Chapter 8

Dead Animal Disposal

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DEAD ANIMAL DISPOSAL - GENERAL

Managing dead animals in livestock and poultry growing situations is continually a greater challenge. Throwing them in the creek or ditch on the backside of the property has never been legal, and it is absolutely unacceptable. Today's environmental climate calls for proper and environmentally sound methods of dead animal disposal. Several disposal options are available. Those that are allowed by the South Carolina Department of Health and Environmental Control are:

1. Burial
2. Constructed Disposal Pit
3. Composting
4. Incineration
5. Daily Pickup
6. Freeze and Pickup
7. Landfilling

Burial

Burial of dead animals has long been the common on-farm approach to disposing of dead animals. This is a viable alternative. Typically this method consists of digging a large pit or trench, inserting dead animals daily, and covering them with one to two feet of soil. Often these pits or trenches fill with water and carcasses may actually float to the surface. The water in the pit is very bacteria-laden and may be a hazard to both animal and human health. There is also high potential for ground water contamination from both bacteria and nutrients.

Burial trenches and pits must have at least a 2.0 foot separation between the bottom of the trench and seasonal high groundwater level. The pits should also have a berm to divert rainfall and runoff from the site. The soil should be able to infiltrate any rainfall that fall directly into the pit.

Vectors (dogs, rats, snakes, flies, etc.) are potential problems in a burial situation. If a producer chooses this method for disposal of dead animals, the carcasses must be covered daily as to reduce vectors in and around the trench or pit.

When a burial pit is full, the site should be capped with a 2 foot mound of soil so that precipitation is not allowed to collect in the closed pit. Also, the area should be grassed as to prevent erosion. The burial area should be monitored so that these conditions remain after settling of decomposing carcasses and capping material.

Regulation 61-43 allows burial of dead animals based upon the following conditions;

1. Proximity to the 100-year floodplain
2. Soil type
3. Depth to the seasonal high water table
4. No burial site should be flooded with surface water.
5. Animals within a burial site must be covered daily with sufficient cover to prohibit exhumation from feral animals (dogs, coyotes, etc.)
6. When the burial site is full, the area should be capped and grassed to prevent erosion.
7. Other factors that the Department may see as relevant.

Constructed Disposal Pit

Constructed disposal pits are most commonly used in the poultry industry. Typically, they are open bottom septic tanks with an opening to insert dead birds. These units must also have at least 1.5 feet of separation between the bottom of the pit and the water table. Birds are dropped into the pit and left to decompose. These pits, just as earthen pits and trenches, have the tendency to fill with water, thus, causing potential groundwater contamination. Also, they may be quite odorous.

