

CARCASS DISPOSAL OPTIONS

Disclaimer: If you are referencing this information for mortality related to a registered CAFO, LMFO, or PFO, you must follow the disposal methods outlined by your Nutrient Management Plan (NMP).

Purpose:

To ensure Oklahomans have efficient access to mortality management practice options accepted by the state. Mortality management practices need to be accessible and efficient in times of loss. This document aims to provide Oklahomans with guidance on options you may select if a normal or catastrophic mortality occurs for your herd, flock, etc.

Mortality management practices should be planned out ahead of time to make the process easier when it occurs. Since mortalities happen for many reasons, having a plan for each situation is important. Situations can include natural causes, injuries, disease, and more.

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Summary of Disposal Options

1. RENDERING

A domestic animal carcass may be disposed of by delivering to a rendering facility within twenty-four (24) hours of death unless the carcass has been refrigerated or frozen.

2. LANDFILLS

See landfill list enclosed.

3. BURIAL

(See attached OSU Factsheets BAE-1748 and OSU ANSI-8820 or NRCS Code 368 Fact Sheet addressing this method)

The general carcass burial disposal guidelines are as follows:

- a. Burial of a domestic animal carcass requires the construction of a pit.
- b. Do not locate the burial pit closer than one foot (1') vertically above the flood plain, or within two feet (2') of the water table or bedrock.
- c. Do not locate the burial pit within three hundred feet (300') of wells, waters of the state, neighboring residences, public areas, or property lines.
- d. After placing the dead in the trench, cover the dead with a minimum of two and a half feet (2 W) of topsoil. Inspect burial sites routinely, add additional soil, if necessary, to ensure that wild animals are not digging and dragging the dead away.
- e. The burial pit shall be mounded so water does not pond. Surface rainwater shall be directed to flow away from pit.
- f. Also, refer to the Criminal Code of the Oklahoma Statutes (enclosed).

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4. INCINERATION

Open-air incineration of carcasses is not allowed unless the animal died of any contagious or infectious disease. Self-contained, closed incinerator and air curtain incinerators are allowed.

5. COMPOSTING

- a. The composting process shall be managed at all times to be practically odorless, prevent fly larvae development, prevent animal depredation, and prevent leaching of waste material which may cause water or soil contamination.
- b. A domestic animal carcass shall be reduced to brittle, easily broken bone after composting.
- c. A minimal peak temperature of 130 degrees Fahrenheit shall be achieved during the composting process to produce pathogen free compost.

6. ABOVE GROUND BURIAL

- a. Above ground burial of a domestic animal carcass requires the construction of a trench. The trench shall have an approximate depth of 24 inches. There shall be a carbon source placed in the trench at an approximate depth of 12 inches. The domestic animal carcass shall be placed on the carbon layer and covered with a soil cap. A suitable vegetative layer shall be planted or seeded on the soil cap.
- b. The domestic animal carcass layer shall be a maximum of two feet deep.
- c. An above ground burial trench shall not be located closer than one (1) foot vertically above the flood plain or within two (2) feet of the water table or bedrock.
- d. An above ground burial trench shall not be located within three hundred (300) feet of a well, waters of the state, neighboring residences, public areas, or property lines.
- e. An above ground burial trench shall not be located along any stream or ravine where a domestic animal carcass may become exposed through erosion of the soil, or where the land is at any time subject to overflow.
- f. After placing a domestic animal carcass in an above ground burial trench, the carcass shall be covered with a minimum of two and one-half (2 ½) feet of soil. If this is not attainable, fencing may be required around the trench area to ensure protection from animals.
- g. An above ground burial trench shall be mounded so water does not pond on the mounded area.
- h. An above ground burial trench shall be routinely inspected to add additional soil, if necessary, and to ensure that animals are not scavenging, digging, or dragging away a domestic animal carcass.
- i. Surface rainwater shall be directed to flow away or around the above ground burial trench.



Submitting Concerns/Complaints

- a. If you have concerns or complaints regarding improper disposal of animal carcasses, complaints can be submitted to the AEMS division.
- b. To submit a complaint, please go to: <https://ag.ok.gov/aems-complaint-form/>

COMPLAINTS

Complaints regarding animals, carcass disposal, CAFOs, PFOs and Pet Breeders and Shelters may be submitted to the Oklahoma Department of Agriculture, Food & Forestry using an online or printed form.

Forms:

- [Printable Complaint Form](#)
- [Online Complaint Form](#)
- [EPA Discrimination Complaint](#)

OKLAHOMA STATUTES CITATIONIZED

TITLE 21. CRIMES AND PUNISHMENTS

Section 1223 - Leaving carcasses in certain places unlawfully – Disposal of domestic animal carcasses

- A. It shall be unlawful for any person to leave or deposit, or cause to be deposited or left, the carcass of any animal, chicken or other fowl in any well, spring, pond or stream of water; or leave or deposit the same within one-fourth (1/4) mile of any occupied dwelling or of any public highway, without burying or disposing of the carcass in accordance with the recommendations and requirements of the Oklahoma Department of Agriculture, Food, and Forestry.
- B. It shall be the duty of the owner of any domestic animal in the State of Oklahoma to dispose of any carcass within twenty-four (24) hours after notice of the knowledge of the death. Disposal shall be in accordance with the recommendations and requirements of the Oklahoma Department of Agriculture, Food, and Forestry. It shall be unlawful to bury any carcass in any land along any stream or ravine where it may become exposed through erosion of the soil, or where the land is at any time subject to overflow.
- C. "Owner" shall mean and include any person having possession of domestic animals either by reason of ownership, rent, hire, loan, or otherwise.
- D. Any person who violates this section shall be guilty of a misdemeanor.

TITLE 2. AGRICULTURE

Chapter 1 -Agriculture Code

Section 2-18.1 -Pollution of Air, Land, or Waters Unlawful-Powers of Board – Orders - Penalties

- A. It shall be unlawful and a violation of the Oklahoma Agricultural Code for any person to cause pollution of any air, land, or waters of the state by persons which are subject to the jurisdiction of the Oklahoma Department of Agriculture, Food, and Forestry pursuant to the Oklahoma Environmental Quality Act.
- B. If the State Board of Agriculture finds that any of the air, land, or waters of the state which are subject to the jurisdiction of the Oklahoma Department of Agriculture, Food, and Forestry pursuant to the Oklahoma Environmental Quality Act have been or are being polluted, the Board shall make an order requiring that the pollution cease within a time period determined by the Department, or require a manner of treatment or of disposition of the water or other polluting material as may in the judgment of the Board be necessary to prevent further

pollution. In addition, the Board may assess an administrative penalty pursuant to Section 2-18 of this title. The person to whom the order is directed shall fully comply with the order of the Board and pay any fine and costs assessed.

- C.
1. Manure shall not be defined as or be considered a hazardous substance or hazardous waste as those terms are defined by state law.
 2. For purposes of this subsection, "manure" means any feces, urine, urea, or other excrement from livestock and shall also only include:
 - a. associated nonhazardous bedding, compost, raw materials, or other nonhazardous materials commingled with the excrement,
 - b. nonhazardous process water associated with the excrement or materials, or
 - c. nonhazardous byproducts, constituents, or substances contained in or originating from the excrement, materials, or process water.
 3. This subsection shall not be construed to affect or limit the applicability of any other provision of the Oklahoma Agriculture Code.

OKLAHOMA ADMINISTRATIVE CODE (OAC) TITLE 35

CHAPTER 18. CARCASS DISPOSAL

35:18-1-1. Purpose

- (a) These rules are for regulating the disposal of all domestic animal carcasses in Oklahoma pursuant to the provisions of Section 1223 of Title 21 of the Oklahoma Statutes.
- (b) The owner of any domestic animal shall be required to dispose of its carcass within twenty-four (24) hours after notice or knowledge of the animal's death.
- (c) These rules shall supercede any other rules related to carcass disposal in Title 35 of the Oklahoma Administrative Code, except for those related to licensed managed feeding operations pursuant to 35:17-3-17. These rules shall not apply to wildlife, but may be used as guidance in disposal of wildlife animal carcasses.

35:18-1-2. Definitions

The following words or terms, when used in this Chapter, shall have the following meaning, unless the context clearly indicates otherwise:

"Burial" means a process by which an animal carcass is disposed of by placement within an excavation into the soil or upon the soil surface where it is then covered by soil material.

"Composting" means the natural biological degradation of plant and animal matter in a controlled, well-aerated system.

"Domestic animal" means any cattle, bison, horses, sheep, goats, asses, mules, swine, domesticated rabbits, chickens, turkeys, other domesticated fowl, and any animal or bird in captivity.

