NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

COMPOSTING FACILITY

(No.)

CODE 317

DEFINITION

A treatment component of an agricultural management system for the biological stabilization of organic material.

PURPOSE

To reduce the pollution potential of organic agricultural wastes to surface and ground water.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Organic waste material is generated by agricultural production or processing;
- A composting facility is a component of a planned agricultural waste management system; and,
- A composting facility can be constructed, operated and maintained without polluting air and/or water resources.

CRITERIA

Process Design. A written description of the composting process to be used shall be defined and provided to the operator to meet the intended use and quality of the final composted product.

Laws and Regulations. The installation and operation of the composting facility shall comply with all federal, state, and local laws, rules, and regulations.

If the composting facility requires conditional exemption from site assignment as a solid waste facility by the Massachusetts Department of Environmental Protection (DEP), then the facility must be registered with the Massachusetts Department of Food and Agriculture (DFA) and must comply with DFA's Guide to Agricultural Composting.

Composting of dead animals is limited to those animals generated on the farm due to normal mortality, and not due to catastrophic mortality. Composting of dead animals may require additional measures to meet state and local regulations.

Facility Siting. Compost facilities should be located outside of floodplains. However, if site restrictions require location within a floodplain, they shall be protected from inundation or damage from a 25-year, 24-hour flood event, or larger if required by law.

Compost facilities shall be located according to the distance requirements shown in Table 1.

Composting facilities shall not be located in the Zone I protection area of a public well. Location of a composting facility within a Zone II or an Interim Wellhead Protection Area (IWPA) is subject to approval from the Town's Board of Health in accordance with its wellhead protection bylaws and health regulations.

Locate compost facilities so prevailing winds and landscape elements such as building arrangement, landforms, and vegetation minimize odors and protect the visual resource.

Table 1 – Minimum separation distance from areas of concern

Area of Concern	Minimum Distance from Facility
Private Well	200 ft.
Non-potable on-farm well or spring	100 ft.
Public Surface Drinking Water Supply	400 ft. from the reservoir, and 200 ft. from tributaries.
Surface water or wetland	100 ft.*****

******* *Less if allowed by Conservation Commission*

Foundation and Soils. The bottom elevation of the composting facility shall be above the seasonal high water table and on soils with an acceptable permeability that does not allow materials to contaminate the ground water, or the facility shall be installed on concrete slabs or other appropriate liners. See Table 2 for Site Limitations for unlined facilities, facilities lined with compacted gravel, and facilities lined with concrete or other liners.

Refer to the criteria under Composting Pad for the requirements for compacted gravel, concrete, and other liners.

Facilities located in a Zone II or Interim Wellhead Protection area may also require lining, regardless of soil and foundation conditions, depending on local bylaws and regulations.

Soils and foundations shall be investigated to a depth at least five feet below the anticipated bottom elevation of the composting facility to support the use of unlined facilities and facilities lined with compacted gravel.

Table 2 – Site Limitations

Soil and Foundation Parameter	Unlined Facilities	Facilities Lined with Compacted Gravel	Facilities Lined with Concrete, Bituminous, or other Liners*
Soil Permeability (in the most permeable layer >12 in. thick) *(use the higher table value in the range for soil layers, or substantiate with perc. test)* *(NASIS Soil Table J1b)*	Maximum of 2 in/hr between ground surface and water table or bedrock (or in top 60" if no water table or bedrock present)	Maximum of 6 in/hr between ground surface and water table or bedrock (or in top 60" if no water table or bedrock present)	Not applicable
Depth to Seasonal Ground Water Table** *(NASIS Soil table K1, verified by test pit)*	• 36" minimum for permeability ≤ 0.6 in/hr • 48" minimum for permeability ≤ 2 in/hr	• 24" minimum for permeability ≤ 2 in/hr • 60" minimum for permeability ≤ 6 in/hr	12 inches beneath liner
Depth to Bedrock** *(NASIS Soil table K2, verified by test pit)*	60"	• 36" minimum for permeability ≤ 2 in/hr • 60" minimum for permeability ≤ 6 in/hr	12 inches beneath liner
Rock fragments, 3" or greater	35% maximum	Not applicable	Not applicable

***** See the Pond Sealing or Lining (521) Standard for requirements for other types of liners.
****** Depths below finish grade of the facility except where noted.

Runoff. Direct surface runoff from outside drainage areas away from or around the composting facility. Practices to exclude outside surface runoff shall be designed on the 25-year, 24-hour storm event.

Contaminated runoff from the composting facility shall be collected, stored and utilized, or treated in an environmentally sound manner. Treatment of runoff water shall be through a filter area, conforming to the Filter Strip (393) standard, or through a constructed wetland (656).

