,500 per ton controlled.

However, the District previously established that the cost effectiveness threshold for add-on control at automotive coating operations is 4,700 pounds per year of VOC (BACT #154). Since the add-on control technology is essentially the same for both a pleasure craft coating operation and an automotive coating operation, the same cost-effectiveness threshold will be applied to this BACT determination.

## C. SELECTION OF BACT:

Based on the review of SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, and EPA BACT Clearinghouses and cost effectiveness determinations, BACT for VOC, PM10, and PM2.5 will be the following:

| **BACT #204 for Pleasure Craft Coating Operation ≤ 4,700 pounds per year** | | |
|---|---|---|
| **Pollutant** | **Standard** | **Source** |
| **VOC** | Compliance with the pleasure craft requirements of SJVUAPCD Rule 4603, except where noted in footnote (A) | SMAQMD (BACT #153)<br>SJVUAPCD (BACT #4.2.8) |
| **NOx** | No standard | |
| **SOx** | No standard | |
| **PM10** | Enclosed paint booth with dry filters or water wash and use of HVLP spray guns or equivalent | SJVAPCD (BACT 4.2.8)<br>SCAMQD (BACT)<br>SDAPCD (BACT) |
| **PM2.5** | Enclosed paint booth with dry filters or water wash and use of HVLP spray guns or equivalent | SJVAPCD (BACT 4.2.8)<br>SCAMQD (BACT)<br>SDAPCD (BACT) |
| **CO** | No standard | |

(A) The following coating category listed in SJVUAPCD Rule 4603 must meet the following standard: antifoulant coatings: aluminum substrate: 440 g/l, other substrates: 330 g/l, - high gloss coatings: 340 g/l - extreme high gloss coatings: 490 g/l - pretreatment wash primers: 420 g/l - primers: 340 g/l - general coatings: 340 g/l.

| **BACT #205 for Pleasure Craft Coating Operation > 4,700 pounds per year** | | |
|---|---|---|
| **Pollutant** | **Standard** | **Source** |
| **VOC** | 1. Compliance with the pleasure craft requirements of SJVUAPCD Rule 4603, except where noted in footnote (A), **and** VOC control system with ≥ 90% overall efficiency, or<br>2. Use of low-VOC materials resulting in an equivalent emission reduction. | BAAQMD (BACT 84.1.1);<br>SMAQMD (BACT #154)<br>SCAQMD (BACT, Rule 1106.1) |
| **NOx** | No standard | |
| **SOx** | No standard | |
| **PM10** | Enclosed paint booth with dry filters or water wash and use of HVLP spray guns | SJVAPCD (BACT 4.5.4)<br>SCAMQD (BACT)<br>SMAQMD (BACT #64)<br>SDAPCD (BACT) |

**SELECTION OF BACT: (continued)**

| BACT #205 for Pleasure Craft Coating Operation > 4,700 pounds per year | | |
|---|---|---|
| **Pollutant** | **Standard** | **Source** |
| **PM2.5** | Enclosed paint booth with dry filters or water wash and use of HVLP spray guns | SJVAPCD (BACT 4.5.4)<br>SCAMQD (BACT)<br>SMAQMD (BACT #64)<br>SDAPCD (BACT) |
| **CO** | No standard | |

(A) The following coating category listed in SJVUAPCD Rule 4603 must meet the following standard: antifoulant coatings: aluminum substrate: 440 g/l, other substrates: 330 g/l, - high gloss coatings: 340 g/l - extreme high gloss coatings: 490 g/l - pretreatment wash primers: 420 g/l - primers: 340 g/l - general coatings: 340 g/l.

| T-BACT for Pleasure Craft Coating Operation | | |
|---|---|---|
| **Pollutant** | **Standard** | **Source** |
| **Organic HAP/VHAP & Inorganic HAP (T-BACT)** | Compliance with NESHAP HHHHHH where applicable. | USEPA |