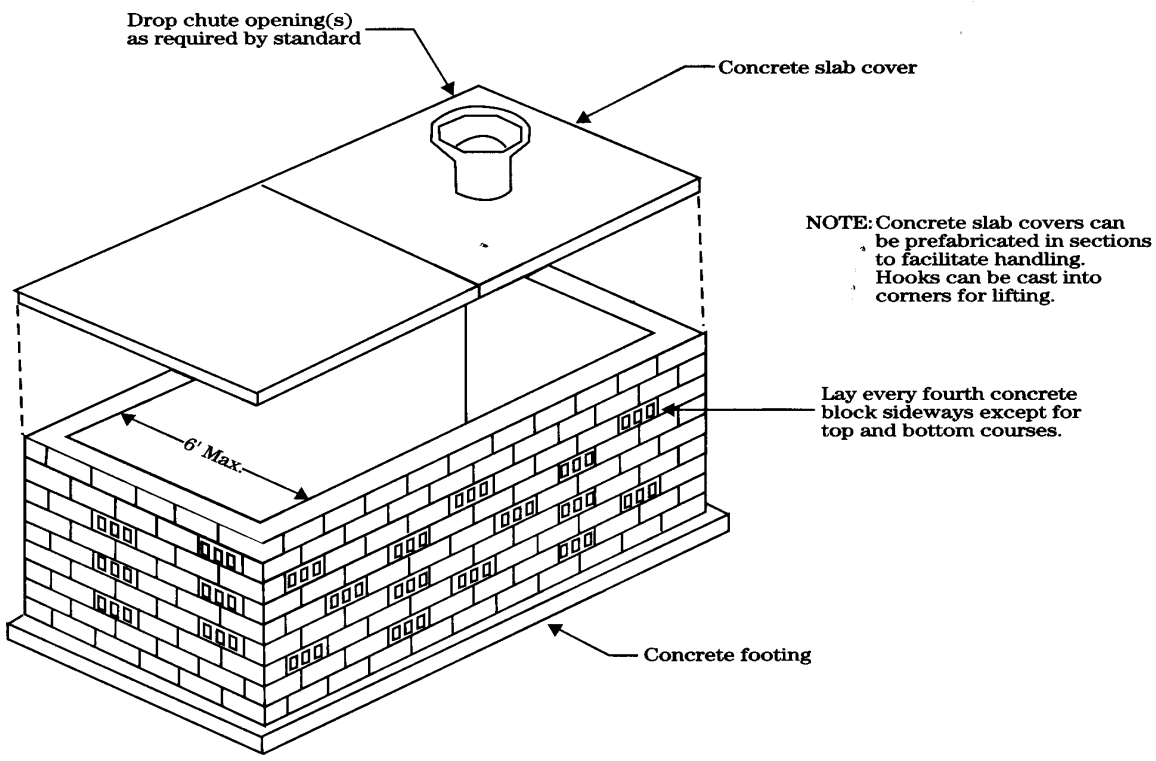

Figure 4.1. Poultry and suckling pig disposal pit constructed with 8"x 8"x 16" concrete blocks. Source: *Agricultural Waste Management Field Handbook,* USDA-NRCS.

Composting

Composting is an aerobic biodegradation process used to decompose organic material. It transforms a waste product (manure and dead animals) into a useful soil amendment. For details on composting of dead animals refer to the fact sheet devoted to that topic.

Incineration

Incineration is a viable alternative in dead animal disposal, especially for smaller animals. These type units have been used on farms in South Carolina for many years.

Requirements for incinerator disposal systems as given in R. 61-43 are:

1. The emission of particulate matter must be less than one pound per hour at the maximum rated capacity.
2. The incinerator must be a package incinerator and have a rated capacity of 500 pounds per hour or smaller, and it must burn virgin fuel only.
3. The incinerator cannot exceed an opacity limit of 10 percent.

Incinerators that meet the above requirements are purchased as package incineration units. "Home-made" incinerators are not recommended and will be required to obtain air quality permits.

Incineration is discussed in greater detail in the Fact Sheet "Dead Animal Disposal – Incineration".

Daily Pick-Up

Daily pick-up is defined as the picking up of dead animals on a daily basis and delivering them to a rendering plant for processing. In these systems, dead animals are loaded into green boxes, similar to typical garbage bins, each day. The integrator or producer will contract with a company to remove the dead animals daily and transport them to a rendering plant.

The major concern in using the daily pick-up disposal system is biosecurity. The, truck which collects the dead animals on each farm, can potentially transport disease from one farm to the next. Although specific measures are taken to prevent disease transmission, it is still a concern to overcome when using this system.

Freezer Pick-Up

The freezer pick-up method is much like the daily pick-up method. This method requires the dead animals to be place in a freezer on a daily basis. The integrator or producer contracts with a company to remove the frozen dead animal on a regular basis, usually less than one week (7 days) but more than one day. The carcasses are taken to a rendering plant for processing.

When using the freezer pick-up method, just as in the daily pick-up method, biosecurity is the primary concern for growers.

