NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

COMPOSTING FACILITY

(No.)
Code 317

DEFINITION

This is 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 groundwater.

CONDITIONS WHERE PRACTICE APPLIES

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

CRITERIA

General Criteria Applicable to All Purposes

Laws and regulations. Install and operate the composting facility to comply with all Federal, state, and local laws and regulations. The producer will be responsible for securing any necessary permits to install structures and for properly managing the facility on a daily basis.

Impact to cultural resources, wetlands and Federal and state protected species shall be evaluated and avoided or minimized to the extent practicable during planning, design and implementation of this conservation practice in accordance with established National and Florida policy, General Manual (GM) Title 420-Part 401; Title 450-Part401, Title 190-Parts 410.22 and 410.26, National Planning Procedures Handbook (NPPH) Florida Supplements to Parts 600.1 and 600.6, National Cultural Resources Procedures Handbook (NCRPH), National Food Security Act Manual (NFSAM), and the National Environmental Compliance Handbook (NECH).

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

Facility siting. Design the bottom elevation of the composting facility to be a minimum of two feet above the seasonal high water table. Design the composting facility floor to be concrete, appropriate liner, or on soils with an acceptable permeability that does not allow materials to contaminate the ground water, and meets all applicable regulations.

Locate the composting facility out of a floodplain unless protected from inundation or damage from a 25-year frequency flood event, or larger.

Locate composting facilities as near the source of organic waste as practical. Locate compost facilities so prevailing winds and landscape elements such as building arrangement, landforms, and vegetation minimize odors and protect the visual resource.

Divert surface runoff away from the compost facility. Divert contaminated runoff from compost facilities to an appropriate storage or treatment facility for further management.

Facility size. Design the composting facility to provide storage for the amount of raw material planned for active composting, space required for curing, and the space for the maximum length of time anticipated between emptying events or storage period. Base the minimum storage period on the timing required for the composting process and environmentally safe waste utilization considering the climate, crops, soil, and equipment. Protect composted material shall be protected from the weather by roofs or other suitable covers.

Select dimensions for elements of the compost facility to accommodate equipment used for loading, unloading, and aeration.

Size facilities for composting dead animals based on normal mortality loss records of the operation in accordance with Agricultural Waste Management Field Handbook (AWMFH), Chapter 10 and National Engineering Handbook (NEH) Part 637, Chapter 2, Composting. If records of normal mortality rates are not available, use locally established mortality rates for similar types of operations.

Facility type. Select composting facility/method based on the availability of raw material, the desired quality of final compost, equipment, labor time, and land available. Design the composting method (passive composting piles, windrow, passively aerated windrows, aerated static pile and in-vessel systems) to meet the requirements of the AWMFH Chapter 10 and NEH Part 637, Chapter 2, Composting.

Facility design. Design facility structural elements such as permanent bins, concrete slabs, and roofs to meet the requirements of Florida NRCS conservation practice standard, Waste Storage Facility, Code 313.

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

Carbon-nitrogen ratio. Use the initial compost mix that has a Carbon to Nitrogen (C:N) ratio between 25:1 and 40:1. See Table 10-6 in the AWMFH for typical C:N ratios of common composting amendments. Compost with a greater carbon to nitrogen ratio can be used if nitrogen immobilization is not a concern.

Carbon source. Store a dependable source of carbonaceous material to be available to mix with the 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. If a non-biodegradable material is used, make provision such as screening for salvage.

Moisture. Make provision for maintaining adequate moisture in the compost mix throughout the compost period within the range of 40 to 65 percent (wet basis). Water used for moisture control must be free of deleterious substances. Prevent excess moisture from accumulating in the compost.

Temperature of compost mix. Manage the compost to attain and then maintain the internal temperature for the duration required to meet management goals.

Ensure a minimum temperature of 130° F is reached during the composting process. If this temperature is not reached, incorporate the resulting compost immediately after land application.

When the management goal is to reduce pathogens, ensure the compost temperature is greater than 130^{o}F for at least 5 days as an average throughout the compost mass.

Achieve this temperature and time criterion during either primary or secondary composting stages or as the cumulative time of greater than 130^{o}F in both stages.

Turning/Aeration. Ensure the frequency of turning/aeration is appropriate for the composting method used, and to attain the desired amount of moisture removal and temperature control while maintaining aerobic degradation.

