**CONSERVATION PRACTICE STANDARD**

# COMPOSTING FACILITY

**(No.)**

**CODE 317**

## DEFINITION

A structure or device to contain and facilitate the controlled aerobic decomposition of manure or other organic material by micro-organisms into a biologically stable organic material that is suitable for use as a soil amendment.

## PURPOSE

To reduce the pollution potential and improve the handling characteristics of organic waste solids; and produce a soil amendment that adds organic matter and beneficial organisms, provides slow-release plant-available nutrients, and improves soil condition.

## CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Organic waste material is generated by agricultural production or processing.
- The facility is a component of a planned waste management system;
- The facility can be constructed, operated and maintained without polluting air and/or water resources;
- There is a need to improve air quality by reducing the emissions of odorous gases.

## CRITERIA (Applicable to all purposes)

**Laws and Regulations.** Install and operate the facility in compliance with all federal, state and local laws, rules and regulations.

**Safety.** Incorporate safety and personal protection features and practices into the facility and its operation as appropriate to minimize the occurrence of equipment and biosecurity hazards during the composting process.

**Facility Siting.** Locate on a base of low permeability soils, concrete, or other liner material that will not allow contamination of ground water. The floor of the composting facility shall be at least two feet above the seasonal high water table.

The composting facility shall be at least 100 feet from surface water bodies and open sinkholes, and where practical, at least 100 feet down or cross gradient from a spring or well, or 200 feet up gradient. Locate outside of floodplains when practical; otherwise protect the facility from inundation or damage from a 25-year flood event.

Locate so that prevailing winds and landscape elements minimize odors and protect visual resources.

The composting site shall be gently sloping with adequate space to allow windrow formation down the slope.

Locate so that water is available to the facility during dry periods to ensure proper moisture and acceptable curing times to meet the management goals.

**Runoff Control.** Runoff from the composting facility shall be minimized by providing a roof, or by building and maintaining windrows or piles with a uniform, sloped cross section without depressions, or by composting in a closed vessel.

Runoff from compost facilities shall be directed to a waste storage facility (PA313), wastewater treatment area (PA635), or constructed wetland (PA656).

**Facility Type.** Select the type of composting facility or method based on the type and availability of raw material, the

desired quality of finished compost, equipment, labor, time and land available.

Meet the structural requirements of conservation practice standard PA313, Waste Storage Facility when designing slabs, walls, and support structures. Meet the requirements of conservation practice standard PA367, Roofs and Covers when designing roofs. If an improved surface is needed, it shall meet the criteria for surface treatment as set forth in Heavy Use Area Protection (PA561).

Acceptance of in-vessel and commercially available compost systems shall be based on the documented design and performance of such existing composter and certified as such by a registered professional engineer licensed in Pennsylvania.

**Facility Size.** Size the composting facilities to accommodate the amount of raw material planned for active composting, with a capacity consistent with the composting processes, including equipment, that will be used to produce the desired compost product, and with sufficient finishing time as required to achieve the desired characteristics. Space for compost storage may be included in the finishing space or in a separate facility. Select dimensions to accommodate handling and processing.

A facility for manure and other agricultural organic waste that is to be used on the farm shall have the capacity to produce compost that can be safely stored without undesirable odors. This requires the temperature of the compost to be maintained above 104$^{o}$F for five days with at least four hours above 130$^{o}$F during that time period.

A facility to produce compost for use off the farm or for sale shall have the capacity to significantly reduce pathogens. For a static pile or within vessel facility this requires the temperature of the compost to be maintained above 130$^{o}$F for three days. The total compost period shall include time for the initial primary stage of composting and time for secondary stage composting. For a windrow system this requires the temperature of the compost to be above 130$^{o}$F for 15 days with a minimum of five turnings of the compost.

If the facility is to be used to compost animal carcasses it shall have the capacity to maintain the compost temperature greater than 130$^{\circ}$ F for at least 5 days as an average throughout the compost mass followed by a compatible time for secondary composting. For a windrow system the temperature of the compost shall be above 130$^{o}$F for 15 days with a minimum of five turnings of the compost. Size animal mortality composting facilities according to the methods provided in the National Engineering Handbook Part 637, Chapter 2 – Composting (NEH 637.0213, *Dead Animal Composting*), National Engineering Handbook Part 651, Agricultural Waste Management Field Handbook, Chapter 10 Mortality Management (NEH 651.1007), NRCS or comparable extension publication (e.g. NRCS-PA Design Guide PA-4, *Animal Mortality Composting*). Base the size of dead animal composting facilities on normal mortality loss records for the operation. If these data are not available use locally established mortality rates for the type of operation. Ensure that the final product of the composting process has no visible pieces of soft tissue remaining.

**Use of Finished Compost.** Land application of finished compost shall be in accordance with conservation practice standard PA590, Nutrient Management; or conservation practice standard PA633, Waste Recycling.

## CONSIDERATIONS

To reduce offensive odors increase the carbon nitrogen ratio. A carbon nitrogen ration of 30:1 in the initial mix should have minimal odors.

Minimize odors and nitrogen loss by selecting carbonaceous material that, when blended with the nitrogenous material, provides a balance of nutrients and porous texture for aeration.

A chemical neutralizing or other additive agent should be used if structural components do not provide adequate odor reduction.

Maximize solar warming by aligning piles or windrows north to south configured with moderate side slopes. A south facing aspect should be utilized wherever possible.

Orient windrows to prevent ponding of surface runoff.

Compost moisture content and runoff control can be improved by covering the windrow or piles with a breathable geotextile or a 6-inch layer of fine organic material such as sawdust or mature compost.

