

## **Management of Animal Mortality in Georgia**

From July 7 to July 14, 1994, Hurricane Alberto stalled over the southern portion of Georgia, resulting in the worst flooding in Georgia in modern times. Over 400,000 acres of farmland were flooded. On one farm 250,000 chickens were killed by the rising waters. Fifty-five counties were declared disaster areas.

In the recent hurricanes of 2004, Gilmer County was the hardest hit of all the northern counties affected by Hurricane Ivan. One farm lost 96,000 chickens and 19 dairy cows.

Proper disposal of dead animals presents a significant problem after such a disaster. Decaying carcasses can present major public health concerns through the spread of harmful pathogens to surviving animals and to humans, the contamination of soil, ground and surface water, and contamination of food crops or stores. The sight and odor of dead animals are also offensive to the senses. Timely and appropriate disposal of dead animals can eliminate or reduce the possibility of these concerns.

Due to Georgia's geographic diversity dead animals resulting from a natural or man-made disaster may include pets, poultry, livestock, wildlife, zoo animals, and because of Georgia's many rivers and coastal location, freshwater and marine wildlife including fish, birds, sea turtles, and large marine mammals such as whales and dolphins. According to Chapter 4, Section 4-5-4 of the Georgia Code of Georgia Annotated (O.C.G.A.) "dead animals" refers to the carcasses or part of all animals, regardless of whether they are considered to be farm livestock, poultry, equines, domesticated animals, pets, or any other type of animal and shall include all such animals regardless of the cause of death of such animals.

### **Disposition of Dead Animals**

According to Georgia O.C.G.A. 4-5-5 the disposal of dead animals must be accomplished within 24 hours after the animal's death or discovery of the carcass. No person can

abandon on any property any animals that have died or been killed, and no animals can be disposed of on another person's property without the landowners' permission. Dead animals can only be disposed of in a landfill with the landfill manager's permission.

Dead animals shall not be abandoned in wells, open pits, or surface waters of any kind either on public or private land.

It is the duty of the Department of Transportation to remove and dispose of the carcasses of all dead animals found within the rights of way of all highways within the state maintained either totally or partly from state funds. The disposal of such carcasses shall be in a manner consistent with this annex.

Disposal of dead animals is also regulated by the Environmental Protection Division of the Department of Natural Resources to protect water and air quality.

### **Approval of Disposal by the Department of Agriculture**

Many facilities such as livestock markets, livestock slaughter establishments, animal feeding operations and licensed animal shelters, kennels, pet dealers, and stables should have in place written and approved methods and place of disposal of dead animals and their wastes for animals that die on their premises. A Certificate of Compliance will be issued by the Department.

Poultry growers, dealers, brokers, and poultry sales establishments will be issued a Certificate of Compliance from the Department of Agriculture when the method of disposal of dead animals is approved.

In addition to a basic plan for normal mortality, all farming operations should have in place a specific emergency plan for the disposal of massive mortality from a natural catastrophe or foreign animal disease outbreak. Normal methods of disposal and

alternative methods to handle large numbers of mortalities in an emergency situation should be in place before the first mortality even occurs on the farm.

### **Methods of Disposal of Dead Animals**

Methods to be used for the disposal of dead animals include burial, composting, burning to ash, incineration, rendering, or any method using appropriate disposal technology, which has been approved by the Commissioner of Agriculture. All methods must provide for the disposal of the dead animal within 24 hours of the death or discovery of the dead animal unless otherwise approved.

**Burial:** Burial has been a traditional method of animal disposal in Georgia and is the simplest, least expensive, and most convenient way of disposing of animal carcasses. Approximately 95% of poultry farmers in Georgia use burial pits to dispose of their mortality. Dead animals that are to be buried must be located more than 100 horizontal feet away from any existing or proposed wells, water supply lines, or seasonable high water table of any water source, and 15 horizontal feet away from the edge of any embankment. The soil for a burial site must be of moderate or slow permeability and must be at least one foot above the seasonal high groundwater elevation. Burial sites must not be in areas with gullies, ravines, dry streambeds, natural or man-made drainage ways or sinkholes. They cannot be located within the 100-year flood plain.

Dead animals must be buried at least three feet below ground level but no more than eight feet deep and have not less than three feet of earth over the carcass.

Animals may be buried in individual graves, in mass burial pits, or in approved landfills.