Compost period. Continue the composting process long enough for the compost mix to reach the stability level where it can be safely

stored without undesirable odors. Continue the composting process to ensure the compost possess the desired characteristics for its use, such as lack of noxious odor, desired moisture content, level of decomposition of original components and texture. To achieve these characteristics, include the primary and secondary composting in the compost period.

Test the finished compost as appropriate to assure that the required stabilization has been reached.

Use of finished compost. Land apply finished compost in accordance with Florida NRCS conservation practice standards Nutrient Management, Code 590, and Waste Utilization, Code 633.

Composting Facility – Building Structure

Composting Facility – Buildings shall be designed as follows:

a. Roof: While composting of some material may be accomplished in the open, it does not work well with dead bird composts. A roof ensures year round operation and controls rain water and percolation. Design the roof structure for applicable wind and dead loads for agricultural buildings according to local building codes. Calculate wind loads using ASAE practice standard ASAE EP 288.5. Design post and beam in accordance with procedure described in the National Forest Products Association's *National Design Specification for Wood Construction.* Design post embedment in accordance with ASAE practice standard ASAE EP486. Include a Florida registered professional engineer signature and seal for all trusses.

b. Concrete Floor: This is critical to all weather operations, secures the composter against rodents, dogs, etc., and prevents contamination of the surrounding area. Consider the required performance and the critical applied loads along with both the subgrade material and material resistance of the concrete slab in the concrete slab design. Where applied point loads are minimal and the subgrade is uniform and dense, design the minimum slab thickness to be 4 inches with a maximum joint spacing of 10 feet. Joint spacing can be increased if steel reinforcing is added based on subgrade drag theory.

c. Building Materials: Specify all lumber in contact with the ground or compost to be pressure-treated in accordance with ASTM D 1760. Specify all metal used in the structure to be galvanized or otherwise protected from corrosion.

d. Facility Size: The volume required for composting is dependent upon estimated mortality rates, market weight, number of animals, days to reach market weight, and a volume factor. Calculate volume by using equation 10-22 in the AWMFH. Table 10-7 of the AWMFH provides suggested mortality rates for various poultry types. A volume factor of 2.5 is recommended for use. Include in the design of the composting facilities a primary composting unit into which alternate layers of low moisture content manure, carbon source material (straw is common), and dead animal carcasses are placed. A secondary composting unit is often necessary to complete the composting process.

Composting Facility – In-Vessel

Rotary drum composting is a type of in-vessel composting which uses a drum partially filled with composting material that can be rotated by mechanical means. As organic material is added to the drum, the drum is rotated to mix the new ingredients. This results in a faster composting process than with other methods. Design the in-vessel composter to be rotated by mechanical means and with automatic aeration system (forced-air). Due to short cycle time required when used for production poultry, it is critical that the compost mix be managed for optimum temperatures. This may require keeping a pile of material "hot" for use in the drum. This may be accomplished by mixing various carbonaceous and bulking materials at the proper moisture in a pile outside the drum so that it preheats to 130° F or more before being added to the drum composter.

a. Design. Rotary drum composter design capacity is determined by the actual weight of mortalities during the cycle divided by the design drum loading rate of 3 pounds of mortality per gallon of total drum capacity. When used for poultry, determine the actual weight of mortalities from producer records, or use the following formula to determine composter capacity:

$$\text{Vol (gal)} = \frac{\text{Nb x M x Wb x WF}}{3}$$

Where: Nb = number of birds in flock
M = mortality rate as a decimal
Wb = weight of birds at maturity
WF = weight factor (use 0.25 for birds with Wb of 4.5 lbs or less, 0.33 for larger birds)

This design capacity may be used to select the size and number of rotary drum units required. Actual volume requirements for a specific flock can vary greatly from this design volume.

If the mortality is pre-processed before being placed in the rotary drum composter, the size of the rotary drum can be smaller than the design capacity calculated using the above equation. Size the rotary drum composter for the pre-processed mortality based on manufacturer's recommendations. Manufacturers of these types of rotary durm composters shall provide adequate documentation that the equipment operates in accordance with this conservation practice standard.

In case of larger than normal losses, excess material may be removed from the rotary drum, stockpiled on a concrete pad, and covered with at least 6 inches of carbonaceous or bulking material. Protect the material from rain, and then finish the composting process as a static pile.

