Avian Influenza Mortality Burial Requirements/Recommendations Comparison

	Iowa	Minnesota	North Carolina
Is on-farm burial allowed	Yes (daily/emergency)	Yes (daily/emergency)	Yes (daily/emergency)
Manure and/or litter allowed	Yes with restrictions	Yes	Maybe
Type of Burial	Trench < 6ft depth	Trench	Trench or open pit
Liner	No	No	Recommended at 250k+ birds
Separation from groundwater	2ft	5ft	3ft (removing 12" allowance)
Soil type considerations	yes	unclear	yes
Cover requirements	30" soil	3ft	3ft
Distance to Property Lines	50ft	50ft	50ft
Distance to Residences	500ft	none	300 ft recommended at 250k+ birds
Distance to private well	100ft	150ft	100ft
Distance to public well	200ft	150ft	300ft
Distance to streams, wetlands etc.	100ft	300ft	300ft
Floodplain	not allowed	unclear	Regulated floodway
Post Disposal Env. Monitoring	No	No	Recommended at 250k+ birds
Deed Recordation	Yes	Yes w/in 90 days	Recommended
GPS Tracking/Reporting	Yes	Yes	Yes
Other Restrictions/Comments	*Iowa allows 44 hogs, 7 cattle 73 sheep or lambs, 400 poultry carcasses per any given acre per year - waived by Gov. proclamation *Trench Design - 7ft bottom width. Length based on 10-12k birds/100ft *15 on-farm burial - Had to shift to other option due to heavy rains	*Requires 1000 ft from pond or lake. 50ft from tile drainage line. Not allowed where known sinkholes, caves, etc. exist *BAH maintains ultimate ultimate authority for conditions approval for disposal *PCA retains authority to enforce for resulting pollution *Occurs under MOU between BAH & PCA	*Recommending gas monitoring on collective burial sites of 250k+

Animal Burial Guidelines During A Declared Emergency

April 2011

Introduction

Hurricane Floyd on September 15, 1999 combined with the weather conditions before and immediately after this hurricane resulted in the most severe flooding and devastation in North Carolina history. The flooding caused an estimated $813 million in agricultural losses affecting 32,000 farmers. In addition to crop loss, there was significant loss of livestock including 2,860,827 poultry, 28,000 swine, and 619 cattle. Disposal of dead animals was a significant problem. Proper burial and disposal will prevent potential public health problems resulting from large numbers of dead and decaying animals including the spread of harmful pathogens, ground and surface water contamination, and pest control. In certain situations, burial of dead animals may be the best alternative for immediate disposal. These guidelines are designed to insure burial is done in a safe and effective manner.

Legal Authority

North Carolina General Statute 106-403 (NCGS) Disposition of dead domesticated animals states that it is the responsibility of the owner or person in charge of his domesticated animals to bury dead animals appropriately within 24 hours after knowledge of the death. It is the responsibility of the municipal or county government to designate appropriate persons to dispose of any domestic dead animals whose owner cannot be identified. (See attached copy of NCGS 106-403 and companion opinion from the Attorney General's Office dated June 8, 1984.)

The NC Department of Agriculture - Veterinary Division is the lead state agency to oversee animal disposal as regulated under existing Administrative Rules, specifically, **Subchapter 52C - Control of Livestock Diseases: Miscellaneous Provisions, Section .0100 - Diseased and Dead Animals** (See Attached)

The State Health Director and by extension the Local Health Director in each county is charged with preventing health risks and disease and promoting a safe and healthful environment according to **NCGS 130A, Articles 1-20**. To the extent that dead animals become a threat to human health, the State and Local Health Director has broad authority to investigate and act on matters to protect health.

The Environmental Management Commission protects the groundwater quality in the State of North Carolina through rules established in **15A NCAC Subchapter 2L - "Classifications and Water Quality Standards Applicable to the Groundwaters of North Carolina."** These rules establish groundwater quality standards that may not be exceeded without a permit issued under the authority of the Commission. The Groundwater Section of the Division of Water Quality is responsible for the administration and enforcement of these rules. Any surface or subsurface activity that has the potential to cause groundwater standards to be exceeded is subject to the regulatory authority of the Commission.

Scope

While it is recognized that there are multiple types and degrees of emergencies that could create the need for dead animal burial, these guidelines focus on the most common cause and the most recent experience, flooding and electrical outages. For example, guidelines for managing dead animals during a foreign animal disease emergency may differ and would be managed through the State Veterinarian.

These guidelines are intended to address dead animal disposal during a declared emergency and therefore do not take the place of the dead animal disposal that occurs under the normal permitted operation of a farm. The Governor can declare a state of emergency in North Carolina with or without a federal declaration of the same.

Emergency Planning

Each farm operation shall make specific plans for animal disposal in the event of an emergency. When burial is determined to be the disposal method of choice, an attempt should be made first to bury the dead animals on the farm according to these guidelines. If proper burial is not possible on the farm then plans should be made for alternative sites.

Burial Guidelines

1. The bottom of the hole where dead animals are to be buried should be 3 feet above the seasonal high water table wherever possible and at least 12 inches above the seasonal high water table. (Farm owners may contact the local NRCS agency or the local health department for assistance in determining the seasonal high water table.)
2. Standing water in the hole does not preclude animal burial as long as the bottom of the hole is at least 12 inches above the seasonal high water table, not in an area of standing water, and the other conditions for proper burial are met.
3. There must be at least 3 feet of soil covering any buried animal. This can be interpreted to mean soil mounded over the animals above the adjacent ground level.
4. The burial site must be at least 300 feet from any existing stream or public body of water.
5. The burial site must be at least 300 feet from any existing public water supply well.
6. The burial site must be at least 100 feet from any other type of existing well.
7. The burial site cannot include any portion of a waste lagoon or lagoon wall.
8. In the case where the burial site is in a waste disposal spray field, the burial site is not available for subsequent waste spraying until a new viable crop is established on the site.
9. The burial site shall be located so as to minimize the effect of stormwater runoff.
10. Burial is not permitted in the tiled area of an underdrained field.
11. A record of the location of the approved site (GPS latitude and longitude coordinates if available), the burial history of each burial site to include the date, species, head count and age must be kept by the owner and reported to the Local Health Director who will in turn report this information to the appropriate State agency - DENR Division of Water Quality, Groundwater Section.
12. Farm owners and operators are encouraged to consider measures that could be taken prior to an imminent emergency that could reduce the impact on the farm and the environment.

Collective Burial Site
A collective burial site may be designated to serve one or more counties in the event of a large-scale emergency whereby individual farm sites are not available. The responsibility for disposal of dead animals remains with the owner, lessee, or person in charge of any land upon which any domesticated animals die. The county or municipality should identify an appropriate burial site(s) with the capacity to bury up to 5% of the steady state live weight of livestock in that jurisdiction. The use of an existing county or municipal landfill as a dead animal burial site is legal and preferred.

Burial Site Location
Best farm practices suggest that burial sites with the capacity to handle the type and number of animals most likely to be needed during an emergency for each farm operation be identified prior to the emergency. It is recommended that the emergency burial plan be incorporated into the farm's existing conservation plan.

Contact Information
- N.C. Department of Agriculture and Consumer Services
  Veterinary Division
  Dr. Tom Ray (Livestock)
  Dr. Sarah Mason (Poultry)
  1030 Mail Service Center
  Raleigh, NC 27699-1030
  (919)733-7601

NCDENR
North Carolina Department of Environment and Natural Resources

Dexter R. Matthews, Director | **Division of Waste Management** | Michael F. Easley, Governor
William G. Ross Jr., Secretary

May 13, 2008

Dr. David Marshall, DVM
State Veterinarian
NCDA&CS Veterinary Division
1030 Mail Service Center
Raleigh, NC 27699-1030

Dear Dr. Marshall:

During recent months, Solid Waste Section staff members participated in the planning sessions for NCDA's Operation Flock Together exercise related to an Avian Influenza event. As part of the discussions related to the disposal of mass animal mortality in such an event, our staff has also conducted two meetings with Drs. Karen Beck and Sarah Mason with NCDA's Emergency Programs Division.

As you stated in your letter dated February 12, 2002 to Greg Thorpe, Acting Director of the NC Division of Water Quality, General Statute 106.403, "Disposition of dead domesticated animals", outlines the authority of your office to oversee disposal of dead domesticated animals. The Solid Waste Section has reviewed our statutory authority, and the Statutes provide the Section with no authority in a mass mortality event, unless mortality arrives at one of our permitted facilities for disposal.

In 2006, the Section conducted a survey of our permitted facilities in the top ten ranking poultry counties in NC, and found that most of the facilities could not handle mass mortality disposal.

Based on that premise and the Statutes not providing the Section a means to regulate such disposal, the Section agrees with the guidance developed by the State Animal Response Team (SART) in 2000 to address burial requirements in a declared disaster event like an Avian Influenza outbreak. The Section also agrees with NCDA's efforts to work with the producers, farmers, etc. to be proactive in their planning for such an event as outlined in the SART document, which would also include contingency plans if their first option is not available.

Sincerely,

Paul S. Crissman, Chief
Solid Waste Section

Cc: Dexter Matthews, Director, Division of Waste Management
Mark Poindexter, Field Operations Branch Head
Dr. Sarah Mason, NCDA&CS Emergency Response

Michael F. Easley, Governor

William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Coleen H. Sullins, Director
Division of Water Quality

June 6, 2008

Dr. David T. Marshall
NCDA& CS, Veterinarian Division
1030 Mail Service Center
Raleigh NC, 27699-1030

Dear Dr. Marshall,

There have recently been discussions among several state agencies about the proper procedures to address animal mortality during a declared emergency. In 2003, the State Animal Response Team (SART) developed a guidance document for farmers and field staff to use when evaluating sites for use as a burial location.

The "Burial Standards" section of the SART memo outlines several standards to follow when determining suitability of a site for burial. It is the Division of Water Quality's opinion that these standards are appropriate and adequate to protect water quality when used during emergency situations.

If you have any questions or comments you can contact me or Keith Larick at (919) 733-3221.

Sincerely,

Theodore L. Bush, Jr., Chief
Aquifer Protection Section

Aquifer Protection Section
Raleigh Regional Office
Internet: www.ncwaterquality.org

1628 Mail Service Center
Location: 3800 Barrett Dr.

Raleigh, NC 27699-1628
Raleigh, NC 27609

Phone (919) 791-4200
Fax (919) 571-4718

Customer Service
1-877-623-6748

Animal Burial Guidelines During A Declared Emergency

State Animal Response Team

Introduction

Hurricane Floyd on September 15, 1999 combined with the weather conditions before and immediately after this hurricane resulted in the most severe flooding and devastation in North Carolina history. The flooding caused an estimated $813 million in agricultural losses affecting 32,000 farmers. In addition to crop loss, there was significant loss of livestock including 2,860,827 poultry, 28,000 swine, and 619 cattle. Disposal of dead animals was a significant problem. Proper burial and disposal will prevent potential public health problems resulting from large numbers of dead and decaying animals including the spread of harmful pathogens, ground and surface water contamination, and pest control. In certain situations, burial of dead animals may be the best alternative for immediate disposal. These guidelines are designed to insure burial is done in a safe and effective manner.

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9. The burial site shall be located so as to minimize the effect of stormwater runoff.
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11. A record of the location of the approved site (GPS latitude and longitude coordinates if available), the burial history of each burial site to include the date, species, head count and age must be kept by the owner and reported to the Local Health Director who will in turn report this information to the appropriate State agency - DENR Division of Water Quality, Groundwater Section.
12. Farm owners and operators are encouraged to consider measures that could be taken prior to an imminent emergency that could reduce the impact on the farm and the environment.

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Burial Standards

animals die. The county or municipality should identify an appropriate burial site(s) with the capacity to bury up to 5% of the steady state live weight of livestock in that jurisdiction. The use of an existing county or municipal landfill as a dead animal burial site is legal and preferred.

Burial Site Location

Best farm practices suggest that burial sites with the capacity to handle the type and number of animals most likely to be needed during an emergency for each farm operation be identified prior to the emergency. It is recommended that the emergency burial plan be incorporated into the farm's existing conservation plan.

Contact Information

- N.C. Department of Environment and Natural Resources
  Division of Water Quality/Groundwater Section
  Arthur Mulberry - Section Chief
  1636 Mail Service Center
  Raleigh, NC 27699-1636
  (919)733-3221

- N.C. Department of Health and Human Services
  Division of Public Health/Epidemiology and Communicable Disease Section
  Dr. Steve Cline - Section Chief
  1902 Mail Service Center
  Raleigh, NC 27699-1902
  (919)733-3421

- SART (State Animal Response Team)

Meg Scott Phipps
Commissioner

Weldon B. Denny
Chief Deputy Commissioner

North Carolina Department of Agriculture and Consumer Services Veterinary Division

David T. Marshall, DVM
State Veterinarian
Assistant Commissioner
of Animal Industry

February 12, 2002

Mr. Greg Thorpe, Acting Director
Division of Water Quality
Department of Environmental and Natural Resources
1601 Mail Service Center
Raleigh, North Carolina 27699-1601

Dear Mr. Thorpe,

Several sections of the General Statutes speak to the authority of the state veterinarian to oversee disposal of dead domesticated animals, including GS 106-403, "Disposition of dead domesticated animals". This section underwent minor technical amendments on April 4, 2001 as part of the Senate Bill 779 as the General Assembly strengthened the authority of this office to deal with issues related to an outbreak of a serious contagious animal disease.

While not obligated to do so, I endorse the guidelines developed by the State Animal Response Team (SART) to address burial requirements in the event of a declared disaster. These guidelines are actually more restrictive than the language in GS 106-403, and were developed through a multi agency/industry effort as a means of addressing a potential problem. I participated in those discussions.

I find the SART burial guidelines as comprehensive and reasonable, and will use them as a blueprint in addressing disposal issues during a declared emergency should we encounter one.

Sincerely,

Dr. David T. Marshall, D.V.M

Dr. David T. Marshall
State Veterinarian

DTM/jaw

Disposal of Domestic Birds Infected by Avian Influenza – An Overview of Considerations and Options

August 11, 2006

U.S. Environmental Protection Agency
EPA530-R-06-009

Disposal of Domestic Birds Infected by Avian Influenza – An Overview of Considerations and Options

1. PURPOSE

This document provides information to State and local decision makers addressing disposal problems associated with domesticated bird carcasses (and associated fecal material) infected by the avian influenza virus H5N1. It provides a description of successful disposal management options for infected carcasses and identifies critical considerations for decision makers. This document draws from a variety of available resources and complements existing guidance from the U.S. Department of Agriculture (USDA). The information contained in this document may be used by State and local governments to conduct advanced planning (e.g., special permit conditions, emergency orders, pre-screening of sites) in coordination with the Federal government and the private sector. The use of any management option in response to an avian influenza outbreak must be in compliance with all State/local requirements (e.g., air, solid waste and public health requirements.) This document is not intended to provide detailed guidance on how to implement specific disposal options but rather it identifies successful approaches taken in the past. And it provides references to specific guidance on the different management and disposal options.

This document focuses on domesticated birds. The Department of the Interior (DOI) is the lead Agency in response to an outbreak of the avian influenza virus H5N1 in wild birds. The USGS National Wildlife Health Center, under DOI, has several sites where more information can be obtained:
http://www.nwhc.usgs.gov/publications/wildlife_health_bulletins/WHB_05_03.jsp, and
http://www.nwhc.usgs.gov/publications/field_manual/chapter_4.pdf.

2. BACKGROUND

In domestic poultry, avian influenza viruses cause two main forms of disease, distinguished by low and high extremes of pathogenicity, as well as many different subtypes (i.e., H5N2, H7, etc). The low-pathogenic (LPAI) form causes relatively mild symptoms (ruffled feathers, drop in egg production), with no serious human health concerns identified. The highly pathogenic (HPAI) form is a much more serious threat to bird health. Occurrence of HPAI in the U.S. has been very infrequent, quickly contained and normally affects only birds. The Asian High Pathogenic Avian Influenza form, which is a subtype of HPAI, also known as H5N1, has been found in Asia, Europe, and Africa, but not in the U.S. to date. It spreads very rapidly through poultry flocks causing mortality rates of domesticated birds that can approach 100% within 48 hours (see Resource: WHO, 2006.) As of December 2005, over 150 million domesticated birds have been killed by the virus or culled to prevent further spread (see Resource: World Health Organization (WHO), 2005.) There have been some cases in Asia and Eastern Europe of HPAI H5N1 spreading to humans through sustained close contact with live birds. The U.S. Department of Agriculture (USDA) has indicated that this virus has the potential to generate large numbers of animal carcasses from the response to an avian influenza outbreak.

2.1 Key Occurrences of HPAI in Domestic Avian Populations

To date, all occurrences of HPAI in U.S. domestic poultry have been caused by H5 or H7 Influenza A subtypes, but not H5N1. Until 1999, HPAI was considered relatively rare, with only 17 outbreaks reported worldwide between 1959 and 1998; however, since 1999 the number of occurrences globally has increased significantly (see Resource: WHO, Avian Influenza Timeline, 2006.) USDA and others have dealt effectively with the management of animal carcasses during HPAI outbreaks (highlighted below).

Occurrences of HPAI in the U.S.				
Year	**Type**	**State**	**Impact**	**Comments**
1924	H7	East Coast	Occurred on the East Coast	Outbreak was contained and eradicated.
1983-1984	H5N2	PA, VA	Caused severe clinical disease & high mortality rates in chickens, turkeys, & guinea fowl. 17 million birds were culled.	A serologically identical but apparently mild virus had been circulating in poultry in the area for 6 months. No human cases identified.

2004	H5N2	TX	About 7,000 Chicken Broilers were culled.	Quickly eradicated due to close coordination b/n USDA, State, Local & Industry. Response included quarantine and culling of birds. Outbreak limited to one flock. No human cases identified.
*Additional outbreaks of HPAI have been identified in a variety of countries.				

These occurrences show how to successfully respond to an avian influenza outbreak in a manner that is protective of human health and the environment. This guide integrates the lessons learned from these previous avian influenza outbreaks by USDA and states as they responded to these occurrences.