Curbs of sufficient height shall surround the facility as needed to direct contaminated runoff to collection or treatment component practices.

Filter strips shall have a settling facility, as described in the 393 standard, unless the treatment strip has the same cross-slope width as the compost facility, and the facility and upslope drainage area do not produce a greater peak flow than the treatment strip can handle as sheet flow. In such cases, a curb or solids retention sill may be used instead of a settling facility.

The filter strip shall be vegetated and functioning prior to the use of the composting facility, unless provisions are incorporated to prevent polluted runoff from leaving the facility until the vegetation is established.

Facility Type. Selection of the type of facility and the composting method shall be based on the availability of raw material, the intended use and desired quality of the final composted product, equipment, labor, time, and available land.

If the final product is to be applied to the land, the facility type and composting methods used shall be consistent with the nutrient management plan for the farm.

Facility structural elements such as permanent bins, and roofs shall meet the requirements of Conservation Practice Standard 313, Waste Storage Facility.

Facility Size. The size of the composting facility shall be based on the composting method, the type and amount of material to be composted, and the length of the composting cycle and curing period.

The size and dimensions of the facility, and the pile spacing and configuration shall accommodate the equipment to be used for loading, unloading, and aeration.

Sizing of facilities for composting dead animals shall be based on normal mortality loss records for the operation. If these records are not available, locally established mortality rates for the type of operation shall be used.

Storage. Provide properly designed pads or other storage facilities sized for the appropriate storage period for raw materials, curing areas and for the finished product as needed to protect the resources. Storage of raw manure shall be in accordance with the Waste Storage Facility (313) standard. Structures and structural components shall meet the requirements in the Waste Storage Facility (313) standard.

Composting Pad. The composting pad shall be designed to support the required loads, shall consider the requirements for liquid tightness as determined in Table 2, and shall consider the requirements for operating and maintaining the surface of the facility.

Subgrade Preparation and Base Course for Concrete and Bituminous Paving: The subgrade shall provide uniform support to the paving.

If the subgrade is *other than* free draining SW, SP, GW, or GP (Unified Soil Classification System), then a compacted base course with a minimum thickness of 6 inches shall be placed on the compacted subgrade and beneath the slab. The base course shall consist of granular material (sand, gravel, crushed stone, or sand/gravel mix) meeting the quality and gradation requirements of Massachusetts DPW 1988 Standard Specification for Highways and Bridges, Sections M1 or M2, except with a maximum stone size of 2 inches and a maximum of 10 percent passing the #200 sieve size.

Compacted Gravel Paving: Compacted gravel paving may be used as shown in Table 2, where liquid tightness is not required. The gravel paving shall of the type that will provide a hard and compacted surface.

A nonwoven geotextile material shall be specified for placement on the completed subgrade prior to placement of the gravel paving.

The thickness of the top course of gravel shall consider the type and size of equipment to be used on the pad. For light duty composting pads, the top course shall be a minimum of 6 inches. On more heavily used areas, the thickness shall be at least 12 inches. A thicker top course layer can prolong the time before repaving is needed.

The gravel shall be meet the requirements as stated in the Barnyard Runoff Management (707) practice standard for Gravel Paving. Rock dust shall be added and compacted with

the gravel to provide a smoother and more impervious surface.

Concrete Paving: Design of concrete paving shall be according to the requirements for liquid-tight slabs in the Waste Storage Facility (313) practice standard criteria for Slabs on Grade.

Bituminous Paving: The thickness of the asphalt course, the kind and size of aggregate, the type of proportioning of bituminous materials, and the mixing and placing of these materials shall be in accordance with Massachusetts DPW 1988 Standard Specification for Highways and Bridges for the expected loading. However, the minimum asphalt pad design shall be a 1½ inch top course over a 2 inch bottom course, after rolling.

Other Liners: Other types of liners shall be designed and installed according to the Pond Sealing or Lining (521) practice standard for the type of liner being considered.

Equipment. Appropriate equipment must be available at the farm for initial mixing, turning, and hauling of carbonaceous, bulking, and composted materials to achieve the intended quality and use of the composted product.

Compost mix. Develop a compost mix that encourages aerobic microbial decomposition and avoids nuisance odors.

Carbon source. A dependable source of carbonaceous material with a high carbon to nitrogen ratio (C:N) shall be available to mix with nitrogen rich waste materials.

Carbon-nitrogen ratio. The initial compost mix shall result in a Carbon to Nitrogen ratio between 25:1 and 40:1. Compost with a greater carbon to nitrogen ratio can be used if nitrogen immobilization is not a concern.

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. If a non-biodegradable material is used, provision shall be made for its salvage.

