## SMAQMD BACT CLEARINGHOUSE

**ACTIVE**

**CATEGORY Type:**

**BOTTLE STERILIZER**

**BACT Category:** MINOR SOURCE

### BACT Determination Information

<table>
<thead>
<tr>
<th>BACT Determination Number:</th>
<th>274</th>
<th>BACT Determination Date:</th>
<th>3/9/2021</th>
</tr>
</thead>
</table>

#### Equipment Information

- **Permit Number:** N/A -- Generic BACT Determination
- **Equipment Description:** BOTTLE STERILIZER
- **Unit Size/Rating/Capacity:** ≤150 ppm VOC and ≤2000 cfm

### District Contact:

- **ROCs**
  - **Standard:** Refer to Comment Section (below)
  - **Technology Description:** Refer to Comment Section (below)
  - **Basis:** Cost Effective

- **NOx**
  - **Standard:**
  - **Technology Description:**
  - **Basis:**

- **SOx**
  - **Standard:**
  - **Technology Description:**
  - **Basis:**

- **PM10**
  - **Standard:**
  - **Technology Description:**
  - **Basis:**

- **PM2.5**
  - **Standard:**
  - **Technology Description:**
  - **Basis:**

- **CO**
  - **Standard:**
  - **Technology Description:**
  - **Basis:**

- **LEAD**
  - **Standard:**
  - **Technology Description:**
  - **Basis:**

### Comments:

Sterilization of food containers ≤ 200 g/l VOC or vent to APC device of 90% collection and 95% control efficiency.
Sterilization of production equipment ≤ 200 g/l VOC or vent to APC device of 90% collection and 95% control efficiency.
Cleaning of production equipment ≤ 25 g/l (0.21 lb/gal) VOC, or vent to APC device of 90% collection and 95% control efficiency, or an output of less than 50 ppm VOC calculated as carbon with no dilution.

Printed: 3/9/2021
BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

DETERMINATION NO.: 274
DATE: July 31, 2020
ENGINEER: Jeff Weiss

Category/General Equip Description: Bottle Sterilizer (Minor Source BACT)

Equipment Specific Description: Bottle Sterilizer

Equipment Size/Rating: 150 ppmv VOC concentration or less and a flow rate of 2,000 cfm or less

Previous BACT Det. No.: N/A

This BACT determination is for a bottle sterilizing process for a dairy products processing line at HP Hood (A/C 26617). The process sterilizes both the bottles as well as the sterilizing equipment. The primary sterilizing chemical is peracetic acid. Acetic acid and hydrogen peroxide are also used in the process and serve primarily to stabilize peracetic acid in storage.

BACT ANALYSIS

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

The following control technologies are currently employed for bottle sterilizing processes.