"Incineration" means the controlled and monitored combustion of animal carcasses for the purposes of volume reduction and pathogen control and the final product is reduced to ashes.

"Landfill" means a solid waste disposal site permitted or approved by the Oklahoma Department of Environmental Quality.

"NRCS" means Natural Resources Conservation Service, an agency in the United States Department of Agriculture.

"Owner" means any person who has possession of a domestic animal by ownership, rent, hire, loan, or otherwise. This definition includes, but is not limited to, an owner or caretaker of an animal and any person who owns or is in control of land on which an animal carcass is found.

"Rendering" means the process or business of recycling animal carcasses and animal by products.

35:18-1-3. Unlawful acts

It shall be unlawful for the owner of any domestic animal to leave or deposit, or cause to be left or deposited, the carcass of any domestic animal in any well, spring, pond, or stream of water; or leave or deposit the carcass within one-fourth (1/4) mile of any occupied dwelling or of any public highway, without burying or disposing of the carcass pursuant to the provisions of this Chapter.

35:18-1-4. Methods of disposal

A domestic animal carcass may be stored in a freezer until such time as the owner is able to dispose of the carcass in one of the following methods:

(1) Burial shall only be used to dispose of a domestic animal carcass if the soil and site conditions are suitable and if no other reasonable alternative exists.

(A) Specific measures and practices shall be utilized to protect the ground and surface waters of the state. The local NRCS office may be available with initial evaluation or an owner may use the NRCS web soil survey tool to perform a desktop site evaluation, but actual site conditions shall be the determining factor when evaluating a site's suitability for burial of a domestic animal carcass.

(B) Requirements for burial of a domestic animal carcass are as follows:

- (i) Burial of a domestic animal carcass requires the construction of a pit or trench.
- (ii) A burial pit or trench shall not be located closer than one (1) foot vertically above the flood plain or within two (2) feet of the water table or bedrock.
- (iii) A burial pit or trench shall not be located within three hundred (300) feet of a well, waters of the state, neighboring residences, public areas, or property lines.
- (iv) A burial pit or trench shall not be located along any stream or ravine where a domestic animal carcass may become exposed through erosion of the soil, or where the land is at any time subject to overflow.
- (v) After placing a domestic animal carcass in a pit or trench, the carcass shall be covered with a minimum of two and one-half (2 ½) feet of soil.
- (vi) A burial pit or trench shall be mounded so water does not pond on the mounded area.
- (vii) A burial pit or trench shall be routinely inspected to add additional soil, if necessary, and to ensure that animals are not scavenging, digging, or dragging away a domestic animal carcass.
- (viii) Surface rainwater shall be directed to flow away or around the burial pit or trench.

(2) Composting of a domestic animal carcass may be utilized as a method of carcass disposal if the following requirements are met:

- (A) The composting process shall be managed at all times to be practically odorless, prevent fly larvae development, prevent animal depredation and prevent leaching of waste material which may cause water or soil contamination.
 - (B) A domestic animal carcass shall be reduced to brittle, easily broken bone after composting.
 - (C) A minimal peak temperature of 130 degrees Fahrenheit shall be achieved during the composting process to produce pathogen free compost.
- (3) A domestic animal carcass may be disposed of in a self-contained, closed incinerator. An air quality permit from the Oklahoma Department of Environmental Quality may be required.
- (4) A domestic animal carcass may be disposed of in a landfill approved to dispose of animal carcasses by the Oklahoma Department of Environmental Quality.
- (5) A domestic animal carcass may be disposed of by delivering to a rendering facility within twenty-four (24) hours of death, unless the carcass has been refrigerated or frozen.
- (6) A domestic animal carcass, other than poultry, may be disposed of by above ground burial.
- (A) Specific measures and practices shall be utilized to protect the ground and surface waters of the state. The local NRCS office may be available with initial evaluation or an owner may use the NRCS web soil survey tool to perform a desktop site evaluation, but actual site conditions shall be the determining factor when evaluating a site's suitability for above ground burial of a domestic animal carcass.
 - (B) Requirements for above ground burial of a domestic animal carcass are as follows:
 - (i) Above ground burial of a domestic animal carcass requires the construction of a trench. The trench shall have an approximate depth of 24 inches. There shall be a carbon source placed in the trench at an approximate depth of 12 inches. The domestic animal carcass shall be placed on the carbon layer and covered with a soil cap. A suitable vegetative layer shall be planted or seeded on the soil cap.
 - (ii) The domestic animal carcass layer shall be a maximum of two feet deep.
 - (iii) An above ground burial trench shall not be located closer than one (1) foot vertically above the flood plain or within two (2) feet of the water table or bedrock.
 - (iv) An above ground burial trench shall not be located within three hundred (300) feet of a well, waters of the state, neighboring residences, public areas, or property lines.
 - (v) An above ground burial trench shall not be located along any stream or ravine where a domestic animal carcass may become exposed through erosion of the soil, or where the land is at any time subject to overflow.
 - (vi) After placing a domestic animal carcass in an above ground burial trench, the carcass shall be covered with a minimum of two and one-half (2 ½) feet of soil. If this is not attainable, fencing may be required around the trench area to ensure protection from animals.
 - (vii) An above ground burial trench shall be mounded so water does not pond on the mounded area.
 - (viii) An above ground burial trench shall be routinely inspected to add additional soil, if necessary, and to ensure that animals are not scavenging, digging, or dragging away a domestic animal carcass.
 - (ix) Surface rainwater shall be directed to flow away or around the above ground burial trench.

35:18-1-5. Variances

Variances from these rules shall only be granted by the Department on a case by case basis. The granting of a variance shall not act as a precedent for any other case, whether similar or not. In each case where a variance is granted, the decision shall be thoroughly documented.

TITLE 27A. ENVIRONMENTAL AND NATURAL RESOURCES

Chapter 1 - Oklahoma Environmental Quality Act

Section 1-1-201 -Definitions

10. "Pollution" means the presence in the environment of any substance, contaminant or pollutant, or any other alteration of the physical, chemical or biological properties of the environment or the release of any liquid, gaseous or solid substance into the environment in quantities which are or will likely create a nuisance or which render or will likely render the environment harmful or detrimental or injurious to public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life, or to property.

TITLE 4. ANIMALS

Section 4-85.1 Definitions

As used in this act, "domestic animals" shall include all domestic animals including, but not limited to, cattle, bison, hogs, sheep, goats, equidae, chickens or other poultry and exotic livestock. The term "domestic animals" shall not include dogs and cats.

NOTE - Interpretation: No animal or poultry carcasses are allowed to lay in air, land, or waters of the state and naturally decompose. Carcasses should be properly disposed of by one of the methods listed on the front page of this document.

MUNICIPAL SOLID WASTE LANDFILLS

County	Facility Name	Phone	Accepts Dead Livestock
BECKHAM	Elk City Municipal Landfill	(580) 225-3246	No
BECKHAM	Sayre Municipal Landfill	(580) 928-3420	No
CANADIAN	OEMA Landfill	(405) 483-5402	Yes
CARTER	Southern OK Regional Disposal Landfill	(580) 226-1276	Yes
COMANCHE	City of Lawton Landfill	(580) 581-3468	Yes
COMANCHE	Ft. Sill Landfill	(580) 442-3266	No
GARFIELD	City of Enid Landfill	(580) 616-7382	Yes
GARVIN	Pauls Valley Landfill	(405) 238-2012	Yes
GRADY	Southern Plains Landfill	(405) 785-2060	Yes
JACKSON	City of Altus Landfill	(580) 477-0120	Yes ^{1,3}
KAY	Ponca City Landfill	(580) 767-0417	Yes ^{1,3}
LINCOLN	Center Point Landfill	(405) 567-3806	Yes
MAJOR	Red Carpet Landfill	(580) 776-2255	Yes ^{1,2}
MCCLAIN	Newcastle Landfill (Pinecrest)	(405) 387-9745	No
MCCURTAIN	City of Broken Bow Landfill	(580) 584-9445	Yes
MCCURTAIN	McCurtain County (Idabel) Landfill	(580) 286-5216	No
MUSKOGEE	Muskogee Security Landfill	(918) 682-7284	Yes ³
NOBLE	Northern OK Disposal	(580) 628-2445	Yes
OKLAHOMA	OKC Landfill	(405) 745-3002	Yes ⁴
OKLAHOMA	SE OKC Landfill	(405) 672-7379	Yes
OKLAHOMA	East Oak Sanitary Landfill	(405) 427-1112	Yes
OKMULGEE	Elliott Construction (Okmulgee) Landfill	(918) 733-2846	Yes
OSAGE	American Environmental Landfill	(918) 245-7786	Yes
OSAGE	Osage Landfill	(918) 336-3159	Yes ⁴
PAYNE	Stillwater Landfill	(405) 387-9745 ext. 201	Yes
PITTSBURG	City of McAlester Landfill	(918) 421-4967	No
PITTSBURG	Alderson Regional Landfill	(918) 426-0985	Yes ¹
PONTOTOC	City of Ada Municipal Landfill	(580) 436-1403	Yes ¹
PUSHMATAHA	Clinton Lewis Construction Landfill	(580) 298-3729	No
SEMINOLE	Sooner Land Management Landfill	(405) 257-6108	No
SEQUOYAH	Sallisaw Solid Waste Disposal Facility	(918) 775-4127	Yes
TULSA	Quarry Landfill	(918) 437-7773	No
WOODWARD	NW OK Solid Waste Disposal Authority	(580) 256-3975	No

Some landfills require prior notification before delivery of dead livestock. It is recommended you contact the facility before transporting any carcasses to the landfill.

