United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

ANIMAL MORTALITY FACILITY

CODE 316

(no)

DEFINITION

An on-farm facility for the treatment or disposal of animal carcasses due to routine mortality.

PURPOSE

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

- Reduce nutrient transport to surface water or groundwater resources.
- Reduce transport of pathogens to surface water or groundwater.
- Reduce impacts to air quality such as objectionable odors or greenhouse gas emissions.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to animal carcass storage, treatment, or disposal for routine mortality in livestock and poultry operations to protect air and water quality including drinking water source protection. Routine mortality is that which occurs at the normally anticipated rate.

This standard does not apply to catastrophic animal mortality. In cases of catastrophic animal mortality, use NRCS Conservation Practice Standard (CPS) Emergency Animal Mortality Management (Code 368). This standard does not apply to disposal of animals in any liquid manure or process wastewater system.

CRITERIA

General Criteria Applicable to All Purposes

Plan, design, and construct the animal mortality facility to meet all Federal, State, Tribal and local laws, rules and regulations. Notify landowner and/or contractor of their responsibility to locate all buried utilities in the project area, including drainage tile and other structural measures. The landowner is also required to obtain all necessary permits for project installation prior to construction.

Include the facility in the agricultural waste management system plan for the operation.

Meet the structural and foundational requirements of NRCS CPS Waste Storage Facility,

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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(Code 313) when designing slabs, walls, and support structures as appropriate.

Select the facility or management system based on cost, availability of raw material, desired quality and form of the final product, equipment, labor, time, land available, and other relevant factors. New or enhanced technologies, components and systems may be used as needed and when the technologies, components and systems meet NRCS standards and specifications.

Include provisions for closing and/or removing the facility where required.

Location

Locate the facility so that prevailing winds and landscape elements minimize odors, dust, and loss of visual resources.

Select a location for the facility that is consistent with the overall site plan for the livestock or poultry operation. Dimensions for the facility must accommodate the use of equipment to be used for loading, unloading, and any processing requirements. Locate the facility so that it is accessible by an all-weather access road with suitable ingress and egress. Avoid locations that would interfere with other travel patterns on the farm, such as livestock pathways and feed lanes.

Floodplain

Locate and design the facility such that it is outside the 100-year floodplain. If site restrictions require the location to be in the floodplain, protect the facility from inundation or damage from a 25-year flood event. Additionally, follow the policy found in the Title 190, General Manual, Part 410, Subpart B, Section 410.25, “Flood Plain Management,” which may require additional protection for storage structures located within the floodplain.

Springs or Wells

Locate the facility down-gradient from springs or wells or provide appropriate protection to prevent contamination of groundwater supply sources.

Stormwater Runoff

Maximize diversion of stormwater runoff from the facility. Control any non-diverted runoff and treat contaminated runoff as appropriate.

Roofs and Covers

Where a roof or cover is an integral component of the facility (such as a bin composter that requires a cover), use NRCS CPS Roofs and Covers (Code 367) as applicable. For other facilities, where necessary, provide adequate protection of the equipment from weather elements to extend the equipment lifespan.

Surface Treatment

Seed and mulch all areas disturbed by construction as needed. Use NRCS CPS Critical Area Planting (Code 342), to revegetate any areas where conditions prevent establishment of vegetation with normal seeding methods.

Use NRCS CPS Heavy Use Area Protection (Code 561), or Access Road (Code 560) for the areas used by vehicles to turn or move compost or carcasses, as applicable.

Safety

Provide warning signs, fences, refrigeration unit locks, and other devices as appropriate, to ensure the safety of humans and livestock.

Address biosecurity concerns in all aspects of planning, installation, operation, and maintenance of an animal mortality facility.

Plan, design and implement all installed electrical components to meet the requirements of the National Electrical Code (NEC) and any State, local or Tribal electrical codes that are more stringent. Protect power supplies from traffic by using bollards or install other safety measures as appropriate, such as signage.

Seepage Control
Determine if seepage will create a water quality concern based on soils and subsurface conditions. Where seepage is a concern, utilize the appropriate NRCS CPS Pond Sealing or Lining such as, Compacted Soil Treatment (Code 520), Geomembrane or Geosynthetic Clay Liner (Code 521), or Concrete (Code 522).
Locate the bottom elevation a minimum of 2 feet above the seasonal high water table, to protect the integrity of the liner, unless special design features are incorporated that address buoyant forces. The water table may be lowered by use of drains to meet this requirement.

