NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

COMPOSTING FACILITY

(No.)

CODE 317

DEFINITION

A facility for the biological stabilization of waste organic material.

PURPOSE

To treat waste organic material biologically by producing a humus-like material that can be recycled as a soil amendment and fertilizer substitute or otherwise utilized in compliance with all laws, rules, and regulations.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where: (1) waste organic material is generated by agricultural production or processing; (2) composting is needed to manage the waste organic material properly; (3) an overall waste management system has been planned that accounts for the end use of the composted material. Municipal sludge, solid waste and other non-farm type wastes other than leaves and grass clippings are not included in this standard.

CRITERIA

Soils. Locate composting facilities on soils having slow to moderate permeability to minimize seepage of dissolved substances into the soil profile and movement toward groundwater. Evaluate site paving needs in terms of effects of equipment operation on trafficability, soil compaction, and potential for contamination from compost and petrol products. The property limits and distances to resource concerns shall be as shown in Table 1 and 2. A soils investigation shall be made of the proposed facility site. As a minimum the underlying soil shall be investigated to an adequate depth to determine if the site meets the requirements set forth in Table 1. If conditions of Table 1 and 2 are not met, the site shall be amended or modified to meet these conditions or adequate justification provided for a variance to be allowed.

Table 1 - Property Limits For Compost Facilities

Property	Limits	Units
Maximum Slope	8.0	Percent
Maximum Permeability (Least Permeable Horizon > 12" thick)	2.0	Inches/Hr
Minimum Depth to Bedrock	30.0	Inches
Minimum Depth to High Water Table	18.0	Inches
Minimum Flooding Event	1 Time	Per 25 Yrs.
Maximum Fraction 3" Rock (Percent by Weight)	35.0	Percent

Table 2 - Minimum Distance from Potential Composting Facility to Resource Concerns

Resource Concern 1/ Sensitivity of outlet shall be considered.	Minimum Downslope Dist. to CF	Minimum Upslope Dist. to CF
Residence or Well (Neighbor)	500 Ft.	500 Ft.
Adjoining Property Line	200 Ft.	100 Ft.
On farm well/spring	300 Ft.	100 Ft.
Lake/Pond/River/Wetland	300 Ft.	100 Ft.
Diversion/Waterway 1/	100 Ft.	25 Ft.
Gully/Swale/Ravine 1/	100 Ft.	25 Ft.

Runoff. Divert surface runoff from outside drainage areas around the compost facility. Collect runoff from the compost facility and utilize or dispose and/or treat it properly. Evaluate the effects of changed infiltration conditions on groundwater recharge, and evaluate changes in volumes and rates of runoff caused by the location of the operation. Properly manage movement of organic material, soluble substances, and substances attached to solids carried by runoff.

Carbon-Nitrogen Ratio. Calculate the amounts of the various ingredients to establish the desired carbon-nitrogen ratio (C:N) of the mix to be composed. The C:N should be between 25:1 and 40:1. Use the higher range of C:N for organic materials that decompose at a high rate (or are highly unstable) with associated high odor production.

Where more than two ingredients are to be blended, the two main ingredients are to be used in the analysis for the desired C:N and mixed accordingly. Adding up to 50 percent by weight of other ingredients to improve workability and air movement is permissible as long as the C:N of the added ingredient does not exceed the target C:N of the compost.

Odor. Select carbonaceous material that, when blended with the nitrogenous material, will result in the desired pH of between 6 and 8. The blended material should have a pH at or slightly below neutral for best odor control. Where odors do not present a problem, pH of 8 to 9 is acceptable, but strong ammonia and amine related odors will be present for up to the first 2 weeks. Adding extra carbon sources may control high pH. Adding lime may increase low pH. At the end of the composting process, pH should be near neutral or 7.0.

Locate composting operations where movement of any odors toward neighbors will be minimized. Buffer areas, vegetative screens, and natural landscape features can help minimize the effects of odors.

Facility Size. Where dead poultry and other small farm animals are composted, establish the size of the composter units on the basis of locally determined animal loss rates. Composting facilities for the purpose of processing animal carcasses are to include a primary composting unit into which alternate layers of low moisture content manure (unusual poultry manure), carbon source material (straw is common), and dead animal carcasses are placed. A secondary composting unit is often necessary to complete the composing process.