An improved (paved) surface will provide year round access and improve the quality of the compost product by minimizing the stone and soil content. This should be weighed against the potential for additional runoff to be stored or treated.

Bio-security should be addressed in all aspects of planning, design, and installation of a composting facility. Traffic patterns and runoff paths between animal production facilities and the composting facility, especially across or adjacent to feeding areas and the young stock housing, should be considered in selecting the site and design.

Protect compost facilities from the wind in cold or dry climates. Wind protection may help prevent excess drying of the compost.

Minimize blown in rain by providing roof overhang.

For facilities that are organic producers or that sell compost to organic producers, ensure that the treated lumber used in the stacking facility meets the requirements for organic production. It may be best to have the producer consult with the organic certifier as to the use and acceptability of treated lumber for litter and compost storage.

## PLANS AND SPECIFICATIONS

Prepare plans and specifications in accordance with the criteria of this standard and describe the requirements for applying the practice to achieve its intended use, including:

- Layout and location of livestock facilities, waste collection points, and/or waste transfer
- Size, type and number of animals or other sources of organic feedstock
- Grading plan showing excavation, fill, and drainage, as appropriate
- Size and capacity needed
- Design requirements
- Safety requirement for operation

The construction specifications for Waste Storage Structure (PA313), Roofs and Covers (PA367), and Heavy Use Area Protection (PA561) provide guidance for this practice.

## OPERATION AND MAINTENANCE

A site specific operation and maintenance plan, consistent with the purposes of this practice and the life of the facility, shall be prepared for and reviewed with the operator.

The O&M Plan shall state that composting is a biological process that requires art and science for success. Hence, the operation may need to undergo some trial and error in the start-up of a new composting facility.

Safety and bio-security requirements for the operation shall be addressed.

**Compost Mix.** Address the specific type of composting to be practiced, the types of material to be composted, and the sequence that they are to be layered and mixed. Develop a compost mix that encourages aerobic microbial decomposition and avoids nuisance odors.

**Carbon-Nitrogen Ratio.** The initial compost mix shall result in a carbon to nitrogen (C:N) ratio between 25:1 and 40:1. Compost with a lesser carbon to nitrogen ratio can be used if nitrogen mobilization is not a concern.

**Carbon Source.** Store a dependable source of carbonaceous material with a high C:N ratio to mix with nitrogen rich waste materials.

**Bulking Materials.** Add bulking materials to the mix as necessary to enhance aeration. The bulking material may be the carbonaceous material used in the mix or a non-biodegradable material that is salvaged at the end of the compost period. Make provision for the salvage of any non-biodegradable material used in the composting process.

**Moisture Level.** Maintain adequate moisture in the compost mix throughout the compost period within the range of 40 to 65 percent (wet basis). Prevent excess moisture from accumulating in the compost

in high precipitation climatic regions. This may require the facility to be covered.

**Temperature of Compost Mix.** Manage the compost to attain and then maintain the internal temperature for the duration required to meet management goals. When the management goal is to reduce pathogens, the compost shall attain a temperature greater than $130^0$F for at least 5 days as an average throughout the compost mass. This temperature and time criterion may be achieved during either primary or secondary composting stages or as the cumulative time greater than $130^0$F in both stages.

It may be necessary for the compost to reach $145^o$F to adequately destroy weed seeds. Closely monitor temperatures above $165^o$F. Take action immediately to cool piles that have reached temperatures above $185^o$F.

**Turning/Aeration.** Keep compost well aerated to minimize nitrogen loss by denitrification. Keeping the pH between 6 and 8 will avoid nitrogen loss by ammonification.

The frequency of turning/aeration shall be appropriate for the composting method used, and to attain the desired amount of moisture removal and temperature control while maintaining aerobic degradation.

The surface of a windrow or static pile composting facility shall be firm throughout the seasons when composting is being mixed, turned, formed into piles or windrows, or otherwise handled by equipment.

Use Waste Treatment (PA629) as a companion practice when needed to meet the intended purpose of the composting facility.

**Compost Period.** Continue the composting process long enough for the compost mix to reach stability level where it can be safely stored without undesirable odors. It shall also process the desired characteristics for its use, such as lack of noxious odor, desired moisture content, level of decomposition of original components and texture. The compost period shall involve primary and secondary composting as required to achieve these characteristics.

**Monitoring:** The operation and maintenance plan shall state that composting is a biological process that needs monitoring and management throughout the composting period to insure proper composting processes. The operation may need to undergo some trial and error in the start-up of a new composting facility. Manage the compost piles for temperature, odors, moisture, and oxygen, as appropriate. Test the finished compost as appropriate (e.g. carbon, nitrogen, moisture, and pH) to assure that the required decomposition has been reached. The compost product should be tested for stability and maturity to prevent phytotoxicity in crops or vegetation receiving the compost.

**Facility:** The O&M Plan shall be consistent with and may include the O&M Plan(s) for other conservation practices designed as part of the facility. The areas of the facility designed for storage of raw and finished product, and for composting and curing, should be clearly defined, The O&M of each of the areas shall be explained.

**REFERENCES**


1. USDA, NRCS. 2000. National Engineering Handbook, Part 637, Chapter 2, Composting. Washington, D.C.
2. Agricultural Composting of Manures, a Supplement to Manure Management for Environmental Protection, PA-DEP Bureau of Water Quality Protection, 1997.
3. USDA, NRCS. 2009. National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook, Washington, D.C.
4. Manual for Economic and Pollution Evaluation of Livestock Manure Management Systems, PA-DEP Bureau of Soil and Water Conservation, 1990.
5. On-Farm Composting Handbook, NRAES-54, Northeast Regional Agricultural Engineering Service, 1992.