## Natural Resources Conservation Service

## CONSERVATION PRACTICE STANDARD

# COMPOSTING FACILITY

## Code 317

## (No)

### DEFINITION

A structure or device to contain and facilitate an aerobic microbial ecosystem for the decomposition of manure and/or other organic material into a final product sufficiently stable for storage, on farm use and application to land as a soil amendment.

### PURPOSE

To reduce water pollution potential and improve handling characteristics of organic waste solids, reuse organic waste as animal bedding, or use as a soil amendment that provides soil conditioning, slow-release plant-available nutrients and plant disease suppression.

### CONDITIONS WHERE PRACTICE APPLIES

This practice applies where at least one of the following conditions occur:

- Organic solid wastes to be composted derive primarily from agricultural production or processing.
- The compost can be reused in the operation, utilized for crop production, soil improvement and/or marketed to the public.

This practice does not apply to the routine handling of livestock and poultry carcasses. Use Conservation Practice Standard (CPS) Animal Mortality Facility (Code 316) for carcass composting facility design.

This practice does not apply to routine storage and handling of animal manure solids. Use CPS Waste Storage Facility (Code 313) for animal manure solids dry stack facilities.

### CRITERIA

**General Criteria Applicable to All Purposes**

**Siting**. Locate and design the compost facility such that it is outside the 100-year floodplain unless site restrictions require locating it within the floodplain. If located within the floodplain, protect the facility from inundation or damage from a 25-year flood event. Additionally, follow the policy found in the NRCS General Manual (GM) 190, Part 410.25, “Flood Plain Management,” which may require providing additional protection for storage structures located within the floodplain.

Follow the setbacks given for Waste Storage Facilities, (Code 313). Redirect upslope surface runoff away from the composting site.

Locate the composting facility to ensure the floor is 2 feet or more above the site identified seasonal high groundwater table unless special design features are incorporated that address nonencroachment of the water table by contaminants.

**Type**. Select the type of composting facility and composting method based on the landowner's goals, kind of organic waste solids, planned quality of finished compost, operator's equipment, labor, time, land available for the facility footprint, and resource concerns.

**Capacity**. Size the composting facility in accordance with NRCS National Engineering Handbook, (NEH) Part 637, Chapter 2, "Composting." Design the composting facility to accommodate the amount of organic waste feedstock generated for active composting and compost curing, along with the needed volume of additional bulking material or carbon source to achieve the composting action. Active composting includes both the primary and secondary stages of composting. Space for both the active composting and compost curing are required for making a stable finished compost product. Select facility dimensions to accommodate all stages of composting with space for turning, handling and processing.

**Moisture.** Orient and design the facility to enable the management of the compost moisture content. A water source is needed for adding moisture in dry conditions. If considerable precipitation is likely, design a cover. Minimize blown-in precipitation on covered facilities by providing a roof overhang or orient the open side of the facility away from the prevailing wind direction.

**Roofs and Roof Runoff.** Design the roof using CPS Roofs and Covers (Code 367). Use CPS Roof Runoff Structure (Code 558) when designing the collection, control and conveyance of runoff from a roof. Use CPS Underground Outlet (Code 620) when designing pipe outlets where erosion may be a concern.

**Foundation.** Design the facility to prevent the contamination of groundwater resources. Evaluate site soils for depth to water table, permeability, texture, and bearing strength based on the design load and frequency of use. For the design of a stable surface treatment, where appropriate, use criteria in CPS Heavy Use Area Protection (Code 561). Guidance on restricting seepage through foundation and subgrade material can be found in NEH-651, Agricultural Waste Management Field Handbook (AWMFH), Appendix 10D.

**Structures.** Use the criteria in CPS Waste Storage Facility (Code 313) when designing composting facility slabs, walls, floors and contaminated runoff water pond liner.

**Wastewater.** Use CPS Waste Transfer (Code 634) for collection and conveyance of any leachate or contaminated runoff from the composting facility to a wastewater storage or treatment facility for further management or reuse.

**Safety.** Incorporate safety and personnel protection features and practices into the facility and its operation to ensure biosecurity and minimize the occurrence of equipment and fire hazards associated with the composting process as appropriate.