The facility size may also be influenced by pile configuration and row spacing for turning and windowing machinery. A separate area for final compost processing and storage may also be needed.

Moisture. The moisture content of the blended material at start-up of the composting process should be approximately 60 percent (wet weight basis) and maintained between 40 and 60 percent during the composting process. The composting process may become inhibited when moisture falls below approximately 40 percent. Water used for moisture control must be free of deleterious substances. A good source of moisture is the recycled runoff and leachate from the compost pad or milkhouse waste water and contaminated runoff water.

Pile Configuration. Compost piles for wind-rowed and static piles should be triangular to parabolic in cross-sectional form with a base width to height ratio of about 2 to 1. Increased surface area favorably affects evaporation and natural aeration and increases the area exposed to infiltration from precipitation in uncovered stacks. Aligning piles north to south and maintaining moderate side slopes maximizes solar warming. Windrows should be aligned to avoid accumulation of precipitation. Use of geotextiles specifically designed for covering compost piles shall be encouraged.

Composting Period. The time needed for completion of the process varies with the material and must continue until the material reaches a stability level at which it can be safely stored without creating undesirable odors and poor handling features. Acceptable stability occurs when microbial activity diminishes to a low level. Stability can be obtained in about 21-28 days but can require up to 60 days to produce the desired quality. Visual inspection and temperature measurements will provide needed evaluation of compost status. If compost is to be sold commercially as a plant nutrient, certain testing procedures to determine compost maturity,

soluble salts and ammonium nitrogen may be required to comply with local regulations.

Storage. Provide properly designed pads or other storage facilities sized for the appropriate storage period for both raw materials and finished product. If possible, protect composted material from the weather by roofs or other suitable covers. Structures must meet the requirements of conservation practice standard, "Waste Storage Structure," Code 313.

Location. Planning for the location of the facility shall consider distances from resource concerns to minimize surface and subsurface water pollution and odor problems (minimum distances are shown in Table 2). Greater distances may be required by local, state and federal regulations. Deviation from these distance guidelines requires documented planning rational that locating facilities closer to the resource concerns will not cause surface and subsurface water pollution or odor problems.

Facilities shall not be located in flood plains from a 25-year, 24-hour storm event, unless flood proofing or elevating the facility will satisfy this requirement.

CONSIDERATIONS

Types. Three types of composting operations are covered in this standard—aerated windrows, static piles, and in-vessel. Aerated windrows are more suited to large volumes of organic material that are managed by power equipment used to turn the composting material periodically. Periodic turning re-aerates the windrows, promoting the composting process.

Organic material in static piles is initially mixed to a homogeneous condition and not turned again throughout the composting process. Static pile material must have the proper moisture content and bulk density to facilitate air movement throughout the pile. Forced air might be necessary to facilitate the composting process.

In-vessel composting in a totally enclosed structure is carried out on a blended organic material under conditions where temperature and air flow are strictly controlled. In-vessel composting also includes naturally aerated processes where organic materials are layered in the vessel in a specified sequence. Layered, in-vessel materials are usually turned once to facilitate the process. Vessel dimensions must be consistent with equipment to be used for management of compost.

Process. Composting is accomplished by mixing an energy source (carbonaceous material) with a nutrient source (nitrogenous material) in a prescribed manner to meet aerobic microbial metabolic requirements. The process is carried out under specific moisture and temperature conditions for a specified period of time. The active composting phase typically is accomplished within a period of three to eight weeks. Curing should continue for at least one month after the active phase. Correct proportions of the various compost ingredients are essential to minimize odors and to avoid attracting flies, rodents, and other small animals.

Carbon Source. A dependable source of carbonaceous material must be available. The material should have a high carbon content and high carbon to nitrogen ratio (C:N). Wood chips, sawdust, peanut hulls, straw, corn cobs, bark peat moss, and well bedded horse manure are good sources of carbon. When selecting a carbon source, consider its availability to microbes (i.e., sawdust is more available than bark).

