CATEGORY Type: **BOTTLE STERILIZER**

BACT Category: MINOR SOURCE

BACT Determination Number: 274	**BACT Determination Date:** 3/9/2021

Equipment Information

Permit Number: N/A -- Generic BACT Determination

Equipment Description: BOTTLE STERILIZER

Unit Size/Rating/Capacity: ≤150 ppmv VOC and ≤2000 cfm

EXPIRED

Equipment Location:

BACT Determination Information

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 calcuated as carbon with no dilution.

777 12th Street, Third Floor

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Sacramento, CA 95814

BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

EXPIRED

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 sterilzing 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.

District/Agency	Best Available Control Technology (BACT)/Requirements
US EPA	**BACT** Source: EPA RACT/BACT/LAER Clearinghouse None. **RULE REQUIREMENTS** Sources: https://www.epa.gov/stationary-sources-air-pollution/new-source-performance-standards https://www.epa.gov/stationary-sources-air-pollution/national-emission-standards-hazardous-air-pollutants-neshap-9 None.

District/Agency	Best Available Control Technology (BACT)/Requirements
CARB	**BACT** Source: https://ww2.arb.ca.gov/BACT-Tool None. **RULE REQUIREMENTS** Source: https://ww2.arb.ca.gov/resources/documents/airborne-toxic-control-measures None.
Sacramento Metropolitan AQMD	**BACT** Source: SMAQMD BACT Clearinghouse None, **RULE REQUIREMENTS** Source: http://www.airquality.org/Businesses/Rules-Regulations. Rule 466 – Solvent Cleaning 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. 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. 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.
South Coast AQMD	**BACT** Source: http://www.aqmd.gov/docs/default-source/bact/bact-guidelines/part-d---bact-guidelines-for-non-major-polluting-facilities.pdf (Page 74) None. **RULE REQUIREMENTS** Source: http://www.aqmd.gov/home/rules-compliance/rules/scaqmd-rule-book

District/Agency	Best Available Control Technology (BACT)/Requirements
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/APCD_bact.pdf None: **RULE REQUIRENTS** 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** Source: http://www.baaqmd.gov/rules-and-compliance/current-rules 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 None. **RULE REQUIREMENTS** Source: 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.

Summary of Achieved-in-Practice Control Technologies	
VOC	Sterilization of Food Containers: No standard Sterilization of Production Equipment 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) 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) Cleaning of Production Equipment 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. (SMAQMD, SCAQMD, SJVAPCD) 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)

The following has been identified as the most stringent, achieved-in-practice control technology.

Best Control Technologies Achieved	
VOC	<u>Sterilization of Food Containers</u>: No standard <u>Sterilization of Production Equipment</u> 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%. <u>Cleaning of Production Equipment</u> 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.

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:

Pollutant	Technologically Feasible Alternatives
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.

<u>Refrigerated Condensation</u>
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 Adsorbtion
Carbon adsorbtion 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 adsorbtion 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 adsorbtion 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):

Pollutant	Maximum Cost ($/ton)
VOC	$17,500/ton
NOx	$24,500/ton
PM10	$11,400/ton
SOx	$18,300/ton
CO	Determined when BACT is triggered

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 mositure 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 percurssor 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.

<u>Wet Scrubber</u>
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 sterilizers 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.

BACT for a Bottle Sterilizer - 150 ppmv VOC Concentration or Less and a Flow Rate of 2,000 cfm or Less		
Pollutant	Control Technology	Source
VOC	Sterilization of Food Containers: Sterilization of food contatiners 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%.	SMAQMD
	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%.	SCAQMD
	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.	SMAQMD SCAQMD SJVAPCD

APPROVED BY: Brian F Krebs **DATE:** 03-09-2021