**Additional Criteria for Electric Powered Mechanically Assisted Composting**

**Power Supply.** All power supply and electrical components, including wiring, boxes, and connectors, shall meet the requirements of the National Electric Code. If the power supply is located in an area that is reasonably accessible by machinery, protect it with strategically placed bollards or other appropriate safety measures.

## CONSIDERATIONS

Consider the landscape elements when locating the facility. Landscape features can buffer prevailing winds which will minimize odors and protect visual resources.

Where appropriate, consider all-weather access roads for the composting facility site.

When locating the facility, consider a location away from food crops typically consumed raw, food contact surfaces, water distribution systems, and other soil amendment sources where it could become a potential source of contamination.

If site is located where fields have been drained consider water quality. Locate or remove field tiles where seepage from the composting facility is a resource concern to groundwater or surface waters.

Consider equipment access for the facility location and determine if a heavy use area apron is needed to properly manage the compost.

If compost facility is in a higher precipitation area or site that will have heavy vehicle traffic, consider using a concrete base for the facility.

When designing for windrows, consider the compost site grade and pile alignment. Grade site to prevent ponding from occurring. Align windrows north to south to maximize solar warming.

Consider protecting compost facilities from wind in cold or dry climates. Wind in cold climates can cause heat loss thru convection, limiting microbial metabolism. In low humidity climates, wind can cause drying, limiting water availability for microbial metabolism.

Consider the options for finished compost storage. Storage space may be included in the compost curing space or in a separate facility that also protects the resources.

Consider the impact of using treated lumber for the construction of composting facilities on the quality and or acceptability of the compost. For production of certified organic compost have the producer consult with an organic certifier as to the use and acceptability of treated lumber for bins and compost storage.

## PLANS AND SPECIFICATIONS

The landowner is required to obtain all necessary permits for project installation prior to construction.

The landowner and/or contractor are responsible for having all buried utilities located in the project area, including identifying the location of drainage tile and other structural measures.

Prepare plans and specifications that describe the requirements for applying the practice to achieve its intended use, including, but not limited to—

- Plan view showing layout and location of composting facility, if applicable, access road to facility, setback distances from water bodies, streams, sensitive areas, property line, etc.
- Drainage and grading plan showing excavation, fill, and drainage containment, as appropriate.
- Pertinent elevations of the facility.
- Utilities located and source of water supply.
- Structural details of all components.
- Material quantities and specifications.
- Safety features, i.e., fire suppression.

## OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of this practice and the design life of the composting facility. Outline periodic inspections and maintenance of equipment and facilities. Include in the plan structural elements of the facility to be inspected or maintained, an inspection interval time frame, and recommendations for preventive maintenance.

Describe essential safety features of the facility to provide protection from or prevention of a compost fire.

Include a statement that explains composting as a microbiological process that needs monitoring and management. Monitoring the temperature of composting material reflects the phases of successive populations of microorganisms and their metabolism as they decompose the organic matter. The operation may need to undergo some trial and error in the start-up of a new composting facility while the operator determines an efficient operating process. The operator must keep accurate records to aid in learning how to operate the facility efficiently.

List the type(s) and volume(s) of animal waste and/or other sources of organic feedstock planned to be composted. Provide information on planned compost recipe ingredients and the sequence for mixing and building the compost piles. Direct the operator to land-grant universities and other recognized entities that provide compost mixture calculators to balance feedstocks in order to meet a target carbon-to-nitrogen (C:N) ratio and moisture content. The CPS Waste Recycling (Code 633) may be used when nonagricultural by-products are included in the composting feedstock.

Manage the compost for temperature, moisture, oxygen, and pH as appropriate. Test the finished compost as appropriate to assure that the product is stable and no longer heating from biological decomposition. Guidance for composting management, monitoring and the testing of compost stability is in NEH, Part 637, Chapter 2, Section 637.0209(h), “Determination of compost stability.”