Facility Size
Size the facility using established mortality rates for the type of animal operation and mortality system. Calculate mortality rate using site specific mortality records, comparable extension publications, other Federal/State methodologies or methods provided in Title 210, National Engineering Handbook (NEH), Part 637, Chapter 2, “Composting”, and 210-NEH, Part 651, Chapter 10, Section 651.1007, “Mortality Management.”

Temporary Storage
Where the mortality management system depends on cyclic operation (including, but not limited to, offsite disposal such as rendering), provide adequate capacity for temporary storage of carcasses until they can be processed or picked up. The temporary storage may be implemented as a pad or bin, a refrigeration unit, or other.

Use of Final Product
Utilize final product according to NRCS CPS Nutrient Management (Code 590), or other acceptable methodology that will provide water quality and environmental protection equivalent or superior to the criteria of CPS 590. The final product should not have any visible pieces of soft tissue remaining.

Additional Criteria for Composters or Composting

Moisture Control
Provide access to water to ensure proper moisture content is maintained to facilitate the composting process. Moisture should be maintained between 40–60 percent by weight.

Temperature
The facility shall have the capacity to maintain the compost temperature greater than 130° F for at least 5 days as an average throughout the compost mass followed by a compatible time for secondary composting. Additional turning of the compost during secondary composting will reduce pathogens and weed seeds and improve the product.

Facility Size
Size the compost operation to contain the carcasses and the raw additive material needed in the composting process, based on the estimated duration of a composting cycle and the expected rate of mortality. For static pile or windrow systems, size the facility using methods provided in Title 210, NEH Part 637, Chapter 2, “Composting”, and 210-NEH, Part 651, Chapter 10, Section 651.1007, “Mortality Management” or equivalent university extension publication. For enhanced systems which utilize forced air, rotary drum, or chopping/mixing preprocessing, size the facility based on university extension recommendations or manufacturer’s recommendations supported with data collected for similar operations.

Use of Chopper or Mixers, Forced Air, or Rotary Drum
Primary composting time can be reduced by cutting/grinding carcasses and mixing them with finished compost and a carbon source using either pile forced aeration or rotary drum composting. This process can reduce primary composting time to as short as 14 days and additionally can reduce potential nitrous oxide emissions. Reduction in the composting time required will result in a reduction in the needed facility size. Use manufacturer's recommendations or university extension publications to size the unit size based on calculated mortality rate.

Additional Criteria for Refrigeration Units

General
Size refrigeration units in conjunction with other animal mortality technologies such as incinerators or gasifiers based on the loading cycle to improve energy use efficiency.

Ensure refrigeration units are compatible with the emptying mechanism. Protect the refrigeration unit from precipitation and direct sunlight as deemed appropriate.

Use the manufacturer's recommendations for unit design, construction, power source and installation. Refrigeration units must be constructed of durable material, be leak proof, and have a life expectancy compatible with other aspects of the waste management system.

Place the refrigeration units on a pad of sufficient strength to withstand vehicle traffic loads during box or tray handling.

Temperature
The refrigeration units will be self-contained models designed to refrigerate or freeze animal carcasses before decomposition occurs. Maintain carcasses to be rendered between 22° and 26° F. Store carcasses that will be composted, incinerated, or gasified at 35° and 36° F which is above freezing to facilitate burning and to reduce the composting time or amount of fuel needed to incinerate or gasify the carcasses.

Alternative Power Source
Provide an alternative source of power, where available, to maintain the integrity of the freezing process during power outages. Where an alternative power source is not available, identify the contingencies for disposal of the animal carcasses in the operation and maintenance plan.

Additional Criteria for Incinerators and Gasifiers

General
Use a Type 4 Incinerator (as defined by the Incinerator Institute of America for human and animal remains) that has been approved for use within the State. Gasifiers must meet all applicable State air quality and emissions requirements. Size the unit based on manufacturer's recommendation based on the calculated mortaltiy rate. Remove ashes daily or according to manufacturer recommendations.

Location
Locate the incinerator/gasifier a minimum of 20 feet from any structure. Place the unit on a concrete pad appropriate to the size of the equipment with the fuel source as distant as practical. If the incinerator/gasifier is covered with a roof, provide a minimum air space between the chimney and any combustible roof part of at least 6 inches, or as recommended by the manufacturer, or as required by building codes, whichever is greater.