For **individual burial** of animals state regulations should be consulted. Burial is a routine method of disposal of companion animals that have died. For a large animal such as a cow or horse a grave 7 feet wide and 8 feet deep may be needed. A grown cow will require at least 14 square feet of floor space.

For mass disposal of certain production animals (poultry, swine, and calves) **burial pits** may be used if they are designed, constructed, maintained, and used in a manner to prevent the spread of diseases. Such pits must be approved by the Georgia Department of Agriculture and must meet the following requirements:

- The pit site must be approved by Georgia Department of Agriculture personnel prior to construction.
- Soil suitability must be evaluated by a certified soil classifier or a certified GDA livestock/poultry field inspector prior to construction.
- The bottom of the pit must be a soil of moderate or slow permeability to prevent leaching.
- Pits must have adequate side support to prevent cave-ins and must not be greater than four feet in width. For top soils with 18 inches or more of sand, pit walls must be supported and maintained by concrete, treated lumber, corrosive-resistant metal or other material approved by the Georgia Department of Agriculture.
- The ground slope where a pit is to be located must not exceed a moderate grade.
- The pit cover must be of solid construction and must allow surface water to drain away from the pit and water supplies. The pit must be sealed to prevent the entry of rodents, insects, and other vermin and prevent the exit of odors.
- A pit will be considered to be closed when covered with more than three feet of loam or clay textured soil with a slight dome (at least six inches higher in the middle than along the edge).
- Any pit deviating from the above requirements must have the approval of the State Veterinarian prior to the issuance of a permit and use.

**Landfill:** Dead animals may be disposed of in landfills if the landfill is approved to receive animal carcasses by the Georgia Department of Natural Resources Environmental Protection Division. Many landfills routinely take companion animals. However, other landfills do not take dead animals except in an emergency situation. Poultry producers need a pre-approved permit from the Georgia Department of Agriculture's Livestock and Poultry Field Forces to dispose of dead poultry in a landfill. Double bagging of the carcass may be required by many jurisdictions. Cost for disposal of animals is a

consideration. Dead animals must be covered by three feet of dirt at the landfill on the same day as delivery in accordance with the Dead Animal Disposal Act. Immediate burial is necessary to insure animals that died from poisoning or by euthanasia drugs are not scavenged by wildlife, causing their subsequent death from consumption of the carcass. The transport of diseased carcasses to the landfill is a concern. Transport should be preapproved. A risk assessment must be done before going to the landfill. Strict disinfection of the transport vehicle will be necessary if the animals died of a contagious or infectious disease. Dead animals must be transported to the landfill or burial site in covered leak proof containers. A list of landfills by county is at the end of this annex.

**Composting:** Composting is an aerobic microbial biodegradation process used to decompose organic material. It transforms waste products, such as manure and dead animals, into useful soil additives. Composting must be consistent with the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) Technical Guidance Standards. Traditionally composting is used to dispose of small farm animals such as dead poultry and pigs, but it can also be a means of disposal of larger livestock such as cows, horses, and hogs as well. One advantage of composting is that it provides a valuable nutrient to the farm's soil and maintains biosecurity on the farm.

For composting to be effective the microorganisms that accomplish the degradation of the carcasses must be maintained in sufficient numbers to start the composting process immediately. The bacteria and fungi responsible for composting require four essential nutrients to thrive: carbon, nitrogen, oxygen, and water. If any of these are lacking or in improper proportions the microbes will not flourish, resulting in insufficient heat for composting. If the litter or other organic material is too dry or too old it may not have enough microorganisms to initiate the process. The moisture content of the composting litter should be 40-60%. Stirring the compost pile adds oxygen needed for the microorganisms as well. With sufficient nutrients, water, and oxygen the microbes in the compost piles will start to multiply, raising the temperature of the litter. When hot the litter is ready to use for composting.

The following techniques of composting have been recommended by the University of Georgia Cooperative Extension Services and by the Georgia Department of Agriculture and can be used for either small or large farm animals.

Composting requires a covered structure consisting of a roof with an overhang and a concrete or otherwise impervious floor to prevent rainwater from reaching the composted material. Composting of large animals outside a physical structure must be approved by the State Veterinarian on a case-by-case basis after a risk assessment by the Georgia Department of Agriculture has been performed to address the possible spread of disease or contamination of ground water. The composter must be designed and constructed to prevent the contamination of ground and surface water.

The composter must be located 100 feet from surface water, drainage ditches, and wet lands. It should be located as far from residences and public roads as possible but at least 200 feet from the property line.