Some landfills require documentation to be completed and signed concerning livestock's cause of death which could require a 24-hour time period.

¹ prefers low volume, 1 or 2 at a time

² less than 10

³ may accept, call to inquire before coming

⁴ may limit quantity

Landfills are regulated by DEQ. Visit their website for an updated list: https://www.deq.ok.gov/wp-content/uploads/land-division/active_waste_facilities.pdf. This list was contacted by AEMS staff to determine acceptance of dead livestock.



Proper Disposal of Routine and Catastrophic Livestock and Poultry Mortality

Josh Payne

Area Animal Waste Management Specialist

Proper management of on-farm animal mortalities is vital to every farming operation. Improper disposal of dead animal carcasses can negatively impact surface water and groundwater from carcass leachate. If the animal died of an infectious disease, pathogenic bacteria and viruses may be present within the carcass. These pathogens can be spread by insects, rodents, predators, and subsurface or above ground water movement, as well as through direct contact with other livestock or poultry leading to increased disease transmission risks. In addition, Oklahoma has rules regulating the disposal of livestock and poultry mortalities. Concerns associated with improper disposal can be avoided by practicing state approved carcass disposal methods.

State Approved Methods

The Oklahoma Department of Agriculture, Food and Forestry, or ODAFF, regulates livestock and poultry mortalities. In the event of a catastrophic mortality loss, ODAFF must be notified immediately. Catastrophic mortalities are defined as any death loss that exceeds the capacity of the current disposal system to accommodate those losses within 24 hours. For both routine and catastrophic mortalities, the state approved methods for carcass disposal are:

- burial
- landfills
- incineration
- rendering
- composting

Burial

Perhaps the most common method of disposal is burial. When proper guidelines are followed, burial is a safe option. However, poor site selection, such as sandy soils or areas with high water tables, may pose a threat to groundwater. Figure 1 illustrates the proper placement of a burial site with respect to distance from water bodies. The current (2009) Oklahoma burial guidelines are listed below. For additional regulations on carcass burial, refer to Oklahoma Statutes Title 21 Sections 1222 and 1223 found by searching www.oscn.net.

Oklahoma Cooperative Extension Fact Sheets are also available on our website at: <http://osufacts.okstate.edu>

- Burial of dead livestock and poultry requires the construction of a pit.
- The bottom of the burial pit must be at least 1 ft. above any floodplain level and at least 2 feet above the seasonal-high water table. If there is bedrock in the area, the bottom of the pit must be at least 2 ft. above the bedrock.
- The burial pit must be located at least 300 ft. away from any wells, waters of the state, neighboring residences, public areas or property lines.
- Carcasses must be covered with a minimum of 2.5 ft. of topsoil after placement in the pit. Burial pits should be routinely inspected to ensure wild animals do not dig and drag carcasses away.

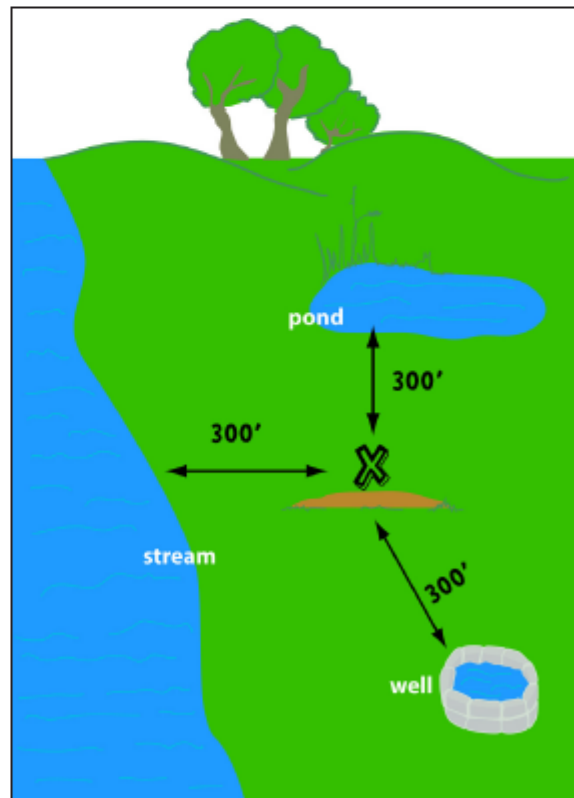


Figure 1. Site selection for burial.

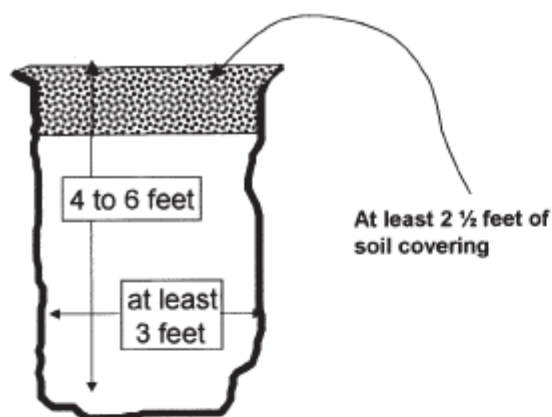


Figure 2. Cross sectional view of burial pit for disposal of poultry mortalities.

Landfills

Disposing of carcasses at a licensed landfill that accepts animal mortalities is another form of burial. Landfills may require notification before delivery and/or documentation from a licensed veterinarian stating the cause of death. Landfill tipping fees should be assessed and may range from \$20 to \$30/ton. Other considerations are transportation costs and breeches of biosecurity by moving carcasses off-farm. For a list of Oklahoma landfills that accept dead animals, visit www.poultrywaste.okstate.edu

Incineration

Incineration is a safe and effective means of carcass disposal, especially from the standpoint of biosecurity. The carcass is completely consumed by fire and heat within a self-contained incinerator. In Oklahoma, an air quality permit may be required by the Department of Environmental Quality (DEQ). This requirement is based on the size and quantity of carcasses burned. For questions concerning permit requirements, contact the DEQ at (405) 702-4100.

Incineration is mainly designed for smaller carcasses and fuel costs should be considered. Due to odor and emission concerns, open air incineration is not allowed in Oklahoma unless the animal died of an infectious or contagious disease.

Rendering

Another state approved carcass disposal method is rendering. This is a heat driven process that cooks the product while killing pathogens and converting it into a value-added product such as an animal feedstuff. These feedstuffs, such as meat and bone meal, are generally used as pet food ingredients. Although rendering is a very effective method, currently, there are few render-

ing services available. The transportation expense of collecting small volumes creates a financial obstacle for most rendering companies. Some rendering facilities require the producer to transport carcasses to the plant and pay a fee. Biosecurity and disease transmission risks should be considered when allowing vehicles on the farm and when transporting carcasses off-farm. Visit www.poultrywaste.okstate.edu for a current list of available rendering services.

Composting

Composting dead animal mortalities is an inexpensive, biosecure and environmentally sound approach to addressing the issue of carcass disposal. By definition, composting is a controlled biological decomposition process that converts organic matter into a stable, humus-like product. The carcass (nitrogen source) is buried in a bulking agent (carbon source), such as wood shavings, allowing for the proper carbon to nitrogen ratio (C:N) required by microorganisms to successfully decompose the carcass while absorbing excess moisture and filtering odor (Figure 3). The high temperatures (130 F to 150 F) achieved through proper composting will destroy most pathogens. Microorganisms will degrade the carcass leaving only a few small bone fragments, which are brittle and break easily. This valuable by-product can then be land-applied as a fertilizer source, adding nutrients and organic matter to the soil or recycled for new compost piles. As with burial, site selection is important. The site should be located in an area that does not pose a risk to surface or groundwater contamination.

