

# **Biosecurity and Mortality Disposal in Catastrophic Losses**

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Catastrophic losses in poultry production could be due to infectious diseases or sudden mortality by failure of fans and/or cooling systems under very hot environmental conditions. The management of previous outbreaks of poultry diseases such as Avian Influenza (AI), Laringotracheitis (LT), and New Castle disease (END/VVND) in and out of the State have left the lesson that preparedness, develop the skills, set up the networking, and identify all the resources with anticipation is absolutely necessary to reduce the cost, duration and impact of this catastrophic events in our poultry industry and in the markets. This presentation is based on the educational material prepared by Dr. Nathaniel Tablante (University of Maryland – College Park) and Dr. George Malone (University of Delaware) on Mass Euthanasia and Disposal Options for Catastrophic Poultry Disease Events.

The threat of having an outbreak of highly pathogenic of AI in the US is a constant concern for the Institutions that control animal and human diseases, and the Poultry Industry. The only practical solution at this moment is to create awareness and be alert to this disease and become prepare to control it and avoid that it will spread. Humans could be affected by AI if an antigenic shift results in a new human influenza A virus subtype. In this case a pandemic disease could occur by sustained person-to-person spread.

In case of an outbreak of infectious diseases the biosecurity should be strengthen. The personnel should become aware of the situation, a quarantine procedure should be installed, and if it is necessary a depopulation procedure should be practiced. The final disposal of the flock and litter is as important as the quarantine procedures to avoid the dissemination of the disease.

## **I. Personnel Protection:**

To control a disease is important to make all personnel involved in poultry live production aware and conscious about each one of the possible mechanisms of transmission of diseases and the adequate quick responses to control them. Most of these viruses are acquired by direct contact with infected poultry or surfaces infected with droppings or respiratory secretions. The virus can also be present in the air in and around the poultry facilities and be inhaled by mouth, nose, or eyes.

All poultry workers should be aware of the signs of the diseases, as well as signs and symptoms of human infection. In the same way, they should know the procedures to seek medical care in the local area in case of experiencing the symptoms and practice

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self-quarantine (minimum 24 hours after resolution of fever). It is important to provide flu (influenza) vaccination for all poultry workers.

The simplest recommendation is keep hygiene practices at all times. Practice hand washing with soap and water for 15-20 seconds and hand disinfection procedures always that the person has been in contact with poultry.

Personnel involved with outbreak responses must additionally use protective equipment such as disposable gloves (nitrile, vinyl, heavy duty rubber), protective clothing (disposable outer garments or coveralls; impermeable apron), and wear disposable protective shoe cover or boots that can be washed and disinfected, safety goggles (preferably non vented or indirectly vented with antifog coating), as well as disposable filtering facepiece respirators (N95 at a minimum), or full facepiece, hood, helmets or loose-fitting facepiece to protect eyes from exposure.

It is important to know the suppliers, data of contact, and keep some stock of materials to protect the personal. It is necessary to decide with anticipation the type of material to use in case of an event. For example there are several types of filter respirators. Respirators that have filters or cartridges are called air-purifying respirators. These types are the most practical and appropriate choices for poultry workers to wear when they might be exposed to infected birds or during day- to-day activities in poultry barns. They are classified according to their resistance to oil and their filter efficiency. The table 1 lists the advantages, disadvantages, and costs of the five types of air-purifying respirators in order of increasing levels of protection.

The N respirator series is not resistant to oil, but it offers good protection in case of a catastrophic disease event. A filter with a minimum of 95% (N95) efficiency should be selected. The advantage of this type of filter is that it is lightweight, low maintenance, and has no effect on mobility. These filter respirators offer minimum protection, do not protect against gases (such as ammonia), do not protect eyes, and have a variable fit. More protective respirators are available in the market and include cooling systems. However, they have higher cost, are heavy, dependent on batteries and produce more noise.

In case of an outbreak of a confirmed highly pathogenic disease, all personnel involved in mass euthanasia and disposal of the birds must shower at the end of the work shift preferably by on site decontamination places. The clothing worn at the poultry farms should not be use outside of these facilities and this includes shoes, underwear, etc.

## **II. Quarantine Policies for Poultry Diseases in North Carolina:**

The North Carolina Department of Agriculture (NCDA) and Consumer Services orders flock quarantine for seven (7) poultry diseases. These include: Pullorosis, Fowl Typhoid,