3. ROLES DURING DISPOSAL ACTIONS

The National Response Plan (NRP), http://www.dhs.gov/dhspublic/interapp/editorial/editorial_0566.xml, identifies USDA as the lead federal agency in responding to a large-scale animal carcass disposal incident. USDA authority to act swiftly to protect U.S. animal health from a foreign pest or disease is identified in the Animal Health Protection Act (AHPA) of 2002. The AHPA gives USDA authority to carry out operations and measures to detect, control, or eradicate any pest or disease of livestock, including poultry. Other departments and agencies of the Executive branch provide supporting roles under this plan. EPA's principal support role includes providing technical assistance, subject matter expertise, and support for decontamination (including licensing use of disinfectant pesticides) and disposal issues, including interpretation of EPA's disposal requirements. Recently, EPA, USDA, HHS, DoD, and DHS issued an interagency document, "Federal Food and Agriculture Decontamination and Disposal Roles and Responsibilities," November 2005, http://www.epa.gov/homelandsecurity/pdfs/conops11222005.pdf, which outlines the Federal government roles, responsibilities and capabilities for decontamination and disposal of diseased animals. Appendix A presents contact information for those agencies involved in the NRP. Appendix B presents how an AI outbreak scenario would unfold according to the interagency plans developed for an AI outbreak and in accordance with the NRP.

It is important to realize that each AI outbreak incident is unique and involves site specific conditions that need to be considered in making the best disposal decision for the situation at the site. The decision making for disposal occurs at the State and local levels, with technical and resource support in place from federal agencies, should the situation require it or should the State and/or local government request it.

4. CRITICAL FACTORS (Transportation, Expedience, & Virus Inactivation)

There are three critical factors that influence the potential management options for disposal of domestic birds associated with an avian influenza outbreak:

1. Contain the virus by limiting transportation of infected birds;
2. Respond expeditiously to reduce the potential for genetic mutations and the transmission of pathogens to humans and other species (USDA's goal is for euthanized carcasses to be disposed of within 24 hours.) USDA describes common methods of disposal to include composting, burial, incineration, landfilling, rendering, and alkaline hydrolysis. (The 24 hr. period should not limit proper packaging, transportation or disposal. Also, it should not preclude composting which can be a very successful option.) See Reference, USDA National Animal Health Emergency Management System Guidelines for Disposal, April 2005, pg 5); and
3. Select carcass treatment/disposal option(s) that ensure containment and inactivation of the virus and protection of the environment given the site-specific conditions.

To minimize the spread of the virus by transportation, USDA prefers on-site management, which limits the options to activities that can be carried out at a poultry farm (USDA Interim Avian Influenza (AI) Response

Plan, January 2006.) On-site management (e.g., on-site composting) minimizes biosecurity concerns involved in moving contaminated carcasses, animal products, and other materials off an affected premises. On-site composting has been shown to be a successfully used practice based on its effectiveness by inactivating the virus in recent AI outbreaks. However, USDA recognizes that not all types of poultry operations (e.g., live bird markets) lend themselves to on-site management, and therefore, secure transport to an off-site treatment/disposal facility may also be a viable option. The need for expeditious response further limits the selection of options to those that are readily available. As for the ability of the virus to survive, in general, HPAI viruses are not particularly hardy under certain circumstances, and thus basic options can be effective and protective.

In the selection of treatment/disposal options, survivability of the virus is a key consideration. Short-term exposure to heat, extremes of pH, and dryness can inactivate avian influenza. However, survivability is lengthened when viruses are protected in organic matter, such as feces or maintained in colder temperatures. Several sources have identified that the avian influenza virus, H5N1, has a limited time of survival without a live host of less than or equal to 1-7 days at temperatures around 70ºF. Survival time may be over 30 days in water at 32ºF, and indefinite in frozen conditions or shortened to ½ to 3 hours at elevated temperatures (132-140ºF). Studies on the survivability of various forms of the avian influenza virus include:

- Studies of domestic ducks have shown that H5N1 can survive in the environment for 6 days at 98ºF. (See References: WHO; Lab study of H5N1 viruses in domestic ducks, Oct 2004.)

- HPAI can persist in feces for 30-35 days at 39ºF, and about 7 days at 68ºF. (See References: Swayne, DE and Halvorson, DA. Avian Influenza, Diseases of Poultry, pg 135-160, 2003.)

- HPAI virus remains viable at moderate temperatures for long periods in the environment and can survive indefinitely in frozen material. It can survive for 4 days in water at 71ºF and for over 30 days at 32ºF. (See Reference: http://www.poultry-health.com/fora/fowlplag.htm, Poultry Health Services website.)

- Lu et al. (2003) reported that Avian Influenza Virus (AIV) can be inactivated in 10 minutes at 140^{o}F or 90 minutes at 133^{o}F. (See Reference: Lu H., Castro A.E., Pennick K., Liu J., Yang Q., Dunn P., Weinstock D. and D. Henzler. 2003. Survival of Avian Influenza virus H7N2 in SPF Chickens and Their Environments. Avian Diseases 47:1015-1021.)

See Appendix C for additional discussion on the environmental persistence of the avian influenza virus.

5. CARCASS MANAGEMENT OPTIONS

The management options presented below are organized with on-site treatment/disposal options presented first followed by off-site landfills and then other potential management options. The order of the treatment/disposal options is not meant to reflect that certain options are better than others. All the options presented can be designed and conducted in an environmentally protective manner, depending on the specific site conditions, which need to be considered.

USDA has several extensive documents that discuss the various management options and the critical factors that need to be considered by States in the decision making process during an avian influenza occurrence. One example of such is a report prepared for the USDA Animal and Plant Health Inspection Service (APHIS) by the National Agricultural Biosecurity Center (NABC). This 2004 report, "Carcass Disposal: A Comprehensive Review" is available at:

http://fss.k-state.edu/research/books/carcassdispfiles/Carcass%20Disposal.html

The overall approach outlined by USDA for an avian influenza outbreak is a three-pronged strategy of depopulation (also known as culling), followed by proper quarantining and disposal of animal carcasses, and disinfection of farms and equipment used in the response. The overall goal of disposal operations, which is the subject of this document, is to eliminate, in a timely, biosecure, aesthetically acceptable, and environmentally responsible manner, all animal carcasses that result from the response to an avian influenza outbreak. Common methods used to manage infected animal carcasses and associated materials include composting, burial, incineration, rendering, and isolation. (See References, USDA National Animal Health Emergency Management System Guidelines for Disposal, April 2005; USDA Interim Avian Influenza Response Plan, January 2006.) As with any of the management options, there are some considerations, such as down time of the poultry house, lack of available equipment, timing, and end use of the material that need to be factored into the decision making process when selecting a management option. With some of the management options, e.g., on-site burial and on-site isolation, the survivability of the avian influenza virus is the critical factor, and as such, decision makers should consult with Federal/State USDA officials to gather the latest information on the survivability of the virus. A brief summary of these waste management options is provided below.

5.1 On-Site Composting

Although not sufficiently rapid to allow disposal of the carcasses within 24 hours, on-site (including in-house) composting will likely be a very widespread practice because its effectiveness has been proven in recent AI outbreaks. On-site composting limits the risk of groundwater and air pollution contamination, the potential for farm-to-farm disease transmission, and transportation costs and tipping fees associated with off-site disposal. Additionally, there is the benefit of producing a potentially useful product, compost. As indicated earlier, HPAI may be inactivated in 3 hours at 132ºF or ½ hour at 140ºF, well within the temperature range of composting. In the case of the Delmarva Peninsula (Delaware, Maryland and Virginia) outbreak in 2004, composting in-house occurred for 10 days, after which the material, which no longer contained a viable virus, was allowed to continue the composting process over several months elsewhere on-site. (See References, 2005 Guidelines for In-House Composting of Poultry Mortalities Due to Catastrophic Disease.)

Composting is defined as the controlled decomposition of organic materials. Decomposition occurs when organic materials go through a "slow cooking" process as microorganisms metabolize the organics. The combination of the cooking process, rapid degradation, and compost cover minimizes odors, flies, and other vectors. For this option to be effective, composting materials need to be available. These materials usually are accessible on most farms and include poultry litter, wood chips, sawdust, ground corn cobs, baled corn stalks, manure, and rice hulls. In March 2006, Virginia issued recommendations for whole-flock disposal of poultry due to Avian Influenza which identifies on-site in-house composting as the preferred disposal method. (See References: VA DEQ Recommendations For Whole-Flock Disposal of Poultry due to Avian Influenza, March 2006.) For some general resources on composting, see the Maryland Center for Agro-Security and Emergency Management website, Virginia Department of Environmental Quality, or the EPA Composting website at:

http://www.agnr.umd.edu/MCE/Publications/Publication.cfm?ID=fs-537
http://www.deq.virginia.gov/waste/pdf/factsheet1va.pdf
http://www.deq.virginia.gov/waste/solid.html
http://www.deq.virginia.gov/waste/pdf/deqaidisposal.pdf
http://www.epa.gov/epaoswer/non-hw/composting/index.htm

When the composting process inactivates the virus, but does not continue long enough to produce usable compost, the material can be further composted on-site, sent off-site to a compost facility, landfill or

incinerator, or buried on-site. If compost is produced, consistent with State compost quality standards, it may be beneficially used on- or off-site to enrich soils by providing nutrients and reducing the need for chemical fertilizers. State officials should be consulted when the ultimate fate of the material is determined.

5.2 On-Site Burial:

On-site burial avoids transportation and can be accomplished in a very expeditious manner. Site conditions, however, need to be carefully assessed to ensure there will not be contamination of groundwater or surface waters by either the HPAI H5N1 virus or conventional pollutants, such as total dissolved solids, nitrate, or ammonia from the decaying carcasses. Adequate upfront assessment of on-site burial can prevent expensive remediation costs. If on-site burial will be used, monitoring of ground water and surface water is a consideration that State officials should take into account, as well as the potential need for a notation on the deed. Potential future land use of the property should be considered in deciding whether this management option is appropriate.

When making decisions regarding on-site burial, those responsible should:

- Consult with the USDA-Natural Resources Conservation Service (NRCS) and State solid waste agencies to obtain soil maps and drainage information. In addition, some local NRCS offices maintain a listing of suitability for "Animal Mortality Burial" by soil map unit (See Reference: Carcass Disposal: A Comprehensive Review.)
- Determine a sufficient distance from the proposed burial site to groundwater wells and surface waters such that the HPAI H5N1 virus will no longer be viable by the time groundwater migrates to such locations. A sufficient distance needs to take into account site-specific hydrogeology.
- Consider practices to ensure groundwater is not contaminated by conventional pollutants, such as total dissolved solids and ammonia. Site-specific factors should be considered such as 1) soil type (e.g., karst areas) and 2) depth to groundwater (e.g., seasonally high). USDA recommends animal carcasses not be buried within 10 ft of the groundwater table. (See Reference: USDA National Animal Health Emergency Management System Guidelines for Disposal, April 2005.) Where site-specific conditions are determined not to be protective, the use of a liner system may be considered.
- Evaluate the potential for the carcasses to rise to the surface after burial.
- Consult with the landowner in those cases where producers do not own the land to determine if the landowner will permit on-site burial.

5.3 On-Site Air Curtain Incineration:

In some cases, site conditions may not be amenable to on-site composting or burial of animal carcasses. One solution is to employ air-curtain incinerators to destroy the virus and burn the carcasses. This involves burning with forced air within a site which greatly accelerates the burning process. Air-curtain incinerators can be moved from place-to-place and from site to site. Air-curtain incinerators also require 1) trained operators to properly operate the equipment and 2) a large amount of fuel because the carcasses have a high water content. Advances in this technology include more efficient burners, and the use of misters to reduce the air emission concerns normally associated with open air-curtain technology. With air-curtain incinerators, the loading of the incinerators and the effect of the carcasses on the combustion process needs to be considered, as well as the ultimate disposal of any solid and/or liquid residue. Upfront planning between poultry growers/companies and air-curtain incinerator suppliers is important to ensure such equipment and operators will be available and discussions with local and State officials are necessary to assure compliance with environmental requirements. Incineration destroys the virus so the ash from an air-curtain incinerator can be disposed of on-site or at an off-site landfill. (See Reference: USDA National Animal Health Emergency Management System Guidelines for Disposal, April 2005, pg 14-15.)

5.4 On-Site Isolation:

In some cases, particularly in warm weather, where the deactivation of the virus is fairly rapid, isolation of carcasses may be a viable option. Considerations for this option should include a covering or the use of bags/containers prior to isolation to improve handling, (i.e., poultry carcasses become difficult to manage after 24 hours) to prevent the spread of the virus, control odors, as well as controls to prevent vectors. This option also can be used in combination with other on-site options to provide additional time to set up composting or air-curtain incinerators or for on-site burial. If the isolation is sufficient to deactivate the virus, the material may be buried on-site or sent off-site to a landfill or incinerator. (See Reference: USDA National Animal Health Emergency Management System Guidelines for Disposal, April 2005, pg 5.)

5.5 Off-Site Landfills:

Off-site landfills that can be used to manage carcasses include municipal solid waste landfills (MSWLFs), in compliance with the Federal criteria (40 CFR Part 258), and industrial solid waste landfills. (In considering this option, the off-site transport of these carcasses will need to be appropriately considered. See discussion below in Section 7 regarding the off-site transport of birds infected with avian influenza virus.) Municipal landfills are properly sited and have the necessary environmental controls to manage the carcasses. Larger MSWLFs have the capacity to handle a larger number and mass of carcasses. The use of a MSWLF, of course, depends upon the willingness of the facility operator to accept the carcasses. These facilities operate under state permits, which might require modifications to allow management of the carcasses.

5.6 Other Management Options:

There also may be consideration of other options, such as: off-site incinerators, mobile incinerators, alkaline hydrolysis units, off-site composting, and rendering without prior deactivation of the HPAI H5N1 virus and possibly new and alternative/innovative approaches. Certain situations may require alternative approaches. For example, very cold temperatures may make some options impractical and dictate different approaches (e.g., burn barrels, boiling, or the use of lime to raise the pH) to respond to an HPAI H5N1 outbreak in a very cold climate.

Incinerators, such as mobile and municipal solid waste incinerators, are contained and controlled devices that can burn the carcasses and limit air emissions in a manner that is environmentally protective. An alkaline hydrolysis unit uses sodium hydroxide or potassium hydroxide to increase the rate of hydrolysis of the biological materials into a sterile solution. Heat is also applied to accelerate the process further. The only solid byproducts of the alkaline hydrolysis unit are the mineral constituents of the carcasses. Rendering of animal carcasses involves conversion of the carcasses into three end products – carcass meal, tallow, and water using mechanical and thermal processes. Carcass rendering processes include size reduction followed by cooking and separation of fat, water, and protein. Such options may prove advantageous when site-specific conditions, timing issues, or some other factors make the previous options less advantageous. As a general matter, however, the off-site options require additional care to prevent the potential spread of the virus, can be more expensive, and may run into public acceptance concerns. Off-site options, however, should not be automatically dismissed – for example, off-site incinerators are well designed to manage wastes and are environmentally protective.

6. EQUIPMENT CLEANING AND DISINFECTION:

With both on-site and any off-site carcass disposal options, farm structures, poultry houses, and equipment should be cleaned and disinfected after the carcasses are removed to prevent spread of the virus and to repopulate. In addition, equipment used on-site, such as trucks, should be cleaned and disinfected prior to

leaving the site to prevent any potential transmission of the virus off-site. Worker's clothing also should be disinfected for the same reason. The USDA's guidance (see References: USDA National Animal Health Emergency Management System Guidelines for Cleaning and Disinfection, November 2005, USDA Interim Avian Influenza Response Plan, Jan 2006) on appropriate disinfectant procedures should be consulted for further information. EPA provides technical support to USDA and others on the use of appropriate disinfectants. A resource that lists EPA registered (or licensed) disinfectants for use in poultry and farm facilities to inactivate avian influenza viruses is available at: www.epa.gov/pesticides/factsheets/avian.htm. EPA registers pesticide products, including disinfectants. Currently, 100 disinfectant products are registered and intended for use against avian influenza A viruses. These products are effective on hard, non-porous surfaces usually with a 10-minute application. If the need arises for an unregistered pesticide or for an unregistered use of a registered product, EPA may (if adequate data are available to support the request) grant an emergency exemption to allow the distribution, sale, and use of the unregistered product or unregistered use of a registered product for a limited period of time.

7. TRANSPORTATION:

The transportation of birds infected with the avian influenza virus from the affected premises to off-site locations will need to consider special procedures to prevent the spread of disease. These procedures include having a disinfectant appropriate for the pathogen or virus, leak-proof transportation, and polyethylene plastic sheets. In addition, it is recommended that a designated government representative accompany these vehicles for biosecurity reasons where practical. In addition, all vehicles should be cleaned and disinfected before they leave the affected premises and again after the material has been unloaded at the disposal site. Cleaning and disinfection procedures are important for all personnel, vehicles, and equipment. (See Reference: USDA National Animal Health Emergency Management System Guidelines for Disposal, April 2005, pg 3-5 and USDA Interim Avian Influenza (AI) Response Plan, January 2006.) Consideration needs to be given to lining the trucks used in transporting carcasses to contain any fluids and to make it easier to remove the carcasses from the vehicles. An alternative to lining trucks may be the use of 1) macro-vaults (i.e., roll-off containers which can be sealed and are used by some portion of the waste management industry) or 2) biomedical waste transport vehicles. For more details on the above environmental issues and to better understand economic and social challenges regarding transportation, see "Lessons Learned from AI Outbreaks in Virginia 1983 and 2002."

8. PERSONNEL PROTECTIVE EQUIPMENT (PPE)

Biosecurity is important for the eradication and control of a disease during an animal health emergency. The use of personnel protective equipment (PPE) is an essential element of a successful biosecurity plan. PPE refers to equipment used as a barrier between an individual and a hazard that could result in an injury or occupational illness. The selection of PPE to protect workers in any given hazard situation should be based on consideration of three factors: 1) information on the nature and magnitude of the hazard, 2) performance data on the PPE under consideration, and 3) the estimated level of residual risk resulting from the quantity or concentration of the agent to which workers will be exposed while the PPE is in use. Appendix B in the USDA Interim Avian Influenza (AI) Response Plan discusses the use of PPE by foreign animal disease diagnosticians (FADDs) and associated personnel charged with investigating reports of animal diseases.

9. SUMMARY

The USDA is the lead federal agency in responding to foreign animal diseases. EPA, along with several other federal agencies, has support roles within the overall federal response. EPA's principal support role includes providing technical assistance and subject-matter expertise and support for disinfection and disposal issues. In

addition, EPA maintains communication with other federal agencies involved in an avian influenza outbreak response, as well as States, Tribes, local agencies, and other solid waste management stakeholders.

