San Joaquin Valley
Unified Air Pollution Control District

Best Available Control Technology (BACT) Guideline 6.4.8

Emissions Unit: On-Farm Dairy Manure Composting

Industry Type: Composting

Equipment Rating: All

Last Update: March 6, 2024

Pollutant	Achieved in Practice or contained in SIP	Technologically Feasible	Alternate Basic Equipment
VOC	1. Establish an initial Carbon to Nitrogen (C:N) ratio of between 25:1 and 40:1; and 2. Maintain a temperature of between 131 F and 170 F for 15 days using a windrow composting system, during which period, the materials must be turned a minimum of five times.	1. 99% overall capture and control efficiency for both active and curing composting phases (composting in enclosure vented to a scrubber, or equivalent) 2. 95% overall capture and control efficiency for both active and curing composting phases (composting in enclosure vented to an activated carbon system, or equivalent) 3. 80% overall capture and control efficiency for both active and curing composting phases (positively aerated piles with Gore Covers, or equivalent)	
NH_3	1. Establish an initial Carbon to Nitrogen (C:N) ratio of between 25:1 and 40:1; and 2. Maintain a temperature of between 131 F and 170 F for 15 days using a windrow composting system, during which period, the materials must be turned a minimum of five times.	1. 99% overall capture and control efficiency for both active and curing composting phases (composting in enclosure vented to a scrubber, or equivalent) 2. 95% overall capture and control efficiency for both active and curing composting phases (composting in enclosure vented to an activated carbon system, or equivalent) 3. 80% overall capture and control efficiency for both active and curing composting phases (positively aerated piles with Gore Covers, or equivalent).	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

***This is a Summary Page for this Class of Source**

Proactive Best Available Control Technology (BACT) Determination

District BACT Guideline 6.4.8

On-Farm Dairy Manure Composting

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I. Introduction

The objective of this project is to proactively create a Best Available Control Technology (BACT) guideline that covers on-farm dairy manure-only composting operations.

This BACT determination will evaluate and incorporate any applicable emission control standards that have been achieved in practice or determined to be technologically feasible, in accordance with the District's BACT policy (APR 1305).

This analysis will address the following items:

- Source of emissions
- Top-down BACT analysis for all pollutants
- Recommendations

II. Source of Emissions

The open windrow composting process has the potential to emit VOCs, NH_3, and odor. After the material is mixed and screened, a front-end loader delivers the material to the composting area and builds the active phase.

In the active phase of composting, micro-organisms rapidly break down the more easily decomposable organic material first. The effect of this high rate of exothermic biochemical activity is the production of VOCs and NH_3 and a rise in temperature of the compost pile, up to 160 degrees Fahrenheit. Generally, the peak pile temperature corresponds to the peak VOC emission rate. According to the District's Compost VOC Emissions Factors Report, 90% of the VOC emissions from composting occur during the active phase.

Upon completion of the active phase, the material has minimal odor and has been reduced in volume. A front-end loader will be used to move the material to commence the curing phase of composting. Due to the rapid decomposition that has taken place over the course of the active phase, the pile has lost its original porosity. Moving the material serves to "fluff it up," thereby promoting a more uniform aeration in the curing phase.

At the end of the curing phase, the compost is considered stable, meaning its decomposition rate, and, in turn, its air contaminant emission rate, is negligible. In the finishing phase, the material is not normally covered or aerated. The purpose of the finishing phase is to cool the composted material and allow excess moisture to evaporate in preparation for loadout.

According to a study published by CalRecycle, Emissions Testing of Volatile Organic Compounds from Greenwaste Composting at the Modesto Compost Facility in the San Joaquin Valley, 70 – 85% of VOCs from open windrow

composting of green waste are emitted from the ridge top. The explanation for this phenomenon is that the windrow produces a natural convection current within the pile. Exothermic reactions taking place in the interior of the pile produce heat and emissions that rise out of the ridge of the windrow while cooler ambient air enters the windrow from the bottom and sides.

III. Top-Down BACT Analysis

As explained earlier, the principal pollutants emitted from on-farm dairy manure composting are Volatile Organic Compounds (VOC) and ammonia (NH_3).