Maintain the rotary drum composter either under a suitable shelter or on a concrete pad with a minimum thickness of 4 inches thick concrete. Extend the pad 4 feet in front and 2 feet in back and sides of the unit.

e. Operation. Operate and maintain the rotary drum composter in accordance with the manufacturer's instructions. On initial start-up, fill the drum to one-fourth capacity with carbonaceous material. Add mortalities and an approximately equal volume of carbonaceous material and rotate the drum until the contents are thoroughly mixed. Do not fill the drum above approximately 75% of its total height in order to insure a thorough and complete mixing of the contents when the drum is rotated. Monitor the moisture content and temperature of the compost daily during the composting period. Take appropriate steps n as needed to maintain the moisture content and temperature at the required levels.

After the flock is sold, place final mortality in composter and rotate each day for three days. Then rest the compost for three days. If the internal temperatures have been sufficient (above 130^{o}F), finish the composting process as a static pile, and land apply or haul off-site the compost.

Other animals and food processing wastes from agricultrual operations can successfully be composted. Contact the state environmental engineer for guidance on design criteria for composting other animals or wastes from agricultual operations in a rotary composter.

CONSIDERATIONS

Consider developing an initial compost mix with a carbon to nitrogen ratio of at least 30:1 to reduce most offensive odors.

Consider minimizing 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.

Composting of waste organic materials should improve water quality by eliminating alternative methods of disposal that could pollute ground and surface water. Soil amended with compost will have an increased available moisture content, which will result in some additional storage of water in the soil profile resulting in less leaching. Caution must be taken to prevent spreading compost near surface waters because high organic matter content could cause oxygen depletion problems and other related problems.

Evaluate site paving needs in terms of effects of equipment operation on trafficability, soil compaction, and potential for contamination from compost and petrol products.

Minimize the effects of odors by adding buffer area, vegetative screens, and natural landscape features can help. Consider locating the facility in such a manner as to not interfere with vehicle traffic.

Increased surface area favorably affects evaporation and natural aeration and increases the area exposed to infiltration from precipitation in uncovered stacks. Align piles north to south and maintain moderate side slopes to maximize

solar warming. Align windrows to avoid accumulation of precipitation.

Heat generated by the process causes the compost pile to dehydrate. As the process proceeds, material consolidates, and the volume of voids through which air flows decreases. Select materials for the composting mix to 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.

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.

Composting operations require close management. Assess management capabilities of the operator and availability of labor as part of the planning and implementing process.

Consider providing additional storage for manure and carbon source material for dead bird composting.

Compare benefits associated with the ultimate use of the composted material to the capital expenditure and operating costs of the composting operations. In addition to cost return, include benefits such as environmental protection, improved handling, disposal of dead poultry and other farm animal carcasses, odor control, and reduced need for storage volume.

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. Include as a minimum in the engineering plans and specifications:

- Location of facility.
- A plan view of composting facility layout including access road to facility, setbacks distances form water bodies streams, sensitive areas, property line, etc.
- Dimensions of the composting facility.
- Type of and number of animals or volume of material the facility is designed to accomodate.
- Structural details of all components.
- References to components supplied by others (eg. truss design).
- Special safety requirements.
- Drainage/grading plan as needed.

OPERATION AND MAINTENANCE

Develop an operation and maintenance (O&M) plan that is consistent with the purposes of this standard, its intended life, safety requirements, and the criteria for its design. Include in the O&M plan recipe ingredients and sequence that they are layered and mixed, maximum and minimum temperature for operation, land application rates, moisture level, management of odors, testing, monitoring temperatures, etc. Make adjustments to the recipe as needed throughout the composting period to ensure proper composting processes. Record any changes in the recipe.

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

Inspect the compost facility regularly when the facility is empty. Replace deteriorated wooden materials or hardware. Patch concrete floors and curbs as necessary to assure water tightness. Examine roof structures for structural integrity and repaired as needed. Inspect exposed metal components for corrosion. Wire-brush and paint corroded metal as necessary.

State in the operation and maintenance plan that composting is a biological process and 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

ASAE Standards
EP 288.5
EP 486
AWMFH
ASTM D 1760-96
Florida NRCS Conservation Practice Standards,
Nutrient Management, Code 590
Waste Utilization, Code 633

Waste Storage Facility, Code 313
General Manual
Title 420-Part 401
Title 450-Part401
Title 190-Parts410.22 and 410.26
National Cultural Resources Procedures Handbook
"National Design Specification for Wood Construction," National Forest Products Association
NEH, Part 637, Chapter 2, Composting
National Environmental Compliance Handbook
National Food Security Act Manual
National Planning Procedures Handbook
Florida Supplements to Parts 600.1 and 600.6