The seasonal high water table must be at least three feet below ground level or else the base of the composter must be built on asphalt, concrete, or 12 inches of clay soil or other surfaces approved by the Department of Agriculture.

The ground surface should be flat enough to prevent runoff and impervious enough to prevent leakage into the ground water. Surface water must be diverted away from all sides of the composter to prevent surface water contamination from run-off.

The capacity of the composter should meet or exceed peak disposal requirements. A layer of 24 inches of fresh litter, litter cake, or other organic carbon containing material with 40-60% moisture content should provide enough of a starter supply of microorganisms to begin the composting process. Carcasses must not be placed within 6 inches of the side walls of the composter or tops of the bins. The walls tend to be cooler so that carcasses near the walls decompose more slowly. Daily mortality added to the composter must be

covered with at least 6-8 inches of composting material for poultry and at least two feet for larger animals.

When a compost bin is full the bin should be capped off with at least 6-8 additional inches of organic material. Composts stacks should not be more than 5 feet in height. Too great a height may result in compaction and decreased oxygen needed for bacterial growth. Measure composting temperature with a compost thermometer inserted 6-8 inches from the top of the pile and at deeper depths to check for proper temperatures. The temperature should be checked daily for the first week or two and every other day thereafter. The temperature should be recorded and maintained in a log. Compost piles must reach a temperature of 131° F for three consecutive days to eliminate most common pathogens. A temperature range of 130-150°F inside the compost pile means the compost is working well and that the compost environment is suitable for use. The proper composting temperature has three effects. 1. The higher temperature contributes to the growth of the microorganisms. 2. This will accelerate the decomposition process. 3. Composts managed at the required temperatures will also result in the destruction of any pathogenic microorganisms and weed seeds.

The materials that go into a composter should be layered as follows:

1. A layer of 12-24 inches (depending on the size of the animals composted) of warm bulky litter or organic (carbonaceous) material with 40% moisture content should be placed on the floor. This layer will supply the bacteria needed to start the process and absorb excess moisture.
2. A thin layer of bulky material to hold oxygen is placed next. This could consist of peanut hulls, wood shavings, straw, or coarse poultry litter cake.
3. A layer of dead carcasses is added next. The dead animals should be arranged in a single layer side by side. The carcasses should touch each other but should be no closer than 5-6 inches from the sides of the composter. The walls of the container tend to be cooler, and the carcasses against a cooler wall will not compost as quickly.

4. A layer of composting material is added next. This layer should have a moisture content of 40-45%. The layer of compost material should be twice as thick as the layer of carcasses underneath it. If composting a large animal the material should be at least a minimum of two feet. It is recommended that if the carcasses of large ruminants are to be composted the rumen should be lanced before composting to prevent the explosive release of rumen gasses and the uncovering of the pile, resulting in odor and the attraction of scavengers. Large animals may also compost more quickly if the body is sectioned into pieces.
5. If only a partial layer is needed for a day's worth of mortality, that portion should be covered with organic material.
6. A small amount of water may need to be added with each layer. If the composting material is too dry not enough bacteria will multiply to compost the mass.
7. After the initial layer is completed, subsequent layers of organic material, bulky ingredient, and carcasses are added to a height not exceeding 5 feet. The last layer will be capped with litter or organic material. Excessive height increases the chance that the composting temperature may exceed 160°F, resulting in the possibility of spontaneous combustion.

Composting will begin as the carcasses are loaded. Depending on the size of the primary cell and the number and size of the dead animals the loading time varies. With active composting material the lower levels may rise to 150°F by the time the cell is capped. Temperature should be monitored and recorded daily. When the oxygen in the pile starts to decrease, the temperature will start to fall. When the temperature drops to 130°F (about 7-21 days after capping), the compost can be moved to a secondary cell. Moving the product mixes and aerates the product so that more complete breakdown of the mass is accomplished. If the chicken carcasses exceed 4.5 to 5 pounds or if material is removed from below or added above, movement to a secondary composting cell will be necessary for adequate decomposition.

When moved to a secondary cell the temperature should start to rise again to 150°F within a matter of days. Delayed movement, poor mixing, inadequate aeration or

moisture content above 60% or below 40% will cause improper heating. After the temperature drops from 150°F to 130°F (after 7-21 days for poultry) the product can be moved again to be used as fertilizer on the farm where the product originated.