A. BACT Analysis for VOC and NH_3 Emissions

Step 1 - Identify All Possible Control Technologies

1. Survey of BACT Guidelines:

   The following BACT clearinghouse references were reviewed to identify any control technologies for VOC and NH_3 emissions from on-farm dairy manure composting facilities:

   - The U.S. Environmental Protection Agency (USEPA) RACT/BACT/LAER Clearinghouse,
   - California Air Resources Board (CARB) BACT Clearinghouse,
   - Bay Area Air Quality Management District (BAAQMD),
   - South Coast Air Quality Management District (SCAQMD),
   - Sacramento Metropolitan Air Quality Management District (SMAQMD),
   - San Diego County Air Pollution Control District (SDCAPCD),
   - Santa Barbara County Air Pollution Control District (SBCAPCD),
   - Ventura County Air Pollution Control District (VCAPCD),
   - Yolo-Solano Air Quality Management District (YSAQMD), and
   - San Joaquin Valley Air Pollution Control District (SJVAPCD)

   The USEPA RACT/BACT/LAER and CARB BACT clearinghouses do not include general guidelines, only determinations made by individual agencies. This database was searched using SIC Code 2875 for fertilizers, mixing only (includes compost) and for “compost”. However, no applicable BACT guidelines were found for composting operations.

   The BAAQMD, SCAQMD, SMAQMD, SDCAPCD, SBCAPCD, VCAPCD, YSAQMD, and SJVAPCD BACT clearinghouses were searched for on-farm dairy manure composting operations, and no applicable BACT guidelines were found.

   For emission control technology transfer purposes, BACT guidelines for co-composting operations were searched. Co-composting as defined in

SJVAPCD Rule 4565 is "*composting where biosolids and/or animal manure and/or poultry litter are mixed with other materials, including amendments, to produce compost.*" Therefore, it is assumed that emission control technologies for co-composting operations could be considered to be technologically feasible for on-farm dairy manure only composting operations via technology transfer. The following BACT guidelines from the SCAQMD (for non-major polluting facilities) and the SJVAPCD were found and are summarized in the table below:

Agency	Guideline	Process and Range	Control Technology
SCAQMD	Non-Major Polluting Facilities	Co-composting (composting where biosolids and/or manure are mixed with bulking agents to produce compost.)	VOC and NH_3: Compliance with SCAQMD Rule 1133.2 (12/5/2003).
SJVAPCD	6.4.10	Co-Composting with Organic Material, Biosolids, Poultry Litter or Animal Manure: ≥ 60,000 ton/year throughput	VOC and NH_3 (Achieved in Practice): 1. 80% overall capture and control efficiency for both active and curing composting phases (positively aerated piles with Gore Covers, or equivalent) VOC and NH_3 (Technologically Feasible): 1. 99% overall capture and control efficiency for both active and curing composting phases (composting in enclosure vented to a scrubber, or equivalent) 2. 95% overall capture and control efficiency for both active and curing composting phases (composting in enclosure vented to an activated carbon system, or equivalent)

2. Survey of Applicable Rules and Regulations:

Federal, State, and Air Pollution Control/Air Quality Management District Rules and Regulations were reviewed to determine applicable emission control requirements currently imposed on on-farm dairy manure composting operations. No rules applicable to on-farm dairy manure composting operations were found at CARB, SCAQMD, SBCAPCD, VCAPCD, or YSAQMD.

The following applicable rules and regulations were found:

- BAAQMD Regulation 13 Rule 3 (Composting Operations). This rule is currently under development and has not been adopted.
- SMAQMD Regulation 489 (Composting Operations). This rule is currently under development and has not been adopted.
- SDCAPCD Rule 67.25 (Composting and Related Operations). This rule is currently under development and has not been adopted.

- SJVAPCD Rule 4565 (Biosolids, Animal Manure, and Poultry Litter Operations)
- SJVAPCD Rule 4570 (Confined Animal Facilities).
- Code of Federal Regulations (CFR).

SJVAPCD Rule 4565 does not apply to on-farm dairy composting operations.