Capacity
Size the incinerator/gasifier to handle the average maximum daily animal mortality during a growing cycle. Refrigeration units may be used in conjunction with the incinerator/gasifier to improve the loading cycle and fuel use efficiency of the incineration/gasification unit.

Additional Criteria for Alkaline Hydrolysis and Dehydration
When either of these methods are selected, follow manufacturer's recommendations supported with data collected for similar operations. When using these methods, the carcasses must be completely processed. Liquid and bone remain from alkaline hydrolysis verses a dried carcass in dehydration. Either plan for immediate use of the resultant material or design storage in a manner that will not cause odors such as storing dehydrated material in a dry environment. The final product can be utilized according to NRCS CPS Nutrient Management (Code 590), or other acceptable methodology.

Use refrigeration temporary storage to optimize batch efficiency.

CONSIDERATIONS

Major considerations in planning animal mortality management are:

- The management capabilities of the operator.
- Available equipment and land application area at the operation.
- The economics of the available alternatives.
- The degree of pollution control required by State and local agencies.
- Effect on wildlife and domestic animals, including minimizing interactions with predators and opportunistic scavengers, some of which may be vectors, and spread disease.
- Location of the facility in relation to the source of mortality, biosecurity, and limiting facility visibility by the general public.

Consider increased level of designed treatment for sites with high priority areas for source water protection or are upstream of community drinking water withdrawal sites. Also consider increased levels of treatment in watersheds where water quality impairments have been shown to have impacted the designated use of downstream waterbodies.

For facilities that are organic producers or that sell compost to organic producers, ensure that the treated lumber used in the facility meets the requirements for organic production. The producer should consult with the organic certifier as to the use and acceptability of the lumber whether treated or not.

Additional Considerations for Composting
Use of in-vessel or bins can improve the space efficiency of composting systems. Consider the type of equipment available when siting and placing bins in the floor plan. Concrete kick walls can be used to reduce wear on boards when concrete is handled using a front end loader. Open floor or channel systems may be used to reduce labor when using automated turning equipment or when carcasses have been preprocess shredded and mixed with carbon material. Use of preprocessing equipment, such as grinding and mixing can shorten the time needed to process mortality. The repeated cutting and mixing of carcasses with finished compost and a carbon source maximizes tissue exposure and batch uniformity to positively influence microbial activity overall.

Composting of any mortality will be hindered if the carcasses are allowed to freeze. Dead animals or birds should be placed in the compost mix as quickly as practical or kept in a dry,

nonfreezing environment until added to the compost mix. Frozen carcasses will require more composting time and will likely require more management to ensure that adequate temperatures are reached during the composting process.

Poultry operations often experience higher rates of mortality as the birds reach maturity.

Leachate, odor, flies and scavenger issues are greatly mitigated through use of preprocessing, forced air, or rotary drum.

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

slopes. Orient windrows to prevent ponding of surface runoff.

Protect compost facilities from the wind in cold or dry climates. Wind protection may help prevent excess drying of the compost. Windbreak/Shelterbelt Establishment and Renovation (CPS 380) may be used for this purpose.

Minimize blown-in rain by providing roof overhang.

Impacts to visual resources can be reduced by screening the facility from view. Hedgerow Planting (CPS 422) may be appropriate for this purpose.

Additional Considerations for Greenhouse Gas Reduction

Consider the use of in-vessel composting or composting with a minimum of one turning per week for the first 5 weeks will reduce greenhouse gas emissions. Greenhouse gas emissions are increased when composting in low oxygen conditions. Low oxygen conditions facilititates the growth of microorganisms that produce methane and nitrous oxide both of which are greenhouse gases more potent than carbon dioxide. Additionally, incinerators and gasifiers typically burn fuels which result in the release of carbon dioxide.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for animal mortality facilities that describe the requirements for applying the practice according to this standard. As a minimum, include in the plans and specifications—

- A plan view showing the location and extent of the practice.
- Pertinent elevations of the facility, if applicable.
- Construction drawings and specifications for the planned mortality facility.
- Quality of materials.
- Drainage/grading plan, if needed.
- Structural details of all components.
- Temporary erosion control measures during construction.
- Vegetative requirements.
- Safety measures, such as signage, physical barriers (fences, bollards, machine guards, etc.) or electrical cutoffs, as appropriate.