Catastrophic losses are best composted in windrows of bulking agent due to the increased quantity of carcasses. Height, width and length of these windrows are dependent on the size and amount of carcasses to be composted. For both routine and catastrophic composting, piles must be appropriately managed to achieve proper decomposition and prevent scavenger invasion.

For additional information on composting livestock carcasses, refer to these resources:

- Auvermann, B., S. Mukhtar, and K. Heflin. 2006. Composting Large Animal Carcasses. Texas Cooperative Extension Publication E-422. College Station, TX. Available at: <http://tammi.tamu.edu/largecarcassE-422.pdf>
- Morse, D.E. 2006. Composting Animal Mortalities. Minnesota Department of Agriculture. St. Paul, MN. Available at: <http://www.mda.state.mn.us/news/publications/animals/compostguide.pdf>
- VanDevender, K., and J. Pennington. 2004. Organic Burial Composting of Cattle Mortality. University of Arkansas Cooperative Extension Publication FSA-1044. Little Rock, AR. Available at: http://www.uaex.edu/Other_Areas/publications/PDF/FSA-1044.pdf

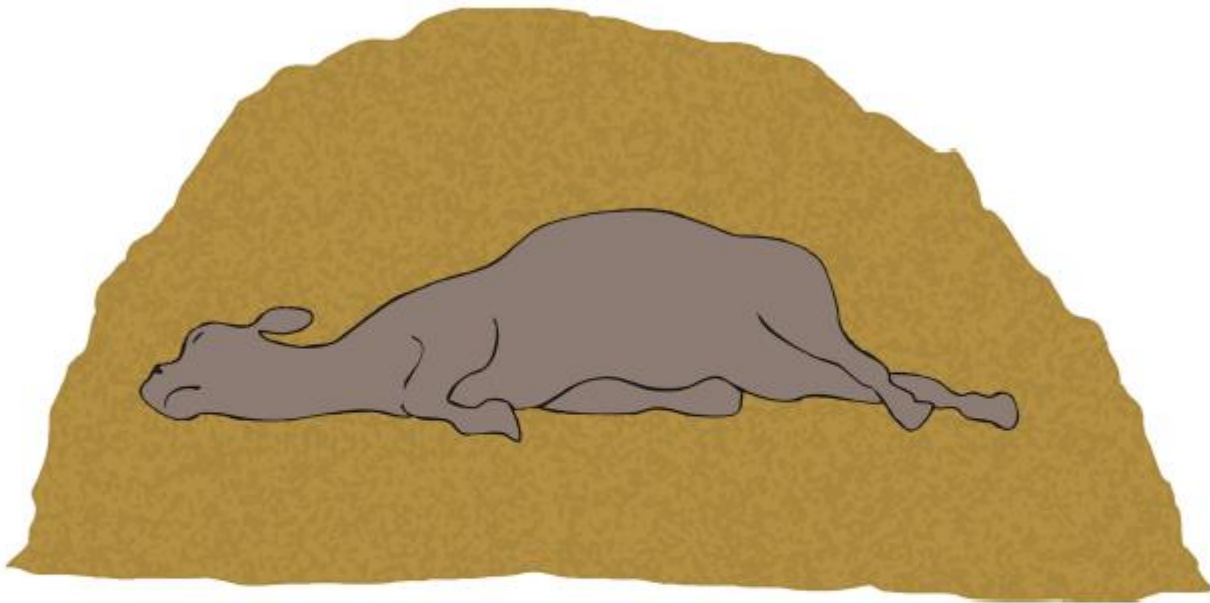


Figure 3. Illustration of composting livestock.

Summary

Proper livestock and poultry mortality disposal is essential to the sustainability and environmental stewardship of farming operations. In addition, state laws regulate disposal methods. By practicing the state approved methods, disease transmission risks to humans

and animals can be reduced. If you have questions about any of these carcass disposal methods, contact the ODAFF Agricultural Environmental Management Services at (405) 522-4659 or visit your local County Extension Office.



On-Farm Mortality Composting of Livestock Carcasses

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Oklahoma Cooperative Extension Fact Sheets
are also available on our website at:
<http://osufacts.okstate.edu>

Livestock mortality is an issue faced by every livestock farming operation, both large and small. For many producers, carcass disposal options are limited, can be costly, and may temporarily disturb the land needed for grazing. Improper disposal of dead animal carcasses and the resulting leachate (carcass fluids) can negatively impact surface water and groundwater quality. If the animal died of an infectious disease, pathogenic bacteria and viruses may be present inside the carcass, thereby increasing risk of disease transmission. Additionally, state regulations exist regarding the proper disposal of livestock mortalities. Oklahoma State University (OSU) Extension fact sheet BAE-1748 provides information about these regulations and the state approved methods for livestock carcass disposal, which include: burial, rendering, incineration, composting and landfills. Table 1 lists the criteria that determine the acceptability and desirability for each carcass disposal method.

Table 1. Goals of carcass disposal.

Fulfills regulations
Creates positive public perception
Reduces disease transmission
Promotes environmental sustainability
Produces beneficial by-product
Economical
Practical

Composting: Simple Solution for Large and Small Farms

One state approved procedure that livestock producers may not be familiar with is composting. Properly managed composting fulfills each of the desired goals established in Table 1. By definition, composting is a controlled biological decomposition process that converts organic matter into a stable, humus-like product. OSU fact sheet BAE-1744 describes the basic process of composting.

While backyard composting systems have a well-blended mixture of components (carbon and nitrogen), which results in a rapid compost cycle, livestock composting is a slower process. Composting livestock carcasses is characterized

by the break down of a large centralized nitrogen source (carcass) that is surrounded by a carbon source (bulking agent). This system requires an initial breakdown of the soft tissues on the exterior of the carcass, followed by thorough mixing to promote an ideal blend of carbon and nitrogen for effective composting.

Four key aspects of composting include:

- 1) Carbon to Nitrogen (C:N) ratio
- 2) Oxygen
- 3) Moisture content
- 4) Temperature

These four aspects determine the efficiency of the livestock composting system and are controlled by the bulking agent. The correct bulking agent provides the proper C:N ratio needed to successfully compost the carcass while ensuring adequate oxygen levels, maintaining ideal moisture and promoting heat retention. The bulking agent also contains any leachate and odors produced during the process, therefore acting as a filter between the carcass and the environment. Microorganisms will degrade the carcass leaving only a few small bone fragments, which are brittle and break easily. This valuable by-product can then be land applied as a fertilizer source, adding nutrients and organic matter to the soil, or reused for additional carcasses. The high temperatures (130 F to 150 F) achieved through proper composting will destroy most pathogens and weed seeds. Table 2 illustrates mortality losses of livestock in Oklahoma and the potential impact of mortality compost nutrients if land applied.

Steps to Composting Livestock Mortalities

Site Selection

One of the more important aspects of macro-composting is careful site selection. An ideal location for an exposed compost pile is an elevated site sufficiently distant from bodies of water and neighboring properties. The site should be located in an area that does not pose a risk to surface water or groundwater contamination. Figure 1 illustrates the proper placement of a compost site with respect to distance from water bodies.

Table 2. Annual Oklahoma cattle and calf death loss and carcass nutrient data.

	<i>Cattle</i>	<i>Calves</i>	<i>Total</i>
OK Inv. (# head)	2.1 million	3.3 million	5.4 million
Death Loss (%)	2.1§	6.4§	4.8
Mortalities (# head)	44,100	212,850	256,950
Average Wt. (lbs)	1246‡	460Ω	-
Avg. Mortality (lbs)	54.9 million	97.9 million	152.8 million
Projected Carcass C (lbs/head)	180	66.5	-
Projected Carcass N (lbs/head)	36	13.3	-
Total Projected C (lbs)	7.9 million	14.1 million	22.1 million
Total Projected N (lbs)	1.5 million	2.8 million	4.4 million
Projected Value of N†	\$556,500	\$990,817	\$1.5 million

† Based on a conservative value of \$0.35 per pound of N as Urea.

* This does not include the added value of increased organic matter, Ca, P, K or other nutrients.

§ National Death Loss Survey, USDA. 1996-2005.

‡ Livestock Marketing Information Center, LMIC. 1999-2008.

Ω National Stocker Survey, BEEF. 2008.

Exposed sites tend to get adequate airflow, but can be affected by local climate and weather patterns. Excessively dry or wet conditions may decrease compost efficiency. Picking an elevated site is desirable to reduce the risk of perched water tables and groundwater contamination. Site slope should be kept to a minimum to discourage excessive erosion around the pile and possible runoff.