For composting a large animal such as a cow or horse the animal can be turned after 5 consecutive days above 130°F. The second stage of composting for a large animal will typically be 120 days. If the animal is not turned it must be composted for 180 days. Temperature must be taken periodically and recorded. After the animal is completely composted, the composted material may be spread on the owner's property or other property under his control. Any bones or skulls that remain must be picked up for disposal according to the Georgia Department of Agriculture rules for the disposal of dead animals. Bones and skulls of large animals should not be spread on property.

Composting is not allowed for all contagious and infectious diseases. In the case of a reportable animal disease the State Veterinarian should be contacted at 1-800-282-5852 or 404-656-3671 for further instructions.

To obtain permits for composting animal mortalities, a written request to the State Veterinarian must be submitted, describing the procedure and the type of facility to be used. The letter requesting the permit must include the producer's pit number if he has one.

**Incineration:** Dead animals may also be disposed of by using a commercial incinerator. Incineration may be the most sanitary means of disposal of dead poultry and small animals. Incinerators are biologically safe but are slow and expensive to operate and can result in odors from the emissions. The incinerator and the methods used must be approved by the U.S. Environmental Protection Agency and by the Georgia Department of Natural Resources Environmental Protection Division. Operation of the incinerator must be in accordance with the owner's manual. Proper operation of the incinerator according to manufacturer's recommendations should result in minimal smoke or odor.

Homemade incinerators do not meet air pollution control standards and are not an acceptable means of incineration. The entire carcass must be reduced to ashes.

There are two basic means of incineration, determined by the size, type, and number of carcasses to be incinerated. These are a basic incinerator, which may be mobile, or permanent, and an air curtain burner.

If a **mobile incinerator** is used, the incinerator should be placed downwind of poultry houses and any populated areas. Ashes should be removed before each firing to assure proper performance, reduce needed maintenance, and maximize the life of the incinerator unit. The incinerator should be protected from weather when not in use if it is a mobile unit, preferably in a block house structure with a roof. There should be a distance of at least four feet between the smoke stacks and wooden structures or trees, including overhanging tree branches. The incinerator should be at least 100 feet from any well, spring or surface water. A mobile unit should be located on a concrete slab to reduce the possibility of grass fires.

Many mobile incinerators are mounted on a wheelbase for transport by a flatbed truck. These can be set up anywhere and can operate in a totally self-sufficient way. The incinerators will result in a complete reduction of volume and rapid oxidation to carbon and water. They are environmentally safe but an air permit may be required depending on local ordinances.

Mortalities can be disposed of as they are generated; therefore no temporary storage is needed. The animals do not have to be physically removed from the farm. The residue from properly incinerated carcasses will not attract insects or rodents.

Another potential benefit includes disposing of diseased material without moving the problem from the farm of origin, but mobile units if moved from farm to farm do have the potential of introducing disease from one livestock holding area to another. Therefore stringent biosecurity measures must be taken with regard to cleaning and disinfection of

the unit. The incinerator must be emptied, cleaned, and thoroughly disinfected before it enters or leaves a livestock premises. Regular maintenance must be performed because the burners may wear out. Soot must be scrubbed out regularly to prevent stack fires. This means the operation of the incinerator requires a dedicated operator thoroughly familiar with the unit.

Many of these units take at least an hour to reach operating temperatures. At 850°C the temperature of these units may not be sufficient to destroy prions, which cause Bovine Spongiform Encephalopathy (Mad Cow Disease) or Chronic Wasting Disease. The ash produced after each firing must be removed to maintain performance and improve incinerator life. The ash produced from these mobile units is not sterile and has no fertilizer potential and should not be placed on land for food agriculture, as there may be a trace of heavy metals from the micronutrients fed to the animals. A plan should be in place to dispose of the ashes generated by incineration. The plan for disposal should include an ash collection bucket or box and a means of disposal of the ash, either on the land or through a community sanitation system. If land application of the ash is used allow one-half acre per 60,000 broilers; 30,000 layers, and 100 adult hogs destroyed.

The fuel for an incinerator may be a significant expense. These units work extremely well for the disposal of poultry, companion animals, and sheep, but only a few large animals may be incinerated at a time, depending on the size of the unit, limiting their use for mass disposal of large breeds of livestock such as horses and cattle.