SJVAPCD Rule 4570 (Confined Animal Facilities) reduces VOC emissions by requiring certain mitigation measures to be implemented; however, this rule does not require a dairy manure composting operation to implement any mitigation measures.

Code of Federal Regulations (CFR), Title 7, Subtitle B, Chapter I, Subchapter M, Part 205 (National Organic Program)[1], Subpart C, Section 205.203(c)(2), "Soil fertility and crop nutrient management practice standard" requires the following:

Composted plant and animal materials produced through a process that:

- Establishes an initial Carbon to Nitrogen (C:N) ratio of between 25:1 and 40:1; and
- Maintains a temperature of between 131 F and 170 F for 3 days using an in-vessel or static aerated pile systems; or
- Maintains a temperature of between 131 F and 170 F for 15 days using a windrow composting system, during which period, the materials must be turned a minimum of five times.

3. Survey of Permits Issued for On-Farm Dairy Manure Composting:

The following are permits issued for on-farm dairy manure composting operations from air pollution control agencies located in the states of California.

A. SJVAPCD Permits:

SJVAPCD currently has 305 combined animal facilities, which are permitted to compost on-farm dairy manure, and which are subject to District Rule 4570 (Confined Animal Facilities). However, District Rule 4570 does not impose any emission control requirements for on-farm dairy manure composting.

B. SCAQMD Permits:

SCAQMD has permits for co-composting facilities, but does not currently have any permitted on-farm dairy manure composting facilities.

[1] https://www.ecfr.gov/current/title-7/subtitle-B/chapter-I/subchapter-M/part-205

4. List of Control Options:

   Based on the above surveys of the BACT guidelines, applicable rules and regulations, and permits issued for manure composting, the following are possible control technology options:

   - 99% overall capture and control efficiency for both active and curing composting phases (composting in enclosure vented to a scrubber, or equivalent)
   - 95% overall capture and control efficiency for both active and curing composting phases (composting in enclosure vented to an activated carbon system, or equivalent)
   - 80% overall capture and control efficiency for both active and curing composting phases (positively aerated piles with Gore Covers, or equivalent)
   - Compliance with CFR requirements
     1. Establish an initial Carbon to Nitrogen (C:N) ratio of between 25:1 and 40:1; and
     2. Maintain a temperature of between 131 F and 170 F for 3 days using an in-vessel or static aerated pile systems[2]; or
     3. Maintain a temperature of between 131 F and 170 F for 15 days using a windrow composting system, during which period, the materials must be turned a minimum of five times.

Step 2 - Eliminate Technologically Infeasible Options

All listed control technology options are feasible.

Step 3 - Rank Remaining Control Technologies by Control effectiveness

Rank	Control Option	% VOC Control	% NH_3 Control	Achieved in Practice
1	Composting in enclosure vented to a scrubber, or equivalent (Active and Curing Phases).	99	99	No
2	Composting in enclosure vented to an activated carbon system, or equivalent (Active and Curing Phases).	95	95	No
3	Positively aerated piles with Gore Covers, or equivalent.	80	80	No
4	Compliance with CFR Part 205 composting requirements.	10*	10*	Yes

*CFR mitigation measure control efficiency is assumed to be similar to that achieved by the mitigation measures in District Rule 4565 since the CFR-required mitigation measures are similar to those in Table 2 of Rule 4565.

[2] No known on-farm dairy manure composting operation uses in-vessel or aerated static pile systems, and if one did, it would almost certainly utilize emission control technologies commensurate with the Technologically Feasible options. Therefore, this option will not be listed as an Achieved in Practice requirement on the BACT guideline.

Step 4 - Cost Effectiveness Analysis

This is a proactive determination that is not part of a permitting action. Therefore, a cost effective analysis is not necessary.

Step 5 - Select BACT

Since this is a proactive BACT determination that is not part of a specific permitting action, selecting BACT is not applicable.

IV. Recommendations

Adopt the draft BACT Guideline 6.4.8 listed in Appendix A.

Appendices

A: Draft BACT Guideline 6.4.8

Appendix A
Draft BACT Guideline 6.4.8

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