Building a Compost Barrier

A barrier wall or fence is optional but does present some advantages during the composting process. At the very least in their design, barriers should guard against physical intrusion from livestock and predators, while restricting movement of carbon material. Barriers do not need to be elaborate or expensive. One inexpensive, yet effective approach is to construct a bin using 4 feet high field fence supported by four steel t-posts (Figure 2). Barriers can also be constructed permanently with a concrete floor, treated wood walls and a metal roof. The design is the producers' choice, but it should be based on the number of animals to compost and the investment level desired. Unrestricted piles must be sloped from the base to the peak much like a pyramid. However, using a barrier will contain the bulking agent depth in a smaller footprint, reducing the amount of C material required. This is an economical benefit that can recoup the cost of barrier construction (See Figure 3). Other options include old pallets, round hay bales or cattle panels.

Compost Bin Foundation

The bin foundation is not as important to the process of composting as to the ease of maintenance on the piles. Foundations range from the ground itself, to pallets, gravel and concrete. Again, the option is completely up to the producer. Using bare soil is acceptable if proper site selection was implemented, and the carbon pad beneath the carcass is of adequate depth to contain carcass leachate. Concrete, on the other hand, makes a very nice permanent foundation that is easy to clean and maintain. Consideration should be given to

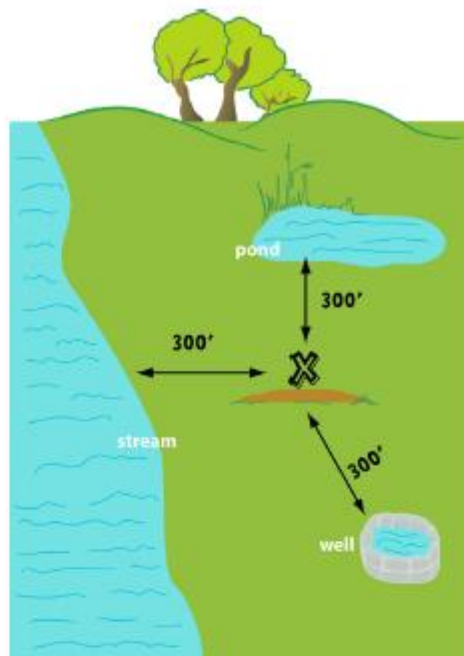


Figure 1. Site selection for composting.



Figure 2. Bin constructed from steel t-posts and net wire.

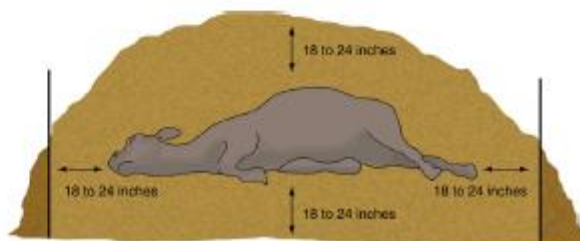


Figure 3. Proper pad design and carcass placement when composting livestock, as well as the potential reduction in required bulking agent when utilizing a barrier.

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the method of aeration, since foundations of gravel, pallets, etc. may prove to be difficult to mix and turn with equipment.

Carbon Source

A C source, preferably with a high C:N, must be chosen before construction can begin. Table 3 lists common C:N ratios for various compost materials. The C source is the “filter” between the carcass and the environment. Therefore, choosing the right carbon source is vital to the success of the livestock composting system. Sources of carbon should be easily obtainable in the local area. Any woody, stemmy or fibrous material usually makes a good C source. Common options are wood chips, shavings or sawdust, hay, straw, corn stubble, chipped tree limbs, rice hulls, etc. These all have moderate to high C:N ratios that when added to the nitrogen rich carcass promote efficient composting.

Select C sources that are fine to medium in porosity for optimum efficiency. Particle size is important in regulating air flow. Too much airflow can cool and dry out a pile, while too little airflow can inhibit oxygen availability, both of which can cause microbial activity to slow. Coarse sources, such as long-stemmed wheat straw, have poor thermal efficiency and allow excessive moisture to escape the pile. When dealing with these types of C sources, such as hay or straw bales, prior weathering or grinding is recommended.

Another recommended option is to incorporate manure with the selected C source. This addition can help to reduce the porosity and further homogenize the C:N. Note: If poultry litter is used in the compost mix, Oklahoma state law requires that it be covered overhead or surrounded by a compacted soil berm to prevent litter movement.

Building a Pad

For single calves up to 800 lbs, a foundation and pad built 8 ft² is sufficient. If there is a possibility of composting

mature cows, this footprint should be increased to 10 ft². The C pad is a very important feature in the composting process. Therefore, certain design rules should be adhered to. The roles of the C pad include providing thermal insulation from the foundation, a “filter” to absorb and contain carcass leachate while preventing its entry into the environment, and a carbon source for composting occurring at the bottom of the carcass. Therefore, the ideal pad should be 18 inches in depth for fine particle sources (shavings, rice hulls, etc.) and 24 inches for coarse particle sources (straw, corn stalks, etc.).

Carcass Placement & Water Requirements

The carcass should be placed on the center of the pad. The head and legs may need to be tied with baling twine to avoid obstruction through the pile (Figure 4). Once the carcass is placed on the pad, an incision should be made along the abdominal cavity, puncturing and deflating the rumen. If this procedure is not performed, the rumen can swell and rupture causing a portion of the pile to collapse. A further option is lancing the large muscle groups and opening the body cavity, exposing the internal organs. This procedure allows microbial access to the interior of the carcass and upon addition of the C source, speeds up decomposition.

The bulking agent used for the pad and cover should contain approximately 50 percent moisture by weight. If using a dry bulking agent, water should be added. Pond water works well because it contains an abundance of microorganisms. As a rule of thumb, the bulking agent should be moist to the touch, but you should not be able to squeeze out drops of water. If piles are too dry, microorganisms may die or remain inactive, resulting in cool piles with slow decomposition rates. If conditions within the pile are too wet, airflow is limited and oxygen availability is reduced, potentially leading to foul odors.

Adding the Carbon Cover

The C cover performs similar functions as the pad. As such, maintaining a thickness of at least 18 inches for fine particle sources and 24 inches for coarse particle sources will meet the desired goals. These goals include reducing odors to minimal or nonexistent levels, providing sufficient C for composting above and later inside the carcass, and in some cases providing a “cap” to shed excess rainfall. Yet, the cover plays the largest role in the efficiency of the decomposition process. Since heat rises and also carries moisture, the cover insulates the core from temperature loss and resultant moisture loss. Maintaining

Table 3. Common compost materials.

<i>Compost Material</i>	<i>C:N</i>
Sawdust ¹	442:1
Straw-wheat ¹	127:1
Rice hulls ¹	121:1
Straw-general ¹	80:1
Corn stalks ¹	60-73:1
Finished compost ¹	30-50:1
Hay-general ¹	15-32:1
Horse manure-general ¹	30:1
Cattle manure ¹	19:1
Grass clippings ¹	17:1
Sheep manure ¹	16:1
Turkey litter ¹	16:1
Broiler litter ¹	14:1
Swine manure ²	14:1
Cottonseed meal ¹	7:1
Soybean meal ¹	4-6:1
Animal carcass ²	5:1

¹On-Farm Composting Handbook, Agriculture, and Engineering Service, NRAES-64, Natural Resource, Ithaca, New York.

²Compost Materials, 1996 EBAE172-93, North Carolina Cooperative Extension Service, Raleigh, North Carolina.



Figure 4. Carcass placed in center of the pad with head and legs tied to avoid obstruction.



Figure 5. Carcass surrounded with at least 18 inches of bulking agent.

an adequate C cover thickness of ideal porosity is the key to optimum livestock composting. In rainy areas, piles should be designed with steep crowns to shed rainfall.

Managing the Pile

Internal pile temperature should be monitored using a long-stem thermometer throughout the composting process (Figure 6). The pile should begin to heat within the first day or two, transitioning from the moderate to high temperature phase. Internal pile temperatures should reach more than 130 F. This is due to the metabolic energy produced by the active

Estimates per 100 lb cattle carcass		
Water	→	7 gals
Carbon	→	15 lbs
Nitrogen	→	3 lbs
Phosphorus	→	0.7 lb
Additional Requirements per 100 lb cattle carcass		
Carbon Source	→	1 cubic yard
Water	→	1 gal to 2 gals



Figure 6. Long-stem thermometer used to monitor temperature.