Landfilling

Depositing dead animals in the local landfill is a practice that has been used by some producers for many years. This option is most commonly used for carcass disposal due either to the occasional death of a large animal or to the catastrophic death of many animals. A landfill that accepts dead animals must have approval from SCDHEC. If landfilling is the chosen method of dead animal disposal, the producer should check to confirm that the local landfill receives these animals.

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Several methods for disposing of dead animals are available. Currently, in South Carolina burial in earthen pits and trenches is the most common method used. Many producers are switching methods to composting and/or incineration. Rendering is also a viable option in which the dead animal is processed for further use; however, there are few rendering plants operating in South Carolina and transportation to the plants can be costly.

For more information on disposing of dead animals contact your local USDA-Natural Resources Conservation Service office or the local Clemson University Cooperative Extension Office.

DEAD ANIMAL DISPOSAL - COMPOSTING

Managing dead animals from a livestock production facility in an environmentally sound manner is very important to producers. Presently most producers dispose of dead animals by landfilling or on-farm burial. However, many landfills will no longer accept dead animals. Much of South Carolina has high water tables which makes on-farm burial difficult and environmentally undesirable.

In the early 1990's, the Natural Resources Conservation Service (NRCS) began composting dead animals, primarily broilers. The first composting unit in South Carolina was installed in 1992. Since then, composting of broilers and other chickens has become a standard practice. However, disposing of larger animals such as swine and grown turkeys is still a challenge. Composting is becoming the method of choice for many producers. It allows the producer to dispose of the dead animals while producing a value-added product.

Composting is the aerobic decomposition and stabilization of organic matter under conditions which allow development of thermophilic temperatures as a result of biologically produced heat. It is a natural process that is enhanced and accelerated by the mixing of organic waste with other ingredients in a prescribed manner for optimum microbial growth.

Composting is accomplished by mixing an energy and structural component (carbonaceous material), a nutrient source (nitrogenous material), water, and oxygen in a prescribed manner to meet aerobic microbial metabolic requirements. The process is carried out under specific moisture and temperature conditions for a specified period of time. The composting process may become inhibited when moisture falls below approximately 40 percent. Correct proportions of the various compost ingredients are essential to minimize odors and to avoid attracting flies, rodents, and other small animals. The final product is sufficiently stable for storage, land application, or marketing without adverse environmental effects. The material improves soil fertility, tilth, and water holding capacity. Composting reduces the bulk organic material to be spread; improves its handling properties; can destroy weed seeds and pathogens; and is proven to be an effective disposal method of dead animals.

The following information gives some of the basics of composting, especially concerning dead animals.

Facility Size

The composting facility shall be designed to provide storage for the maximum length of time anticipated between emptying events or storage period. The minimum storage period shall be

based on the time required for the composting process and environmentally safe waste utilization considering the climate, crops, soil, equipment, and local, state, and Federal regulations.

Composting Method

The composting method must fit the individual farm operation. Several methods include aerated windrow, static pile and in-vessel (bin). Compost piles for windrowed and static piles should be triangular to parabolic in cross-sectional form with a base width to height ratio of approximately 2 to 1. The typical dead animal composter uses the in-vessel (bin) method. However, windrowing or a combination may be used.

Figure 8.2. Typical poultry composting building with first and second stage bins.

Site Considerations

Composting facilities shall be located as near the source of organic waste as practical. Composting operations shall be located where movement of any odors toward neighbors will be minimized. Setback distances should be in accordance to the South Carolina Department of Health and Environmental Control (SCDHEC) specifications. Typically for composting structures it will be equal to the setback(s) for the facility.

Site paving needs should be evaluated in terms of effects of equipment operation on trafficability, soil compaction, and potential for contamination from compost and petrol products. Special consideration should be given to designing high traffic areas in front of the primary bins which must be used daily in all weather conditions. One alternative for supporting traffic may be the installation of a geotextile fabric with crusher run gravel on top.