This document identifies three critical factors and considerations in the disposal decision-making process during an avian influenza outbreak: contain the virus by limiting transportation of infected birds; respond expeditiously to reduce the potential for genetic mutations and transmission of pathogens to humans and other species (USDA's goal is for euthanized carcasses to be disposed of within 24 hours); and select carcass treatment/disposal options that ensure containment and inactivation of the virus and protection of the environment given the site-specific conditions. As for key potential carcass management options, this document provides information on on-site composting, burial, incineration, and isolation, and off-site landfills. In addition, other management options are briefly identified. Numerous references and resources are provided in Appendix D for those seeking more detailed information.

USDA and others have effectively dealt with a variety of animal diseases, including the disposal of HPAI contaminated animal carcasses. Through the combined efforts of the federal, state, and local governments, management of an avian influenza H5N1 outbreak can be handled in a manner that is protective of human health and the environment.

APPENDIX A

CONTACT INFORMATION FOR KEY PROGRAM OFFICES AND EMERGENCY OPERATION CENTERS

Agency	Phone Number	Website
National Response Center (NRC) *To report oil or chemical spills*	**800-424-8802**	http://www.nrc.uscg.mil/
U.S. Dept of Agriculture (USDA)	**877-677-2369** (toll free)	http://www.usda.gov/
Animal & Plan Health Inspection Service (APHIS)		http://www.aphis.usda.gov/
APHIS Emergency Operations Center (EOC)		
APHIS Plant Protection and Quarantine (PPQ)		http://www.aphis.usda.gov/ppq/
Food Safety Inspection Service (FSIS)		http://www.fsis.usda.gov/
Veterinary Services (VS)		
U.S. Dept of Defense (DoD)	**703-428-0711**	http://www.dod.gov/
U.S. Dept of Interior (DOI)	**202-208-4108**	http://www.doi.gov/
U.S. Dept of State (DOS)	**202-647-1512**	http://www.state.gov/
U.S. Dept of Health & Human Services (HHS)	**301-443-1240**	http://www.hhs.gov/
Food and Drug Administration (FDA)		http://www.fda.gov/
FDA Emergency Operations Center (EOC)		
U.S. Dept of Homeland Security (DHS)	**202-282-8000**	http://www.dhs.gov/
Homeland Security Operations Center (HSOC)	**202-282-8100**	
U.S. Environmental Protection Agency (EPA)	**202-272-0167**	http://www.epa.gov
Office of the Administrator	**202-564-6978**	http://www.epa.gov/adminweb/
Office of Homeland Security		http://www.epa.gov/homelandsecurity/
Office of Enforcement and Compliance Assurance (OECA)	**202-564-2440**	http://www.epa.gov/compliance/
Office of Criminal Enforcement	**202-564-2480**	
Training and Forensics	**202-564-2523**	
Criminal Investigation Division		
Office of Prevention, Pesticides, and Toxic Substances (OPPTS)	**202-564-2902**	http://www.epa.gov/oppts
Office of Pesticide Programs (OPP)	**703-305-7090**	http://www.epa.gov/pesticides/
Office of Solid Waste & Emergency Response (OSWER)	**202-566-0200**	http://www.epa.gov/swerrims/
Emergency Operations Center	**202-564-3850**	http://www.epa.gov/swerrims/emergencies.htm
Office of Emergency Management	**202-564-8600**	
Office of Water (OW)	**202-564-5700**	http://www.epa.gov/OW
Office of Groundwater and Drinking Water	**202-564-3750**	http://www.epa.gov/safewater/
Water Security Division	**202-564-3779**	http://cfpub.epa.gov/safewater/watersecurity/index.cfm

APPENDIX B

AVIAN INFLUENZA OUTBREAK SCENARIO

- A farmer observes either sick or dying birds within his or her flock and notifies the State Department of Agricultural or State veterinarian (depending on the state). The state veterinarian would then notify USDA.

- An agency/laboratory obtains the initial suspected sample (e.g., a domestic bird) and notifies the USDA of the suspected sample. The USDA sends the suspected sample to USDA's National Veterinary Services Laboratory (NVSL) in Ames, IA for confirmation.

- USDA initiates a Foreign Animal Disease Investigation with the appropriate State Department of Agriculture and State Lead Veterinarian to initiate confirmatory sampling. USDA notifies the Department of Homeland Security (DHS).

- DHS notifies the National Interagency Contingency Team (NICT) with a Situation Report (SITREP) to the USDA Emergency Operations Center network, who then notifies the other Federal Interagency Emergency Operation Centers.

- USDA and DHS activate the Joint Information Center (JIC).

- Upon confirmation of the detection of the HPAI H5N1 virus, USDA will issue a public message and notify commercial poultry operators of the possibility of H5N1 in the area.

- USDA, with State and local agencies, initiates control (quarantine and depopulation) and cleanup efforts (disposal and disinfection).

- EPA, if requested, provides technical guidance to the decision makers at USDA, States, and the solid waste and poultry industries on decontamination, disposal, and information on approved disinfectants.

- The process above continues throughout the cleanup and clearance phases and for as many incidents that are reported.

APPENDIX C

Environmental Persistence & Transmission of Avian Influenza Viruses
(Source: Diseases of Poultry, 11th ed)

Avian influenza viruses are relatively unstable in the environment. Physical factors such as heat, extremes for pH, nonisotonic conditions, and dryness can inactivate avian influenza viruses. Because avian influenza viruses have lipid envelopes, they are inactivated by organic solvents and detergents, such as sodium desoxycholate and sodium dodecylsulfate. In the presence of organic matter, avian influenza virus can be destroyed by chemical inactivants such as aldehydes (formaldehyde or gluataraldehyde), beta-propiolactone and binary ethylenimine. After removal of organic matter, chemical disinfectants such as phenolics, ammonium ions (including quaternary ammonium disinfectants), oxidizing agents (such as sodium hypochlorite), dilute acids, and hydroxylamine can destroy avian influenza viruses. In field situations, influenza viruses are protected by organic material such as nasal secretions or feces, which increase resistance to physical and chemical inactivation. Cool and moist conditions favor long survival of avian influenza viruses in the environment. avian influenza viruses have been viable in liquid manure for 105 days in the winter and in feces for 30-35 days at 39ºF and for 7 days a 68ºF. Proper inactivation and elimination of avian influenza viruses shed in the environment is essential in the control of field infection and can be accomplished through integrated approaches including heating of buildings to 90-100°F for one week, thorough removal and proper disposal of manure and litter, cleaning and disinfecting of buildings before restocking. Virus in manure and litter must be inactivated or disposed of by burial, composting, or incineration. Effective disinfectants against avian influenza viruses on clean surfaces include 5.25% sodium hypochlorite, 2% sodium hydroxide (lye), phenolic compounds, acidified ionophore compounds, chlorine dioxide disinfectants, strong oxidizing agents and 4% sodium carbonate/0.1% sodium silicate. However, organic material must be removed before disinfectants can work properly." Swayne, DE and Halvorson, DA. Avian Influenza. Diseases of Poultry, 11th Ed. Saif, Y.M. et.al Ed. Iowa State Press, pp. 135-160, 2003.

Infectivity and inactivation of H7N2 avian influenza virus under various environmental conditions was studied by Lu H, et al. in 2003. The virus in these studies was completely inactivated when combined with field chicken manure in less than a week at an ambient temperature of 59-58° F. At a pH 2, heating at 132° F, and exposure to 70% ethanol or a commercial disinfectant (DC&R), the avian influenza virus infectivity was destroyed in less than 30min. Lu, H, Castro, AE, Pennick, K, Liu, J, Yang, Q, Dunn, P, Weinstock, D, Henzler, D. Survivial of avian influenza virus H7N2 in SPF chickens and their environments. Av. Dis. 47 (3 Suppl) 1015-21, 2003.

Study of waterfowl epidemiology of avian influenza viruses resulted in finding that temperature, pH and salinity of water affect the persistence of these viruses in surface water. When temperature alone was examined, linear regression models predicted a initial concentration of 1 x 106 TCID50/ml water could remain infective for up to 207 days at 62°F and up to 102 days at 82°F, suggesting these viruses are adapted to survive in waterfowl wintering habitats. When pH and salinity effects were studied, persistence was found to be 100 days at 62°F, 0 ppt salinity at pH 8.2 and only 9 days at 82° F, 20 ppt salinity and a pH of 8.2. Overall, the duration of infectivity decreased with increasing salinity and pH. Stallnecht, DE, Kearney, MT, Shane, SM, Zwank, PJ. Persistance of avian influenza in water. Avian. Dis. 34: 406-411, 1990 Stallnecht, DE, Kearney, MT, Shane, SM, Zwank, PJ. Effects of pH, temperature, and salinity on persistence of avian influenza viruses in water. Avian Dis. 34: 412-428, 1990.

APPENDIX D

REFERENCES AND RESOURCES

NAME OF REFERENCE	TYPE	WEBSITE AVAILABILITY	SOURCE
Animal Disposal Following an Emergency , Sep 05	Article	http://www.bt.cdc.gov/disasters/animaldisposal.asp	Centers for Disease Control & Prevention
Carcass Disposal: A Comprehensive Review, 04	Reference	http://fss.k-state.edu/research/books/carcassdispfiles/	National Biosecurity Resource Center for Animal Health Emergencies
Environmental Survival of Avian Influenza Viruses, Feb 06	Article	http://www.cidrap.umn.edu/cidrap/content/influenza/avianflu/biofacts/avflu.html	Center for Infectious Disease Research & Policy
Guidelines for In-house Composting of Catastrophic Poultry Mortality, 02	Fact Sheet	http://www.agnr.umd.edu/MCE/Publications/Publication.cfm?ID=fs-801	University of MD Agriculture & Natural Resources
Guidelines for In-House Composting Poultry Mortality as a Rapid Response to Avian Influenza	Fact Sheet	http://www.deq.virginia.gov.waste/pdf/factsheet1va.pdf	VA. DEQ
VA DEQ Recommendations For Whole-Flock Disposal of Poultry due to Avian Influenza, Mar 06	Article	http://www.deq.virginia.gov/waste/pdf/deqaidisposal.pdf	VA DEQ Preferred Methods of Disposal of Poultry due to AI
National Response Plan, Dec 04	Reference	http://www.dhs.gov/dhspublic/interapp/editorial/editorial_0566.xml	US Department of Homeland Security
Federal Food and Agriculture Decontamination and Disposal Roles and Responsibilities", Nov 05	Reference	http://www.epa.gov/homelandsecurity/pdfs/conops11222005.pdf	US Department of Agriculture and other Federal Agencies
USDA Interim Avian Influenza Response Plan, Jan 06	Plan	Unavailable	USDA
USDA National Animal Health Emergency Management System Guidelines for Disposal, Apr 05	Guidelines	Unavailable	USDA
USDA National Animal Health Emergency Management System Guidelines for Cleaning and Disinfection	Guidelines	Unavailable	USDA
WHO; Lab study of H5N1 viruses in domestic ducks, Oct 04	Article	http://www.who.int/csr/disease/avian_influenza/labstudy_2004_10_29/en/print.html	World Health Organization (WHO)
Avian Influenza. Diseases of Poultry, pg 135-160, 03	Article	Unavailable	Swayne, DE and Halvorson, DA.
Fowl Plague, Avian Influenza-Highly Pathogenic	Fact Sheet	http://www.poultry-health.com/fora/fowlplag.htm	Poultry Health Services
Composting Dead Birds, 1991	Fact Sheet	http://www.agnr.umd.edu/MCE/Publications/Publication.cfm?ID=fs-537	Dennis W. Murphy and Lewis Carr
Lessons Learned From AI Outbreaks in VA 1983 & 2002	Article	ftp://ftp.deq.virginia.gov/pub/solidwst/2002leslearned.doc	Eric S. Bendfeldt, Robert W. Peer, and Gary A. Flory
AI Carcass Disposal, 2006	Presentation	http://www.deq.virginia.gov/waste/pdf/vaaidpre.pdf	Gary A. Flory, VA DEQ
Extensive Poultry Information Source	Reference	http://www.dpichicken.org/index.cfm?content=poultry-links	Delmarva Poultry Industry, Inc
2005 Guidelines for In-house Composting of Poultry Mortalities Due to Catastrophic Disease	Presentation	http://www.rec.udel.edu/poultry	Nathaniel Tablante, Univ of MD George W. Malone, Univ. of DE

APPENDIX D (CONTINUED)

REFERENCES AND RESOURCES

NAME OF RESOURCE	TYPE	SOURCE	SUBJECT(s)
American Veterinarian Medical Assoc	Website	http://www.avma.org/	Animal Health/ Avian Influenza Specific
EPA Pesticides	Website	http://www.epa.gov/pesticides/	Disinfectants approved by EPA
ASTSWMO	Website	http://www.astswmo.org/	State Disposal Contacts
National Chicken & Turkey Councils, Egg Safety Center	Website	http://www.avianinfluenzainfo.com	AI Info from Industry
National Biosecurity Resource Center for Animal Health Emergencies	Website	http://www.biosecuritycenter.org/	Animal Carcass Disposal Info
Poultry Health Services	Website	http://www.poultry-health.com/fora/fowlplag.htm	Avian Influenza Forum
Center for Agro-Security & Emergency Management (UMD)	Website	http://www.agnr.umd.edu/AgroSecurity/	Composting Research Articles & Presentations
Centers for Disease Control & Prevention	Website	http://www.cdc.gov/	Avian Flu Specific Information
USDA Center for Animal Disease Information & Analysis	Website	http://www.aphis.usda.gov/vs/ceah/cadia/	Animal Health Surveillance & Emerging Animal Diseases
EPA National Agriculture Compliance Assistance Center	Website	http://www.epa.gov/oecaagct/	Biosecurity & Homeland Security issues in Agriculture
EPA Homeland Security Links	Website	http://www.epa.gov/ohs/htm/links.htm	Links EPA Homeland Security
EPA Homeland Security Research	Website	http://www.epa.gov/ordnhsrc/index.htm	Homeland Security Research
Food and Agriculture Organization (FAO) of the UN	Website	http://www.fao.org/ag/againfo/subjects/en/health/diseases-cards/special_avian.html	International Avian Influenza Information
Integrated Waste Services Assoc	Website	http://www.wte.org/	Municipal Waste to Energy Assoc
National Association of State Departments of Agriculture	Website	http://www2.nasda.org/NASDA	AI Info Resource Site/Outreach
National Biosecurity Research Center	Website	http://www.biosecuritycenter.org/error404.php	State Carcass Disposal Regs & Info
Solid Waste Management Association of North America	Website	http://www.swana.org/	Training, Certification, & Communication
US Poultry & Egg Association	Website	http://www.poultryegg.org/	AI from an Industry Perspective
Avian Flu & Pandemic Flu	Website	http://www.pandemicflu.gov/	U.S. Government avian & pandemic flu info
Delmarva Poultry Industry, Inc	Website	http://www.dpichicken.org/index.cfm?content=poultry-links	Academic, Industry & Government Websites on Poultry Issues
World Health Organization	Website	http://www.who.int/csr/disease/avian_influenza/en/index.html	International Avian Influenza Information
EPA Composting	Website	http://www.epa.gov/epaoswer/non-hw/composting/index.htm	Composting Information

APPENDIX E
State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
ALABAMA (AL)			
Dept of Ag & Industries Richard Beard Bldg P.O. Box 3336 Montgomery, AL 36109 Phone: (334) 240-7100 Fax: (334) 240-7190 http://www.agi.state.al.us/	**Div of Wildlife & Freshwater Fisheries** Dept of Conservation & Nat Res 64 N. Union St Montgomery, AL 36130 Phone: (334) 242-3849 Fax: (334) 242-3032 http://www.outdooralabama.com	**Dept of Public Health** The RSA Tower, Ste 1552 201 Monroe St Montgomery, AL 36104 Phone: (334) 206-5200 Fax: (334) 206-2008 http://www.adph.org	**Dept of Environ Mngmt** Land Div, Waste Programs Branch P.O.Box 301463 Montgomery, AL 36130-146 Phone: (334) 271-7755 Fax: (334) 279-3050 http://www.adem.state.al.us/landdivision/solidwaste/SolidWasteMainInfo.htm
ALASKA (AK)			
Division of Agriculture Dept of Natural Resources 1800 Glenn Highway, Suite 12 Palmer, Alaska 99645-6736 Phone: (907) 745-7200 Fax: (907) 745-7112 http://www.dnr.state.ak.us/ag/index.htm	**Dept of Fish & Game** P.O. Box 25526 Juneau AK 99802-5526 Phone: (907) 465-4100 Fax: (907) 465-2332 http://www.dnr.state.ak.us	**Division of Public Health** 350 Main Street, Room503 P.O. Box 110610 Juneau, AK 99811 Phone: (907) 465-3090 Fax: (907) 586-1877 http://www.hss.state.ak.us/dph	**Dept Environmental Conservation** Division of Environ Health Solid Waste Program 555 Cordova Street Anchorage, AK 99501 Phone:907/269-7802 Fax:907/269-7655 http://www.dec.state.ak.us/
AMERICAN SOMOA (AS)			
Dept of Agriculture AS Government Executive Office Bldg, Utulei Territory of AS Pago Pago, AS 96799 Phone: 011(684) 699-1497 Fax: 011(684) 699-4031 http://www.asg-gov.net/AGRICULTURE.htm	**Marine & Wildlife Resources Dept** P.O. Box 3730 Pago Pago, AS 96799 Phone: (684) 633-4456 Fax: (684) 633-5944 http://www.asg-gov.net/MARINE%20&%20WILDLIFE%20RESOURCES.htm	**Dept of Health** LBJ Tropical Medical Center Pago Pago, AS 96799 Phone: (684) 633-4606 Fax: (684) 633-5379 http://www.asg-gov.net/HEALTH.htm	**Solid Waste Manager** AS Power Authority AS Government EQC P.O. Box PPB Pago Pago, AS 96799 Phone: (684) 699-1462 Fax: (684) 699-8070
ARIZONA (AZ)			
Dept of Agriculture 1688 W. Adams St Phoenix, AZ 85007 Phone: (602) 542-4373 Fax: (602) 542-5420 Web: http://www.azda.gov/	**Game & Fish Dept** 2222 W. Greenway Rd Phoenix, AZ 85023-4312 Phone: (602) 942-3000 Fax: (602) 789-3924 Web: http://www.azgfd.com/	**Dept of Health Services** 1740 W. Adams, Rm 407 Phoenix, AZ 85007 Phone: (602) 542-1025 Fax: (602) 542-1062 Web: http://www.hs.state.az.us/	**Dept of Environmental Quality** Waste Programs Div 1110 W. Washington St Phoenix, AZ 85007 Phone: (602) 771-4208 Fax: (602) 771-2302 http://www.azdeq.gov/environ/waste/solid/
ARKANSAS (AR)			
Dept of Agriculture No. 1 Natural Resource Dr. Little Rock, AR 72205 Phone: (501) 683-4851 Fax: (501) 683-4852 Web: http://aad.arkansas.gov/	**Game & Fish Commission** #2 Natural Resources Dr Little Rock, AR 72205 Phone: (501) 223-6305 Fax: (501) 223-6448 Web: http://www.agfc.state.ar.us/	**Dept of Health** 4815 W. Markham St Little Rock, AR 72205 Phone: (501) 611-2111 Fax: (501) 671-1450 http://www.healthyarkansas.com	**Dept of Environmental Quality** Solid Waste Management Div 8017 Interstate 30, P.O. Box 8913 Little Rock, AR 72219-8913 Phone:(501) 682-0600 Fax: (501) 682-0611 www.adeq.state.ar.us/solwaste/default.htm