**Table 1. Advantages, Disadvantages, and Costs of Air-purifying Respirators for Protecting Poultry Workers**

Respirator type	Advantages	Disadvantages	Cost US \$ (2004)
Filtering facepiece (disposable; dust mask)	Lightweight. No maintenance or cleaning needed. No effect on mobility.	Provides no eye protection. Provides no protection against irritant gases such as ammonia. Can add to heat burden. Inward leakage at gaps in face seal. Many models do not have adjustable head straps. Difficult for a user to do a seal check. Level of protection varies greatly among models. Communication may be difficult. Fit testing required to select proper facepiece size. Some eyewear may interfere with facepiece fit.	\$0.70 to \$10
Elastomeric half-facepiece	Low maintenance. Reusable facepiece and replaceable filters and cartridges. Dual cartridges can be used to protect workers from exposures to particles, gases, and vapors. No effect on mobility.	Provides no eye protection. Can add to heat burden. Inward leakage at gaps in face seal. Facepiece must be cleaned and disinfected before reuse, this can be a contact-exposure risk. Communication may be difficult. Fit testing required to select proper facepiece size. Some eyewear may interfere with facepiece fit.	Facepiece: \$12 to \$35 filters: \$4 to \$8 each
Powered with hood, helmet, or loose-fitting facepiece	Provides eye protection. Protection for people with beards, missing dentures, or facial scars. Low breathing resistance. Combination cartridges can be used for exposures to particles, gases, and vapors. Flowing air creates cooling effect. Face seal leakage is generally outward. Fit testing is not required. Prescription glasses can be worn. Communication less difficult than with rubber half-facepiece or full-facepiece respirators. Reusable components and replaceable filters.	Added weight of battery and blower. Awkward to wear for some tasks. Components must be cleaned and disinfected before reuse; this can be a contact-exposure risk. Battery requires charging. Air flow must be tested with flow device before use.	Unit: \$400 to \$1000 filters: \$10 to \$30

**Source:** Avian Influenza protecting poultry workers at risk- <http://www.osha.gov/dts/shib/shib121304.html>

Ornithosis (Turkeys), Laryngotracheitis, Avian Influenza, *Mycoplasma gallisepticum*, and Exotic Newcastle Disease (END) or Viscerotropic Velogenic Newcastle Disease (VVND). There are specific policies for the quarantine and release of quarantine of each disease.

Flocks affected by **Pullorosis**, **Fowl Typhoid** and **Ornithosis** will have to go to quarantine when flocks are found serologically positive (1:20 or greater by Complement Fixation (CF) test), and positive isolation by culture of the specific microorganism. Flocks will be released of this quarantine once they are treated with Tetracyclines for 21 days. It is recommended to use 400 g/ton of feed for 14 days, and latter 200 g/ton of feed for 7 days, with a withdraw period of minimum 48 hours before slaughter. If at least 30 days after last day on medicated feed the culture to isolate the microorganism is negative, the flock is released from quarantine.

Flocks affected by **Laryngotracheitis (LT)** will be quarantined when the typical gross lesions and signs are observed, or the infection is confirmed by histopathology or virus isolation. The quarantine indicates strict restriction of traffic (people and equipment), obtain a permit from NCDA to mobilize alive or dead birds off premises, and dispose of the birds as soon as possible by a NCDA approved method. After the flock has been sent to processing, the houses should be closed for one week before litter is removed and kept with high temperature (100 °F). Latter, the litter should be removed, the house wash down and disinfected, and before placing the birds the NCDA should be contacted for inspection and quarantine release. An alternative method is kept the house vacant for 45 days after removal of the birds, but in all cases NCDA officials should be contacted for inspection and quarantine release. The vaccination against LT is controlled by the NCDA. Companies interested on vaccinate broiler breeder and commercial layer flocks should apply annually (prior to January 1) for a permit to buy the vaccine, and the only approved method of administration is by ocular drop.

**Avian Influenza (AI)** affected flocks will be quarantined when they are serologically positive or the virus has been isolated until the virus subtype has been determined. The release of quarantine will be authorized if subtypes other than H5 or H7 are identified, the flock is free of clinical signs, no virus is isolated in two attempts, or when the isolated virus is proven to be no pathogenic. If there is serological evidence of subtype H5 or H7 or the isolated virus is confirmed to be pathogenic, an epidemiological study should be conducted, and considered as an emergency disease situation and appropriate actions taken. The same procedures should be taken in case of confirming an **END/VVND**.

Flocks found positive or suspicious serological titers, and/or with clinical signs suggestive of *Mycoplasma gallisepticum* (Mg) should be quarantined. The release quarantine from positive cases is only authorized in commercial flocks for slaughter, the premises should be cleaned and disinfected. In case of suspicious cases, the release quarantine will be authorized when sufficient testing has been done, Mg has not been isolated, and there are no signs or serological titers in offspring (breeder flocks).

### **III. Depopulation and Mass Euthanasia**

In some cases of highly virulent diseases such as Avian Influenza is necessary to depopulate the flock with a humane method, which guarantee minimum pain, fear and distress. Current recommendations for mass poultry euthanasia are under review for the AVMA Panel on Euthanasia. Factors to take in consideration to select the appropriate method are the animal welfare, the animal species; the age, house and disposal options available; the human safety; the skills of the operators and resources available. The main objective is to minimize or eliminate disease spread (<http://www.avma.org/resources/euthanasia.pdf>).