<table>
<thead>
<tr>
<th>District/Agency</th>
<th>Best Available Control Technology (BACT)/Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>US EPA</td>
<td><strong>BACT</strong>&lt;br&gt;Source: EPA RACT/BACT/LAER Clearinghouse&lt;br&gt;None.</td>
</tr>
<tr>
<td>District/Agency</td>
<td>Best Available Control Technology (BACT)/Requirements</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td><strong>BACT</strong> Source: <a href="https://ww2.arb.ca.gov/BACT-Tool">https://ww2.arb.ca.gov/BACT-Tool</a></td>
</tr>
<tr>
<td></td>
<td>None.</td>
</tr>
<tr>
<td></td>
<td><strong>RULE REQUIREMENTS</strong> Source: <a href="https://ww2.arb.ca.gov/resources/documents/airborne-toxic-control-measures">https://ww2.arb.ca.gov/resources/documents/airborne-toxic-control-measures</a></td>
</tr>
<tr>
<td></td>
<td>None.</td>
</tr>
<tr>
<td>CARB</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>BACT</strong> Source: SMAQMD BACT Clearinghouse</td>
</tr>
<tr>
<td></td>
<td>None.</td>
</tr>
<tr>
<td></td>
<td><strong>RULE REQUIREMENTS</strong> Source: <a href="http://www.airquality.org/Businesses/Rules-Regulations">http://www.airquality.org/Businesses/Rules-Regulations</a>.</td>
</tr>
<tr>
<td></td>
<td>Rule 466 – Solvent Cleaning</td>
</tr>
<tr>
<td></td>
<td>Sterilization of food manufacturing and processing equipment is limited to 200 g/l (1.68 lb/gal) or must vent to an APC device with a collection efficiency of 90% and either a destruction efficiency of 95% or have an output of less than 50 ppm calculated as carbon with no dilution.</td>
</tr>
<tr>
<td></td>
<td>Maintenance cleaning activities are limited to 25 g/l (0.21 lb/gal) or must vent to an APC device with a minimum collection efficiency of 90% and either a minimum destruction efficiency of 95% or have an output of less than 50 ppm calculated as carbon with no dilution.</td>
</tr>
<tr>
<td></td>
<td>These standards do not apply to the sanitizing of products that are labeled and applied to food-contact surfaces that are used to process dry and low-moisture food products and are not rinsed prior to contact with food.</td>
</tr>
<tr>
<td>Sacramento Metropolitan AQMD</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>BACT</strong> Source: <a href="http://www.aqmd.gov/docs/default-source/bact/bact-guidelines/part-d---bact-guidelines-for-non-major-polluting-facilities.pdf">http://www.aqmd.gov/docs/default-source/bact/bact-guidelines/part-d---bact-guidelines-for-non-major-polluting-facilities.pdf</a> (Page 74)</td>
</tr>
<tr>
<td></td>
<td>None.</td>
</tr>
<tr>
<td>South Coast AQMD</td>
<td></td>
</tr>
<tr>
<td>District/Agency</td>
<td>Best Available Control Technology (BACT)/Requirements</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| South Coast AQMD     | **Rule 1131 – Food Product Manufacturing and Processing Operations**  
                       Sterilization of food product manufacturing equipment is limited to 200 g/l or must vent to an APC device with a minimum collection efficiency of 90% and a minimum destruction efficiency of 95%.  
                       **Rule 1171 – Solvent Cleaning**  
                       Maintenance cleaning activities are limited to 25 g/l (0.21 lb/gal) or must vent to an APC device with a minimum collection efficiency of 90% and either a minimum destruction efficiency of 95% or have an output of less than 50 ppm calculated as carbon with no dilution. |
| San Diego County APCD| **BACT**  
                       Source: https://www.sandiegocounty.gov/content/dam/sdc/apcd/PDF/Misc/APC_D_bact.pdf  
                       None: **RULE REQUIREMENTS**  
                       Source: https://www.sandiegocounty.gov/content/sdc/apcd/en/Rule_Development/Rules_and_Regulations/  
                       None (Note: San Diego Rule 1203 for ethylene oxide sterilizers pertains only to the control of ethylene oxide gas.) |
| Bay Area AQMD        | **BACT**  
                       Source: http://www.baaqmd.gov/permits/permitting-manuals/bact-tbact-workbook  
                       None: **RULE REQUIREMENTS**  
                       Regulation 8, Rule 4 - General Solvent and Surface Coating Operations  
                       Cleaning solvents must not exceed 50 g/l (0.42 lb/gal) as applied or be vented to a control device with a capture/control efficiency of at least 85%. This rule does not apply to sterilization activities. |
### District/Agency | Best Available Control Technology (BACT)/Requirements
---|---
**San Joaquin Valley APCD** | **BACT**
Source: [https://www.valleyair.org/busind/pto/bact/bactchidx.htm](https://www.valleyair.org/busind/pto/bact/bactchidx.htm)
None.

**RULE REQUIREMENTS**
Source: [https://www.valleyair.org/rules/1ruleslist.htm](https://www.valleyair.org/rules/1ruleslist.htm)

Rule 4663 – Organic Solvent cleaning, Storage, and Disposal
Whenever organic solvent use exceeds 55 gallons/year, maintenance cleaning activities must be limited to 25 g/l (0.21 lb/gal) or must vent to an APC device with a collection efficiency of 90% and either a destruction efficiency of 95% or have an output of less than 50 ppm calculated as carbon with no dilution.