APPENDIX E (Continued)
State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
CALIFORNIA (CA)			
CA Dept of Food & Agriculture 1220 N. St, Ste A-400 Sacramento, CA 95814-5607 Phone: (916) 654-0433 Fax: (916) 654-0403 http://www.cdfa.ca.gov/	**CA Dept of Fish & Game** P.O. Box 944209 Sacramento, CA 94244-2090 Phone: (916) 653-7667 Fax: (916) 653-1856 http://www.dfg.ca.gov/	**CA Dept of Health Services** 1501 Capitol Ave, Ste 6001 Sacramento, CA 95814 Phone: (916) 440-7400 Fax: (916) 440-7404 http://www.dhs.ca.gov/	**CA Integrated Waste Mngmt Board** 1001 I St, P.O. Box 4025 Sacramento, CA 95812 Phone: (916) 341-6000 Fax: (916) 341-6054 http://www.ciwmb.ca.gov/Landfills/
COLORADO (CO)			
Dept of Agriculture 700 Kipling St, Ste 4000 Lakewood, CO 80215-8000 Phone: (303) 239-4100 Fax: (303) 239-4125 http://www.ag.state.co.us/	**Division of Wildlife** 6060 Broadway Denver, CO 80216 Phone: (303) 291-7208 Fax: (303) 294-0874 http://www.wildlife.state.co.us/	**Dept of Public Health & Environment** 4300 Cherry Creek Dr, South Glendale, CO 80246 Phone: (303) 692-2000 Fax: (303) 691-1979 http://www.cdphe.state.co.us/	**Dept of Public Health & Environment** Hazardous Materials & Waste Management Div 4300 Cherry Creek Dr, South Denver, CO 80246-1530 Phone: (303) 692-3300 Fax: (303) 759-5355 http://www.cdphe.state.co.us/hm/hmhom.asp
CONNECTICUT (CT)			
Dept of Agriculture 165 Capitol Ave. Hartford, CT 06106 Phone: (860) 713-2500 Fax: (860) 713-2514 http://www.ct.gov/doag/site/default.asp	**Bureau of Natural Resources** CT Dept of Environmental Protection 79 Elm St Hartford, CT 06106-5127 Phone: (860) 424-3010 Fax: (860) 424-4078 http://www.dep.state.ct.us/	**Dept of Public Health** 401 Capitol Ave Hartford, CT 06134 Phone: (860) 509-7101 Fax: (860) 509-7111 http://www.dph.stats.ct.us	**Dept of Environmental Protection** Bureau of Waste Management 79 Elm St, 4th Floor Hartford, CT 06106-5127 Phone: (860) 424-3021 Fax: (860) 424-4060 http://www.dep.state.ct.us/wst/
DELEWARE (DE)			
Dept of Agriculture 2320 S. DuPont Highway Dover, DE 19901 Phone: (302) 698-4500 Fax: (302) 697-4463 http://www.state.de.us/deptagri/	**Division of Fish & Wildlife** 89 Kings Highway Dover, DE 19901 Phone: (302) 739-5295 Fax: (302) 739-6157 http://www.fw.delaware.gov	**Health and Social Services** Jesse Cooper Bldg 417 Federal St Dover, DE 19901 Phone: (302) 739-4700 Fax: (302) 739-6659 http://www.dhss.delaware.gov/dhss/index.html	**Dept of Natural Resources & Environ Control** Air and Waste Management Div Hazardous and Solid Waste Management 89 Kings Highway Dover, DE 19901 Phone: (302) 739-9403 Fax: (302) 739-5060 http://www.dswa.com/

APPENDIX E (Continued)
State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
DISTRICT OF COLUMBIA (DC)			
DC Dept of Health 825 N. Capitol St, NW, Ste 4400 Washington, DC 20002 Phone: (202) 442-5999 Fax: (202) 442-4788 http://dchealth.dc.gov/doh/site/default.asp	**Fisheries & Wildlife Program** Environmental Health Administration Fisheries & Wildlife Div 51 N. St, NE, 5th Floor Washington DC 20002-3323 Phone: (202) 535-2266 Fax: (202) 535-1373 http://dchealth.dc.gov/doh/cwp/view,a,1374,Q,584468,dohNav_GID,1810,.asp	**DC Dept of Health** 825 N. Capitol St, NW, Ste 4400 Washington, DC 20002 Phone: (202) 442-5999 Fax: (202) 442-4788 http://dchealth.dc.gov/doh/site/default.asp	**DC Dept of Public Works** Solid Waste Administration 2750 S. Capitol St, S.E. Washington, D.C. 20032 Phone: (202) 727-5907 Fax: (202) 727-9314 http://dchealth.dc.gov/doh/cwp/view,a,3,Q,573184,dohNAV_GID,1802,dohNAV,|33200|33215|,.asp
FLORIDA (FL)			
Dept of Agriculture & Consumer Services The Capitol, PL10 Tallahassee, FL 32399-0810 Phone: (850) 488-3022 Fax: (850) 922-4936 http://doacs.state.fl.us/	**Fish & Wildlife Conservation Commission** 620 S. Meridian St Tallahassee, FL 32399-1600 Phone: (850) 488-2975 Fax: (850) 921-5786 http://myfwc.com/	**Dept of Health** 2585 Merchants Row Blvd Tallahassee, FL 32399 Phone: (850) 245-4321 Fax: (850) 487-3729 http://www.doh.state.fl.us/	**Dept of Environmental Protection** Division of Waste Management Bureau of Solid & Hazardous Waste Solid Waste Mgmt Section (MS 4565) 2600 Blair Stone Rd , Tallahassee, FL 32399-2400 Phone: (850) 245-8707 Fax: (850) 245-8811 http://www.dep.state.fl.us/waste/categories/solid_waste/default.htm
GEORGIA (GA)			
GA Dept of Agriculture 204 Agricultural Bldg 19 Martin Luther King, Jr. Dr Atlanta, GA 30334 Phone: (404) 656-3600 Fax: (404) 651-8206 http://agr.georgia.gov	**GA Dept of Natural Resources** 2 Martin Luther King, Jr. Dr., SE, Ste 1252 East Atlanta, GA 30334 Phone: (404) 656-3500 Fax: (404) 656-0770 Web: http://www.gadnr.org/ **GA Wildlife Resources Division** 2070 US Highway 278, SE Social Circle, GA 30025 Phone: (770) 918-6401 Fax: (706) 557-3030 http://www.gadnr.org	**GA Dept of Human Resources** 2 Peachtree Street, NW, Suite 7-300 Atlanta, GA 30303 Phone: (404) 657-2700 Fax: (404) 657-2715 http://health.state.ga.us/	**GA Dept of Natural Resources** Environmental Protection Division Land Protection Branch 4244 International Parkway Atlanta, GA 30354 Phone:(404) 362-2537 Fax: (404) 362-2580 http://www.gaepd.org/Documents/index_land.html

APPENDIX E (Continued)
State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
GUAM (GU)			
GU Dept of Agriculture 192 Diary Road Mangilao, GU 96923 Phone: (671) 734-3942 Fax: (671) 734-6569	**Div of Aquatic & Wildlife Resources** Dept of Agriculture 192 Dairy Road Mangilao GU 96923 Phone: (671) 735-3984 Fax: (671) 734-6570 http://www.guamdawr.org/	**Dept of Public Health & Social Services** P.O. Box 2816 Agana, GU 96910 Phone: (671) 735-7102 Fax: (671) 734-5910 http://www.govguam.net/agency/dphss/index.html	**GU Environmental Protection Agency** Air & Land Programs Div P.O. Box 22439 GMF Barrigada, GU 96921 Phone: (671) 475-1609 Fax: (671) 477-9402 http://www.guamepa.govguam.net/
HAWAII (HI)			
HI Dept of Agriculture Office of the Chairperson 1428 S. King St Honolulu, HI 96814 Phone: (808) 973-9551 Fax: (808) 973-9613 http://www.hawaiiag.org/hdoa/	**HI Dept of Land & Natural Resources** PO Box 621 Honolulu, HI 96809 Phone: (808) 587-0401 Fax: (808) 587-0390 http://www.state.hi.us/dlnr/	**HI Dept of Health** 1250 Punchbowl St Honolulu, HI 96813 Phone: (808) 566-4410 Fax: (808) 586-4444 http://www.state.hi.us/health	**HI Dept of Health** Environmental Management Division Solid & Hazardous Waste Branch 919 Ala Moana, Ste 212 Honolulu, HI 96814 Phone: (808) 586-7497 Fax: (808) 586-7509 http://www.hawaii.gov/health/environmental/waste/sw/index.html
IDAHO (ID)			
ID Dept of Agriculture 2270 Old Penitentiary Rd Boise, ID 83712 Phone: (208) 332-8500 Fax: (208) 334-2170 http://www.idahoag.us/	**ID Fish & Game Dept** Box 25, 600 S. Walnut Boise ID 83707 Phone: (208) 334-5159 Fax: (208) 334-4885 http://fishandgame.idaho.gov/	**ID Dept of Health & Welfare** 450 W. State St, Box 83720 Boise, ID 83720 Phone: (208) 334-5500 Fax: (208) 334-6558 http://www.healthandwelfare.idaho.gov/	**ID Dept of Environmental Quality** Waste Management & Remediation Div 1410 N. Hilton St Boise, ID 83706 Phone: (208) 373-0502 Fax: (208) 373-0154 http://www.deq.state.id.us/waste/assist_business/solid_waste/index.cfm
ILLINOIS (IL)			
IL Dept of Agriculture State Fairgrounds P.O. Box 19281 Springfield, IL 62794-9281 Phone: (217) 782-2172 Fax: (217) 785-4505 http://www.agr.state.il.us/	**IL Dept of Natural Resources** One Natural Resources Way Springfield, IL 62702-1271 Phone: (217) 785-0075 Fax: (217) 785-9236 http://dnr.state.il.us/	**IL Dept of Public Health** 535 W. Jefferson St Springfield, IL 62761 Phone: (217) 782-4977 Fax: (217) 782-3987 http://www.idph.state.il.us/	**IL Environmental Protection Agency** Bureau of Land Div of Land Pollution Control 1021 N. Grand Ave. East, P.O. Box 19276 Springfield, IL 62794-9276 Phone: (217) 785-8604 Fax: (217) 557-4231 http://www.epa.state.il.us/land/

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State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
INDIANA (IN)			
IN Board of Animal Health 805 Beachway Dr., Ste 50 Indianapolis, IN 46224 Phone: (317) 227-0300 Fax: (317) 227-0330 http://www.boah.in.gov	**Division of Fish & Wildlife** IN Dept of Natural Resources 402 W. Washington St, Rm W-273 Indianapolis, IN 46204 Phone: (317) 232-4091 Fax: (317) 232-8150 http://www.state.in.us/dnr/fishwild	**IN State Dept of Health** 2 North Meridian Street Indianapolis, IN 46204 Phone: (317) 233-7400 Fax: (317) 233-7387 http://www.in.gov/isdh/	**IN Dept of Environmental Mngmt** Office of Land Quality P.O. Box 6015, Rm 1154 Indianapolis, IN 46206-6015 Phone: (317) 233-6591 Fax: (317) 232-3403 http://www.in.gov/idem/programs/land/index.html
IOWA (IA)			
IA Dept of Agriculture & Land Stewardship Wallace Bldg, 502 E. 9th St Des Moines, IA 50319 Phone: (515) 281-5322 Fax: (515) 281-7046 http://www.agriculture.state.ia.us/	**IA Dept of Natural Resources** E. Ninth & Grand Ave Des Moines, IA 50319-0034 Phone: (515) 281-5385 Fax: (515) 281-6794 www.iowa.gov/state/main.agnr.html	**IA Dept of Public Health** Lucas State Office Bldg 321 E. 12th St Des Moines, IA 50319 Phone: (515) 281-5605 Fax: (515) 281-4958 http://www.idph.state.ia.us/	**IA Dept of Natural Resources** Energy & Waste Management Bureau 502 E. 9th St Des Moines, IA 50319-0034 Phone: (515) 281-8927 Fax: (515) 281-8895 http://www.iowadnr.com/waste/index.html
KANSAS (KS)			
KS Animal Health Dept 708 SW Jackson Topeka, KS 66603-3714 Phone: (785) 296-2326 Fax: (785) 296-1765 http://www.kansas.gov/kahd/index.html	**Wildlife Operations** KS Dept of Wildlife & Parks 512 SE 25th Ave Pratt, KS 67124-8174 Phone: (316) 672-5911 Fax: (316) 672-6020 http://www.kdwp.state.ks.us/	**KS Dept of Health & Environment** Curtis State Office Bldg 1000 SW Jackson, Ste 300 Topeka, KS 66612 Phone: (785) 296-1086 Fax: (785) 296-1562 http://www.kdhe.state.ks.us/	**KS Dept of Health & Environment** Division of Environment Bureau of Waste Management 1000 SW Jackson, Ste 320 Topeka, KS 66612-1366 Phone: (785) 296-1612 Fax: (785) 296-8909 http://www.kdheks.gov/waste/index.html
KENTUCKY (KY)			
KY Dept of Agriculture Rm 188, Capitol Annex Frankfort, KY 40601 Phone: (502) 564-5126 Fax: (502) 564-5016 http://www.kyagr.com/	**KY Dept of Fish/Wildlife Resources** One Game Farm Rd Frankfort, KY 40601 Phone: (502) 564-7109 X333 Fax: (502) 564-6508 http://www.kdfwr.state.ky.us/	**KY Dept for Health Services** 275 E. Main St Frankfort, KY 40621 Phone: (502) 564-3970 Fax: (502) 564-6533 http://publichealth.state.ky.us	**KY Dept for Environmental Protection** Div of Waste Mngmt, Solid Waste Branch Frankfort Office Park 14 Reilly Rd Frankfort, KY 40601 Phone: (502) 564-6716 Fax:(502) 564-4049 http://www.kdheks.gov/waste/index.html

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State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
LOUISIANA (LA)			
LA Dept of Ag & Forestry P.O. Box 631 Baton Rouge, LA 70821-0631 Phone: (225) 922-1234 Fax:(225) 922-1253 http://www.ldaf.state.la.us/	**LA Dept of Wildlife and Fisheries** P. O. Box 98000 Baton Rouge, LA 70898-9000 Phone: (225) 765-2623 Fax: (225) 765-2607 http://www.wlf.state.la.us/	**LA Dept of Health & Hospitals** P.O. Box 3214 Baton Rouge, LA 70821 Phone: (225) 342-8093 Fax: (225) 342-8098 http://www.oph.dhh.state.la.us/	**LA Dept of Environmental Quality** Office of Environmental Assessment Environmental Technology Div 602 N. Fifth St Baton Rouge, LA 70802 Phone: (225) 219-3406 Fax: (225) 219-3474 http://www.deq.louisiana.gov/portal/
MAINE (ME)			
ME Dept of Agr, Food & Rural Resources Deering Bldg (AMHI), #28 State House Station Augusta, ME 04333 Phone: (207) 287-3419 Fax: (207) 287-7548 http://www.maine.gov/agriculture/index.html	**ME Dept of Inland Fisheries & Wildlife** 284 State Street, Station #41 Augusta, ME 04333 Phone: (207) 287-5202 Fax: (207) 287-6395 http://www.state.me.us/ifw/	**ME Dept of Human Services** 157 Capitol St Augusta, ME 04333 Phone: (207) 287-8016 Fax: (207) 287-9058 http://www.state.me.us/dhs/boh	**ME Dept of Environmental Protection** Bureau of Remediation & Waste Mngmt Div of Solid Waste Management 17 State House Station Augusta, ME 04333-0017 Phone: (207) 287-2651 Fax: (207) 287-7826 http://www.maine.gov/dep/rwm/solidwaste/index.htm
MARYLAND (MD)			
MD Dept of Agriculture 50 Harry S. Truman Parkway Annapolis, MD 21401 Phone: (410) 841-5880 Fax: (410) 841-5914 http://www.mda.state.md.us/	**Wildlife & Heritage Service** MD Dept of Natural Resources 580 Taylor Ave. E-1 Annapolis, MD 21401 Phone: (410) 260-8549 Fax: (410) 260-8595 http://www.dnr.state.md.us/	**MD Dept of Health & Mental Hygiene** 201 W. Preston St, Ste 500 Baltimore, MD 21201 Phone: (410) 767-6500 Fax: (410) 767-6489 http://www.dhmh.state.md.us/	**MD Dept of the Environment** Waste Management Administration Solid Waste Program 1800 Washington Blvd Baltimore, MD 21230-1719 Phone: (410) 537-3318 Fax: (410) 537-3842 http://www.mde.state.md.us/Programs/LandPrograms/Solid_Waste/home/index.asp
MASSACHUSETTS (MA)			
MA Dept of Ag Resources 251 Causeway St, Ste 500 Boston, MA 02114-2151 Phone: (617) 626-1700 Fax: (617) 626-1850 http://www.mass.gov/agr/	**Division of Fisheries & Wildlife** MA Dept of Fisheries, Wildlife & Environmental Law Enforcement One Rabbit Hill Road Westborough, MA 01581 Phone: (508) 792-7270 Fax: (508) 792-7275 http://www.state.ma.us/dfwele/dfw	**MA Dept of Public Health** 250 Washington St, 2nd Floor Boston, MA 02108 Phone: (617) 624-6000 Fax: (617) 624-5206 http://www.state.ma.us/dph/dphhome.htm	**MA Dept of Environmental Protection** Bureau of Waste Prevention Waste Branch, Regulatory Standards Unit One Winter St Boston, MA 02108 Phone: (617) 292-5574 Fax: (617) 292-5778 http://www.mass.gov/dep/recycle/