Moisture level. Provisions shall be made for maintaining adequate moisture in the compost mix throughout the compost period within the range of 40 to 65 percent (wet basis). A reliable source of water must be available for moisture control from startup through completion.

Care shall be taken to prevent excess moisture from accumulating in the compost. Facility or pile covers may be required to provide for a suitable product

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^{o}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 of greater than 130^{o}F in both stages.

Turning/aeration. 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.

Compost period. The composting process shall be long enough for the compost mix to reach the stability level where it can be safely stored without undesirable odors. It shall also possess 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. Test the compost as appropriate to ensure that the required stabilization has been reached.

Use of finished compost. Land application of finished compost shall be in accordance with the nutrient management standard (590) and the waste utilization standard (633).

Compost intended to be sold commercially may need additional testing to determine the compost maturity, nutrient content, and contaminants to comply with local regulations.

Safety. Safety and personal protection features and practices shall be incorporated into the facility and its operation as appropriate to minimize the occurrence of equipment hazards and biological agents during the composting process.

If the facility poses a health or safety hazard to humans or livestock, then the facility shall be fenced according to the Fence (382) standard.

CONSIDERATIONS

Consider locating the composting facility at least 100 feet from an adjoining property line.

For facilities that meet the requirements in Table 2 and do not require lining, evaluate the need for ground surface improvement and the type of paving that might be needed to avoid rutting, mixing of soil and composting materials, and to improve the overall operation of the facility.

Locate facilities in areas with relatively gentle slopes (1 to 3 percent) to minimize grading and runoff. Avoid slopes greater than about 6 percent.

Consider the need for improved surfaces for access to and from the facility. Refer to the Access Road (560) standard.

Consider the need to pre-process the material to break down bulky items, eliminate undesirable material, and create a more homogeneous mix. Such equipment as shredders, grinders, and screens may be needed. Also, screening of the final composted material may be needed depending on its intended use.

Develop an initial compost mix with a Carbon to Nitrogen ratio of at least 30:1 to reduce most offensive 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.

Maximize solar warming by aligning piles north to south configured with moderate side slopes.

To prevent ponding and sogginess in humid areas, do not locate piles (windrows) across the slope.

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

Consider use of windrow or pile covers to manage moisture content and minimize potential for leaching and reduce the concentration of contaminated runoff.

A curing period of at least one month should be included to fully stabilize the compost.

Long stem thermometers should be available to properly manage the composting process. A pH kit may also be needed.

Composting operations require close management. The management capabilities of the operator and the availability of equipment and labor should be assessed as part of the planning and design process.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

OPERATION AND MAINTENANCE

Develop a written operation and maintenance plan, developed with the full knowledge and input from the operator, that is consistent with the purposes of this practice and the life of the composting facility. The plan shall address the composting process, the facility, and all associated practices. The plan shall be in sufficient detail so the operator can manage the facility to produce the quality of composted material to serve its intended use.

Manage the compost piles for temperature, odors, pH, moisture, and oxygen, as appropriate. Make adjustments throughout the composting period to insure proper composting processes.

Closely monitor temperatures above 165^{o}F. Take action immediately to cool piles that have reached temperatures above 185^{o}F.

Maintain a log of the operation of the facility, which is useful in estimating amounts of compost to be produced, but also is helpful in making adjustments to the operation for improved efficiency and product.

Safety requirements for operation of the composting facility shall be provided.

Maintain the compost facility surface. Compacted gravel paving may need replacing or repairing to maintain its design thickness and eliminate ruts.

Bituminous and concrete paving may need repair to seal any cracks that may develop.

Maintain treatment and storage components according to the operation and maintenance requirements of the individual component practices.

The operation and maintenance plan shall state that composting is a biological process. It requires a combination of 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.

REFERENCES

Agricultural Waste Management Field Handbook, Part 651, National Engineering Handbook, USDA-NRCS, 1992.

National Engineering Handbook, Part 637, Environmental Engineering, Chapter 2, Composting, 2000.

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

Field Guide to On-Farm Composting. Northeast Regional Agricultural Engineering Service NRAES-114, 1999.

Guide to Agricultural Composting. Massachusetts Department of Food and Agriculture, 1992

Agricultural Composting Program Regulations. Massachusetts Department of Food and Agriculture, 330 CMR 25.00. (http://www.massdfa.org/legal/regs/index.htm)

Site Assignment Regulations for Solid Waste Facilities. Massachusetts Department of Environmental Protection, 310 CMR 16.00. (http://www.state.ma.us/dep/bwp/dswm/files/310cmr16.htm)

Design of Slabs on Grade. ACI360R-97, American Concrete Institute, 1997.

Subgrades and Subbases for Concrete Pavements. American Concrete Pavement Association, 1995.

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