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

<table>
<thead>
<tr>
<th>VOC</th>
<th>Summary of Achieved-in-Practice Control Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sterilization of Food Containers: No standard</td>
<td></td>
</tr>
<tr>
<td>Sterilization of Production Equipment</td>
<td></td>
</tr>
<tr>
<td>1. Sterilization of food product manufacturing equipment is limited to 200 g/l or must vent to an APC device with a minimum collection efficiency of 90% and a minimum destruction efficiency of 95%. (SCAQMD)</td>
<td></td>
</tr>
<tr>
<td>2. Sterilization of food manufacturing and processing equipment is limited to 200 g/l (1.68 lb/gal) or must vent to an APC device with a minimum collection efficiency of 90% and either a minimum destruction efficiency of 95% or have an output of less than 50 ppm calculated as carbon with no dilution. (SMAQMD)</td>
<td></td>
</tr>
<tr>
<td>Cleaning of Production Equipment</td>
<td></td>
</tr>
<tr>
<td>1. Maintenance cleaning activities are limited to 25 g/l (0.21 lb/gal) or must vent to an APC device with a collection efficiency of 90% and either a destruction efficiency of 95% or have an output of less than 50 ppm calculated as carbon with no dilution. (SCAQMD, SMAQMD, SJVAPCD)</td>
<td></td>
</tr>
<tr>
<td>2. Cleaning solvents must not exceed 5 tons/year VOC or be vented to a control device with a minimum capture/control efficiency of at least 85%. This rule does not apply to sterilization activities. (BAAQMD)</td>
<td></td>
</tr>
</tbody>
</table>
The following has been identified as the most stringent, achieved-in-practice control technology.

<table>
<thead>
<tr>
<th>Best Control Technologies Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VOC</strong></td>
</tr>
<tr>
<td>Sterilization of Food Containers:</td>
</tr>
<tr>
<td>No standard</td>
</tr>
<tr>
<td>Sterilization of Production Equipment</td>
</tr>
<tr>
<td>Sterilization of food product manufacturing equipment is limited to 200 g/l or must vent to an APC device with a minimum collection efficiency of 90% and a minimum destruction efficiency of 95%.</td>
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<tr>
<td>Cleaning of Production Equipment</td>
</tr>
<tr>
<td>Maintenance cleaning activities are limited to 25 g/l (0.21 lb/gal) or must vent to an APC device with a collection efficiency of 90% and either a destruction efficiency of 95% or have an output of less than 50 ppm calculated as carbon with no dilution.</td>
</tr>
</tbody>
</table>

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” per Rule 202, §205.1.a:

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Technologically Feasible Alternatives</th>
</tr>
</thead>
</table>
| **VOC**   | 1) Thermal Oxidizer (99% Control Efficiency)  
2) Wet Scrubber (98% Control Efficiency)  
3) Refrigerated Condenser (Not technologically feasible)  
4) Carbon Adsorber (Not technologically feasible)  
5) Sterilization of food containers and food product manufacturing equipment limited to 200 g/l VOC or must vent to an APC device with a minimum collection efficiency of 90% and a minimum control efficiency of 95%. |

The following control technologies are not considered to be technologically feasible for VOC.

**Refrigerated Condensation**

Refrigerated condensers are not technologically feasible because of the high water content and low VOC content of the emission stream. Because of the low VOC content, sufficient control can only be attempted at outlet temperatures below 0 °C. However, at these temperatures, the high water content of the emission stream will solidify and clog a condenser before an appreciable VOC reduction occurs. Therefore, refrigerated condensation is not technologically feasible.
Carbon Adsorption

Carbon adsorption is not technically feasible because of the high humidity of the inlet gas stream and because of safety issues. According to the EPA Cost Manual (7th Edition, Section 3, Page 1-6, (10/18)), water molecules are readily adsorbed by activated carbon which reduces the number of potential VOC adsorption sites on the carbon media. This can reduce the control efficiency by 30%. Further, moisture in the bed also promotes biological growth on the carbon surfaces which can further reduce the control efficiency.