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State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
MICHIGAN (MI)			
MI Dept of Agriculture Box 30017 525 W. Allegan Lansing, MI 48909 Phone: (517) 373-1052 Fax: (517) 335-1423 http://www.michigan.gov/mda	**MI Dept of Natural Resources** P.O. Box 30028 Lansing, MI 48909 Phone: (517) 373-2329 Fax: (517) 335-4242 http://www.michigan.gov/dnr	**MI Dept of Community Health** 201 Townsend Lansing, MI 48913 Phone: (517) 335-8165 Fax: (517) 335-8263 http://www.michigan.gov/mdch	**MI Dept of Environmental Quality** Waste and Hazardous Materials Div Storage Tank & Solid Waste Section P.O. Box 30241 Lansing, MI 48909-7741 Phone: (517) 335-4035 Fax: (517) 373-4797 http://www.michigan.gov/deq/0,1607,7-135-3311--,00.html
MINNESOTA (MN)			
MN Dept of Agriculture 90 West Plato Blvd St. Paul, MN 55107 Phone: (651) 297-3219 Fax: (651) 297-5522 http://www.mda.state.mn.us/	**Division of Fish and Wildlife** MN Dept of Natural Resources 500 Lafayette Rd St. Paul, MN 55155-4007 Phone: (651) 297-4218 Fax: (651) 297-7272 http://www.dnr.state.mn.us/	**MN Dept of Health** 85 East 7th Place, Ste 400 St. Paul, MN 55164 Phone: (651) 215-5800 Fax: (651) 215-5801 http://www.health.state.mn.us/	**MN Pollution Control Agency** Municipal Div 520 Lafayette Rd, North St. Paul, MN 55155 Phone: (651) 296-7340 Fax: (651) 297-8676 http://www.pca.state.mn.us/waste/index.html
MISSISSIPPI (MS)			
MS Dept of Ag & Commerce 121 N. Jefferson St Jackson, MS 39201 Phone: (601) 359-1100 Fax: (601) 354-7710 http://www.mdac.state.ms.us/	**MS Dept of Wildlife, Fisheries & Parks** 2906 Building, P.O. Box 451 Jackson, MS 39205 Phone: (601) 432-2001 Fax: (601) 432-2024 http://www.mdwfp.com/	**MS Dept of Health** 2423 N. State St P. O. Box 1700 Jackson, MS 39215 Phone: (601) 576-7634 Fax: (601) 576-7931 http://www.msdh.state.ms.us/	**MS Dept of Environmental Quality** Office of Pollution Control Solid Waste Management Branch 2380 Highway 80 W., P.O. Box 10385 Jackson, MS 38289 Phone: (601) 961-5304 Fax: (601) 961-5785 http://www.deq.state.ms.us/MDEQ.nsf/page/SW_Home?OpenDocument
MISSOURI (MO)			
MO Dept of Agriculture P.O. Box 630 Jefferson City, MO 65102 Phone: (573) 751-3359 Fax: (573) 751-1784 http://www.mda.mo.gov/	**MO Dept of Conservation** P.O. Box 180 Jefferson City, MO 65102-0180 Phone: (573) 522-4115 Fax: (573) 751-4467 http://www.mdc.mo.gov/	**MO Dept of Health & Senior Services** 912 Wildwood Dr Jefferson City, MO 65102 Phone: (573) 751-6001 Fax: (573) 751-6041 http://www.dhss.mo.gov/	**MO Dept of Natural Resources** Div of Environmental Quality Solid Waste Management Program 1738 E. Elm St, P.O. Box 176 Jefferson City, MO 65102 Phone: (573) 526-3900 Fax: (573) 526-3902 http://www.dnr.mo.gov/env/swmp/index.html

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State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
MONTANA (MT)			
MT Dept of Agriculture P.O. Box 200201 Helena, MT 59620-0201 Phone: (406) 444-3144 Fax: (406) 444-5409 http://agr.mt.gov/	**MT Dept of Fish, Wildlife & Parks** P O Box 200701 Helena, MT 59620-0701 Phone: (406) 444-3186 Fax: (406) 444-4952 http://fwp.state.mt.us/	**MT Dept of Public Health & Human Services** 111 N. Sanders, 3rd Floor Helena, MT 59604 Phone: (406) 444-5622 Fax: (406) 444-1970 http://www.dphhs.state.mt.us/	**MT Dept of Environmental Quality** Permitting & Compliance Div Waste & Underground Tank Management Bureau P.O. Box 200901 Helena, MT 59620-0901 Phone: (406) 444-5300 Fax: (406) 444-1374 http://www.deq.mt.gov/SolidWaste/index.asp
NEBRASKA (NE)			
NE Dept of Agriculture P.O. Box 94947 301 Centennial Mall S., 4th Floor Lincoln, NE 68509-4947 Phone: (402) 471-2341 Fax: (402) 471-6876 http://www.agr.state.ne.us/	**NE Game & Parks Commission** 2200 North 33rd, Box 30370 Lincoln NE 68510 Phone: (402) 471-5539 Fax: (402) 471-5528 http://www.ngpc.state.ne.us/default.asp	**NE Health & Human Services System** P. O. Box 95007 Lincoln, NE 68509 Phone: (402) 471-8566 Fax: (402) 471-9449 http://www.hhs.state.ne.us/	**NE Dept of Environmental Quality** Waste Management Div 1200 N St, Ste 400 Lincoln, NE 68509-8922 Phone: (402) 471-0001 Fax: (402) 471-2909 http://www.deq.state.ne.us/
NEVADA (NV)			
NV Dept of Agriculture 251 Jeanell Ave., Ste 3 Carson City, NV 89703 Phone: (775) 688-1180 Fax: (775) 688-1178 http://agri.state.nv.us/	**NV Dept of Wildlife** 1100 Valley Rd Reno NV 89512 Phone: (775) 688-1599 Fax: (775) 688-1595 http://www.ndow.org	**NV State Health Div** 505 E. King St, Rm 201 Carson City, NV 89710 Phone: (775) 684-4200 Fax: (775) 684-4211 http://health2k.state.nv.us/	**NV Div of Environmental Protection** Bureau of Waste Management Solid Waste Branch 901 S. Stewart St, Ste 4001 Carson City, NV 89701 Phone:(775) 687-9467 Fax: (775) 687-6396 http://ndep.nv.gov/bwm/bwm01.htm
NEW HAMPSHIRE (NH)			
NH Dept of Agriculture, Markets, & Food P.O. Box 2042 Concord, NH 03302-2042 Phone: (603) 271-3551 Fax: (603) 271-1109 http://agriculture.nh.gov/	**NH Fish & Game Department** Hazen Dr Concord, NH 03301 Phone: (603) 271-3422 Fax: (603) 271-1438 http://www.wildlife.state.nh.us/	**NH Dept of Health & Human Services** 129 Pleasant St. Concord, NH 03301 Phone: (603) 271-8560 Fax: (603) 271-4912 http://www.dhhs.state.nh.us/	**NH Dept of Environmental Services** Waste Management Div Solid Waste Management 6 Hazen Dr Concord, NH 03301-6509 Phone: (603) 271-2925 Fax: (603) 271-2456 http://www.des.state.nh.us/SW/

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State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
NEW JERSEY (NJ)			
NJ Dept of Agriculture P.O. Box 330 John Fitch Plaza Trenton, NJ 08625 Phone: (609) 292-3976 Fax: (609) 292-3978 http://www.state.nj.us/ agriculture/	**NJ Div of Fish & Wildlife** P.O. Box 400 Trenton, NJ 08625 Phone: (609) 292-9410 Fax: (609) 292-8207 http://www.state.nj.us/dep/fgw/	**NJ Dept of Health & Senior Services** P. O. Box 360, Rm 805 Trenton, NJ 08625 Phone: (609) 292-7837 Fax: (609) 292-0053 http://www.state.nj.us/health	**NJ Dept of Environmental Protection** Solid & Hazardous Waste Program P.O. Box 414 Trenton, NJ 08625-0414 Phone: (609) 633-1418 Fax: (609) 777-0769 http://www.nj.gov/dep/dshw/
NEW MEXICO (NM)			
NM Dept of Agriculture P.O. Box 30005, MSC: 3189 Las Cruces, NM 88003-8005 Phone: (505) 646-3007 Fax: (505) 646-8120 http://www.nmda.nmsu.edu/	**NM Game & Fish Dept** One Wildlife Wy Santa Fe, NM 87507 Phone: (505) 476-8008 Fax: (505) 476-8124 http://www.wildlife.state.nm.us	**NM Dept of Health** 1190 Saint Francis Dr Santa Fe, NM 87502 Phone: (505) 827-2613 Fax: (505) 827-2530 http://www.health.state.nm.us/	**NM Environmental Dept** Environmental Protection Div Solid Waste Bureau 1190 St. Francis Dr., P.O. Box 26110 Santa Fe, NM 87503 Phone: (505) 827-0197 Fax: (505) 827-2902 http://www.nmenv.state.nm.us/swb/index.htm
NEW YORK (NY)			
NY Dept of Agriculture & Markets 10B Airline Dr Albany, NY 12235 Phone: (518) 457-4188 Fax: (518) 457-3087 http://www.agmkt.state.ny.us/	**Div of Fish, Wildlife & Marine Resources** NY Dept of Environmental Conservation 625 Broadway, 5th Floor Albany, NY 12233-4750 Phone: (518) 402-8924 Fax: (518) 402-8925 http://www.dec.state.ny.us/	**NY Dept of Health** Empire State Plaza Corning Tower Bldg. 14th Floor Albany, NY 12237 Phone: (518) 474-2011 Fax: (518) 474-5450 http://www.health.state.ny.us/	**NY Dept of Environmental Conservation** Div of Solid & Hazardous Materials 625 Broadway Albany, NY 12233-7250 Phone: (518) 402-8651 Fax: (518) 402-9024 http://www.dec.state.ny.us/website/dshm/sldwaste/index.htm
NORTH CAROLINA (NC)			
NC Dept of Agriculture & Consumer Services 1001 Mail Service Center Raleigh, NC 27699 Phone: (919) 733-7125 Fax: (919) 733-1141 http://www.ncagr.com/	**NC Wildlife Resources Commission** 512 N. Salisbury St Raleigh, NC 27604-1188 Phone: (919) 733-3391 Fax: (919) 733-7083 http://www.ncwildlife.org/	**NC Dept of Health & Human Services** 101 Blair Dr Raleigh, NC 27626 Phone: (919) 733-4261 Fax: (919) 715-4645 http://www.state.nc.us/DHR	**NC Dept of Environ & Nat Resources** Div of Waste Management Solid Waste Section 1646 Mail Service Center Raleigh, NC 27699-1646 Phone: (919) 508-8497 Fax: (919) 733-4810 http://www.wastenotnc.org/swhome/swhome.htm

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State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
NORTH DAKOTA (ND)			
ND Dept of Agriculture Board of Animal Health 600 E. Blvd Ave., Dept. 602 Bismarck, ND 58505-0020 Phone: (701) 328-2231 Fax: (701) 328-4567 http://www.agdepartment.com/ Programs/Livestock/BOAH/BOAH.html	**ND Game & Fish Dept** 100 North Bismarck Expressway Bismarck, ND 58501 Phone: (701) 328-6351 Fax: (701) 328-6352 http://gf.nd.gov/	**ND Dept of Health** 600 East Boulevard Avenue Bismarck, ND 58505 Phone: (701) 328-2378 Fax: (701) 328-4727 http://www.ndhealth.gov/	**ND Dept of Health** Div of Waste Management 918 E. Divide Ave Bismarck, ND 58501-1947 Phone: (701) 328-5166 Fax: (701) 328-5200 http://www.health.state.nd.us/WM/
NOTHERN MARIANNA ISLANDS			
Director of Agriculture Department of Lands & Natural Resources P.O. Box 10007 Saipan, MP 96950	**Dept of Lands & Natural Resources** P.O. Box 10007 Saipan, MP 96950 Phone: (670) 322-9834 Fax: (670) 322-2633 http://www.dfw.gov.mp/default.htm	**Northern Marianna Ils Dept of Public Health** P.O. Box 500409 Saipan, MP 96950 Phone: (670) 234-8950 Fax: (670) 234-8930 http://www.dphsaipan.com/	**Commonwealth of the Northern Mariana Ils** Div of Environmental Quality 3rd Floor Morgen's Bldg., San Jose P.O. Box 50134 Saipan, MP 96950 Phone: (670) 664-8500 Fax: (670) 664-8540
OHIO (OH)			
OH Dept of Agriculture 8995 E. Main St Reynoldsburg, OH 43068-3399 Phone: (614) 466-2732 Fax: (614) 466-6124 http://www.ohioagriculture.gov/	**OH Division of Wildlife** 2045 Morse Rd, Bldg G Columbus, OH 43229-6605 Phone: (614) 265-6304 Fax: (614) 262-1143 http://www.dnr.state.oh.us/wildlife/default.htm	**OH Dept of Health** 246 N. High St P. O. Box 118 Columbus, OH 43266 Phone: (614) 466-2253 Fax: (614) 644-0085 http://www.odh.state.oh.us/	**OH Environmental Protection Agency** Div of Solid & Infectious Waste Mngmt 122 S. Front St, P.O. Box 1049 Columbus, OH 43216-1049 Phone: (614) 644-2621 Fax: (614) 728-5315 http://www.epa.state.oh.us/
OKLAHOMA (OK)			
OK Dept of Agriculture, Food, & Forestry P.O. Box 528804 Oklahoma City, OK 73152-8804 Phone: (405) 521-3864 Fax: (405) 522-0909 http://www.oda.state.ok.us/	**OK Dept of Wildlife Conservation** P.O. Box 53465 Oklahoma City, OK 73152-3465 Phone: (405) 521-4660 Fax: (405) 521-6505 http://www.wildlifedepartment.com/	**OK Dept of Health** 1000 N. East 10th St Oklahoma City, OK 73117 Phone: (405) 271-5600 Fax: (405) 271-3431 http://www.health.ok.gov/	**OK Dept of Environmental Quality** Waste Management Div 707 N. Robinson, P.O. Box 1677 Oklahoma City, OK 73102 Phone: (405) 702-5100 Fax: (405) 702-5101 http://www.deq.state.ok.us/lpdnew/swindex.html

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State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
OREGON (OR)			
OR Dept of Agriculture 635 Capitol Street, NE Salem, OR 97301-2532 Phone: (503) 986-4552 Fax: (503) 986-4750 http://egov.oregon.gov/ODA/	**OR Dept of Fish & Wildlife** 3406 Cherry Ave N.E. Salem, OR 97303-4924 Phone: (503) 947-6044 Fax: (503) 947-6042 http://www.dfw.state.or.us/	**OR Dept of Health Services** 800 NE Oregon St, Ste. 930 Portland, OR 97232 Phone: (503) 731-4000 Fax: (503) 731-4078 http://www.oregon.gov/dhs	**OR Dept of Environmental Quality** Land Quality Div Solid Waste Policy & Program Development 811 S.W. Sixth Ave Portland, OR 97204 Phone: (503) 229-5808 Fax: (503) 229-6977 http://www.deq.state.or.us/wmc/solwaste/rsw.htm
PALAU			
Republic of Palau Office of the President PO Box 6051 Palau, PW 96940 P: (680) 488-2403/2828 F: (680) 488-2424/1662 http://www.palaugov.net/minresources/agriculture.html	**Republic of Palau** Office of the President PO Box 6051 Palau, PW 96940 P: (680) 488-2403/2828 F: (680) 488-2424/1662 http://www.palaugov.net/minjustice/DFWP/index.html	**Republic of Palau** Office of the President PO Box 6051 Palau, PW 96940 P: (680) 488-2403/2828 F: (680) 488-2424/1662 http://www.palaugov.net/minhealth/publichealth/index.htm	**Republic of Palau** Office of the President PO Box 6051 Palau, PW 96940 P: (680) 488-2403/2828 F: (680) 488-2424/1662 http://www.palaugov.net/minresources/publicwrk.html
PENNSYLVANIA (PA)			
PA Dept of Agriculture 2301 N. Cameron St Harrisburg, PA 17110-9408 Phone: (717) 7722853 Fax: (717) 705-8402 http://www.agriculture.state.pa.us/	**PA Fish & Boat Commission** P.O. Box 67000 Harrisburg, PA 17106-7000 Phone: (717) 657-4515 Fax: (717) 657-4033 http://www.state.pa.us/PA_Exec/Fish_Boat/pfbcho m2.html **PA Game Commission** 2001 Elmerton Ave Harrisburg, PA 17110-9797 Phone: (717) 787-3633 Fax: (717) 772-0502 http://www.pgc.state.pa.us/	**PA Dept of Health** P. O. Box 90, Room 802 Harrisburg, PA 17108 Phone: (717) 787-6436 Fax: (717) 772-6959 http://www.health.state.pa.us/	**PA Dept of Environmental Protection** Bureau of Land Recycling & Waste Management Division of Municipal & Residual Waste P.O. Box 8471 Harrisburg, PA 17105-8471 Phone: (717) 787-7381 Fax: (717) 787-1749 http://www.depweb.state.pa.us/landrecwaste/cwp/view.asp?a=1216&q=462227
PUERTO RICO (PR)			
PR Dept of Agriculture P.O. Box 10163 Santurce, PR 00908-1163 Phone: (787) 722-0871 Fax: (787) 723-8512 http://www.agricultura.gobierno.pr/	**Marine Resources Division** PR Dept of Natural Resources P.O. Box 9066600 San Juan, PR 00906-6600 P: (787) 723-3090 F: (787) 724-0365 http://www.gobierno.pr/drna	**PR Dept of Health** P. O. Box 70184 San Juan, PR 00936 Phone: (787) 274-7602 Fax: (787) 250-6547 http://www.salud.gov.pr/	**Environmental Quality Board** Office of the Governor Land Pollution Area P.O. Box 11488 Santurce, PR 00910 P: (787) 763-4448 F: (787) 766-0150