OPERATION AND MAINTENANCE

The operation and maintenance (O&M) plan developed for the animal mortality facility will become part of the overall waste management plan. The plan should document necessary actions to ensure that the practice performs adequately.

As a minimum, include the following information in the O&M plan:

- Method and procedures of mortality disposal for normal losses.
- Odor management or minimization requirements.
- Biosecurity protocols.
- Safety measures and procedures.
- Periodic inspections.
- Need for prompt repair or replacement of damaged components.
- Site references and/or manufacturer or installer for troubleshooting.

Additional Operation and Maintenance for Composters

Compost Recipe. Include a recipe of ingredients which gives the ingredient quantities and layering/mixing sequence.

Carbon-Nitrogen Ratio. The initial compost mix should result in a carbon-to-nitrogen (C:N) ratio between 25:1 and 40:1. Compost with a lesser C:N ratio can be used if nitrogen mobilization is not a concern.

Carbon Source. Store a dependable source of carbonaceous material with a high C: N ratio to mix with nitrogen-rich waste materials. Up to 50 percent of the carbonaceous material may consist of the finished compost material. If this is done, adequate blending of the carbonaceous material and the finished compost is required. Include information about recycling of finished compost as carbonaceous material if applicable for the site.

Provide an estimate of the volume of carbon source needed for proper operation of the composter as a volume per unit time to assist the producer in determining storage needs.

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 nonbiodegradable material that is salvaged at the end of the compost period. Make provision for the salvage of any nonbiodegradable material used in the composting process.

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

Moisture Level. Maintain adequate moisture in the compost mix throughout the compost period within the range of 40 to 60 percent (wet basis). Prevent excess moisture from accumulating in the compost in high precipitation climatic regions. This may require the facility to be covered.

Temperature of Compost Mix. Closely monitor temperatures above 165°F. Take action immediately to cool piles that have reached temperatures above 185°F. If the pile is too hot, turn it to aerate the pile and release heat build-up.

Turning/Aeration. The frequency of turning/aeration should be appropriate for the composting method used, and to attain the desired amount of moisture removal and temperature control while maintaining aerobic degradation and reducing potential for nitrous oxide emissions.

Monitoring. The operation and maintenance plan should state that composting is a biological process that needs monitoring and management throughout the composting period to ensure proper composting processes. The operation may need to undergo some trial and error in the start-up of a new mortality composting facility. Manage the compost piles for temperature, odors, moisture, and oxygen, as appropriate. Test the finished compost as appropriate to

ensure that the required decomposition has been reached. Include the method, procedure, and record-keeping requirements for proper utilization of compost.

Scheduling. Provide a management table to assist the producer in using the appropriate bins when needed. The management table should show the days a bin is filled, in use and emptied.

Odors. To reduce offensive odors, increase the carbon-nitrogen ratio or reduce the moisture to less than 60 percent (wet basis). A carbon nitrogen ratio of 30:1 in the initial mix should have minimal 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.

Additional Operation and Maintenance for Enhanced Composting

Mix materials in accordance with the design and the manufacturer's recommendations. Follow the maintenance plan for the equipment (including things such as greasing bearings, belt inspections, etc.).

Additional Operation and Maintenance for Incinerators and Gasifiers

Use the incinerator and gasifier only for the disposal of animal carcasses.

Operate the unit properly to maximize equipment life and minimize emission problems. Load the unit according to the manufacturer's recommendations.

Remove ashes frequently to maximize combustion and prevent damage to equipment. Include methods for collecting and disposing of the ash material remaining after incineration.

Inspect the unit periodically to ensure that all components are operating as planned and in accordance with the manufacturer's recommendations.

Additional Operation and Maintenance for Refrigeration, Alkaline Hydrolysis and Dehydration Units

Operate the unit properly to maximize equipment life and minimize potential problems.
Load the unit according to manufacturer's recommendations and do not exceed the design capacity. Use the unit only for the dead animals associated with the planned operation.
Inspect the unit periodically for leaks, structural integrity, and temperature for refrigeration units.

REFERENCES

Nutsch, A., J. McClaskey, and J. Kastner, Eds., 2004. Carcass disposal: a comprehensive review, National Agricultural Biosecurity Center, Kansas State University, Manhattan, Kansas.

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