There are also safety issues. Carbon bed fires can result from exothermic reactions that can occur when oxygen bearing compounds (e.g. acetic and peracetic acid) are adsorbed onto activate carbon. Due to the efficiency and safety issues, carbon adsorption is not considered to be technologically feasible for this process.

**Cost Effectiveness Analysis**

After identifying the technologically feasible alternatives, a cost analysis is performed to take into consideration the economic impacts for all technologically feasible controls identified. A control technology is considered to be cost-effective if the cost of controlling one ton of that air pollutant is less than the limits specified below (except coating operations):

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Maximum Cost ($/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC</td>
<td>$17,500/ton</td>
</tr>
<tr>
<td>NOx</td>
<td>$24,500/ton</td>
</tr>
<tr>
<td>PM10</td>
<td>$11,400/ton</td>
</tr>
<tr>
<td>SOx</td>
<td>$18,300/ton</td>
</tr>
<tr>
<td>CO</td>
<td>Determined when BACT is triggered</td>
</tr>
</tbody>
</table>

**Thermal Oxidizer**

Control with a thermal oxidizer with a control efficiency of 99% was studied. A recuperative thermal oxidizer, a catalytic thermal oxidizer, and a regenerative thermal oxidizer were evaluated, but none of the thermal oxidizers were viable as a control. For a recuperative thermal oxidizer, the following results show that it is not cost effective.

- Waste Gas Flow Rate = 1,790 scfm (Applicant Data)
- Equipment Life = 20 years (EPA Expected Equipment Life)
- Total Capital Investment = $172,393
- Direct Annual Cost = $284,513 per year
- Indirect Annual Cost = $47,635 per year
- Total Annual Cost = $322,148 per year
- VOC Removed = 12.0 tons per year
- Cost of VOC Removal = $27,789 per ton reduced

Since the cost of removal of $27,789 per ton is greater than the SMAQMD cost effectiveness threshold for VOC of $17,500 per ton, the add-on thermal oxidizer is not considered to be cost effective. All figures are expressed in 2016 dollar values since District policy is to use the
most current publicly available numbers. A detailed cost effectiveness calculation for the recuperative thermal oxidizer is shown in Appendix A.

Control with a catalytic thermal oxidizer was also studied. The EPA Cost Manual spreadsheet states that an emission flow of at least 2,000 scfm is required for the analysis. Despite the sterilizer flow rate being only 1,790 scfm, a cost effectiveness analysis was run for a catalytic thermal oxidizer. The following results show that a catalytic thermal oxidizer is not cost effective by a small margin. A detailed cost effectiveness calculation is shown in Appendix A.

- Waste Gas Flow Rate = 2000 scfm
- Equipment Life = 20 years (EPA Expected Equipment Life)
- Total Capital Investment = $202,897
- Direct Annual Cost = $162,532 per year
- Indirect Annual Cost = $51,072 per year
- Total Annual Cost = $213,604 per year
- VOC Removed = 12.0 tons per year
- Cost of VOC Removal = \$17,865 per ton reduced

In addition to not being cost-effective, the catalytic thermal oxidizer also generates criteria and toxic emissions through the combustion of natural gas. Natural gas is needed to supplement combustion because of the low VOC and high moisture content of the emission stream.

In this case, the thermal oxidizer generates VOC emissions of 95 lb/year and NOx emissions of 643 lb/year by combusting 33.63 scfm of natural gas using a 30 ppm NOx burner. However, the oxidizer of 99% control will only reduce VOC emissions an extra 241 lb/year more than a wet scrubber of 98% control (refer below). This 241 lb/year VOC reduction will result in an extra 643 lb/year of NOx being generated. Since NOx is a more important ozone precursor than VOC, the thermal oxidizer is less suitable than a wet scrubber of 98% control.