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State **Agricultural, Wildlife, Public Health & Solid Waste Contacts**

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
RHODE ISLAND (RI)			
RI Div of Agriculture, DEM 235 Promenade St, Rm 370 Providence, RI 02908-5767 Phone: (401) 222-2781 Fax: (401) 222-6047 http://www.dem.ri.gov/programs/bnatres/agricult/index.htm	**RI Div of Fish & Wildlife** Stedman Government Center 4808 Tower Hill Rd Wakefield, RI 02879 Phone: (401) 789-3094 Fax: (401) 783-4460 http://www.dem.ri.gov/programs/bnatres/fishwild/index.htm	**RI Dept of Health** 3 Capitol Hill, Rm 401 Providence, RI 02908 Phone: (401) 222-2231 Fax: (401) 222-6548 http://www.health.ri.gov/	**RI Dept of Environmental Management** Office of Waste Management 235 Promenade St Providence, RI 02908 Phone: (401) 222-2797 Fax: (401) 222-3812 http://www.dem.ri.gov/programs/benviron/waste/index.htm
SOUTH CAROLINA (SC)			
SC Dept of Agriculture Wade Hampton Office Building P.O. Box 11280 Columbia, SC 29211 Phone: (803) 734-2190 Fax: (803) 734-2192 http://www.scda.state.sc.us/	**SC Dept of Natural Resources** P.O. Box 167 Columbia SC 29202 Phone: (803) 734-4007 Fax: (803) 734-6310 http://water.dnr.state.sc.us/	**SC Dept of Health & Environmental Control** 2600 Bull St Columbia, SC 29201 Phone: (803) 898-3300 Fax: (803) 898-3323 http://www.scdhec.net/	**SC Dept of Health & Environmental Control** Bureau of Land & Waste Management Div of Mining & Solid Waste Mngmt 2600 Bull St Columbia, SC 29201 Phone: (803) 896-4202 Fax: (803) 896-4001 http://www.scdhec.gov/lwm/html/min.html
SOUTH DAKOTA (SC)			
SD Dept of Agriculture 523 E. Capitol Pierre, SD 57501-3182 Phone: (605) 773-5425 Fax: (605) 773-5926 http://www.state.sd.us/doa/	**SD Game, Fish and Parks Dept** 523 E. Capitol Pierre, SD 57501-3182 Phone: (605) 773-3387 Fax: (605) 773-6245 http://www.state.sd.us/gfp/	**SD Dept of Health** 600 E. Capitol Pierre, SD 57501 Phone: (605) 773-3361 Fax: (605) 773-5683 http://www.state.sd.us/doh	**SD Dept of Environmental & Natural Resources** Div of Environmental Services Waste Management Program Foss Bldg, 523 E. Capitol Pierre, SD 57501-3182 Phone: (605) 773-3153 Fax: (605) 773-6035 http://www.state.sd.us/denr/des/WasteMgn/SWaste/SWpage1.htm
TENNESSEE (TN)			
TN Dept of Agriculture P.O. Box 40627 Nashville, TN 37204 Phone: (615) 837-5100 Fax: (615) 837-5333 http://www.state.tn.us/agriculture/	**TN Wildlife Resources Agency** P.O. Box 40747 Nashville, TN 37204 Phone: (615) 781-6552 Fax: (615) 781-6551 http://www.state.tn.us/twra/index.html	**TN Dept of Health** 3rd Floor Cordell Hull 425 Fifth Ave, N. Nashville, TN 37247 Phone: (615) 741-3111 Fax: (615) 741-2491 http://tennessee.gov/health	**TN Dept of Environ & Conservation** Div of Solid & Hazardous Waste Management 5th Floor, L & C Tower 401 Church St Nashville, TN 37243-1535 Phone:(615) 532-078 Fax: (615) 532-0886 http://tennessee.gov/environment/swm/

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State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
TEXAS (TX)			
TX Dept of Agriculture P.O. Box 12847 Capitol Station Austin, TX 78711 Phone: (512) 463-7476 Fax: (512) 463-1104 http://www.agr.state.tx.us/	**TX Parks & Wildlife Dept** 4200 Smith School Rd Austin, TX 78744 Phone: (512) 389-4802 Fax: (512) 389-4814 http://www.tpwd.state.tx.us/	**TX Dept of State Health Srvs** 1100 W. 49th St Austin, TX 78756 Phone: (888) 963-7111 Fax: (512) 458-7477 http://www.dshs.state.tx.us/	**TX Commission on Environ Quality** Waste Permits (MC 126) P.O. Box 13087 Austin, TX 78711-3087 Phone: (512) 239-2334 Fax: (512) 239-2007 http://www.tceq.state.tx.us/permitting/waste_permits/waste_planning/wp_swasteplan.html
UTAH (UT)			
UT Dept of Agriculture P.O. Box 146500 Salt Lake City, UT 8411 Phone: (801) 538-7101 Fax: (801) 538-7126 http://ag.utah.gov/	**UT Div of Wildlife Resources** 1594 W. North Temple, Ste 2110 P.O. Box 146301 Salt Lake City, UT 84114 Phone: (801) 538-4703 Fax: (801) 538-4709 http://wildlife.utah.gov/index.php	**UT Dept of Health** 288 North 1460 ,West P. O. Box 142802 Salt Lake City, UT 84114 Phone: (801) 538-6111 Fax: (801) 538-6306 http://health.utah.gov/	**UT Dept of Environmental Quality** Div of Solid & Hazardous Waste P.O. Box 144880 Salt Lake City, UT 84114-4880 Phone:(801) 538-6170 Fax: (801) 538-6715 http://www.hazardouswaste.utah.gov/SWBranch/SWSection/SolidWasteSection.htm
VERMONT (VT)			
VT Agency of Agriculture, Food & Markets Drawer 20, 116 State St Montpelier, VT 05620 Phone: (802) 828-2430 Fax: (802) 828-2361 http://www.vermontagriculture.com/	**VT Dept of Fish & Wildlife** 103 S. Main St, 10 South Waterbury, VT 05671-0501 Phone: (802) 241-3730 Fax: (802) 241-3295 http://www.vtfishandwildlife.com/	**VT Dept of Health** 108 Cherry St Burlington, VT 05402 Phone: (802) 863-7280 Fax: (802) 865-7754 http://www.healthvermont.gov	**VT Dept of Environ Conservation** Waste Management Div Solid Waste Management 103 S. Main St Waterbury, VT 05671-0404 Phone: (802) 241-2368 Fax: (802) 241-3296 http://www.deq.state.va.us/waste/solid.html
VIRGIN ISLANDS (VI)			
VI Dept of Agriculture #1 Estate Lower Love St. Croix, VI 00850 Phone: (340) 778-0997 Fax: (340) 778-7977 http://www.usvi.org/agriculture/index.html	**Div of Fish & Wildlife** Dept of Planning & Natural Resources 6291 Estate Nazareth 101 St. Thomas, VI 00802 Phone: (340) 775-6762 Fax: (340) 775-3972 http://www.dpnr.gov.vi	**VI Dept of Social & Health Svcs** 48 Sugar Estate St. Thomas, VI 00802 Phone: (304) 774-0117 Fax: (304) 773-4001 http://www.usvi.org/health/	**VI Dept of Planning & Natural Resources** Div of Environmental Protection 45 Mars Hill, Frederiksted St. Croix, VI 00840-4472 Phone: (340) 773-1082 Fax: (340)773-9310 http://www.dpnr.gov.vi

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State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
VIRGINIA (VA)			
VA Dept of Agriculture & Consumer Srvs 1100 Bank St, Ste 210 Richmond, VA 23219 Phone: (804) 786-3501 Fax: (804) 371-2945 http://www.vdacs.virginia.gov/	**VA Dept of Game & Inland Fisheries** 4010 W. Broad St, Box 11104 Richmond, VA 23230 Phone: (804) 367-9231 Fax: (804) 367-0405 http://www.dgif.state.va.us/	**VA State Health Dept** 1500 E. Main St P. O. Box 2448 Richmond, VA 23218 Phone: (804) 786-3561 Fax: (804) 786-4616 http://www.vdh.state.va.us/	**VA Dept of Environmental Quality** Waste Division P.O. Box 10009 629 E. Main St, 10th Floor Richmond, VA 23240-0009 Phone: (804) 698-4145 Fax: (804) 698-4234 http://www.deq.state.va.us/waste/solid.html
WASHINGTON (WA)			
WA Dept of Agriculture P.O. Box 42560 Olympia, WA 98504-2560 Phone: (360) 902-1887 Fax: (360) 902-2092 http://agr.wa.gov/	**WA Dept of Fish & Wildlife** 600 Capitol Way North Olympia WA 98501-1091 Phone: (360) 902-2225 Fax: (360) 902-2947 http://wdfw.wa.gov/	**WA Dept of Health** 101 Israel Rd SE Tumwater, WA 98501 Phone: (360) 236-4501 Fax: (360 586-7424 http://www.doh.wa.gov/	**WA Dept of Ecology** Waste Management Div Solid Waste & Financial Srvs Program P.O. Box 47600 Olympia, WA 98504-7600 Phone: (360) 407-6103 Fax: (360) 407-6102 http://www.ecy.wa.gov/programs/swfa/index.html
WEST VIRGINIA (WV)			
WV Dept of Agriculture 1900 Kanawha Blvd East Charleston, WV 25305 Phone: (304) 558-2201 Fax: (304) 558-2203 http://www.wvagriculture.org/	**Wildlife Resources Section** WV Div of Natural Resources 1900 Kanawha Blvd, East Charleston WV 25305 Phone: (304) 558-2771 Fax: (304) 558-3147 http://www.wvdnr.gov	**WV Bureau for Public Health** 350 Capitol St, Rm 702 Charleston, WV 25301 Phone: (304) 558-2971 Fax: (304) 558-1035 http://www.wvdhhr.org/bph	**WV Dept of Environmental Protection** Div of Water & Waste Management 1356 Hansford St Charleston, WV 25301-1401 Phone: (304) 926-0465 Fax: (304) 926-0477 http://www.dep.state.wv.us/item.cfm?ssid=11&ss1id=727
WISCONSIN (WI)			
WI Dept of Ag, Trade, & Consumer Protection 2811 Agriculture Dr Madison, WI 53708 Phone: (608) 224-5012 Fax: (608) 224-5045 http://datcp.state.wi.us/index.html	**WI Dept of Natural Resources** Box 7921 Madison, WI 53707-7921 Phone: (608) 266-2621 Fax: (608) 266-6983 http://www.dnr.state.wi.us/	**WI Div of Public Health** 1 W. Wilson St P.O. Box 2659 Madison, WI 53701 Phone: (608) 266-1251 Fax: (608) 267-2832 http://www.dhfs.state.wi.us/	**WI Dept of Natural Resources** Bureau of Waste Management P.O. Box 7921 Madison, WI 53707 Phone: (608) 266-0014 Fax: (608) 267-2768 http://www.dnr.state.wi.us/org/aw/wm/solid

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State Agricultural, Wildlife, Public Health & Solid Waste Contacts

AGRICULTURE	WILDLIFE	PUBLIC HEALTH	SOLID WASTE
WYOMING (WY)			
WY Dept of Agriculture 2219 Carey Ave Cheyenne, WY 82002 Phone: (307) 777-6569 Fax: (307) 777-6593 http://wyagric.state.wy.us/	**WY Game & Fish Dept** 5400 Bishop Blvd Cheyenne ,WY 82006 Phone: (307) 777-4501 Fax: (307) 777-4699 http://gf.state.wy.us/	**WY Dept of Health** Hathaway Bldg 2400 Capitol Ave Cheyenne, WY 82002 Phone: (307) 777-7656 Fax: (307) 777-7439 http://wdh.state.wy.us/main/index.asp	**WY Dept of Environmental Quality** Solid & Hazardous Waste Div SW Permitting & Corrective Action 152 North Durbin, Ste 100 Casper, WY 82601 Phone: (307) 473-3450 Fax: (307) 473-3458 http://deq.state.wy.us/shwd/Old%20Stuff/index_old.asp?pageid=4

Burial

Summary

Definition and objectives

Burial methods are disposal practices in which plants and dead animals (contaminated biomaterials) are placed in earth-filled trenches or pits. These contaminated biomaterials are disposed of in a properly selected, enclosed environment and may be mixed with soil and solid waste in landfills.

In handling contaminated animals and plants, the objectives of burial methods are to:

- Provide the conditions that impede the growth and spread of pathogens from the contaminated materials and to limit access to them by vermin
- Convert the contaminated materials into inert compounds (mainly minerals)
- Control nuisance odors
- Dispose of and degrade the materials so that they neither pose a health hazard nor pollute the air, water, leachate or soil

Burial and landfilling can be used only where allowed by permits and the depths of the soil and water table.

Large amounts of contaminated materials can be disposed of by trench burial (animals), landfilling (animals and plants), mass burial (animals) and field burial (plants). To select a feasible method, consider the classification of the contaminated materials and the logistics—cost, location, facilities and environmental impact—for handling them (Table 1).

Table 1. Methods considerations for the burial of contaminated plants and animals.

Consideration	Trench burial	Landfilling	Mass burial	Field burial
Application	Animals	Animal/plants	Animals	Plants
Transportation concerns	No	Yes	Yes	No
Pathogens inactivated	Viruses and non-spore-forming bacteria	Viruses and non-spore-forming bacteria	Viruses and non-spore-forming bacteria	All field crop diseases
Disposal capacity[1]	Small to large	Small to medium	Small to medium	Small to large (acreage)
Potential for environmental impact	High	Medium	Medium	Low
Regulatory restrictions[1]	Medium	High	High	Low
Cost[3]	Low	Medium	High	Low
Availability of resources	High	Medium	Low	High
Procedure speed	High	Medium	Low	High

[1] Animal mortality (tons): Low = < 100 t; Medium = 100–300 t; High = > 300 t
[2] The stringency of restrictions imposed by federal, state and local agencies
[3] Cost estimate (per ton): Low = < $200; Medium = $200–800; High = > $800
(Cutoff points may vary, depending on such factors as transportation, carcass load, animals affected, disposal facility and level of security.)

Trench burial

In the trench burial method, animal carcasses are placed in unlined trenches or pits that are then backfilled with excavated soil. The soil absorbs the leachate and microorganisms and minimizes carnivorous feeders.

Trench burial provides a confined soil environment for absorbing carcass fluids and preventing heat loss, thus speeding up the anaerobic degradation process at low moisture content.

This method offers several advantages:

- It is logistically simple and relatively easier than are the other burial options.
- The equipment needed for this disposal method is widely available at farms and feed yards.
- Burying the animals on site eliminates the need for transporting potentially infectious materials to landfills or mass burial sites.

However, this method encourages vermin and increases the potential for groundwater contamination. Also, routine poultry carcasses are usually not permitted to be buried on site. Some states, such as Texas, permit the on-site burial of poultry carcasses in emergencies when the mortality rate exceeds 0.3 percent of the total on-farm inventory per day.

Although the trench burial method needs much less area than does mass burial, a limiting factor is the availability of sites with the appropriate soil and hydraulic properties.

From an environmental perspective, trench burial is the least preferred burial option for carcass disposal because the trench walls and bottom are not lined with an imper-

meable barrier, as is required for mass burial and landfilling.

The decomposition time for buried carcasses depends on the species, carcass size and soil properties (texture, temperature, moisture and chemical composition).

Another disadvantage of trench burial is that although the carcass body fluid will drain within about 2 months, it can take a long time to release much of the pollutant load from the carcass material. Buried carcasses may continue to produce both leachate and gas for as long as 20 years; they may harbor spore-forming bacteria such as *Bacillus anthracis* for 200 years, as has been seen from old, infected graves.

Despite the heat generated from the buried carcasses, many bacteria may survive, especially when they are buried in cold climates or during cold seasons. Summer is a more suitable time in which to bury dead animals because they decompose faster then and the soil is easier to excavate.

Landfilling: Description

Landfilling is an excellent option for disposing of carcasses if the farm operation or organizations supporting the incident response have access to vehicles large enough and suitable for transporting the carcasses quickly and biosecurely.

The aim of landfilling is to deposit the dead animals in an engineered, sealed containment area between layers of compacted solid waste and impermeable lining materials. The leachate from the contaminated carcasses is either expelled or transferred to a wastewater treatment plant, where it is sprayed and recirculated on the surface of the landfill area.

Of the landfill area designated for carcass disposal, only 30 percent is used for the actual burial of carcasses. The remaining acreage is required for runoff and leachate collection, drop-off stations, a buffer area and sites from which cover soil can be obtained or "borrowed."

The base and walls of modern landfills are built with 2 to 3 feet (0.6 to 0.9 meter) of compacted impermeable soil. The soil's hydraulic conductivity must be less than 0.00034 inch per day. The landfill base and walls are lined with a thick, flexible membrane that is at least 30 mils (0.76 millimeter) thick. Lining made of high-density polyethylene must be 60 mils (1.52 millimeters) thick.

Although adding this lining increases the cost of disposal, it reduces the risk of exposure to the environment and reduces future liabilities.

For modern landfilling sites, the amount of setup time for carcass disposal is minimal if the disposal arrangements are made in advance. However, the carcasses may take longer to degrade at a landfill than in a trench burial site because the co-fill materials in landfills are less homogenous than the soil in trenches, and they absorb moisture inconsistently.

In addition to the inconsistent moisture contents, landfills have widely varying temperatures, which can also slow the biochemical reactions in the carcasses. These reactions may generate landfill gases, including methane and carbon dioxide as well as trace amounts of hydrogen, hydrogen sulfide and carbon monoxide. If the landfill operations are conducted improperly, these noxious gases may be released to the air, and leachate and gases may migrate to the soil and water.

Another drawback is that the temperatures in landfills do not reach high enough to inactivate heat-resistant organisms and spore-

forming bacteria. Also, modern landfills are not available in every state.

Some landfill sites are owned by municipalities; others are privately owned. Those owned by municipalities may not have enough capacity for additional waste such as carcasses. All owners may face political consequences of accepting the carcasses. Some landfills may not accept carcass materials because of local opposition or fear of disease transmission.

Long-term requirements and costs for this method include the maintenance of the landfill's lined surface (cap) to control pollution and prevent settling.

The standard operating procedure for landfilling animals can be used for disposing of plant materials. Because of the nature of plant pathogens, those planning plant disposal operations should focus more on costs and logistics issues than on biosafety.