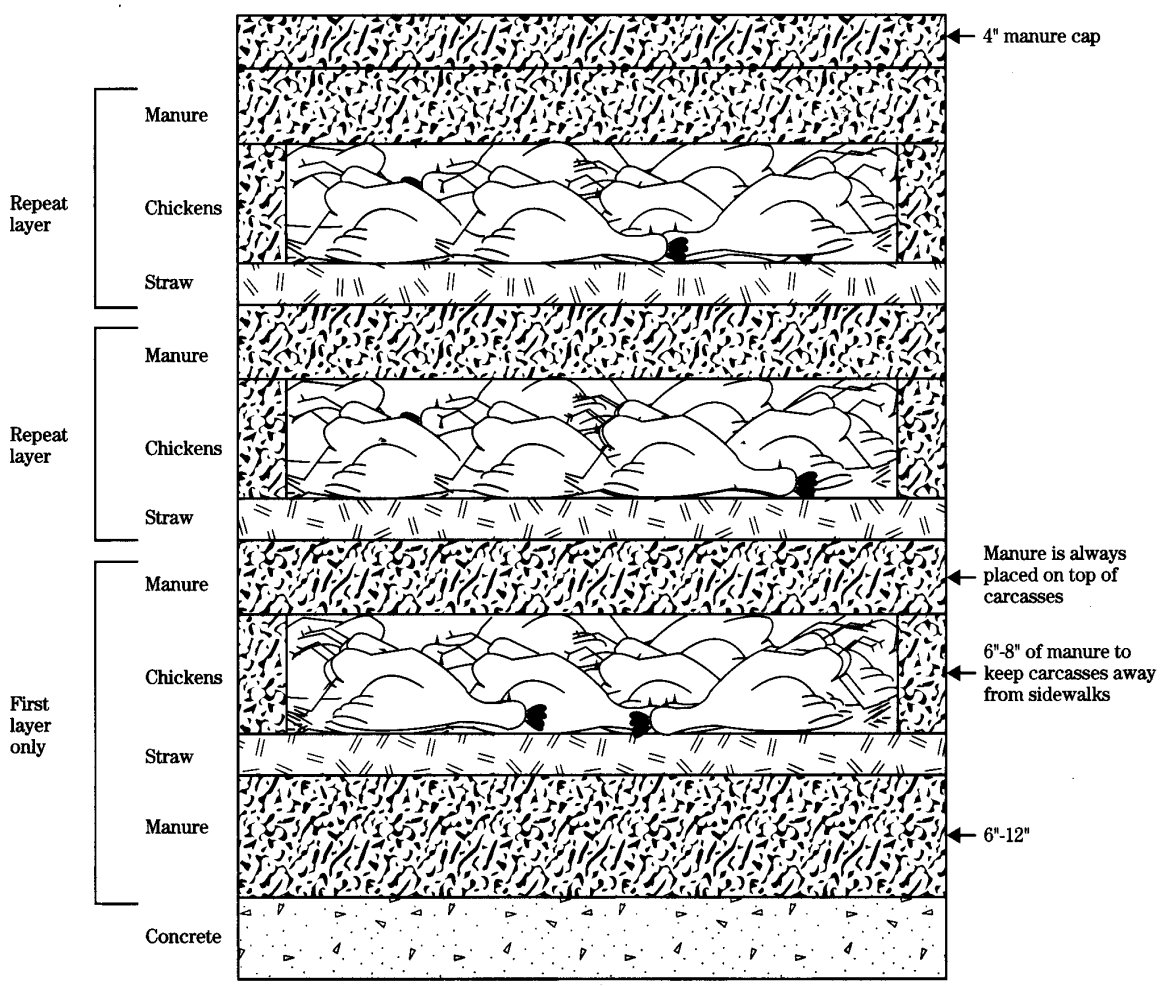

Figure 8.3. Layering diagram for dead bird composting

Buffer area(s), vegetative screens, and natural landscape features can help minimize the effects of odors.

