Disposal of Domestic Birds Infected by Avian Influenza

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1. PURPOSE

This document provides guidance to State and local decision makers by identifying critical considerations and potential options for the management of domesticated birds (and associated fecal material) infected by the avian influenza virus H5N1. The guidance draws from a variety of available resources and complements existing guidance from the U.S. Department of Agriculture (USDA), who is the lead federal agency in an avian influenza outbreak.

2. BACKGROUND

In domestic poultry, avian influenza viruses cause two main forms of disease, distinguished by low and high extremes of virulence, 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 and Europe, but not in the U.S. to date, 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 H5N1 spreading to humans through 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.

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 an avian influenza outbreak including the disposal of animal carcasses from an HPAI outbreak (highlighted below).

Occurrences of HPAI in the U.S.

Year	Type	State	Impact	Comments
1927	H7	East Coast	Occurred in an East Coast Live Bird Market	Outbreak was contained and eradicated.
1983	H5N2	PA	Caused severe clinical disease and high mortality rates in chickens, turkeys, and 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.

*Additional outbreaks of HPAI have been identified in a variety of countries.

These occurrences provide experience on how to successfully respond to an avian influenza outbreak and disposal of carcasses in a manner that is protective of human health and the environment. This guide integrates the lessons learned from these occurrences that USDA and states have had in responding to previous avian influenza outbreaks.

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 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, USDA 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 C 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 typically 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. See Appendix A for contact information for those agencies involved in the NRP.

4. CRITICAL FACTORS

There are 3 critical factors that influence the potential management options for disposal of domestic birds associated with an avian influenza outbreak:

1. The desire not to spread the virus by transporting infected birds;
2. The need to respond expeditiously to minimize potential transmission of pathogens (USDA's goal is for euthanized carcasses to be disposed of within 24 hours; see Reference, USDA National Animal Health Emergency Management System Guidelines for Disposal, April 2005, pg 5); and
3. The ability of the virus to survive, which dictates which management options are effective.

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 minimizes biosecurity concerns involved in moving contaminated carcasses, animal products, and other materials off an affected premises. 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.

Short-term exposure to heat, extremes of pH, dryness and common detergents can inactivate avian influenza. However, the 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 ≤1-7 days at temperatures around 70 ℉. Survival time may be lengthened to over 30 days in cold conditions or shortened to ½ to 3 hours at elevated temperatures (132-140 ℉). Additional studies on the survivability of the virus include:

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

- HPAI can persist in feces for 30-35 days at 39 ℉, and about 7 days at 68 ℉. (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 71 ℉ and for over 30 days at 32 ℉. (See Reference: http://www.poultry-health.com/fora/fowlplag.htm, Poultry Health Services website).

- Inactivation of the virus occurs under the following conditions:

    - Temperatures of 132 ℉ for 3 hrs or 140 ℉ or more for 30 mins
    - Acidic pH conditions
    - Presence of oxidizing agents such as sodium dodecylsulfate, lipid solvents, and B-propiolactone
    - Exposure to disinfectants: formalin, iodine compounds. (See Resource, http://www.cidrap.umn.edu/cidrap/content/influenza/avianflu/biofacts/avflu.html Source: Center for Infectious Disease Research & Policy, University of Minnesota.)

EPA registers pesticide products, including disinfectants. Currently, 100 disinfectant products are registered and intended for use against avian influenza A viruses which are effective on hard, non-porous surfaces with a 10 minute application. See Appendix B for additional discussion on the environmental survival of avian influenza virus.

5. MANAGEMENT OPTIONS

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 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, air curtain incineration, 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:

On-Site Composting:

Although not sufficiently rapid to dispose of the carcasses within 24 hours, setting up on-site (including in-house) composting will likely be a very widespread practice. It 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 usable product, compost. As indicated earlier, HPAI may be inactivated in 3 hours at 132 ℉ or ½ hour at 140 ℉, well within the temperature range of composting. In the case of the Delmarva Peninsula experience 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, Guidelines for In-house Composting of Catastrophic Poultry Mortality, 2002)

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 sawdust, straw, ground corn cobs, baled corn stalks, manure, hay, leaves, and rice hulls. In March 2006, the state of 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 06). 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/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 sufficiently long to produce usable compost, the material can be buried on-site or sent off-site to a landfill or incinerator without concern for the virus. If compost is produced, it may be beneficially used on- or off-site to enrich soils by providing nutrients and reduce the need for chemical fertilizers.

On-Site Burial:

This option avoids transportation and can be accomplished in a very expeditious manner. Site conditions, however, need to be assessed to ensure there will not be contamination of groundwater or surface waters by either the H5N1 virus or conventional pollutants such as total dissolved solids or ammonia from the decaying carcasses. 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) 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 H5N1 virus will no longer be viable by the time groundwater migrates to such locations. For example, using a very fast groundwater flow rate of ~8,000 ft/yr, and assuming the virus is viable for 35 days, the minimum distance would be 770 ft. (See Reference: Industrial Waste Management Evaluation Model, 2002.)
- Consider site-specific factors such as soil type and depth to groundwater to ensure groundwater is not contaminated by conventional pollutants, such as total dissolved solids and ammonia. 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)

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 use Air-Curtain incinerators to destroy the virus and burn the carcasses. This involves burning with forced air that greatly accelerates the burning process. Air-Curtain incinerators are mobile, can be moved from site to site, and require trained operators to establish appropriate fuel requirements and to properly operate the equipment. Advances in this technology include more efficient burners, and the use of misters may reduce the air emission concerns normally associated with open air-curtain technology. However, with air-curtain incinerators, the management of loading 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 and Air-Curtain incinerator suppliers is necessary to ensure such equipment and operators will be available and discussions with local and State officials are important to assure compliance with environmental requirements. The ash from the Air-Curtain incinerator can be disposed of on-site or at an off-site landfill without concern for the virus. (See Reference: USDA National Animal Health Emergency Management System Guidelines for Disposal, April 2005, pg 14-15.)