10 Steps for Proper Large Animal Carcass Composting

1. Construct barrier and base at chosen site.
2. Prepare carbon pad at least 18 inches deep.
3. Place animal in center, ensuring the carcass is at least 24 inches from the pad edge.
 - a. If necessary, use baling twine to hold legs and head in position.
4. Lance rumen to deflate gas buildup.
5. Add water to carcass and pad until C source is damp but not wet.
6. Finish with at least 18 inches of carbon cover over the entire carcass.
7. For exposed piles, form a steep peak to shed excess water.
8. After 75 days, the first heat cycle should be finished. Turn the pile while mixing and aerating the carbon material. Large bones should remain in the core of the pile.
9. After 150 days, the second heat cycle is nearing completion. Turn the pile again to further cure.
 - a. Remaining bone fragments should be brittle but can be placed in the next pile for complete decomposition.
10. Land apply the material as you would fertilizer or use to compost additional carcasses.

microorganisms. Over time, the microorganisms consume the available soft tissue, carbon and oxygen within the pile. As microbial activity decreases, the temperature within the pile begins to drop, thus entering the cooling phase. This process may take one month to five months depending on climate, C source, etc. Opening the pile too soon may lead to an undesirable release of foul odors. Once the temperature drops 30 F below maximum temp, or below 110 F, it is time to turn the pile.

Using a front end loader, turn the pile while mixing the remaining carcass and bulking agent. Introduce new oxygen by cascading the bulking agent from the loader into the pile (Figure 7). Assess moisture levels to determine if water should be added. Make sure all carcass parts are once again covered with adequate bulking agent depth. A similar rise and fall in temperature should occur as active microorganisms decompose bones. If properly managed, the pile should begin to enter the curing process. At this point, the producer can decide to land apply the compost as a valuable fertilizer source or aerate the pile again to further cure. The finished compost can also be recycled to seed the new pile with microorganisms or used as a bulking agent with new mortalities. Any remaining large bones should be brittle and break easily (Figure 8). If desired, they can be added to another compost pile for further decomposition.

Since all producers may not have access to a long-stem thermometer, it is beneficial to have a timeline for correct pile management. OSU research on livestock composting has shown that by 75 days after adding a carcass, the first heat cycle is ending, and it is recommended to turn the pile.



Figure 7. Turning the pile with a front-end loader.



Figure 8. A hollow, brittle femur bone following 150 days of composting with pine shavings and poultry litter mixture.

Following proper aeration, the second heat cycle will be completed in an additional 75 days. Final turning and aeration can be performed at this time. Compost piles should not be turned any sooner than this, as these guidelines are minimum time requirements. Other factors that can lengthen turn times include cool winter temperatures, which slow the decomposition process, and larger carcasses, which require a longer decomposition time.

An OSU field study conducted in southeast Oklahoma, near Stigler, compared three bulking agents for composting stocker calf carcasses. The treatments consisted of pine shavings (S), a 50:50 mixture of pine shavings and poultry litter (S&L), and hay (H). Each treatment was replicated four times, and piles were turned on days 75 and 150. The findings indicated that S, S&L and H treatments were all effective at decomposing stocker calf soft tissue over a 150 day period. Shavings and S&L treatments formed a humus-like product and were more effective at decomposing bones when compared to the H treatment. Additionally, S and S&L treatments maintained sufficient temperatures required for effective pathogen reduction or elimination, while H treatments lost heat and moisture due to a higher porosity (Figure 9).

Windrowing for Multiple Mortalities

When composting multiple livestock mortalities, establishing windrows of bulking agent is recommended due to the increased quantity of carcasses. Site selection and pad width and depth should follow previous bin construction recommendations. However, pad length and carcass placement differ slightly. The back of one carcass may rest on the legs of the adjacent carcass as illustrated in Figure 10. Assure 24 inches of space from the carcass to the edge of the pad. Providing a fence structure may not be feasible. Therefore, properly covering the carcass with 24 inches of bulking agent is essential to prevent scavenger invasion. The length of the pile is dependent on the number of mortalities to be composted. Pile management should follow similar recommendations as previously outlined for bin structures.

Summary

Sustainable livestock production requires proper management of on-farm mortalities regardless of farm size. These methods should adequately dispose of animal carcasses without negatively affecting the environment, while also remaining economical to the producer. When properly managed,

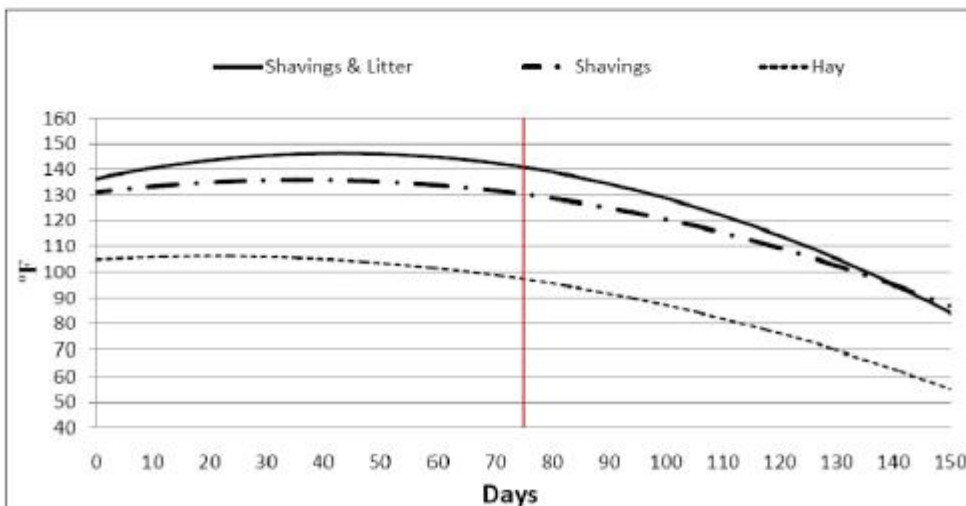


Figure 9. Temperature variation over time of pine shavings and poultry litter mixture (S&L), pine shavings (S) and hay (H) compost piles each containing a stocker calf.

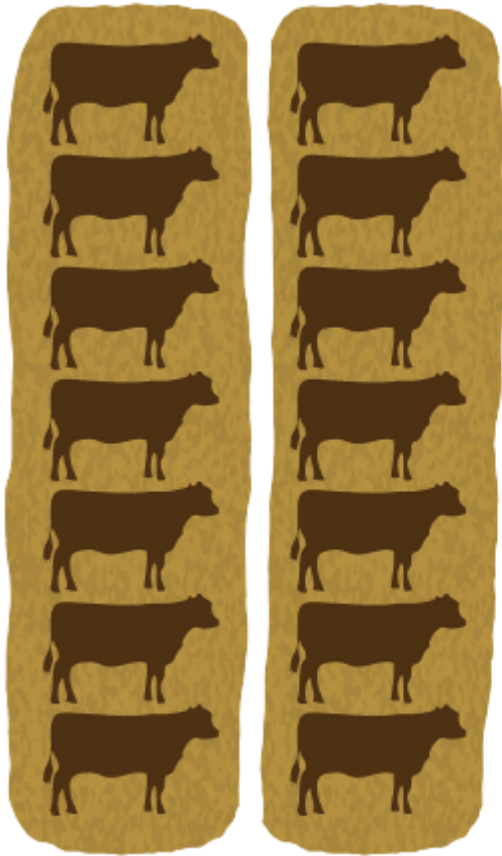


Figure 10. Windrow composting for multiple mortalities.

composting livestock mortalities is a safe, effective option for producers to consider, while producing a valuable soil amendment.

For additional information on composting livestock carcasses, refer to these resources:

Auvermann, B., S. Mukhtar, and K. Heflin. 2006. Composting Large Animal Carcasses. Texas Cooperative Extension Publication E-422. College Station, TX. Available at: <http://tammi.tamu.edu/largecarcassE-422.pdf>

Bonhotel, J., L. Telega, and J. Petzen. 2002. Natural Rendering: Composting Livestock Mortality and Butcher Waste. Cornell Waste Management Institute. Ithaca, NY. Available at: <http://compost.css.cornell.edu/naturalrenderingFS.pdf>

Morse, D.E. 2006. Composting Animal Mortalities. Minnesota Department of Agriculture. St. Paul, MN. Available at: <http://www.mda.state.mn.us/news/publications/animals/compostguide.pdf>

VanDevender, K., and J. Pennington. 2004. Organic Burial Composting of Cattle Mortality. University of Arkansas Cooperative Extension Publication FSA-1044. Little Rock, AR. Available at: http://www.uaex.edu/Other_Areas/publications/PDF/FSA-1044.pdf



Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD
EMERGENCY ANIMAL MORTALITY MANAGEMENT

CODE 368

(no)

DEFINITION

A means or method for the management of animal carcasses from catastrophic mortality events.

PURPOSE

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

- Reduce impacts to surface water and ground water including downstream drinking water sources
- Reduce the impact of odors
- Decrease the spread of pathogens

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to animal operations where a catastrophic event results in the need to manage animal carcasses.