Mass burial

Mass burial is used when large numbers of animal carcasses are collected from multiple disaster locations and buried at remote designated sites that have pre-engineered and constructed pits.

Mass burial is appropriate if no licensed landfill in the disaster area accepts carcasses. Generally, the inputs and resources needed for mass burial sites are in many ways similar to those of landfilling.

Mass burial is an engineered technology that requires lead time for proper design and construction as well as prior regulatory approvals. The pits in mass burial are built with sophisticated liners and proper drainage to collect the carcass leachate and to minimize

the risk of contaminating the groundwater. Although this lined design may make the option more costly, it greatly minimizes the risk of future liabilities and harm to the environment.

Mass burial may be necessary at the height of a large outbreak such as during the United Kingdom's incidence of foot-and-mouth disease, when the number of diseased, at-risk or humanely slaughtered animals overwhelmed other disposal methods.

In emergency situations, the mass burial of carcasses is done in shallow (about 3 feet [0.9 meter] deep) trenches. Therefore, mass burial requires more land area than does trench burial. Preconstructed mass burial sites can reach to 10 feet (about 3 meters) deep.

Because the lined walls and bottoms of mass burial pits are sealed, the carcass leachate is not absorbed. Therefore, the leachate collection system must be engineered properly, with the leachate being conveyed to a treatment facility.

Mass burial pits should be located on ground that is level or gently sloping (less than 5 percent).

Field burial

Field burial is suitable for disposing of contaminated plant materials, particularly annual field crops. Generally termed *tillage* or *cultivation* in field crop production, field burial is used to remove established vegetation and to prepare the soil for planting a new crop.

The goal of this method of disposal is to bury contaminated plant materials under the soil surface, thus sequestering the pathogens and beginning the decomposition of the overturned plant materials. Field burial is probably the most economical and practical method for disposing of contaminated plant materials in the field.

Several types of plows are available for use in field burial, including disk, moldboard, ripper and chisel plows.

In conventional tillage, a moldboard plow turns up the soil to a depth of 8 to 12 inches. This operation buries the contaminated plant materials and pathogens (disease-causing organisms) beneath the soil surface and can help control a plant disease epidemic.

Shallow plowing (about 6 inches deep) may be enough to bury the pathogen spores and control new infections.

Coordination and jurisdictional considerations

Burial should be undertaken only with the explicit approval of the local and state institutions and agencies competent in making determinations about protecting the environment. States have established orders of priority for carcass disposal, and the incident command structure must exhaust higher disposal priorities before undertaking burial activities.

The location of burial activity should be chosen by the members of the incident command structure established by local or state authorities. Local authorities must establish an intercounty memorandum of understanding so that the carcass overflow can be easily transported to nearby counties for burial.

If the carcasses are to be transported to nearby counties, the incident command structure must consider the added problem of transportation safety and contamination of other property.

Pollution and other property damage considerations

The exercise of police power gives governmental entities and agencies wide discretion in making decisions about burying carcasses to protect public health. However, this power does not shield the entities against nuisance actions if the proper precautions are not taken.

Burying carcasses near wells, residences, water bodies, public areas or property lines could trigger nuisance or other types of lawsuits. Sovereign immunity may not be a defense to such action.

If the carcasses are buried in an area not included in the list of "suitable areas" as defined by the local Natural Resource Conservation Service, the burial could constitute a violation of the incident command structure rules and serve as a basis for due process, equal protection, nuisance or other challenges.

Because injury to people or property could trigger suits claiming violation of site selection procedures, the burial decision must be made jointly by the members of the appropriate technical group within the incident command structure.

Planning considerations

Consult with state solid-waste-management officials and regional, county or municipal authorities to obtain the required permits and information about the restrictions on burial methods and the permissible volume of animal carcasses. States and counties may assist by providing draft permits as part of their emergency management plans.

When planning for emergency carcass disposal by burial, obtain input from private contractors (heavy machinery operators), animal producers, first responders and personnel from fire departments, law enforcement, county roads and public works departments, departments of transportation, parks and recreation departments, regulatory agencies, the USDA Natural Resources Conservation Service (NRCS) and the Extension service. Maintain a current list of telephone, fax and e-mail information for key representatives of the collaborating agencies.

Consult the NRCS offices to obtain soil maps, drainage information, records of seasonally high water table depth and other relevant data on environmental impacts. County NRCS offices may maintain a listing of suitability for "Animal Mortality Burial (Catastrophic)" by soil map unit.

When choosing a burial site, consider its proximity to wells, residences, roadways, municipalities, public areas, religious sites, archaeological zones, property lines and bodies of water (Table 2).

Table 2. Capacity and setback distances of carcass burial options for various soil types.

Burial option	A	B	C	D	E	F (Capacity)
Trench burial	150 ft	200 ft	500 ft	1,000 ft.	1,325 ft.	Variable
Landfill	—	—	—	—	—	40t/200ft^2 4,000t/acre
Mass burial	150 ft	200 ft	500 ft	1,000 ft	1,325 ft	Variable

A. Minimum distance from private wells, springs, watercourses, sinkholes, streams, springs (or any source of water used for domestic purposes), and public areas.
B. Minimum distance from residences or property lines.
C. Minimum distance from public wells.
D. Minimum set-back distance from water supply well for the burial of disease-infected carcasses.
E. Minimum distance from pubic roads, highways, and parks.
F. Sometimes the carcass depth in LF may reach to 6 ft., and thus the capacity will be 80 tons of carcass in 400 ft.^{2}

Also when locating a burial site, consider various soil properties, including slope, texture, permeability, surface fragments (cobbles or stones), the depth to bedrock and the presence of fractured or cavernous bedrock.

Do not locate a burial site in highly permeable soils such as sands, loamy sands or old gravel quarries. Locate it in an area with appropriate soil (loam or finer) or provide a mixture of clay and low-porosity sand (fine texture) to cover the carcasses. This coverage prevents seepage into the groundwater and maximizes the natural decomposition of carcasses.

Work with university Extension and NRCS personnel to conduct sampling as part of a geotechnical investigation of the proposed burial sites to determine the appropriate areas for excavation of trenches and pits. Plan to take soil samples to a depth of 2 feet (0.6 meter) below the lowest planned excavation point.

Before excavation, consider the landfilling, trench burial and mass burial dimensions to estimate the burial area (Table 3). Multiple pits should be spaced at least 20 feet (about 6 meters) apart.

Also before excavation, contact the local utility company or other state-approved notification center to check for underground utilities in the general work area.

Do not bury animal carcasses where the water table is within 10 feet (about 3 meters) of the bottom of the burial site. High concentrations of ammonia and dissolved solids have been reported in groundwater near burial sites and around the poultry carcass disposal pits.

Fence and stake the burial site to keep out unauthorized personnel, pets, wildlife and farm animals.

Under no circumstance should you bury in trenches, pits or landfills any carcasses infected with chronic wasting disease or transmissible spongiform encephalopathy (TSE), such as bovine spongiform encephalopathy, or "mad cow disease." TSEs are not inactivated by any burial process and can seriously threaten the health of people and animals.

Plan to collect and dispose of the carcasses as quickly as possible to avoid negative public reaction resulting from the prospect of odors and the fear of disease transmission. Rapid burial prevents carnivorous feeders, scavengers and vermin from feeding on the carcasses and possibly spreading diseases.

Table 3. Trench/pit/landfill dimensions for burial of animal carcasses.

Burial option	Volume ratio[a]	Width	Depth	Length[d]
Trench burial	2–4	4–10 ft	3–12 ft[c]	—
Landfill	—	14 ft	10–20 ft	30 ft
Mass burial	2–4	4–6 ft[b]	3–12 ft[c]	—

[a] Ratio of the volume of excavated trenches to the volume of carcasses
[b] Historical data show a width of up to 20 ft, but most new references recommend a width of up to 6 ft.
[c] Depth excludes 2 ft and 4 ft of mound to shed rain water and divert runoff for trench burial and mass burial, respectively.
[d] As needed to bury a given number of carcasses in trench burial and mass burial. Each bovine carcass is equivalent to five adult sheep or five mature hogs and requires 5 ft of trench length. Additionally, a 10–14 ft^2-area is required at the bottom of trench/pit for one mature cattle carcass.

Train the members of the disposal crew on how to use safety equipment while excavating the trenches or pits, especially for the deeper trenches. Also educate them about safety, biosecurity and operational procedures, such as how to receive and properly stage the carcasses.

Plan well in advance to protect the excavated soil from erosion until it is used as backfill.

Provide equipment for digging pits and burying carcasses. Each cubic yard of the bucket size can excavate about 100 cubic yards (about 76.5 cubic meters) of trench per hour.

Also provide machinery and equipment for handling, loading, unloading, cleaning and disinfecting, as well as for lighting and safety, as described in the "Thermal" chapter. The capacity of the equipment depends on the amount of carcasses and the time required (usually 24 to 48 hours, but up to 72 hours in cold climates) for a proper burial process.

Provide a backhoe, scraper, bulldozer or other equipment that can excavate a trench and/or burial pit, and use tools suited to working in rocky soils. For information on some of the equipment suppliers, operators and contractors of the trench burial, landfilling and mass burial options, see Table 4.

Plan to decontaminate the equipment used for handling, packing, storing and conveying the carcasses as described in the Transportation section of the "General Considerations" chapter.

Table 4. Contractors and operating companies for trench burial, landfilling and mass burial systems.

Company	Nature and capacity of work	Contact information
Phillips and Jordan, Inc.	Contractor of trench burial up 50 t/hr	Robbinsville, NC 28771 800-511-6027, 909-337-0083 or 919-605-4571 *www.pandj.com*
Riverside County Waste Management	Carcass landfilling 40–80 t/day	14290 Frederick Street Moreno Valley, CA 92553 909-468-3308 *www.rivocowm.org*
Crowder Excavating, Inc.	Contractor, up to 10 t/hr	901 Geddie Road Tallahassee, FL 32304 850-576-7176; 800-992-6207 or 251-653-6590 *www.environmentalexpert.com*
Tetra Tech EM Inc.	Consultant and contractor for landfilling and burial up to 50 t/day	8030 Flint Street Lenexa, KS 66214 913-894-2600 *www.tetratech.com*

This is not an exhaustive list. No endorsement of companies or individuals or their services mentioned is intended, nor is criticism of similar companies implied.

Planning for trench burial

When considering trench burial, plan for an alternative burial method in case no area with suitable soils is available for trench burial of large amounts of animal carcasses.

Where the soil type is not necessarily suitable for trench burial, you may need a source of clay to supplement the base (bottom layer) of the trench. This clay will minimize the potential for environmental contamination.

Do not consider sites that have no cutoffs, drainage or other special design features if water (apparent, perched or seasonal) is likely to emerge just above the level of the trench bottom or if it flows down into the trench or away from the site.

Do not allow vehicular traffic to come within 4 feet (1.3 meters) of the trench/pit edges. Vehicles may damage the topsoil near the trenches/pits and may create cracks or fractures in the subsoil, making it permeable to leachate.

Planning for landfilling

Lessons learned from the outbreak of foot-and-mouth disease in the United Kingdom and from outbreaks of poultry diseases in the United States suggest that state and county carcass disposal plans should include prior approvals to use landfills. Prepare contingency contracts in advance to avoid delays and high costs once an outbreak occurs.

When planning for disposal of carcasses in Type I landfills, involve landfilling and state solid waste management officials.

Identify the Type I landfills available for disposal of carcasses. Because they are equipped to collect leachate and gas, modern or Type I landfills are permitted to accept carcasses except those contaminated with prions such as mad cow disease, Creutzfeldt-Jakob disease or chronic wasting disease.

Modern landfills must meet the requirements of the Resource Conservation and Recovery Act, Subtitle D, and many other federal, state and local regulations. Subtitle D stands for sanitary landfills that keep wastes "dry" and minimize the production of leachate and gases, the major byproducts of waste degradation.

Planning for mass burial

The base of an excavated pit for mass burial should be built at least 10 feet (about 3 meters) above the historical high groundwater level.

Use unlined, excavated pits for mass burial only when the carcasses will be stored temporarily and disposed of promptly.

Be prepared to provide adequate containment and collection systems for the landfill and the leachate generated in mass burial.

Planning for field burial

If the plants are confirmed to be contaminated with pathogens on the Select Agent and Toxin List published by the USDA Animal and Plant Health Inspection Service (APHIS), the plants may need to be buried at a designated, approved site. The list is located at *http://www.aphis.usda.gov/programs/ag_selectagent/ag_bioterr_toxinslist.html.*

A practical option for disposing of annual field crops is on-site field plowing. This method does not require that the plant materials be transported from the farm, and air quality issues are not a concern.

Landfill burial is a practical choice for perennial field crops and nursery greenhouse plants. However, a limiting factor can be the

proximity of the farm to the landfill. Consider landfill burial also for trees and lumber if thermal destruction is unfeasible and if they can be transported in a timely, cost-effective manner.

Because plant pathogens are not known to cause human diseases, the biosecurity and environmental safety efforts should focus on preventing the spread of pathogens to crops in other regions.

Procedure for trench burial

When considering trench burial of contaminated plants or animals—except those contaminated with prions—first verify that they need to be disposed of immediately. Determine whether they are contaminated with aggressive pathogens with a great potential to cause an epidemic. If they are not considered to be an immediate threat, consider using a natural decomposition or crop rotation method.

Select a cross-sectional geometry (trapezoidal or rectangular) for the carcass burial site.

Determine the length of the trench from the cross-sectional area of the trench geometry. The ratio of trench volume to carcass volume should be:

- 4:1 for burying one to two layers of large carcasses (1,000 pounds [about 450 kilograms] or more)
- 2:1 for burial of two to three layers of medium-sized or small carcasses.

To determine the length of the trench, see the calculations in Figure 1.

Dig the trenches/pits with relatively level bottoms according to the dimensions in Table 3. Some states, such as Iowa, permit the construction of burial trenches with vertical walls if the wall height is less than 5 feet (about 1.5 meters). See Figure 2 for details.

In general, there must be at least 2 feet (about 0.6 meter) of impermeable soil between the bottom of the trench and the water table. The carcasses should be covered with at least 2 feet of soil.

Adjust the width, depth and side slopes of the trench to match the needs of the equipment without compromising the safety of the crew. Prevent trench cave-in hazards by using

Occupational Safety and Health Administration (OSHA) standards for the people building or working in or around trenches/pits during excavation and material emplacement.

Where space is limited, use more than one trench/pit and separate them by a minimum of 3 feet (about 0.9 meter) of undisturbed or compacted soil.

To inhibit bloating, which can displace and shift the soil or even raise the carcasses to the trench/pit surface, vent the carcasses before burial, especially those of large animals. This venting will minimize the accumulation and entrapment of gases.

For small animals such as poultry or nursery pigs, place a layer of carcasses at the trench/pit bottom and cover it with at least 1 foot (about 0.3 meter) of soil. For large animals such as hogs or cattle, place the layer of carcasses at the trench bottom and cover it with at least 2 feet (about 0.6 meter) of soil. Repeat this process for up to three layers of carcasses in deep trenches/pits (Fig. 2).

To reduce potential predator problems in and around the trenches/pits during the burial process, cover the carcasses daily, particularly if the burial process takes more than 24 hours.

Mound the trenches with at least 2 feet of soil, preferably impermeable soil (Fig. 2). Do not try to compact the earth-filled trenches/pits because compaction is difficult to achieve; it also may impede the natural decaying process.

Refill the caved-in mounds to prevent access by vermin (or vectors, which are organisms that transmit pathogens away from their source) and collection of surface water.

Figure 1. Length calculation for burial of 100 cattle in deep or shallow trenches.

Assumptions

1 - Average weight of carcass = 1,000 lb
2 - Bulk density of carcass = about 62.4 lb/ft^3
3 - Volume ratio for a two-layer or one-layer burial trench = 4 ft^3 of trench/ft^3 of carcass
4 - Trench depths for one layer and two layers = 4 ft (shallow trench) and 8 ft (deep trench), respectively
5 - Trench width for both cases = 6 ft; two carcasses lie side by side
6 - Length of each cattle carcass = about 5 ft

Solutions

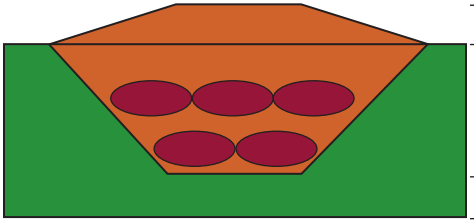
A. Deep trench

1 - Trench length in a deep trench = {(100 cattle)*(1,000 lb/cattle) (4 volume ratio)} ÷ {(62.4 lb/ft^3) (8 ft deep) (6 ft wide)} about 130 ft
2 - Number of buried cattle in two layers and two rows = {(130 ft.)*(2 layers)*(2 rows)} ÷ (5 ft length/carcass) = 104 carcasses

B. Shallow trench

1 - Trench length in shallow trench = {(100 cattle)*(1,000 lb/cattle) (4 volume ratio)} ÷ (62.4 lb/ft^3)(4 ft deep) (6 ft wide)} ~ 260 ft
2 - Number of buried cattle in two layers and two rows = {(260 ft)*(2 rows)} ÷ (5 ft long/carcass) = 104 carcasses

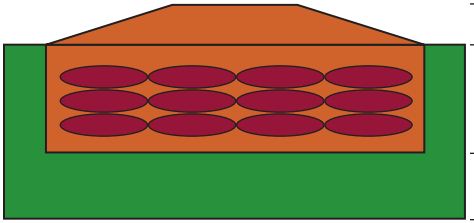
Figure 2. Cross sections (not to scale) of a trapezoidal trench (top) and a vertical trench used for burying carcasses. For massive carcass burial, trenches of up to 12 feet deep with no more than two 3-foot layers of dead animals are recommended. The bottom soil should be highly impermeable, without fractured or cavernous rock.



2 ft height of mounding soil with side slopes 3:1

6 ft height of soil with side slopes 1.5 (horizontal):1 (vertical) containing 2–3 layers of carcasses (1–3 ft thick). Each medium or large carcass layer is separated by a 1-ft thick layer of soil.

Minimum 2 ft of soil between trench bottom and the water table



2 ft height of mounding soil with side slopes 3:1

5 ft of excavated trenches/pits with the vertical wall containing a maximum of 3 layers of small carcasses (each 1 ft thick)

Minimum of 2 ft of soil between trench bottom and the water table

Procedure for landfilling

All landfills used must agree to the delivery of carcasses. Most landfills, even those closed to the public, accept carcasses. Confirm with the operator that the landfill is properly designed and is designated to accept carcasses, and either collect and treat the leachate on site or transport it to a waste treatment plant.

