NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

COMPOSTING FACILITY

(NO.)

CODE 317

DEFINITION

A facility to process raw manure or other raw organic by-products into biologically stable 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;
- A composting facility can be constructed, operated and maintained without polluting air and/or ground and surface water resources;
- There is a need to improve air quality by reducing the emissions of odorous gases;
- The facility is operated as a component of an agricultural management system, including a compost utilization plan;
- the risk of spread of disease is reduced;
- nuisances such as flies, vermin, and scavenging animals are prevented

CRITERIA

Federal, State, and Local Laws

Disposal of compost as well as the installation and operation of the composting facility shall adhere to all federal, state, and local laws, rules and regulations. It is the responsibility of the producer to secure any permits necessary to install structures and for properly managing the facility on a daily basis. Compost sold or moved off-farm may be subjected to registration or licensing from the Ohio EPA.

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.

Siting

Facilities shall have the following minimum separation distances from wells

Minimum setback distances from water supply wells, sinkholes & agricultural drainage wells

Water well designation	Composting facilities and burial pits
Public water system supply well (Community, and Non-transient Non-community (NTNC))	Not within the inner management zone (1 year time of travel), or not within 1000 ft. when the time of travel has not been established
Public water system supply well (Community, and Non-transient Non-community (NTNC))	Not within a protection area determined as highly susceptible (5 year time of travel)
Transient non-community (TNC) public water system supply well	300 ft
Private water supply well not controlled by the owner of the facility to be installed under this practice	300 ft
Private water supply well controlled by the owner of the facility to be installed under this practice	100 ft
Known Sinkhole or Agricultural Drainage well	300 ft. unless it is determined by an engineering geologist or registered professional engineer that a lesser distance with special design considerations will not cause pollution; in this case the distance can be reduced to 100 ft

A subsurface geological exploration is required for all facilities to determine conditions that may adversely affect groundwater quality or foundation stability. The exploration shall extend a minimum of three (3) ft. below the bottom of the planned facility.

The bottom elevation of the composting facility shall be located a minimum of 3 feet above the seasonal high water table and on soils with an acceptable permeability that does not allow materials to contaminate the ground water. In addition, the facility and its siting shall meet all applicable regulations or the facility shall be installed on concrete slabs or other appropriate liners.

Ideally, 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 flood event, or larger.

Locate compost facilities where movement of odors toward neighbors will be minimized. Prevailing winds and landscape elements such as buildings, landforms and vegetation should be considered. Buffer areas, vegetative screens, and natural landscape features can help minimize the effects of odor, in addition to protecting the visual resource.

Composting facilities should be located as near the source of organic material as practical with consideration given to:

(a) The location of neighboring dwellings and how they will be affected by prevailing winds.
(b) Location of ingress and egress so as not to interfere with traffic flow or utilities.
(c) Location of the access for easy loading and unloading of compost.

The area surrounding the composting facility will be subject to a high traffic load during loading, mixing, and unloading. This area must be a well-drained stable area. It is recommended that this area be concrete or gravel with filter fabric for ease of clean up and stability.

Direct surface runoff away from the compost facility. Direct contaminated runoff from compost facilities to an appropriate storage or treatment facility for further management. Leachate and runoff from a composter without a roof shall be collected, stored and/or utilized as per the operation and maintenance plan. It is required to 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. Runoff may be treated by meeting the requirements of Vegetative Treatment Area (635) or Constructed Wetlands (656).

Compost Mix

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

Pile Configuration

Windrows and static piles should be triangular to parabolic in cross-section. Windrows and static piles shall be aligned to avoid accumulation of precipitation. Positive drainage shall be maintained on the pad parallel to the windrows. Windrows and static piles shall be rounded to shed rainfall.

Carbon-Nitrogen Ratio

The initial compost mix shall result in a carbon to nitrogen (C:N) 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.

Carbon Source

A dependable source of carbonaceous material with a high C:N ratio shall be stored and available to mix with 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, provision shall be made for its salvage.

Moisture Level

Provision may be made for maintaining adequate moisture in the compost mix throughout the compost period within the range of 40 to 65 percent (wet basis).

In high precipitation climatic regions, care shall be taken to prevent excess moisture from accumulating in the compost. Facility 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 135^{o}F for at least 3 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 135^{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.

Facility Type

Selection of the composting facility/method shall be based on the availability of raw material, the desired quality of final compost, equipment, labor, time and land available.

Structural: Facility structural elements such as permanent bins, concrete slabs and roofs shall meet the requirements of Waste Storage Facility (313) and Waste Facility Cover (367) as applicable. Details of material requirements shall be determined by the designer on a case by case basis. All posts and planks shall be pressure-treated and all metal shall be galvanized.

In-Vessel Composters may be used when all the following conditions are met:

- In addition to the in-vessel composter, the overall composting system must include a minimum of 30 days combined storage for curing and storage phases
- When the management goal is to reduce pathogens, the manufacturer documents that the in-vessel composter will produce temperatures that will rise above 135° F for a 3-day period or greater throughout the compost mass for year round operation.
- The manufacturer documents that material at the composter discharge point can be maintained at a wet basis moisture content of 45 to 60%, and all provisions necessary to achieve this moisture content such as carbon amendments and supplemental air are incorporated into the design
- The in-vessel manufacturer has been building on-farm composters for a minimum of 5 years; or if the manufacturer does not have a 5 year history, provide documentation during project planning
    - NRCS in another state has accepted the system, or