This standard may not apply to catastrophic mortality resulting from disease. In cases of disease-related catastrophic mortality, this standard is applicable only when the appropriate State or Federal authority (typically the State veterinarian or USDA Animal and Plant Health Inspection Service (APHIS)) approves the use of the methods in this standard.

This standard does not apply when animal carcasses are contaminated with hazardous waste, potentially hazardous or radioactive material.

This standard does not apply to routine animal mortality. For routine animal mortality, use NRCS Conservation Practice Standard (CPS) Animal Mortality Facility (Code 316).

CRITERIA

General Criteria Applicable to All Purposes

Plan, design, and construct this practice to comply with all Federal, State, Tribal, and local regulations. The landowner must obtain all necessary permissions from regulatory agencies or document that no permits are required. The landowner and contractor are responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

Address biosecurity concerns in all aspects of planning, installation, operation, and maintenance of a catastrophic animal mortality operation. Provide warning signs, fences, refrigeration unit locks, and other devices, as appropriate, to ensure the safety of humans and livestock. Include provisions in the design for closing or removing temporary components of the emergency mortality management operation, where required.

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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Plan for the maximum size animals that might be dealt with and in conjunction with a complete depopulation schedule for the facility. In lieu of more site-specific data, use the following animal carcass densities.

Table 1. Animal Densities

Animal	Density ¹ pounds per cubic foot
Beef cattle	60
Dairy cattle	62
Horse	60
Poultry	60
Sheep	65
Swine	60

¹ Data source: NRAES-54. On-farm Composting Handbook, table 7.4.

Onsite Disposal

Location

Choose the location of onsite mortality management activities using the following criteria:

- The prevailing winds and landscape elements minimize odors and protect visual resources.
- Down-gradient from springs or wells, where possible, or take steps necessary to prevent ground water contamination.
- Above the 100-year floodplain elevation unless site restrictions require location within the floodplain and the management operations located within the floodplain are portable and can be quickly relocated if it becomes necessary (i.e., loading site for transportation to offsite disposal location).
- Where runoff from the 25-year, 24-hour storm can be diverted around the site.
- Where ingress and egress for mortality management will not interfere with other travel patterns on the farm, such as livestock pathways, feed lanes, and other ongoing daily activities.
- Where a minimum of 2 feet between the bottom of the mortality management site and the seasonal high water table can be achieved unless special design features are incorporated that address seepage.
- Follow State regulations for required distances away from streams, lakes, deep wells, residences, drains, and other sensitive features, as applicable.

Refer to applicable soil interpretations found in the "Disaster Recovery Planning" category under "Soil Suitabilities and Limitations for Use" in the Web Soil Survey (<https://websoilsurvey.nrcs.usda.gov/app/>) as an initial screening tool to identify areas that are likely to be most suitable for this practice. If a suitable location cannot be found on the farm for onsite disposal, use an offsite disposal method.

Use the criteria in NRCS CPS Critical Area Planting (Code 342) to revegetate all areas disturbed by mortality management activities, as applicable.

Burial pit or trench

General

Bury catastrophic mortality onsite or as otherwise directed by State and local regulatory agencies. More than one pit/trench (pit) may be required. When possible, time the burial of catastrophic mortality to minimize the effects of mortality carcass expansion during the early stages of the decay process. Where possible and permitted by State law, leave large animal mortality uncovered or lightly covered until bloating has occurred, or use methods to reduce or vent thoracic and abdominal cavities to eliminate bloating. Retain topsoil to regrade the disposal site after the ground has settled as the decay process is completed.

Remove or render inoperable all field drainage tile (subsurface drains) within the operational area of the burial pit.

Soil suitability

Perform an onsite soils investigation to determine the suitability of the site for a burial pit. Locate burial pits on soils that do not flood and that do not have a water table within 2 feet of the bottom of the burial pit. Avoid areas that have the presence of hard bedrock, bedrock crevices, or highly permeable strata at or directly below the proposed pit bottom. These sites are unacceptable because of the potential pollution of ground water.

Seepage control

Where seepage will create a potential water quality problem, provide a liner that meets the requirements of the NRCS National Engineering Handbook (NEH) (Title 210), Part 651, Chapter 10, Appendix 10D, "Design and Construction Guidelines for Waste Impoundments Lined with Clay or Amendment-treated Soil," or other acceptable liner technology.

Size and capacity

Size the pits to accommodate the catastrophic mortality using appropriate weight to volume conversions shown in table 1. Construct the pit bottoms to be relatively level. Soil suitability and slope may limit the length of the pit. Separate multiple pits by a minimum of 3 feet of undisturbed or compacted soil. Place a minimum of 2 feet of cover over the mortality. Provide a finished grade for the burial site that is above natural ground elevation to accommodate settling and to reduce ponding from precipitation events. Divert runoff from burial location.

Burial trench safety

Use excavation techniques that are Occupational Safety and Health Administration (OSHA) compliant. For pits that are 4–5 feet deep, provide a step or bench 18 inches wide and 1 foot deep dug around the perimeter of the main pit so that the remaining vertical wall will not exceed 4 feet. For pits greater than 5 feet deep, provide earthen walls that are sloped at 2 horizontal and 1 vertical or flatter. Use barriers to keep vehicular traffic at least 4 feet from the edge of the pit. Keep equipment, animal carcasses, stockpiled soil, and other materials a minimum of 2 feet from the edge of the burial pit.

Composting

If composting mortality is planned, refer to NRCS 210-NEH, Part 637, Chapter 2, "Composting," and Part 651, Chapter 10-651.1007, "Mortality Management" design requirements.

Plan for the needed amount and type of carbonaceous material required to facilitate the composting action.

Protect composting mortality from precipitation as necessary or provide an appropriate filter area or means for collecting contaminated runoff. Cover dead animals in static piles or windrows with a minimum of 18 inches of sawdust, finished compost, or other carbonaceous material to discourage scavenging animals and minimize odors. Do not protect the piles or windrows from precipitation or scavengers by covering with an impervious material as air exchange and oxygen are needed to fuel the composting action.

Incinerators and gasifiers

General

Use type 4 (human and animal remains) incinerators approved for use within the State. Gasification (a high temperature method of vaporizing biomass without direct flame but with oxidation of the fumes in an after-burning chamber) must meet all applicable State air quality and emissions requirements.

Capacity

Base the minimum incinerator or gasifier capacity on the average weight of animals times the number of animals in the event. Refrigeration units may be necessary in conjunction with incinerators and gasifiers to improve the loading cycle and fuel use efficiency of the incineration or gasification unit.

Open-air burning

Open-air burning involves combustion of waste at high temperatures, converting the waste into heat, gaseous emissions, and ash. The gaseous emissions are vented directly into the atmosphere in the human breathing zone without passing through a stack or chimney.

Open-air burning operations are strictly regulated, usually by State and/or local officials. A permit is usually required to perform open-air burning, if it is allowed at all.

Open-air burning includes burning carcasses in open fields and on combustible open heaps, or pyres, or air curtain destructors. Burning must take place as far away as possible from the public. Local conditions and circumstances may determine if this is a feasible disposal option to choose.

On-farm preprocessing may be required prior to open-air burning. Preprocessing could include the grinding of carcasses that can be transported in sealed containers or subjected to fermentation or freezing. However, grinding or shredding of carcasses infected with an infectious disease such as highly pathogenic avian influenza (HPAI) is not recommended because of the risk of aerosolizing the virus.

Use NRCS CPS Critical Area Planting (Code 342) to revegetate all areas disturbed by burning operations.

Temporary mortality storage with refrigeration unitsGeneral

Catastrophic mortality may be held in refrigeration units prior to disposal. Because of the large number of dead animals normally encountered in a catastrophic mortality situation, if refrigeration is used, it is likely that multiple units will be needed. Use refrigeration units with a construction compatible with the mechanism to be used to empty the refrigeration unit. Where necessary, provide protection for the refrigeration unit from precipitation and direct sun.

The refrigeration unit design, construction, power source, and unit installation will be in accordance with manufacturer's recommendations. Refrigeration units will be constructed of durable material and leakproof.

Place refrigeration units on a pad of suitable strength to withstand loads imposed by vehicular traffic used to load or remove mortality from the unit.

Temperature

The refrigeration units will be self-contained units designed to freeze animal carcasses before decomposition occurs. Maintain carcasses to be rendered between 22–26°F. Carcasses that will be composted, incinerated, gasified, or burned should be stored a few degrees above freezing to facilitate burning and to reduce the composting time or amount of fuel needed to incinerate or gasify the carcasses.

