United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

COMPOSTING FACILITY

CODE 317

(no)

SD REVIEW

DEFINITION

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

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Reduce water pollution potential
- Conserve energy by reducing mass and improving handling characteristics of organic waste solids
- Reuse organic waste as animal bedding
- Transform organic waste into a soil amendment that improves soil health, provides slow-release plant-available nutrients, and suppresses plant disease

CONDITIONS WHERE PRACTICE APPLIES

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

- 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, improve soil health, or marketed to the public

This practice applies construction of a structure or device to contain and facilitate the composting process. Use NRCS Conservation Practice Standard (CPS) Nutrient Management (Code 590) for producer land application of finished compost to provide nutrients or as a soil amendment.

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

CRITERIA

General Criteria Applicable to All Purposes

Plan, design, and construct the composting facility to comply with all Federal, State, and local laws and regulations. The landowner is required to obtain all necessary permits for project installation prior to construction.

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service State office or visit the Field Office Technical Guide online by going to the NRCS website at https://www.nrcs.usda.gov/ and type FOTG in the search field.

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Refer to the Ohio Environmental Protection Agency and the Ohio Department of Agriculture for rules and regulations that may apply to the operation of composting facilities. Compost sold or moved off-farm may be subjected to registration or licensing from the Ohio EPA.

Siting
Locate and design the composting facility so 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) (Title 190), Part 410, Subpart B, Section 410.25, “Flood Plain Management,” which may require providing additional protection for storage structures located within the floodplain.

Locate facility a minimum of 50 feet from wells, streams, or other water features. Comply with siting criteria found in OH CPS Waste Storage Facility (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 ground water table unless special design features are incorporated that will address the potential for leaching of contaminants to the water table. The water table may be lowered by use of drains to meet this requirement.

Ensure all-weather access to the composting facility. Use NRCS CPSs Access Road (Code 560) or Heavy Use Area (Code 561) if the site lacks appropriate existing access.

Capacity
Size the composting facility in accordance with NRCS National Engineering Handbook (NEH) (Title 210), 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
If a roof is needed, design the roof using NRCS CPS Roofs and Covers (Code 367). Use NRCS CPS Roof Runoff Structure (Code 558) when designing the collection, control, and conveyance of runoff from a roof that could pose a resource concern. Use NRCS CPS Underground Outlet (Code 620) when designing pipe outlets to prevent erosion or contamination of clean runoff water by composting materials.

Foundation and structure
Design the facility to prevent the contamination of ground water resources.

Conduct a subsurface geologic exploration to determine conditions that may adversely affect groundwater quality or foundation stability. The eploration must extend a minimum of three (3) ft. below the bottom of the planned facility. 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 NRCS CPS Heavy Use Area Protection (Code 561). Use the criteria in NRCS CPS Waste Storage Facility (Code 313) when designing composting facility slabs, walls, and floors. Prevent seepage of compost stack leachate in amounts that would pollute surface or ground water with collection and disposal of liquids in a safe

PREVIEW

manner, as necessary. Where seepage will be an issue, use NRCS CPSs Pond Sealing or Lining—Geomembrane or Geosynthetic Clay Liner (Code 521), Pond Sealing or Lining—Concrete (Code 522), or Pond Sealing or Lining—Compacted Soil Treatment (Code 520). Guidance on restricting seepage through foundation and subgrade material can be found in NRCS 210-NEH, Part 651, Chapter 10, Appendix 10D, "Design and Construction Guidelines for Impoundments Lined with Clay or Amendment-treated Soil." Seepage control may not be necessary on sites that have a roof, waste material with little seepage potential, or in certain climates.

Power supply
Where needed for mechanically stirred composting systems, all power supply and electrical components, including wiring, boxes, and connectors, must 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.

Wastewater
If leachate or contaminated runoff is anticipated, use NRCS 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. Use NRCS CPS Waste Storage Facility (Code 313) or other applicable NRCS CPS for that purpose.

Control the 25-year, 24-hour rainfall event within the composting, storage and utilization area without discharge to the waters of the state or from the landowner's property.

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. For composting bins, limit the stack height to 6 feet unless a forced aeration system is provided. This will allow air to reach the center of the pile for proper composting and minimize the potential for spontaneous combustion.

Additional Criteria for Electric Powered Mechanically Assisted Composting

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 resonably accessible by machinery, protect it with strategically placed bollards or other appropriate safety measures.

The composter must have a minimum functional design life of 10 years.

CONSIDERATIONS

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

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 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 the site is located where fields have been artificially drained consider potential water quality issues. Locate or remove field tiles where seepage from the composting facility to ground or surface water is a resource concern.