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. Studies have shown the virus to be deactivated in <1-7 days at temperatures around 70 ℉. Isolation could occur in-house for a sufficient time for the virus to die off. Considerations for this option should include a covering to prevent the spread of the virus and control odors, as well as 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 to dig a trench for burial. If the isolation is sufficient to deactivate the virus, the material can be buried on-site or sent off-site to a landfill or incinerator without concern for the virus. (See Reference: USDA National Animal Health Emergency Management System Guidelines for Disposal, April 2005, pg 5.)

Cleaning and Disinfection:

With both on-site and any off-site carcass disposal options, cleaning and disinfection of farm structures, poultry houses, and equipment will be needed after the carcasses are removed to prevent spread of the virus and to repopulate. In addition, equipment, such as trucks, used on-site should be cleaned and disinfected prior to leaving the site in order to prevent any potential transmission of the virus off-site. Worker's clothing also will need to 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 the 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

Transportation:

Special procedures must be followed to prevent the spread of disease when transporting birds that still have the virus from the affected premises to off-site locations. This includes having a designated government representative accompany these vehicles for biosecurity reasons. 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 must be followed for all personnel, vehicles, and equipment. (See Reference: USDA National Animal Health Emergency Management System Guidelines for Disposal, April 2005, pg 3-5). Consideration needs to be given to lining the trucks used in transporting any 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 macro-vaults used by some portion of the waste management industry. Lessons learned from Avian Influenza outbreaks in Virginia in 1983 and 2002 indicated that off-farm carcass disposal methods also introduce additional economic, environmental, and social challenges. (See Reference: Lessons Learned From AI Outbreaks in Virginia 1983 and 2002)

Other Management Options:

There also may be consideration of other options, such as: off-site landfills or incineration without prior deactivation of the HPAI virus; alkaline hydrolysis; and possibly new and innovative approaches. 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 can increase the potential spread of the virus, can be more expensive, and may run into public acceptance concerns. Off-site options, however, should not be totally dismissed – for example, off-site landfills and incinerators are well designed to manage wastes and are environmentally protective.

Off-Site Landfills:

Off-site landfills that can be used to manage carcasses include municipal solid waste landfills (MSWLFs). MSWLFs, in compliance with the Federal criteria for municipals landfills, are properly sited and have the necessary environmental controls to potentially manage the carcasses. Larger MSWLFs have the capacity to handle a greater number of carcasses. The use of a MSWLF, however, depends upon the acceptance of the facility manager and the ability of the facility to accept the carcasses based upon their permit.

6. 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, 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 3 critical considerations in the disposal decision making during an avian influenza outbreak: the desire not to spread the virus by transporting birds; the need to respond expeditiously to minimize potential transmission of pathogens (USDA's goal is for euthanized carcasses to be disposed within 24 hours); and the ability of the virus to survive, which dictates which disposal options are effective. As for key potential carcass management options, information is provided on composting, burial, air curtain incineration, isolation, disinfection and other management options. In addition, numerous references and resources are provided in section 7 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.

7. 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
VA DEQ Recommendations For Whole-Flock Disposal of Poultry due to Avian Influenza, March 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
Guidelines for In-house Composting of Catastrophic Poultry Mortality, 02	Fact Sheet	http://www.agnr.umd.edu/MCE/Publications/Publication.cfm?ID=557&cat=C	Nathaniel Tablante, George W. Malone, Fidelis N. Hegngi, Lewis Carr, Paul H. Patterson, Gary Felton & Nickolas Zimmermann
Lessons Learned From AI Outbreaks in VA 1983 and 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
Industrial Waste Management Evaluation Model, 2002	Reference	http://www.epa.gov/epaoswer/non-hw/industd/iwem_tbd.htm	EPA Office of Solid Waste and Emergency Response
Extensive Poultry Information Source	Reference	http://www.dpichicken.org/index.cfm?content=poultry-links	Delmarva Poultry Industry, Inc
Guidelines for In-house Composting of Catastrophic Poultry Mortality, 2005	Presentation	http://www.rec.udel.edu/Poultry/2005%20In-House%20Composting%20of%20Poultry%20Mortalities.pdf	Nathaniel Tablante, Univ of MD George W. Malone, Univ. of DE

7. REFERENCES AND RESOURCES (CONTINUED)

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 and Emergency Management (U of MD)	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 and 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 Regulations & Info
Solid Waste Management Association of North America	Website	http://www.swana.org/	Training, Certification, and 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 information
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	Up to Date International Avian Influenza Information
EPA Composting	Website	http://www.epa.gov/epaoswer/non-hw/composting/index.htm	Composting Information

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

APPENDIX B

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 39 ℉ and for 7 days a 68 ℉. 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 ℉ 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 their 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 ℉ and up to 102 days at 82 ℉, 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 ℉/ 0ppt salinity/pH 8.2 and only 9 days at 82 °F/20ppt salinity and pH 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 C

Avian Influenza Outbreak Scenario

- A farmer observes either sick or dying birds within their 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.