A regenerative thermal oxidizer was not studied because the sterilizing process is rated at a flow rate of 1,790 scfm but the scope of the EPA Cost Manual is for regenerative incinerators above 10,000 scfm. Consequently, a regenerative thermal oxidizer is not suitable for the process. In addition, the regenerative thermal oxidizer will also generate emissions of NOx and VOC emissions which will partially offset any control that is achieved.

Wet Scrubber
The EPA Cost Manual states that scrubbers can achieve a control from 90% to 99.9%. The higher end of this range of 99.9% can only be achieved in best case scenarios. In the case of the bottle sterilizer scrubber, the emissions stream has a combined acid gas concentration of only 150 ppm. This is below the EPA Cost Manual’s design threshold of 250 ppm to 10,000 ppm. Nevertheless, a cost effectiveness analysis was run for an emission stream at the EPA threshold limit of 250 ppm and a control efficiency of 98%. All figures are expressed in 2016 dollar values since District policy is to use the most current publicly available numbers. As the following results show, a scrubber is not cost effective for this bottle sanitizing process scenario.
Waste Gas Flow Rate = 1,790 scfm (Applicant Data)
Equipment Life = 10 years (District Policy)
Total Capital Investment = $425,059
Direct Annual Cost = $271,899 per year
Indirect Annual Cost = $83,314 per year
Total Annual Cost = $355,213 per year
VOC Removed = 19.7 tons per year
Cost of VOC Removal = $18,031 per ton reduced

Solvent limited to 200 g/l or a collection/control efficiency of 90%/95%
The most stringent technology that has been achieved in practice is the sterilization of food product manufacturing equipment that is limited to 200 g/l VOC or is vented to an APC device with a minimum collection efficiency of 90% and a minimum control efficiency of 95%. Since the chemical agent that sterilizes the process equipment should be the same agent as the one that sterilizes the food containers, this control technology is the same for both sterilization of equipment and sterilization of food containers. Therefore, this technology is already achieved in practice for food container sterilization and a cost effectiveness analysis is not necessary.

Conclusion
None of the technologically feasible alternatives were proven to be cost effective. The applicant is proposing to treat a 150 ppm or less VOC emissions stream that vents under negative pressure to a wet scrubber with a control efficiency of 98%. However, this control technology will not be considered BACT for the following reasons: (1) it has only been proposed and not yet established by testing, (2) the information provided by the applicant shows a likely range between 90-99.9% efficiency, meaning 98% is on the upper end of what may be possible, (3) the analysis doesn’t support a 98% control efficiency when flow rates are below 2000 cfm, as is the case for this type of operation, and (4) changes in the chemical characteristics of the emission stream of other bottle sterilization processes will affect the control efficiency that can be achieved. Therefore, because a control efficiency of 98% can’t be confidently applied to the equipment category, BACT will be the use of a sterilizing agent with a VOC content limited to 200 g/l or use of an APC device with a 90% collection and 95% control efficiency. No further cost effectiveness determination is required.
C. SELECTION OF BACT:

BACT will be the most stringent emissions strategy that is deemed to be technologically feasible.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Control Technology</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC</td>
<td>Sterilization of Food Containers: Sterilization of food containers is limited to 200 g/l VOC or must vent to an APC device with a minimum collection efficiency of 90% and a minimum control efficiency of 95%. Sterilization of Production Equipment Sterilization of food product manufacturing equipment is limited to 200 g/l or must vent to an APC device with a minimum collection efficiency of 90% and a minimum control efficiency of 95%. Cleaning of Production Equipment Maintenance cleaning activities are limited to 25 g/l (0.21 lb/gal) or must vent to an APC device with a collection efficiency of 90% and either a control efficiency of 95% or have an output of less than 50 ppm calculated as carbon with no dilution.</td>
<td>SMAQMD SCAQMD SMAQMD SCAQMD SJVAPCD</td>
</tr>
</tbody>
</table>

APPROVED BY: Brian J Krebs DATE: 03-09-2021