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

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

Moisture

A water source must be available for compost pile moisture control from start-up through completion. The moisture content of the blended material at start-up of the composting process should be approximately 55 percent (wet weight basis) and maintained between 40 and 60 percent during the composting process.

Proper moisture content is critical in a carcass composting process and varies greatly with carcass species and size. Water is also a by-product of aerobic decomposition of animal and poultry carcasses. Moisture is important in initiating the composting process. Learning to control moisture is a trial and error process for each size and species of carcass. For poultry, a good rule of thumb for moisture is to spray the carcasses with a light mist roughly equivalent to an autumn morning dew. The composting of large swine carcasses requires a larger quantity of water to initiate the process. A longer period of time is required before by-product water is released by the swine carcass. Initial moisture application for swine varies from 0.25 to 0.65 pounds of water per pound of carcass depending upon carcass size. A 350 pound sow requiring approximately 0.5 pounds of water per pound of carcass would require an initial addition of 175 pounds or 21 gallons of water.

Carbon-Nitrogen (C:N) Ratio

The amounts of the various ingredients shall be calculated to establish the C:N ratio of the mix to be composted. For composting typical organic matter or typical manure, the C:N ratio should be between 25:1 and 40:1. However, for composting dead animals the C:N ratio should be in the range of 10:1 to 20:1. Typical C:N ratios for composting amendments are found in the USDA-NRCS Agricultural Waste Management Field Handbook or the On-Farm Composting Handbook by the Northeast Regional Agricultural Engineering Service (NRAES). Organic materials with higher C:N ratios should be used for materials that decompose at a high rate (or are highly unstable) and result in greater odor production.

Figure 8.4. Layers of sawdust, dead animal, and broiler litter form the bin (static, in-vessel) composting pile.

Carbon Source

A dependable source of carbonaceous material must be available. The material should have a high carbon content and high carbon-nitrogen (C:N) ratio. Wood chips, sawdust, peanut hulls, straw, corn cobs, peat moss, and well bedded horse manure are good sources of carbon.

Aeration and Oxygen

Aerobic composting consumes large amounts of oxygen. Thus, aeration in the process is critical. Aeration also removes excess heat generated by microorganisms, gases within the material, and

excess moisture. Proper aeration may be achieved by passive air exchange, forcing air through the material, mechanical turning, or a combination of any of these methods.

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

Proper aeration minimizes nitrogen loss by denitrification. Maintaining the pH at neutral (7.0) or slightly lower avoids nitrogen loss by ammonification. High amounts of available carbon will aid nitrogen immobilization. Phosphorus losses will be minimized when the composting process is managed according to the requirements of this standard.

Increased surface area favorably affects evaporation and natural aeration and increases the area exposed to infiltration from precipitation in uncovered stacks. Aligning uncovered stacks north to south and maintaining moderate side slopes maximizes solar warming. Windrows should be aligned to avoid accumulation of precipitation.

Bulking Materials

Bulking materials should be added to provide the porosity, structure, and texture to enhance air flow within the composting material. Piles that are too compact will inhibit the composting process. Good results are usually obtained when the bulking agent has particle sizes ranging from 1/8 to 2 inches in diameter. The carbonaceous material can be considered as a bulking agent. Where it is desirable to salvage carbonaceous material, provisions for removing the material, such as screening, must be made.

Temperature

Temperature is the primary indicator to determine if the composting process is working properly. A minimum temperature of 130° F shall be reached during the composting process. A temperature of 140° F is optimum; however, temperatures may range up to 160° F. If the minimum temperature is not reached, the resulting compost shall be incorporated immediately after land application or recomposted by turning and adding moisture as needed. Compost managed at the required temperatures will favor destruction of any pathogens and weed seeds.