To handle the disposal of larger animals, such as cows, horses, and hogs efficiently, a better means of incineration would be an **air curtain burner**. The Georgia Department of Transportation has at least two of these on hand and many construction companies will also have these to dispose of construction debris. High velocity air is introduced into the burning chamber in such a way that over-oxygenation of the fire is accomplished, resulting in temperatures of about 1,500°C (2,000 to 2,500 degrees Fahrenheit). The resulting particulate matter is trapped under the air curtain and effectively combusted. They are totally portable for quick and easy deployment to disaster areas and can be

readily moved from site to site. They arrive fully assembled and, with the right kind of trailer, require no crane, just a winch, for loading and unloading. Some units are powered by a Diesel engine, and require no external electric power or natural gas to achieve combustion, as they feed on the very waste that is introduced into them. Operation as near as 100 yards to occupied dwellings is usually permitted, as the menace from smoke and emissions is very controlled. It is the extremely high temperature that causes most particulates to be rapidly combusted within the chamber.

Emergency management agencies have used air curtain burners in support of hurricane disaster recovery efforts in Florida and the Carolinas. The units are easily set up on site. They can dispose of large quantities of waste and debris in a short amount of time with low emission rates. They are long lasting and require little operator skill and can be operated several days at a time.

The air curtain burner has been used to dispose of animal carcasses from Bovine Spongiform Encephalopathy and Foot and Mouth Disease in the United Kingdom and deer and elk that died of Chronic Wasting Disease in the United States. Air curtain burners can perform animal carcass disposal on site or at a central processing location or rendering facilities. The high temperature incineration produces 100% combustion with minimal escaped particulates and virtually eliminates smoke. The high temperatures of 1,500°C can be maintained for many hours and will result in the destruction of prions in BSE/CWD cases with a carcass internal temperature of 850°C sustained for a minimum of two seconds. The residual ash that results from use of the air curtain burner is sterile and can be safely applied to the land and is extremely beneficial for certain clay-like soils. Once the burner has achieved operating temperature a 450-pound animal can be reduced to ash in about 15 minutes. The time can be affected by number of cadavers burned, the fat and water content of the carcass, the pit temperature, and type of wood waste used to fuel the burners. The amount of carcasses processed per hour can be up to 14 tons per hour, but more practically will probably burn about 5-6 tons of carcasses an hour. The air curtain burner works well for disposal of hogs and moderately well for ruminants but may not work well for poultry because of the water content of the feathers

and the low body fat content. No transport, rendering, or further handling of the carcass is required.

The air curtain burner does require a supply of wood to fuel the fire, and 1.5 to 3 gallons of diesel fuel/hour are required to drive the 4-6-cylinder engine. Supplying the wood and diesel could be a biosecurity hazard, so the supply trucks will need to be disinfected as they leave the burn site.

In the event of a catastrophic event such as a hurricane or potential introduction of a foreign animal disease, the use of an air curtain burner would probably be of greater benefit for the disposal of large livestock. Their use has been proven in the UK with BSE and FMD and will result in the destruction of the prions of BSE and CWD, a strong consideration for our interests of mass disposal.

**Burning:** Burning dead animals must comply with federal, state, and local statutes. Burning is not a preferred method of disposal because of the resulting air pollutants. The entire carcass must be reduced to ashes.

Mass cremation of dead animals should be performed in a flat area that is easily accessible to heavy vehicles for transporting the carcasses and away from public view. The site must be away from buildings, public roads, and overhead electric and telephone lines, underground utility wires, and shallow underground pipes or gas lines. The fire will burn more efficiently if constructed at right angles to the prevailing winds. It should be taken into consideration if any populated areas are in the direction of the smoke drift. The carcasses should be placed on a raised platform made of combustible material such as wood, coal, or straw. Old tires cannot be used as an incendiary material according to current Georgia law. The amount of combustible material needed will be determined by the number and species of animals to be cremated. The fire must be monitored at all times and a fire truck should be present at the site.

**Rendering:** Rendering is a heating process resulting in the extraction of recyclable ingredients such as protein and fat from animal tissue, which may be converted into a useable resource for animal feeds. Rendering is a suitable alternative to incineration or burial to those near a rendering plant. There are nine rendering facilities in the state of Georgia. The rendering plants are listed at the end of this annex. Carcasses disposed of by rendering must be delivered to the rendering plant within 24 hours of death unless the carcasses are frozen or refrigerated and must be delivered in covered leak-proof containers.