**Monitoring Documentation**

Provide a record-keeping form for the operator to use listing at a minimum, the date, amounts and types of material added, compost temperature, weather conditions, and actions taken to manage the compost. Monitoring may include but not be limited to—

- Compost Mix.—Build a compost mix that encourages aerobic microbial decomposition and avoids nuisance odors. Blend feedstock, build compost pile, and handle the compost mix to develop a porous structure for uniform aeration during composting.
- Carbon-Nitrogen Ratio.—The recommended C:N ratio of the initial compost mix is between 25:1 and 40:1. Compost with a lesser C:N ratio can be used if nitrogen mobilization and odors are not a concern. If the C:N ratio is above optimal, the composting process will be slower.
- Carbon.—If needed, store a dependable source of carbonaceous material with a high C:N ratio for mixing with nitrogen rich waste materials. Minimize odors and ammonia volatilization by blending sufficient carbonaceous material with the nitrogenous material (C:N ratio).
- 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 slowly-degradable natural organic material or a nonbiodegradable or slowly-degradable material that is salvaged at the end of the compost period for reuse in additional composting cycles. Make provision for the salvage of any nonbiodegradable or slowly-decomposing 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 60 percent (wet basis). Prevent excess moisture from accumulating in the compost. This may require the pile be covered.
- Temperature of Compost Mix.—Manage the compost to attain and then maintain the target internal temperature for the duration required to meet the desired compost product. It may be necessary for the compost to reach 145°F to adequately kill weed seeds. Closely monitor temperatures above 165°F as that will inhibit the composting process by destroying the thermophilic bacteria. Take action immediately to cool piles that have reached temperatures above 185°F to prevent combustion.
- Turning/Aeration.—Schedule the turning/aeration frequency to attain the desired amount of moisture removal and temperature control appropriate for the composting method used while maintaining aerobic degradation.
- Odors.—If initial compost mixing and compost pile structure do not provide adequate odor reduction, strategies may include altering the recipe to add more carbon, modify the moisture content, modify the pH by applying a material compatible with compost quality and with any specifications for its end

use (e.g,. certified organic), or use a biological inoculant.

**Compost**

**Compost Products.** Time, temperature and turning of composted products can limit uses.

General compost material, to be used in the same way as manure solids, must store safely without undesirable odors. Typically this requires a temperature phase to be maintained above 104°F for 5 days with at least 4 hours above 131°F or higher during that time period.

Organic compliant compost for organic vegetable crops and off farm use or sale, which meets the USDA National Organic Program standards, requires a stable finished compost that has further pathogen reduction. This includes compost that can be used on farm for crops subject to the Food Safety Modernization Act (FSMA) Standards for the Growing, Harvesting, Packing and Holding of Produce for Human Consumption (Produce Safety Rule).

- For processing organic compliant compost in either a static aerated pile or an in-vessel compost system, the temperature of the compost is required to be maintained between 131˚F and 170˚F for 3 days.
- For a windrow system the temperature of the organic compliant compost is required to be between 131˚F and 170˚F for 15 days with a minimum of five turnings of the compost to ensure the windrow is mixed and evenly composted.

For crops subject to the Produce Safety Rule, direct growers to the rule for additional criteria that may be applicable. See http://www.fda.gov/food/guidanceregulation/fsma/ucm334114.htm.

Local compost certification regulations may vary.

**Use of Finished Compost.** Compost can be reused in the operation, utilized for crop production, soil improvement and/or marketed to the public.

Use the CPS Nutrient Management (Code 590) for producer land application of finished compost to provide nutrients and/or as a soil amendment where the finished compost is stable decomposed material that will not reheat, is reduced in pathogenic organisms and most weed seed are no longer viable.

When applying a general compost material that is not a stable pathogen reduced compost product, follow CPS Nutrient Management (Code 590*)* criteria for *manure* solids application, and any state or local rules that may detail crop type, location and timing restrictions for *manure* application.

**REFERENCES**

USDA, NRCS. 2000. National Engineering Handbook, Part 637, Chapter 2, Composting. Washington, D.C.

Northeast Regional Agricultural Engineering Service (NRAES). 1992. On-Farm Composting Handbook, NRAEAS-54.

USDA. 2000. National Organic Program (NOP): Final rule. Codified at 7 CFR Ch. 1 (1-1-11 Edition), part 205.203, (c) (2).

United States Food and Drug Administration. 2015. Food Safety Modernization Act (FSMA): Final rule. Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption. 21 CFR.