**REVIEWED BY:** _____ **DATE:** _____

**APPROVED BY:** _____ **DATE:** _____

# Attachment A

## Review of BACT Determinations published by EPA

COMPREHENSIVE REPORT
Report Date:08/24/2018

## Facility Information

| | | | |
|---|---|---|---|
| **RBLC ID:** | CA-1168 (final) | **Date Determination Last Updated:** | 12/10/2009 |
| **Corporate/Company Name:** | NASSCO | **Permit Number:** | 986868-72 |
| **Facility Name:** | NASSCO | **Permit Date:** | 08/14/2008 (actual) |
| **Facility Contact:** | | **FRS Number:** | 0607300158 |
| **Facility Description:** | | **SIC Code:** | 3731 |
| **Permit Type:** | A: New/Greenfield Facility | **NAICS Code:** | 336611 |
| **Permit URL:** | | | |
| **EPA Region:** | 9 | **COUNTRY:** | USA |
| **Facility County:** | SAN DIEGO | | |
| **Facility State:** | CA | | |
| **Facility ZIP Code:** | 92113 | | |
| **Permit Issued By:** | SAN DIEGO COUNTY APCD, CA (Agency Name)<br>MR. GARY SMITH(Agency Contact) (858)586-2722 gary.smith@sdcounty.ca.gov | | |
| **Other Agency Contact Info:** | MR. ARTURO GONZALEZ<br>858-586-2721<br>ART.GONZALEZ@SDCOUNTY.CA.GOV | | |
| **Permit Notes:** | | | |

### Process/Pollutant Information

| | |
|---|---|
| **PROCESS NAME:** | SPRAY BOOTH |
| **Process Type:** | 41.024 (Ship Building & Repair Surface Coating) |
| **Primary Fuel:** | NATURAL GAS |
| **Throughput:** | |
| **Process Notes:** | FIVE (5) CONCENTRATOR(S)/RTO(S) HAVE BEEN ISSUED ACS. AS OF OCTOBER 14, 2008, NO CONSTRUCTION HAS TAKEN PLACE. |

**POLLUTANT NAME:** Volatile Organic Compounds (VOC)

**CAS Number:** VOC

**Test Method:** Unspecified

**Pollutant Group(s):** ( Volatile Organic Compounds (VOC) )

**Emission Limit 1:** 2.0000 T/YR

**Emission Limit 2:**

**Standard Emission:**

**Did factors, other than air pollution technology considerations influence the BACT decisions:** U

**Case-by-Case Basis:** BACT-PSD

**Other Applicable Requirements:**

**Control Method:** (A) VOC CONCENTRATOR AND RTO

**Est. % Efficiency:**

**Cost Effectiveness:** 0 $/ton

**Incremental Cost Effectiveness:** 0 $/ton

**Compliance Verified:** Unknown

**Pollutant/Compliance Notes:**

https://www.sdapcd.org/content/dam/sdc/apcd/notices/APP-004079%20T5%20DRAFT%20renewal%20NASSCO.PDF

# Attachment B

## Cost Effectiveness Determination for Carbon Adsorption and Thermal Oxidizers

# 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

**VOC Parameters**

| | | |
|---|---|---|
| VOC of concern | | Toluene |
| Cost of pure VOC ($/ton) | | 100 |
| Molecular weight of VOC (Refer to Control Cost Manual, pg 3-63) | | 92.13 |
| Emission rate (lbs/hr - inlet) | | 2.4 |
| Inlet concentration (ppm) | | 22 |
| k factor (Refer to Control Cost Manual, Chapter 1, Table 1.1) | | 0.551 |
| m factor (Refer to Control Cost Manual, Chapter 1, Table 1.1) | | 0.11 |
| Partial pressure (psi) | | 0.000317514 |

**Gas Parameters**

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

**Equipment Parameters**

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

**Operating Parameters**

| | | |
|---|---|---|
| Hours per day | | 8 |
| Days per week | | 5 |
| Weeks per year | | 52 |
| Days per year | | 261 |

**Carbon Requirements**

| | | |
|---|---|---|
| Controlled VOC Emissions with max operation (tons/year) | ((2.4 lbs VOC/hr)*(0.9)*(8 hours/day)*(261 days/year)/(2000 lbs/ton) | 2.25504 |
| VOC Emissions BACT add on limit (pounds/year) | | 5475 |
| Controlled VOC Emissions BACT add on limit (tons/year) | (5475 lbs/year)*0.9 | 2.46375 |
| Carbon working capacity (lb VOC/lb carbon) | EPA Cost Control Manual, Equation 1.15 | 0.2500 |
| Amount of carbon needed (lbs) | (5475 lbs VOC)/(0.25 lb VOC/lb carbon) | 19,710 |
| Carbon cost | ($1.5/lb carbon)*(15,509 lbs carbon) | $29,565 |
| Carbon life (years) | | 5 |