Rendering is an environmentally safe alternative to producers as it results in the removal of mortality from the farm premises and relieves the owner of the property of environmental worries that exist with other alternatives to mortality management. Through the rendering process the carcasses are recycled into a biologically safe and potentially valuable protein by-product. The concerns to be addressed with rendering include the potential for spread of pathogenic material during the pick-up and delivery of dead animals from one site to another. Strict sanitation and disinfection of transport vehicles and personnel must be followed. Rendering should not be used as a method of disposal of animals that have died as a result of poisoning or from the use of euthanasia drugs. Rendering also will kill most foreign animal diseases, but it does not destroy the prions that cause Transmissible Spongiform Encephalopathies (TSE's).

Preservation of the carcasses before pick-up for rendering can be a challenge. Timing is crucial in the warm spring and hot summer months. The producer or renderer must also have the equipment needed for loading large animals. An economic feasibility study should be performed for carcass preservation methods, which will permit on-farm storage and less frequent pick-ups. Some methods to investigate for storage of carcasses before transporting for rendering include freezing, fermentation, and acid preservation. All three methods require approval from the Georgia Department of Agriculture.

**1. Freezing:** Freezing is the most commonly used method in Georgia for storing carcasses prior to rendering and is the least labor intensive of the three methods of

preservation. The purchase of a freezer for cold storage of dead animals will be necessary unless animals are delivered on a daily basis to the rendering plant. Such freezers must be animal and vermin-proof. The expense of purchase of the freezer and the expense of maintaining and operating the unit should be considered. This method of storage is generally limited to poultry or young animals.

**2. Fermentation:** Fermentation is a method for holding poultry carcasses for up to three months before rendering the carcasses. It is an allowed method of preservation in Georgia but it is not recommended. Some rendering facilities may not accept the product. It is both environmentally and biologically safe if fresh carcasses are used. The fermentation process mixes fresh poultry carcasses which have been ground into one inch pieces with a fermentable carbohydrate such as sugar, ground corn, or molasses. The process reduces the pH to 4.0 or 5.0 so that pathogenic microorganisms are destroyed and the organic material is preserved. However, if decomposed carcasses are used the proper pH may not be achieved, resulting in spoilage. Properly prepared product can be sent to rendering and thus used as a valuable food ingredient. The process is commonly referred to as “pickling.”

**3. Acid Preservation:** Acid preservation is another method for preserving dead poultry for future rendering. This technique is similar to the fermentation process except propionic, phosphoric, or sulfuric acid is added to the carcasses instead of a fermentable carbohydrate. Sulfuric acid is the preferred acid because it reduces spoilage and is the least expensive to use. To prepare carcasses for storage the carcasses must be punctured with a blunt metal rod instead of being put into a grinder. Then the carcasses are stored in airtight plastic containers to protect the mixture as well as the environment. The process eliminates the potential for spread of pathogens into the rendered product or to the environment. Carcasses are then removed from the solution without the accumulation of sludge in the holding tank. The transportation costs to haul the acidified poultry carcasses to the rendering plant is far cheaper than hauling frozen carcasses. However, safety around the dangerous acids is a primary concern, and the acids and the associated

equipment are expensive. Because of this danger, no permits have been issued for the use of acid preservation in Georgia.

**Alkaline hydrolysis:** Alkaline hydrolysis is a method of disposal of dead animals using a 50% solution of sodium hydroxide to digest the carcass at a temperature of 150°C and a pH of 14 for 6 hours under pressure. The method is increasingly used as a means of carcass disposal at larger institutions such as veterinary colleges and industrial settings. No local producers in Georgia have been issued permits to use this technique. The volume and weight of the carcass are reduced by more than 97% and completely destroys pathogens. This process converts the proteins, lipids, nucleic acids, and carbohydrates in the tissues of the carcass, as well as any pathogenic microorganisms, including RNA and DNA viruses, to a sterile water solution consisting of peptides, amino acids, sugar, soaps, and electrolytes. Alkaline hydrolysis is the only process validated to destroy the prions of TSE's such as bovine spongiform encephalopathy. This solution can then be disposed through a sanitary sewage system, where it provides nutrients for microorganisms in wastewater treatment plants, and the alkalinity of the solution offsets the acidity resulting from the sewage biodegradation processes.

Alkaline hydrolysis also eliminates radioactivity from contaminated tissues and will neutralize poisonous fixing agents such as formalin, cytotoxic agents, and other toxic materials from embalmed or fixed tissues.