A good carcass compost should heat up to the 140 range within a few days. Failure of the compost material to heat up properly normally results from two causes. First, the nitrogen source is inadequate (example wet or leached litter). A pound of commercial fertilizer spread over a carcass layer will usually solve this problem. Secondly, the compost fails when too much water has been added and the compost pile becomes anaerobic. An anaerobic compost bin is

characterized by temperatures less than 120 , offensive odors, and black oozing compound flowing from the bottom of the compost bin.

It is possible, though unlikely, for the temperature to rise above the normal range and create conditions suitable for spontaneous combustion. If temperature rises above 170° F, the material should be removed from the bin and cooled. If temperature falls significantly during the composting period and odors develop, or if material does not reach operating temperature, investigate piles for moisture content, porosity, and thoroughness of mixing.

Composting Period

Sufficient time shall be planned to complete the compost process. The time needed for completion of the composting process varies with the material and must continue until the material reaches a stability level at which it can be safely stored without creating undesirable odors and poor handling features. Acceptable stability occurs when microbial activity diminishes to a low level. For typical manure and other organic matter, the initial decomposition process can be completed in about 21-28 days. However, the material will reach stability after a 90 or more day curing process. After curing the compost may have the desired quality for a marketable soil amendment.

Figure 4.5. Aerating the composting material through mechanical lifting and dropping with a front-end loader and adding water to increase the moisture content during second stage composting.

The time required for dead animals to compost is directly proportional to the size of the animal. For smaller animals, 21-28 days in each stage is usually adequate. However, for large animals,

60-90 days in each stage is necessary. In each case a curing period of about 90 days is needed after composting is completed for the material to reach stability. Visual inspection and temperature measurements will provide needed evaluation of compost status.

Land Application of the Compost

Land application of compost shall be based upon the compost and soil analysis, as well as crop nutrient requirements (based on crop yield). The compost should be applied to the land at recommended agronomic rates. The compost should be analyzed to determine the nutrient content.

Water Quality Considerations

Composting of waste organic materials should improve water quality by eliminating alternative methods of disposal which could pollute ground and surface water. Soil amended with compost will have an increased available moisture content, which will result in some additional storage of water in the soil profile resulting in less leaching. The compost material must be properly managed to prevent movement of soluble substances and of items attached to solids carried by water runoff. Caution must be taken to prevent spreading compost near surface waters because high organic matter content and an increase nutrient loading could cause eutrophication of the water bodies.

Odor Considerations

When odor is a concern, select carbonaceous material that, when blended with the nitrogenous material, will result in the desired pH. The blended material should have a pH at or slightly below neutral for best odor control. Where odors do not present a problem, pH of 8 to 9 is acceptable, but strong ammonia and amine related odors will be present for up to the first 2 weeks.

Another method of minimizing odor is to design a mix that results in desired C:N ratios as given above. When the C:N ratio is very low, 10:1 or less, a loss of nitrogen generally occurs through rapid decomposition and volatilization of ammonia.

Management

The composting process must be managed properly in order to achieve good results. It is a biological process that can have excellent results or it can be a catastrophe. Temperature is the primary indicator that the process is working. If adequate temperatures are not achieved the process must be evaluated to correct the problem.

Loading the composter with the correct materials at the proper ratios is critical. The addition of water is the most crucial. Inadequate water will slow the process, while too much water will fill the pore space and will not allow air to permeate throughout the pile resulting in an anaerobic condition. Odor is generally a good indicator of anerobic conditions.

Other troubleshooting methods are to test compost material for carbon, nitrogen, moisture, and pH if compost fails to reach desired temperature or if odor problems develop. The finished compost material should be periodically tested for constituents that could cause plant phytotoxicity as the result of application to crops.

Biosecurity.

Anyone working on or about an animal production facility shall follow biosecurity techniques to prevent the spread of diseases. If possible, entry into poultry houses or other animal production facilities should be avoided. However, if entry is necessary, the farm operator's permission is required.

In order for proper pathogen kill to occur in the composting process, it is necessary to maintain a temperature of 135 degrees F for a minimum of three days within the active composting area. Other than testing, monitoring temperatures is a good indicator of pathogen kill.