**Direct Costs:**

Purchased Equipment Cost

| | | |
|---|---|---|
| Adsorber and auxiliary equipment (Vessel Cost) | EPA Cost Control Manual, Equation 1.25 | $9,749.21 |
| Instrumentation | 1% of equipment cost ($9749)*0.1 | $974.92 |
| Sales taxes | 8.25% of equipment cost ($9749.20698272062)*0.0825 | $804.31 |
| Freight | 5% of equipment cost ($9749.20698272062)*0.05 | $487.46 |
| **Purchased Equipment Cost** | | $12,015.90 |
| | | |
| Direct installation costs | | |
| Foundations & supports | | $ - |
| Handling & erection | | $ - |
| Electrical | | $ - |
| Piping | | $ - |
| Insulation | | $ - |
| Painting | | $ - |
| **Direct installation costs** | | $ - |
| **Indirect Costs:** | | |
| Indirect Costs (installation) | | |
| Engineering | | $ - |
| Construction and field expenses | | $ - |
| Contractor fees | | $ - |
| Start-up | 2% of equipment cost ($9204)*0.02 | $ 240.32 |
| Performance test | 1% of equipment cost ($9204)*0.01 | $ 120.16 |
| Contingencies | 3% of equipment cost ($9204)*0.03 | $ 360.48 |
| **Total Indirect Costs** | | $ 720.95 |
| | | |
| **Total Capital Investment** | | $12,736.85 |
| | | |
| Interest Rate | 2% plus 6-month average, rounded to next integer | 5% |
| Equipment Life (years) | | 10 |
| Capital Recovery Factor (CRF) | | 0.1295 |
| **Capital recovery cost** | ($12736.85*0.1295) | $1,649.48 |
| | | |
| **Direct Annual Costs** | | |
| Labor wage ($/hr) | 51-9122 Painters, Transportation Equipment (May 2017) | $ 22.30 |
| operator hour (hrs/shift) | | 0.5 |
| shifts per day (shift/day) | | 1 |
| days of work per year (days/year) | | 260 |
| | | |
| Operator labor | | |
| Operator | ($22.3)*(0.5 hours/shift)*(1 shift/day)*(260 days/year) | $2,899.00 |
| Supervisor | | $0.00 |
| Material | equal to operator costs | $2,899.00 |
| Replacement labor | | $0.00 |

| | | |
|---|---|---|
| Utilities | | |
| Electrical Cost | | |
| kW/hp | | 0.746 |
| hp | | 10 |
| hours/year | | 2086 |
| kWh price | | 0.1382 |
| Electrical | (0.746 kw/hp)*(10 hp)*(2085.72 hours/year)*($0.1382/kwh) | $2,150.61 |
| **Total Direct Annual Costs (without carbon costs)** | | $7,948.61 |

| | | |
|---|---|---|
| **Indirect Annual Costs** | | |
| Overhead | 60% of maintenance labor and materials | $3,478.80 |
| Administrative Charges | 2% of Total Capital Investment | $ 254.74 |
| Property Tax | 1% of Total Capital Investment | $ 127.37 |
| Insurance | 1% of Total Capital Investment | $ 127.37 |
| **Total Indirect Annual Costs (without Capital Recovery)** | | $3,988.27 |

| | | |
|---|---|---|
| Ton VOC controlled | | 2.5 |
| Carbon needed | | 19,710 |
| **Cost of Carbon per year** | (15,509 lb carbon)*($1.50/lb carbon) | $29,565.00 |

| | | |
|---|---|---|
| **Total Annual Costs** | | $43,151.36 |
| **Cost of VOC Removal** | ($43151)/(2.5 tons VOC) | $17,514.51 |

Determination of Maximum Annual VOC Limit Not Requiring Add-on BACT

| | |
|---|---|
| Annual Direct Operating Cost (without carbon costs) | $7,948.61 |
| Annual Indirect Operating Cost | $5,637.75 |
| Carbon working capacity (lb carbon/lb VOC) | 0.2500 |
| **Annual lb VOC PTE** | 5475 |
| Annual tons Controlled VOC | 2.46375 |
| Control Efficiency | 0.900 |
| | |
| Amount of Carbon Needed | 19,710 |
| Cost of Carbon | $29,565.00 |
| Total Annual Cost | $43,151.36 |
| **Cost per ton VOC Controlled** | $17,514.51 |