    - Published data from a university that validates attainment of the performance requirements of this standard
- The manufacturer must certify that the composter has a minimum functional design life of 10 years
- The manufacturer provide operating instructions for the system to achieve necessary composting temperatures and finished moisture content to achieve the composting management objectives for the entire system; and provide maintenance instructions to assure the 10 year functional design live can be achieved

Composting Pads- The following pad types are acceptable for roofed or unroofed facilities:

- Type I or Type II concrete slab as defined in the Ohio Concrete Construction Standard
- A gravel pad meeting the requirements of Heavy Use Area Protection (561) may be used when all the following apply
  - DRASTIC index is less than 160
  - Distance to aquifer zone is > 15 feet
  - Pad is underlain with a subgrade consisting of a 3' minimum thickness of soils in permeability groups II, III, or IV as listed in Table 10D-2 of AWMFH- Appendix 10D

Facility Size

Size the compost facility to accommodate the amount of raw material planned for active composting plus space required for curing.

Dimensions selected for elements of the compost facility shall accommodate equipment 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 this data is not available, locally established mortality rates for the type of operation shall be used. See "Animal Mortality Facility", Conservation Practice Standard (316).

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

Use of Finished Compost Land application of finished compost shall be in accordance with Nutrient Management (590) and Waste Utilization (633).

Biosecurity

It is very important for anyone working on or about poultry or animal farms to follow biosecurity techniques to prevent the spread of diseases. Biosecurity measures should be followed when working in or around poultry or animal buildings and where animals, manure, debris, and poultry manure exist. If possible, entry into poultry houses or animal facilities

should be avoided. However, if entry is necessary, the farm operator's permission is required.

CONSIDERATIONS

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.

A chemical neutralizing agent should be used if structural components do not provide adequate odor reduction.

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

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

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

Gravel pads, while acceptable under certain conditions, will require special care during operation so that gravel does not get displaced and mixed with the compost. When high quality finished compost is desired, a concrete pad is encouraged.

Successful operation of the composting facility should include all weather access for delivery of organic materials to the facility from areas of livestock production and for turning the compost.

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. All standard drawings shall be accepted for this practice provided that they comply with this standard and are approved by a Registered Professional Engineer in Ohio, or the Natural Resources Conservation Service, or are issued by the Extension Service. For standard drawings that originate in other states, special attention should be paid to the structure's ability to handle the snow or wind loads required in Ohio as stated in Conservation Practice Standard 367, Waste Facility Cover.

OPERATION AND MAINTENANCE

Develop a written operation and maintenance plan that is consistent with the purposes of this practice, and the life of the composting facility. Recipe ingredients and sequence that they are layered and mixed shall be given in the plan.

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

Manage the compost piles for temperature, odors, 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.

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.

As a minimum, the operation and maintenance plan shall include:

1. The mix proportions, moisture requirements, and materials to be used. Composting mix design spreadsheets developed by The Ohio State University, Ohio Agricultural Research and Development Center (OARDC) may be used to proportion the mix (referenced below).
2. The design sheet used to size the facility.
3. The process to be followed in loading the bins, windrows, or static piles.
4. Temperature monitoring requirements.
5. The aeration or turning schedule.
6. Frequently encountered mistakes in composting and brief "fix it" scenarios.
7. Utilization Plan as per the Waste Utilization Standard, 633.

To decrease the chances of fire, the bin walls shall be no more than 5 feet high and static piles or windrows shall be no more than 7 feet at the peak.

REFERENCES

Ohio EPA Composting rules (Ohio Administrative Code): http://codes.ohio.gov/oac/3745-27 (sections 40-47) and http://codes.ohio.gov/oac/3745-37

Composting mix design spreadsheets developed by The Ohio State University, Ohio Agricultural Research and Development Center (OARDC): http://www.oardc.ohio-state.edu/ocamm/t01_pageview3/Workshops_and_Conferences.htm

Murphy, D.W. and T.S. Handwerker, Preliminary investigation of composting as a method of dead bird disposal, Proc. National Poultry Waste Mgt. Symp., Columbus, Ohio; Apr 1988.

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Murphy, D.W. and L.E. Carr, Composting Dead Birds, Fact Sheet 537, Cooperative Extension Service, University of Maryland System.

Delaware Cooperative Extension Service, Delaware Two-Stage Composter; Construction Details, 1988.

Maryland Cooperative Extension Service, Maryland Free-Standing 2-Stage Composter; Isometric Poultry Composting Shed. 1988.1.

Murphy, D.W. Video. Composting Poultry Mortality. University of Maryland. Video Resource Center, 0120 Symons Hall, College Park, Maryland. 20742.

USDA, Soil Conservation Service, Animal Waste Management Field Handbook, Chapter 10, pages 58 - 62.

Fulhage, C., Water Quality Publication # 225, Composting Dead Swine, Extension Publications, University of Missouri-Columbia, 2800 Maguire, Columbia, MO 65211.

Arkansas Cooperative Extension Service, Suggested Composter Size, University of Arkansas, 2201 Brookwood Drive, P.O. Box 391, Little Rock, Arkansas 72203. (501) 671-2000

Arkansas Cooperative Extension Service, Recommended Operating Procedures (for) Swine Composting (Recipe), University of Arkansas, 2201 Brookwood Drive, P.O. Box 391, Little Rock, Arkansas 72203. (501) 671-2000

Arkansas Cooperative Extension Service, Basic Operating Procedures, University of Arkansas, 2201 Brookwood Drive, P.O. Box 391, Little Rock, Arkansas 72203. (501) 671-2000

Northeast Regional Agricultural Engineering Service, Cooperative Extension "On-Farm Composting Handbook", NRAES-54.