REFERENCES

- Agricultural Waste Management Field Handbook. 1992. USDA - Natural Resources Conservation Service.
- Henry, S.T. 1990. Composting Broiler Litter Effects of Two Management Systems. Clemson University
- Northeast Regional Agricultural Engineering Service. 1992. NREAS - 54, "On Farm Composting Handbook". Ithaca, NY.
- SCDHEC. 1998. Standards for the Permitting of Agricultural Animal Facilities. Regulation 61-43. June 1998.

DEAD ANIMAL DISPOSAL - INCINERATION

Managing dead animals in livestock and poultry growing situations is continually a greater challenge. Today's environmental climate calls for proper and environmentally methods of disposing of dead animals. Incineration is a suitable method to dispose of small animals to prevent pollution and improve environmental quality.

Many farms currently incinerate as the preferred method of dead animal disposal. Incinerators must either be permitted by the South Carolina Health and Environmental Control (SCDHEC), Bureau of Air Quality or qualify for an exemption. Typically, incinerators installed for dead animal disposal qualify for an exemption and do not require a permit. However, if a problem exists SCDHEC may require a permit.

Three criteria must be met in order for a incinerator to qualify for an exemption from an air quality permit.

1. The emission of particulate matter must be less than one pound per hour at the maximum rated capacity.
2. The incinerator must be a package incinerator and have a rated capacity of 500 pounds per hour or smaller, and it must burn virgin fuel only.
3. The incinerator cannot exceed an opacity limit of 10 percent.

Incinerator Capacity

Incinerator capacity will be based on average daily weight of dead animals anticipated. The following table lists factors to use in determining dead animal weight per day:

Table 1. Daily loss factors for determining incinerator capacity for dead animal disposal.

Type Animal	Daily Loss Factor (lb/day/animal)
Chickens:	
Broilers	0.0024
Laying Hens	0.0015
Breeding Hens	0.0019
Breeder, Male	0.0082
Turkeys:	
Hen	0.0081
Tom	0.0318
Swine:	
Suckling Pigs	0.042 (per sow)

Examples of calculations for determining incinerator capacity required for broilers and small swine.

Example 1:

Capacity of broiler houses: 36,000

Average daily weight of dead birds:
36,000 x 0.0024 = 86.4 lbs/day

Incinerator capacity:
Minimum 86.4 lbs.

Example 2:

Size of swine unit: 500 sows (total on farm)

Average daily weight of dead suckling pigs:
500 x 0.042 = 21 lbs/day

Incinerator capacity:
Minimum 21 lbs.

Collection of Incinerator By-Product (Ash)

All incineration disposal of dead animals shall have a plan for collecting and disposing of the ash material remaining after incineration. The plan should include an ash collection box or bucket and disposal of the ash on the land or through a community trash disposal system. If land application is used, allow one,half acre for each 60,000 broilers; 30,000 layers; and 100 sow/hog facility.

Location of Incinerators

Locate the incinerator at least 100 ft. from any well, spring, or surface water course and at least 20 ft. from any building to prevent spontaneous combustion. The incinerator shall be located on a concrete slab.

Consideration should be given to enclosing the incinerator in a block house structure with a roof or roof protection to extend the life of the unit.

OPERATIONS AND MAINTENANCE

Operation of the incinerator shall be as specified in the owner's manual. Improper loading may result in the production of heavy black smoke and objectionable odor. Operation of the incinerator according to the manufacturers recommended practice should result in little to no smoke or objectionable odor.

The use of the incinerator to dispose of waste oil, hazardous waste, or any other waste chemical is prohibited. The use of the incinerator will be limited to dead animal disposal only unless otherwise approved by SCDHEC's Bureau of Air Quality.

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For more information of the sizing and selection of incinerators for dead animal disposal contact your local USDA - Natural Resources Conservation Service office of your local Clemson University Cooperative Extension office.