Alkaline hydrolysis is less expensive than an incinerator and is environmentally safe because there are no harmful pollutants released to the atmosphere or to the environment. The remaining byproducts of the process are the mineral or ash components of the bones and teeth of vertebrates, which are soft enough after the removal of organic matter to be easily crushed by hand. This pulverized material can then be recovered as calcium phosphate and used as sterile bone meal for institutional landscaping. If potassium hydroxide is used as the alkali instead of sodium hydroxide, the resulting solution, after dilution, can be used for direct application on crops and landscaping as a liquid fertilizer containing carbon, nitrogen, and potassium.

**Plasma torch arc:** The plasma torch arc is an innovative, if not yet practical means of disposal of dead carcasses. The temperature of a plasma torch can reach 7,000°C and can gasify just about any material. Organic material is burned or volatilized and the resulting slag is hardened into an inert glassy rock-like mass. This material may be recycled for concrete filler in roadbed construction, composition roofing, and insulation. The gas generated can be used as boiler gas for the production of methanol. The technology has been used in Japanese municipal waste plants to process 1 ton/hr with two torches. It eliminates environmental pollution and the by-products are inert and totally recyclable. However, the technology is expensive, but may be useful after an outbreak of a foreign animal disease when dealing with mounds of below ground (or above ground) buried carcasses. The material could be vitrified because a plasma torch can operate without disturbing the burial site. The unit does require air to operate. There are no portable systems available in the U.S. at present and none in Georgia.

Alternative methods of disposal of dead animals must be approved by the State Veterinarian on a case-by-case basis. Some of the less common methods of dead animal disposal include feeding fresh non-diseased poultry carcasses to alligators and carnivorous fur bearing exotic animals and extrusion processing into animal feed.

### **Comparative Costs for Various Methods of Disposal**

Costs may be a factor in the disposal of dead animals. Equipment for storage of dead animals, electricity for freezers, fuel costs for incinerators and air curtain burners, landfill costs, and transportation and fuel costs for vehicles must all be taken into consideration. Annual net cost can be used to compare mortality management methods. The following comparative costs for various methods of carcass disposal were taken from Sanders, Warbington, and Myers, 2002.

#### **Cost per Pound for Disposal**

<b>Pit Burial</b>	<b>Landfill</b>	<b>Incineration</b>	<b>Rendering</b>	<b>Composting</b>
0.75¢-4.24¢	1.3¢-3.75¢	10¢-12¢	5.25¢-12.15¢	2.1¢-8.4¢

## **Transportation of Dead Animals**

The Commissioner of Agriculture may prohibit the transportation of dead animals and their resulting effluent. Dead animals must be transported in covered, leak-proof containers. If the carcasses have infectious or contagious diseases, the vehicle must be properly disinfected before and after pick-up and delivery of the carcasses. The route for transport may be determined by the Commissioner to prevent the spread of contagious or infectious diseases. Persons engaged in the commercial hauling of dead animals must be permitted by the Georgia Department of Agriculture. Dead animals, except for green salted hides, are not allowed to enter Georgia except by written permit issued by the Georgia Department of Agriculture. However, written permission is not needed for licensed research institutions, accredited or state colleges and universities, and municipal governments to transport or receive dead animals if used for research or investigational purposes only.

## **Enforcement**

Any person, firm, partnership or corporation violating the rules of the Department of Agriculture concerning disposal of dead animals shall be guilty of a misdemeanor and if convicted shall be punished as required by law. (O.C.G. A. Sec 4-5-11).

## **References And Links:**

Air Curtain Burner. Air Burners LLC

<http://www.airburners.com/ab-FAQE.tpl#ANIMAL%20CARCASS%20DISPOSAL>

Air Curtain Burners-Disaster Recovery

<http://www.airburners.com/ab-disaster.tpl>

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Animal Burial Guidelines During a Declared Emergency. SART.

<http://www.ncsart.org/burial.asp>

A Practical Approach to the Burning of Beetle Infested Trees.  
[http://www.perfecthit.net/enviro/asian\\_longhorned\\_beetle.htm](http://www.perfecthit.net/enviro/asian_longhorned_beetle.htm)

Biological Waste Management by Alkaline Hydrolysis. Technical Data Monograph.  
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Atlanta Journal/Constitution. October 31, 2004. Foothills Bear Ivan's Imprint. Page E1.

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<http://tammi.tamu.edu/burialguidance.pdf>

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