SOLPREVIEW

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

If the composting facility is in a higher precipitation area or the site 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 the composting facilities from wind in cold or dry climates. Wind in cold climates can cause heat loss through convection, limiting microbial metabolism. In low humidity climates wind can cause drying, limiting water availability for microbial metabolism. Dry, pulverized compost is also susceptible to undesirable wind transport from the facility.

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 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 that will meet the design life span for bins and compost storage structures.

PLANS AND SPECIFICATIONS

The landowner is required to obtain all necessary permits for project installation prior to construction. The landowner and/or contractor is 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; and 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.
- Notification to the landowner and contractor of their responsibility to locate all buried utilities in the project area.
- Subgrade work (excavation, earthfill/drainfill, compaction requirements).
- Structural details of all components.
- Construction 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 structural elements of the facility to be inspected or maintained, an inspection interval time frame, and recommendations for preventative maintenance.

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

Provide procedures to monitor and maintain vibrant microbiological decomposition of the organic materials according to the design and site conditions and pertinent nuances of the organic materials to be composted. Guidance provided should be based on the needs and goals of the producer using literature provided by local university extension publication; NRCS 210-NEH, Part 637, Chapter 2, “Composting”; “NRAEAS 54: On-Farm Composting Handbook”; or other appropriate composting literature. Monitoring the

SD REVIEW

temperature and moisture content 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 startup 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.

Specify the types and volumes of animal waste and other sources of organic feedstock 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 to meet a target carbon-to-nitrogen (C:N) ratio and moisture content. The NRCS CPS Waste Recycling (Code 633) may be used when nonagricultural byproducts 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 the product is stable and no longer heating from biological decomposition. Guidance for composting management, monitoring, and the testing of compost stability is in NRCS 210-NEH, Part 637, Chapter 2, Section 637.0209(h), “Determination of compost stability.”

Monitoring Documentation

Provide a recordkeeping 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 is not 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.
- C:N Ratio.—Developing a composting recipe is a balancing act as both the C:N ratio and the moisture content of the individual materials need to be within acceptable ranges. The recommended initial C:N ratio of 20:1 to 40:1 for rapid composting is consistent with the nutrient needs of the bacteria and fungi in the compost pile. The composting process relies on the balance of carbon- and nitrogen-containing materials. If carbon is present in excessive amounts relative to nitrogen so that the C:N ratio is above the optimal range, the composting process slows. For composting animal mortalities, C:N ratios as low as 14:1 may be effective and practical. Lower C:N ratios may lead to increased odor and ammonia loss.
- 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 carbonaceous material used in the mix, slowly-degradable natural organic material, or nonbiodegradable or slowly biodegradable material salvaged from the compost mix at the end of the cycle. Make provisions for the salvage of any nonbiodegradable or slowly-decomposing material used in the composting process.
- Moisture Level.—Throughout the composting period, maintain moisture in the compost mix within the range of 40 to 60 percent (wet basis). Prevent excess moisture from accumulating in the compost. This may require covering the pile.
- 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 will 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, generally applying water and then mixing, to cool piles that have reached temperatures above 185°F to prevent combustion. Include the need to train workers regarding the recognition of the potential for spontaneous combustion for their safety and to prevent damages.
- Turning/Aeration.—Schedule the turning/aeration frequency to attain the desired amount of oxygen, moisture removal, and temperature control appropriate for the composting method used to optimize

SAMPLE VIEW

aerobic biodegradation.

- Odors.—If the initial compost mixing and compost pile structure do not accomplish adequate odor reduction, strategies may include altering the recipe to add more carbon, modifying the moisture content, modifying the pH by applying a material compatible with compost quality and with any specifications for its end use (e.g., certified organic), or using a biological inoculant.

Composting

Time, temperature, and turning the compost materials is critical, and if not carried out properly the composted materials may have limited uses.

Composted materials, 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 during that time period.

Compost, for vegetable crops and off-farm use or sale, or compost used on any organic crops, must meet USDA National Organic Program requirements. For this, the compost must be stable when finished, be adequately dried, and contain limited quantities of pathogens. This includes compost used onfarm 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 compost in either a static aerated pile or 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 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 FSMA Produce Safety Rule, direct growers to the rule for additional criteria that may be applicable. See https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety.

Local compost certification regulations may vary.

Use of Finished Compost

Compost can be reused in the operation and utilized for crop production or bedding. It also serves to improve soil quality and can be marketed to the public.

Use NRCS CPS Nutrient Management (Code 590) for producer land application of finished compost to provide nutrients, as a soil amendment, or both 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 product, follow NRCS CPS Nutrient Management (Code 590*)* criteria for manure solids application. For this, abide by any State or local rules that may detail crop type, location, and timing restrictions for manure application.

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SOIL REVIEW

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SDL REVIEW