For the carcass disposal process, use the conventional equipment that is available in Type I landfills. At the landfill site, load the carcasses evenly at deepest part of the pit to a height of 3 to 6 feet. Cover this layer of animal carcasses with a 3-foot (about 0.9-meter) layer of solid waste (household trash) and compact it to reduce its porosity.

Repeat adding 3-foot layers of solid waste only, and compact each layer until a total height of 10 feet is reached (Fig. 3). The deepest part of landfill is not necessarily in the preconstructed and lined bottom. The landfill may have a depth of 20 feet (about 6 meters) of compacted trash.

At the end of each day, cover the left-over solid waste (co-filling materials) with a thin layer of soil (less than 1 foot [0.3 meter] thick) to keep the landfill in a sanitary condition and to minimize nuisance problems such as odors, vectors and predators.

Mound the top (final) compacted layer of solid waste with at least 2 feet (0.6 meter) of impermeable soil.

Continue to monitor the mound for settling and caving-in. Fill and recompact the mound to shed water and to prevent the release of odors and noxious gases.

Figure 3. Two views of carcass disposal in the Badlands Landfill, in Moreno Valley California *(Photos courtesy of Riverside County, Waste Management Department, CA)*.

Procedure for mass burial

For mass burial, select a cross-sectional geometry (rectangular or trapezoidal) according to Figure 4.

When excavating to more than 5 feet (about 1.5 meters) deep, prepare the side slopes with a minimum ratio of 1.5 (horizontal) to 1 (vertical).

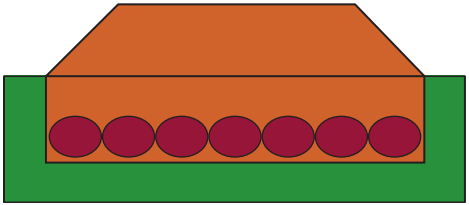
Prepare gravel drainage channels to convey the seepage to the leachate collection sumps. To prevent or minimize seepage, line the inside (walls and bottom) of the trenches/pits with clay or an impermeable membrane.

Divert the upstream runoff by building berms or a cutoff ditch along the up-gradient side of the pit.

In the burial process, place one or two layers of carcasses in shallow or deep pits. The carcass layers can be a maximum of 2 feet [0.6 meter] or one large animal thick. The depth of a shallow pit is 3 feet (0.9 meter); that of a deep pit is 10 feet (3 meters).

Cover each carcass layer with up to 3 feet of soil (Fig. 4). Fill the pits with excavated soil and mound them with 4 feet (about 1.2 meters) of impermeable soil above the ground level (Fig. 5).

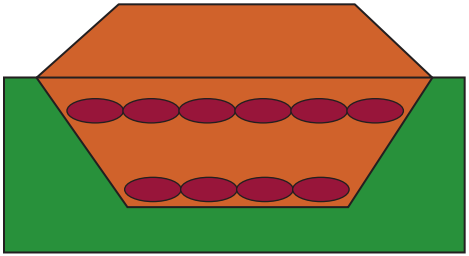
Figure 4. Cross sections of vertical pits (top) for temporary mass burial and of a trapezoidal trench/pit for mass burial of carcasses at preconstructed sites. The walls and bottom of the trenches/pits are built with 2 to 3 feet of impermeable soil such as compacted clay, especially in the deep pits used for mass burial. The bottom soil should not be highly permeable.



4-ft height of mounding soil with side slopes 3:1

5 ft of excavated trenches/pits containing one layer of carcass (1–3 ft thick) covered with 2-3 ft soil

Minimum 2 ft of soil between trench bottom and water table.



4-ft height of mounding soil with side slopes 3:1

10 ft of excavated trench/pit with side slopes of 1.5 (horizontal): 1 (vertical) containing a maximum of 2 layers of carcasses (1–3 ft thick). Each carcass layer is separated by 3 ft of soil.

Minimum 2 ft of soil between pit bottom and water table.

Figure 5. Great Orton, United Kingdom, in 2005 after mass burial in 2001. *(Photo courtesy of Scudamore et al. 2002)*. *http://www.visitcumbria.com/footandmouth.htm*, accessed Nov. 6. 2006.

Procedure for field burial

When considering field burial of contaminated plants or animals—except those contaminated with prions—first verify whether they need to be disposed of immediately. Determine whether the plants are contaminated with aggressive pathogens with a great potential to cause an epidemic. If they are not deemed to be an immediate threat, consider using a natural decomposition/crop rotation method.

Prepare the equipment (tractors and appropriate plows) and personnel for the operation. Before field plowing, remove the established vegetation (such as trees and shrubs) by mechanical or chemical means.

Generally, plowing 6 inches deep can effectively dispose of the pathogens and crop residues, which will ultimately reduce the pathogen population significantly. In severely diseased areas, consider plowing 12 inches deep.

Turn but do not compost the soil because plant residues generally decompose quickly when they are mixed with soil aerobically; they decompose slowly when they are buried deeply (anaerobically) as compact layers.

A timeframe of 1 hour per acre is estimated for field plowing. Do not plow the area again because this may simply return the active pathogens to the soil surface.

Table 5. Guidelines for the use of personal protective equipment.

Nature of work	Mask/respirator[a,b,c]		Protective clothing[a]	Eye/hearing protection[a]	Gloves[a]	Head/foot protection
	Zoonotic agent	Non-zoonotic agent				
Direct handling of contaminated materials	Disposable particulate respirator (N95, N99, or N100); half or full facepiece	None recommended unless for foot-and-mouth disease	Impermeable to liquids; depending upon heat situation	***Eyes:*** Full facepiece respirator or indirectly vented goggles; contact lenses should not be worn under goggles or safety glasses; consider prescription safety goggles ***Hearing:*** Consider disposable earplugs if necessary	***Gloves:*** Heavy duty (15–18-mil) chemical resistent gloves that can be disinfected or disposed; if desired, 10–12-mil nitrile gloves worn under leather gloves	***Feet:*** For workers handling carcasses, steel-toe/steel shank waterproof boots; for others, steel-toe work shoes or boots ***Head:*** Hard hat
No direct handling of contaminated materials	None recommended	None recommended	No special clothing required; work clothing appropriate for season	***Eyes:*** Safety eyewear ***Hearing:*** Consider disposable earplugs, if necessary	Work gloves if necessary	***Feet:*** Steel-toe work shoes or boots ***Head:*** Hard hat

[a] For a list of vendors recommended by OSHA, visit *www.safetyequipment.org*.
[b] For information about a full respiratory protection program, visit *www.osha.gov/SLTC/repiratoryprotection/index*.
[c] Regulations governing the use of personal protective equipment in hazardous waste operations can be found at 29 CFR 1910.134 and 29 CFR 1910.156 and are summarized in the Safety section of the "General Considerations" chapter of this manual.

Diseases of concern

For burial methods, the diseases of concern include those caused by viruses, bacteria and prions.

Viruses and non-spore-forming bacteria: Burial is an effective method for controlling the spread of viral and non-spore-forming bacteria.

For viruses such as those that cause foot-and-mouth disease (FMD) and classical swine fever (CSF), some of the viruses will persist after burial. Reports estimate that these viruses may survive for up to 40 days before they begin to deteriorate. Although some viruses persist in the soil longer than do non-spore-forming bacteria, burial is still an acceptable disposal method for them.

Precautions must be taken to prevent inhalation of airborne pathogens. Personal protective equipment is essential for worker safety while the carcasses are being transported and handled on site.

The diseases for which burial is an acceptable method include African swine fever, brucellosis, CSF, contagious bovine pleuropneumonia, FMD, glanders, highly pathogenic avian influenza, Japanese encephalitis, Q fever, Rift Valley fever, rinder pest, tularemia and vesicular stomatitis.

Spore-forming bacteria: Burial is not recommended for materials infected with spore-forming bacteria because the spores may persist indefinitely in the soil. Spore-forming bacteria must be incinerated thoroughly. If it is not possible to incinerate the carcasses immediately, they must remain intact to prevent the spores from spreading into the external environment.

Diseases of concern include anthrax.

Prions: Extremely high temperatures are necessary to destroy carcasses infected with prions. Prions are resistant to thermal and

environmental degradation. The best method of destruction is fixed-facility burning. **Do not bury prion-infected carcasses.**

Prion-based diseases include bovine spongiform encephalopathy.

Notes on safety

During extreme heat, rest periods must be instated to prevent heat stress and dehydration. OSHA recommends establishing a work/rest schedule that decreases heat exposure. Develop this schedule according to worker needs.

A worker with a core temperature of 100.4 °F is considered to be at a heat stress level. To prevent dehydration, allow the workers to drink water at liberty.

Heavy equipment operations are inherently dangerous. Use a safety observer with the training and authority to minimize the risk of dangerous situations.

Other suggestions from OSHA:

- Implement a training program for managers and employees on how to recognize and treat heat stress.
- Before beginning burial activities, screen the workers to identify existing health conditions.
- Institute procedural programs guiding the workers on what to do if a heat-related emergency arises.

For more information on heat stress and work/rest cycles, see the Safety section of the “General Considerations” chapter of this guide.

Control of scavenging animals is of paramount importance in controlling the spread of disease from the burial site. Insects, birds and animals that come into contact with the diseased carcasses can become vectors, spreading the disease outside the site or containment area.

To prevent easy access by vermin to the contaminated material, follow the engineering guidelines for burial sites carefully. The carcasses must be covered with soil by the end of the work day to prevent scavenging by wildlife. Institute controls for birds, vermin and other scavengers.

Place and compact the backfill material so as to prevent or minimize contact of the excavator or compactor with the carcasses. Compactors should not touch the carcass material until the backfill material is in place.

The site where animal carcasses are being deposited should be closed to all nonessential vehicles and personnel. Keep all other vehicles clear of the area accepting animal carcasses.

Equipment and truck drivers must remain in their vehicles while on the burial site to avoid contamination of footwear and clothing. Provide another set of personnel on the ground to open tailgates and offload carcasses.

Personnel and vehicles must be decontaminated before they leave the disposal site. See additional information in the Safety section of the “General Considerations” chapter of this guide.

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Groundwater pollution

Because each state sets its own regulations for burial of hazardous waste, it is critical to identify the appropriate authorities before selecting a landfill for carcass disposal.

It is absolutely essential that you work closely with state agriculture and environmental regulatory agencies before burying large volumes of contaminated plant and animal materials. The appropriate state and local agencies are best able to handle considerations such as soil type, groundwater depth, nearby surface water flows, proximity to drinking water wells and assessment of ground water monitoring approaches.

Landfill operators must provide the required information on this topic and will have the authority to deny burial of hazardous carcass waste at their sites if they believe the environmental risk to be greater than acceptable.

The most relevant human hazards are the waterborne protozoa, pathogenic bacteria and transmissible spongiform encephalopathies that may be transported by groundwater and can contaminate water supplies. Controlled conditions and groundwater monitoring will minimize the risk of contamination; they are instrumental in preventing a public health hazard.

Air pollution

There should be no notable emissions if the burial methods are followed carefully according to the guidelines presented in this handbook.

Concerns are limited to on-site workers who will need personal protection equipment to minimize their exposure to airborne or aerosolized biological agents.

Operating landfills

All owners/operators of municipal solid waste landfills must comply with the requirements for proper landfill management:

- **Receipt of regulated hazardous waste:** The owner/operator must set up a program to detect and prevent the disposal of regulated quantities of hazardous waste. The program must include procedures for random inspections, record keeping, training of personnel to recognize hazardous wastes and notification of the appropriate authorities if such waste is discovered at the facility.
- **Cover material:** The owner/operator must cover the solid waste with at least 6 inches of earthen material at the end of each operating day to control fires, odors, vectors, scavengers and blowing litter. An approved state or tribe may allow an owner/operator to use an alternative cover material or depth and/or grant a temporary waiver of the cover requirement.
- **Vectors:** The owner/operator is responsible for controlling populations of vec-

tors, which include rodents, flies, mosquitoes and other animals and insects that can transmit diseases to humans. Application of cover at the end of each operating day generally controls vectors.

- **Explosive gases:** The owner/operator must set up a program to check for methane gas emissions at least every 3 months. If the limits specified in the regulations are exceeded, the owner/operator must immediately notify the state director (that is, the official in the state or area responsible for implementing the landfill criteria) and take immediate steps to protect human health and the environment.
- **Access:** The owner/operator must control public access to prevent illegal dumping, unauthorized vehicular traffic and public exposure. Artificial and/or natural barriers may be used to control access.
- **Storm water run-on/runoff:** The owner/operator must build and maintain a control system designed to prevent storm waters from running onto the active part of the landfill. Runoff waters must be managed according to the requirements of the Clean Water Act, particularly the restrictions on the discharge of pollutants into water bodies and wetlands.
- **Surface water protection:** All landfills must be operated in a way that ensures they do not release pollutants that violate the Clean Water Act.

For details in planning, see *http://www.epa.gov/epaoswer/non-hw/muncpl/criteria/landbig.txt.*

The costs of burial (Fig. 6) follow the category definitions from the "General Considerations" chapter of this guide. The cost of burial depends critically on labor, equipment and outlays for off-site burial and related transportation.

Table 6 lists estimates of direct costs for on-site burial of cattle, calves, hogs, sheep, lambs and goats. For formulas to estimate direct costs of burial, see Figure 7.

For indirect cost items, see the Cost section of the "General Considerations" chapter of this guide.

Figure 6. Components of direct and indirect costs for burial operations.

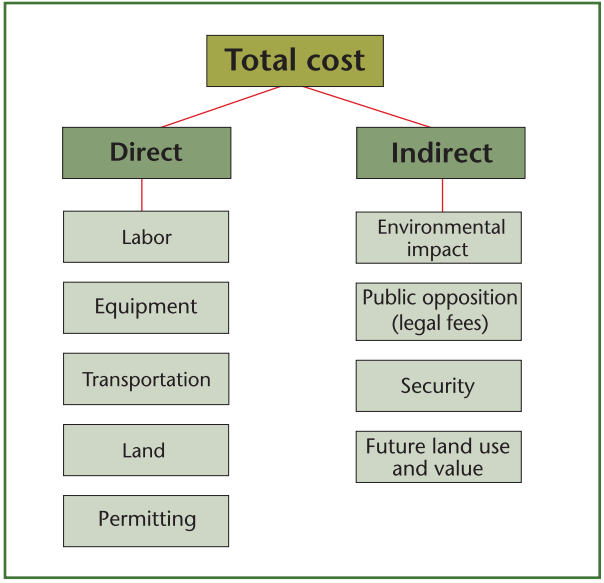

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Table 6. Estimates of direct cost items for on-site carcass burial.

	Cattle	Calves	Weaned hogs	Preweaned hogs	Others (sheep, lambs, goats)
Estimated average cost per carcass ($ per carcass)					
Labor cost	$3.33	$1.67	$1.67	$0.17	$1.67
Equipment cost	$11.67	$5.83	$5.83	$0.58	$5.83
Permitting fee	n/a	n/a	n/a	n/a	n/a
Transportation cost	n/a	n/a	n/a	n/a	n/a
Land cost	n/a	n/a	n/a	n/a	n/a
Average cost per carcass	**$15.00**	**$7.50**	**$7.50**	**$0.75**	**$7.50**
Estimated average cost per ton ($ per ton)					
Labor cost	$8.89	$12.53	$25.06	$55.56	$43.29
Equipment cost	$31.11	$43.86	$87.72	$194.99	$151.52
Permitting fee	n/a	n/a	n/a	n/a	n/a
Transportation cost	n/a	n/a	n/a	n/a	n/a
Land cost	n/a	n/a	n/a	n/a	n/a
Average cost per ton	**$40.00**	**$56.39**	**$112.78**	**$250.55**	**$194.81**

Source: *Livestock mortalities and burial costs in 2002 by Sparks Companies, cited by a report by the National Agricultural Biosecurity Center Consortium for Carcass Disposal.*

Figure 7. Formulas to estimate direct variable cost relating to burial.

If the hourly labor and equipment costs are \$10 and \$35 respectively, the direct variable (DVC) cost of on-site burial can be estimated using the following formulas:

- **By number of carcasses:**

$$DVC = 15.00Q_{\text{cattle}} + 7.50Q_{\text{calves}} + 7.50Q_{\text{weaned hogs}} + 0.75Q_{\text{preweaned hogs}} + 7.50Q_{\text{others}}$$

Where Q_i is the total number of carcasses in animal category *i.*

- **By weight:**

$$DVC = 40.00W_{\text{cattle}} + 56.39W_{\text{calves}} + 112.78W_{\text{weaned hogs}} + 250.00W_{\text{preweaned hogs}} + 194.81W_{\text{others}}$$

Where W_i is the total weight in tons of animal category *i.*

If the hourly labor cost and equipment cost are C_L and C_E rather than \$10 and \$35, the total direct variable cost (DVC) of on-site burial can be estimated using the following formulas:

- **By number of carcasses:**

$$DVC = (C_L + C_E)[0.33Q_{cattle} + 0.17Q_{calves} + 0.17Q_{weaned\ hogs} + 0.02Q_{preweaned\ hogs} + 0.17Q_{others}]$$

- **By weight:**

$$DVC = (C_L + C_E)[0.89W_{cattle} + 1.25W_{calves} + 2.51W_{weaned\ hogs} + 5.56W_{preweaned\ hogs} + 4.33W_{others}]$$

Estimating the costs of field burial for plant materials

The **fixed cost** is the daily rental cost of the tractor equipped with a plow. Below is a case example using a 60-horsepower tractor with a three-bottom, 16-inch moldboard plow. However, the field manager must be aware that the fuel consumed and the fixed cost will depend on the size of the tractor and the moldboard plow.

Hourly operation cost = Equipment rental cost per hour + Hourly labor + Hourly fuel cost

The **variable cost** is the sum of the labor cost plus the fuel cost during the operation.

Using the formula above, if the labor cost is $10 per hour, the fuel price is $3 per gallon for diesel, and **1 hour of operation** is estimated to plow **1 acre of field,** the **hourly operation cost** is estimated to be:

Hourly operation cost = Equipment rental cost per hour + $10 + $16.98

Hourly operation cost = Equipment rental cost per hour + $26.98