# COST EFFECTIVENESS ANALYSIS FOR THERMAL INCINERATION

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

**VOC Parameters**

| | |
|---|---|
| VOC of concern | Toluene |
| Molecular weight of VOC (see Control Cost Manual, p 2-39) | 92.13 |
| Heat of combustion (Btu/lb - see Control Cost Manual, p 2-39) | 17,601 |
| Heating value of VOC (Btu/scf) | 4,074 |
| Emission rate (lbs/hr - inlet) | 2.4 |
| Inlet concentration (ppm) | 21 |

**Gas Parameters**

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

**Equipment Parameters**

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

**Operating Parameters**

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

**Incinerator Parameters**

| | |
|---|---|
| Volumetric heat of combustion of effluent (Btu/scf) | 0.09 |
| Heat of combustion per pound of effluent (Btu/lb) | 1.15 |
| 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) | $0.14 |
| System fan (kWh/yr) | 61,651.20 |
| Total Power Used (kWh/yr) | 61,651.20 |

**Gas Usage**

| | |
|---|---|
| Price of gas ($/1000 cu.ft.) | $8.04 |
| Auxiliary fuel required (scfm) | 87.43 |

## CAPITAL COST

Direct Costs:

| | | |
|---|---|---|
| Incinerator | | $110,000 |
| Auxiliary equipment (if not included above) | | $0 |
| | Equipment Cost (A) | **$110,000** |
| Instrumentation (0.1A if not included above) | | $11,000 |
| Sales taxes (0.0825A) | | $9,075 |
| Freight (0.05A) | | $5,500 |
| | Total Equipment Cost (B) | **$135,575** |

Direct Installation Costs:

| | | |
|---|---|---|
| Foundation & Supports (0.08B) | | $10,846 |
| Handling & erection (0.14B) | | $18,981 |
| Electrical (0.04B) | | $5,423 |
| Piping (0.02B) | | $2,712 |
| Insulation for duct work (0.01B) | | $1,356 |
| Painting (0.01B) | | $1,356 |
| | Direct Installation Cost | **$40,673** |
| Site preparation | | $0 |
| Facilities & buildings | | $0 |
| | **Total Direct Costs** | **$176,248** |

Indirect Costs (installation)

| | | |
|---|---|---|
| Engineering (0.10B) | | $13,558 |
| Construction & field expenses (0.05B) | | $6,779 |
| Contractor fees (0.10B) | | $13,558 |
| Start-up (0.02B) | | $2,712 |
| Performance test (0.01B) | | $1,356 |
| Contingencies (0.03B) | | $4,067 |
| | **Total Indirect Costs** | **$42,028** |

| | |
|---|---|
| **TOTAL CAPITAL INVESTMENT** | **$218,276** |

## ANNUAL COST

Direct Annual Costs

Operating Cost

| | |
|---|---|
| Operator (@ $22.30/hr & .5 hr per shift ) | $5,798.00 |
| Supervisor (15% of operator) | $869.70 |
| Operating materials | $0.00 |

Maintenance

| | | |
|---|---|---|
| | Labor (@21.21/hr & .5 hr per shift) | $5,514.60 |
| | Material (same as labor) | $5,514.60 |
| Utilities | | |
| | Price of electricity ($/kWh) | $0.14 |
| | Price of gas ($/1000 cu.ft.) | $8.04 |
| | Electricity ($/yr) | $3,699.07 |
| | Natural Gas ($/yr) | $87,723.25 |
| | **Total Direct Costs** | **$109,119.22** |

Indirect Annual Costs

| | |
|---|---|
| Overhead | $10,618.14 |
| Administrative charges | $4,365.52 |
| Property taxes | $2,182.76 |
| Insurance | $2,182.76 |
| Interest rate (%) | 4% |
| Equipment life (years) | 10 |
| CRF | 0.1233 |
| Capital recovery | $26,911.42 |
| **Capital Recovery Inflation Adjustment** | $31,668.51 |
| **Total Indirect Costs** | **$51,017.68** |

| | |
|---|---|
| **TOTAL ANNUAL COST** | **$160,136.90** |

| | |
|---|---|
| Annual Cost ($/yr) | $160,136.90 |
| Annual Emissions Uncontrolled (lbs/year) | 21,140 |
| Annual Emissions Reductions (tons/yr) | 9.15 |

(annual emissions based on BACT determination limit for add-on controls)

| | |
|---|---|
| **COST PER TON OF VOCs REDUCED ($/ton)** | **$17,501.30** |