Moisture Control. Large amounts of water evaporate during the composting process because operating temperatures drive off water. A source of water must be available for compost pile moisture control from start-up through completion. Proper moisture facilitates the composting process and helps control odors.

Equipment Needs. Appropriate equipment must be available for initial mixing, turning, and hauling composted material and carbonaceous material. Appropriate long stem thermometers should be available for managing the composting material. A pH kit may be needed on some sites.

Bulking Materials. Bulking materials may be added to enhance air flow within the composting material. Piles that are too compact will inhibit the composting process.

The carbonaceous material can be considered as a bulking agent. Where it is desirable to salvage carbonaceous material, provisions for removing the material, such as screening, must be made. High moisture organic wastes may be blended with absorbent bulking materials such as straw or leaves to attain an overall desirable moisture level. (Rule of Thumb: Materials are too wet if water can be squeezed out by hand and too dry if material does not fee moist to the touch).

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

Economics. Benefits associated with the ultimate use of the composed material should be compared to the capital expenditure and operating costs of the composting operations. In addition to cost return, benefits can include environmental protection, improved handling, disposal of dead poultry and other farm animal carcass, odor control, and reduced need for storage volume.

Safety. If the facility poses a health of safety hazard, fencing, meeting Code 382 - Fence, shall be installed. Signs and other safety devices shall also be installed. Considerations also should include respiratory ailments aggravated by the composting process.

Location. Composting site locations shall be selected considering proximity to urban, suburban and rural populations, transportation availability and other infrastructure. Site selections shall also consider groundwater, surface water, soils and geology, topography, landscape screening, wind direction, and other physical conditions.

PLANS AND SPECIFICATIONS

Plans and specifications for organic composting facility shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. A written operation and maintenance plan shall be developed with full knowledge and input of the owner-operator and included with the documents provided to the owner-operator. A Nutrient Management Plan shall be developed to show the location, timing, application rates, and incorporation of composted material in an environmentally sound manner, if the material cannot be sold commercially.

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan shall be prepared for the Composting Facility and any other associated conservation practices. The plan should include the periodic mowing of vegetation and the removal of trees, brush and other woody vegetation around the composing facility. The plan should also include the inspection and repair of the facility as needed, including re-vegetating barren and damaged areas.

Temperature. For best results, operating temperature of the composting material should be 130 °F to 170 °F once the process has begun. It should reach operating temperature within about 7 days and remain elevated for up to 14 days to facilitate efficient composting. The material should remain at or above 110 °F for the remainder of the designated composting period.

If temperature falls significantly during the composting period and odors develop, or if material does not reach operating temperature, investigate piles for moisture content, porosity, and thoroughness of mixing. Compost managed at the required temperatures will favor destruction of any pathogens and weed seeds.

Aeration. Heat generated by the process causes piles to dehydrate. As the process proceeds, material consolidates, and the volume of voids through which air flows decreases. Materials selected for the composting mix should provide for adequate air movement throughout the composting process. Periodically turning the pile and maintaining proper moisture levels for windrows and static piles will normally provide adequate aeration.

Nutrients. Keep compost well aerated to minimize nitrogen loss by denitrification. Keep pH at neutral or slightly lower to avoid nitrogen loss by ammonification. High amounts of available carbon will aid nitrogen

immobilization. Phosphorus losses will be minimized when the composting process is managed according to the requirements of this standard. Include compost nutrients in nutrient management plans and determine the effects of use and management of nutrients on the quality of surface water and ground water as related to human and livestock consumption.

Testing Needs. Test compost material for carbon, nitrogen, moisture, and pH if compost fails to reach desired temperature or if odor problems develop. The finished compost material should be periodically tested for constituents that could cause plant phytotoxicity as the result of application to crops. Composted materials that are prepared for the retail market as a plant nutrient will require testing for labeling purposes.

Site. Maintain surface drainage of adjacent areas away from pad surfaces. Re-grade and vegetate as needed.

REFERENCES

1. On Farm Composting Handbook, NRAES-54, Northeast Regional Agricultural Engineering Service, Ithaca, NY, by Rynk, Robert et al, June 1992
2. Agricultural Waste Management Field Handbook, Rev. 1997, USDA, Natural Resources, Conservation Service