Capacity

Size the refrigeration units to accommodate the volume of mortality. When calculating the volume required, use the number of dead animals, the average weight of the animal, and a conversion factor for weight to volume.

Power Source

Provide an adequate source of power for cooling or freezing carcasses or both.

Offsite Disposal

In some instances, onsite disposal of all or a portion of the mortality may not be practical. In these instances, transportation and disposal by a third party at an offsite facility will be necessary. Tipping fees for offsite services will be required.

Transportation

Truck beds, trailers, dumpsters, etc. used to transport mortality to another location for disposal will be leakproof, tarped, and covered. Farmer and contractor will comply with all requirements established by local and Federal regulatory agencies.

Rendering

Rendering animal mortalities involves conversion of carcasses into three end products—carcass meal, melted fat or tallow, and water—using mechanical processes (e.g., grinding, mixing, pressing, decanting, and separating), thermal processes (e.g., cooking, evaporating, and drying), and chemical processes (e.g., solvent extraction). When the proper processing conditions are achieved the final product is free of pathogenic bacteria and unpleasant odors.

In an outbreak of disease such as foot and mouth disease, transport and travel restrictions may make it impossible for rendering plants to obtain material from traditional sources within a quarantine area. Additionally, animals killed because of a natural disaster, such as a hurricane, might not be accessible before they decompose to the point that they cannot be transported to a rendering facility and must be disposed of onsite.

Use of some pharmaceuticals may eliminate rendering as a option, due to residual of some drugs in the end products. Producers should contact renderer on what to avoid.

Collect and transfer animal mortalities in a hygienically safe manner according to State and local rules and regulations.

Landfill

Use Subtitle D landfill sites for animal carcass disposal. State and local governments will have reviewed approved Subtitle D landfill sites, and the necessary environmental protection measures will be preexisting; therefore, landfills represent a disposal option that generally poses little risk to the environment.

Modern Resource Conservation and Recovery Act Subtitle D landfills are highly regulated operations, engineered and built with technically complex systems specifically designed to protect the environment. The environmental protection systems of a Subtitle D landfill are generally more robust than those small, arid, or remote landfills that meet U.S. Environmental Protection Agency (EPA) criteria for exemption from environmental protection systems. Subtitle D landfills would likely be less prone to failure following high organic loading from the disposal of large quantities of carcass material than those exempt from EPA criteria.

In many States disposal of animal carcasses in Subtitle D landfills is an allowed option. However, it is not necessarily an available option as individual landfill operators generally decide whether to accept carcass material.

Producers should verify with individual landfill operators to determine availability for a particular event and for any requirements to utilize the landfill. Some landfills may require bagging of carcasses for disposal. During an emergency or instance of catastrophic loss, time is often very limited; therefore, landfills offer the advantage of infrastructures for waste disposal that are preexisting and immediately available. Furthermore, the quantity of carcass material that can be disposed of in landfills can be relatively large.

CONSIDERATIONS

Major considerations in planning emergency animal mortality management include—

- Available equipment and land application area at the operation.
- The management capabilities of the operator.
- The emotional impact on the producer caused by the mortality losses.
- The degree of pollution control required by State and local agencies.

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- Effects on wildlife and domestic animals.
- The economics of the available alternatives.
- Effects on neighbors (aesthetic, odors, traffic on public roads).

Consider taking measures to maintain appropriate visual resources, reduce odor, and provide dust control. Measures may include use of existing vegetative screens and topography to shield the catastrophic animal mortality disposal from public view, to reduce odors, and to minimize visual impact.

An alternative to prevent bloating of catastrophic mortality includes opening animal thoracic and abdominal cavities and viscera prior to placing the required cover.

Consider using the applicable operating procedures described in USDA Animal and Plant Health Inspection Service "Emergency Carcass Management, Desk Reference Guide."

State requirements for recordkeeping vary. State or local regulations may require recording items such as burial site location, type and quantity of mortality, burial date, photographs documenting the burial process, and other pertinent details.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for emergency animal mortality management to comply with this standard and that describe the requirements for applying this practice to achieve its intended purpose. As a minimum, include—

- Contact information for State authorities since they may have specific requirements dependent upon cause of death, animal species, and housing.
- Amount, type, and weight of mortality.
- Layout and location of on-farm mortality management activities.
- Number, capacity, and type of on-farm disposal methods.
- Grading plan showing excavation and fill. Include drainage features, as appropriate.
- Soil and foundation findings, interpretations, and reports, as appropriate.
- Requirements for onsite disposal (i.e., composting, burial, etc.) and quantity of materials, as appropriate.
- Structural details of all components, as appropriate.
- Vegetative requirements for preventing erosion, as appropriate.
- Odor management or odor minimization requirement.
- Name, location, and contact information for the selected offsite transportation and disposal facility if offsite disposal, such as rendering or landfilling, will be used.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan specific to the facilities installed for use by the landowner or operator responsible for operation and maintenance. The plan should provide specific instructions for operating and maintaining facilities to ensure they function properly. At a minimum, address—

- Specific instructions for proper operation and maintenance of each component of this practice. Detail the level of inspection and repairs needed to maintain the effectiveness and useful life of the practice.
- Safety considerations.
- Biosecurity concerns in all aspects of installation, operation, and maintenance.
- Contact(s) and phone numbers of person(s) to contact for catastrophic losses (figure 1).
- Maintaining recordkeeping of number, average weight, cause, and date of animal deaths.
- Method and procedures of catastrophic mortality disposal.

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- Periodic inspections of disposal sites, as appropriate.
- Prompt repair or replacement of damaged components, as appropriate.
- Site references and/or manufacturer or installer for trouble shooting mechanical equipment, as appropriate.

Additional Operation and Maintenance for Burial

- Inspect after significant storm events and at least twice a year to identify maintenance needs.
- Inspect burial site for settlement and cracks in soil cover. Maintain at least 2 feet of soil cover as final cover over carcasses. Add soil and regrade the carcass burial site as decay and settlement occur.
- Regrade area if runoff is flowing onto the location of the burial site.
- Promptly repair and revegetate bare spots and eroded areas. Apply fertilizer and lime as appropriate to maintain vigorous vegetation.
- Inspect for damage from rodents or burrowing animals. Repair any damage and take appropriate corrective actions to prevent further damage.
- In areas where animal encroachment is excessive, install a barrier (temporary fence) around the burial site to protect against scavengers such as bears, coyotes, etc., or add additional cover.
- When the site can be returned to use, remove and properly dispose of fencing materials, if used. Level the land to original grade.

Additional Operation and Maintenance for Composting

- Identify operational information and equipment that will need to be readily available.
- Locate, as soon as practical, a source for carbonaceous material sufficient to provide for the catastrophic event.
- Include a recipe of ingredients that gives the layering or mixing sequence.
- Provide maximum and minimum temperatures for operation, land application rates, moisture level, management of odors, testing, etc.
- Become familiar with composting methods and procedures as soon as practical.
- Instructions for monitoring temperature and moisture, and how to adjust as necessary to ensure that the compost operation is proceeding as planned.
- Instructions for turning the pile as appropriate.
- In areas where animal encroachment is excessive, install a barrier (temporary fence) around the burial site to protect against scavengers such as bears, coyotes, etc., or add additional cover.
- When the site can be returned to use—
 - Remove and properly dispose of fencing materials, if used.
 - Collect any bones remaining on the soil surface and disposed of them properly.
 - Level the land to original grade.
- Instructions for properly utilizing the finished compost.

Additional Operation and Maintenance for Incinerators and Gasifiers

- Operate units properly to maximize efficiency of disposal and minimize emission problems.
- Load the units 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. Plan for ash weight of up to 20 percent of carcass weight.

Additional Operation and Maintenance for Refrigeration Units

- Load the refrigeration unit according to manufacturer's recommendations and do not exceed the

- design capacity.
- Inspect the refrigeration unit periodically for leaks, structural integrity, and temperature.

Figure 1. Emergency Mortality Response Contacts and Farm Information

**EMERGENCY MORTALITY RESPONSE
Emergency Contacts and Farm Information**

Plan Date:	
Farm Name:	
Owner/Operator:	
County:	
Physical Address of Facility:	
Directions to Facility:	
Emergency Contacts	
Local Veterinarian:	
On-Call Veterinarian:	
Integrator	
Other:	
Local Emergency Number:	
List of Agencies to notify within 24 hours	
State Animal Health Agency:	
State Veterinarian:	
Federal Area Veterinarian in Charge:	
Heavy Equipment Contractor	
for handling carcasses:	
for excavating burial pits:	
Composting Material Supplier:	
Incinerator:	
Landfill:	
Rendering Facility:	
Other (specify):	

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