Procedures recommended for mass euthanasia in poultry are limited to cervical dislocation and inhalant gases. The cervical dislocation procedure has the disadvantage of causing contact with humans what is a concern in case of AI. The gases available for massive euthanasia are carbon dioxide (CO<sub>2</sub>), nitrogen, argon, and carbon monoxide (CO).

The application of CO<sub>2</sub> can be done in the whole or partial house, portable panels with tarp, livehaul cage euthanasia cabinets, poly euthanasia tents, and by fire fighter foam application. The CO<sub>2</sub> causes anesthesia with respiratory arrest. It is widely accepted, inexpensive, readily available in gas and liquid forms (gas preferably), and has minimal risk.

To estimate the amount of CO<sub>2</sub> needed, determine the volume of enclosure (cubic feet) and determine the amount of CO<sub>2</sub> gas to reach 70% (broilers 50-55%, and turkeys 65%). To apply the gas, confine birds to 20% of floor space or as close as possible, seal building tight with 6 millimeter plastic. In breeder houses place plywood along slats.

If polypropylene is used in the depopulation procedure is necessary to remove it six to 12 hours after finished the depopulation procedure. This can be done by attaching a tow rope to back corner of a poly sheet, and using a farm tractor or skid-steer loader to pull the polypropylene out of the house. Later it can be burned, if it is approved.

### **IV. Disposal Methods for Catastrophic Poultry Mortality Loss**

The method to dispose catastrophic mortality related to infectious diseases should be oriented to minimize the spread of the disease in the area, in a timely, cost-effective and environmentally friendly manner (Table 2). The recommended methods for disposal of catastrophic poultry mortality related to infectious diseases are in order of preference: in-house composting, on-farm composting, incineration, on-site burial, landfill, and rendering. All methods require proper sanitation procedures for tools and equipment. It is recommended to have available different crews for mass euthanasia, disposal and sanitation processes.

The NCDA regulations indicate that animal and poultry mortalities should be disposed within 24 hours. Disposal of mortalities is the responsibility of the owner or person in charge of the animals, or the owner or person in charge of the land which the animals die. This means integrators and growers should work together in the disposal of these mortalities.

Once the disposal procedure is finished is necessary to install a stronger rodent and insect control programs. Post warning signs on the doors of poultry houses and at the farm gates. Heat the houses for at least 3 days and provide minimum ventilation. All tools and equipment should be removed and sanitized.

**Table 2. Disposal Costs – Virginia Outbreak – 2002**

<b>Method</b>	<b>\$</b>
CO2	400
Plastic	3,200
Trucks	7,000
Pay loader	1,200
Landfill fees	15,675
Miscellaneous supplies	300
Labor	2,000
Skid loaders	400
<b>Total Cost</b>	<b>30,175</b>
<b>Cost/lb of mortality</b>	<b>0.072</b>

**Source:** Tablante and Malone, 2005. Mass Euthanasia and Disposal Options for Catastrophic Poultry Disease Events.

### **1. Composting**

Composting is a biological process that utilizes thermophilic microorganisms to degrade organic matter into humus-like material called compost. Composting generates high temperatures between 135 °F (57° C) to 145 °F (63 °C), enough to eliminate AI virus and other heat sensitive pathogens. It requires the selection of a suitable site that will not have excessive overhead water. The site should be 150 feet of the top of an elevation. This is to prevent water from running into and through the compost pile. Some form or earthen structure can be constructed to divert water from running through the compost site. Recommendations about proper management of composting systems can be found at the North Carolina Cooperative Extension Service website:

[http://www.ces.ncsu.edu/depts/poulsci/tech\\_manuals/composting\\_poultry\\_mortality.html](http://www.ces.ncsu.edu/depts/poulsci/tech_manuals/composting_poultry_mortality.html)

**In-House Composting** is a viable, biosecure and practical option for the disposal of catastrophic poultry mortalities. It eliminates the problem of environment (air and groundwater) contamination. It inactivates the pathogens in both litter and mortality before their removal from the houses. It has been used in AI events with success.

There are three methods for in-house composting: layering, shredding and piling, and mixing and piling. The mix and pile method is the least expensive and requires less personnel and time. In-house composting may tie up the poultry house no more than 4 weeks, but as little as 2 weeks, if the windrows are stockpiled outside after the initial turning (18 d). Shredding large carcasses may facilitate the composting process.

The plan for a possible in-house composting procedure includes:

1. Assess in each house the amount of additional sawdust needed for composting
2. Consult with skid-steer operator on a plan of action that meets the composting needs and involves the least material handling and supplemental sawdust
3. Calculate materials according to bird age, litter depth in each part of the house, litter moisture and condition, access to end door for sawdust and compost removal, ability to turn piles and house ceiling height.

The minimum litter required per pound of poultry meat per square foot space is 0.8 inches. Increase this ratio to 1 inch for large turkeys or when using the layering compost procedure.

*Example:*

A 40 x 500 ft house (20,000 ft<sup>2</sup>) with 28,000 broilers weighing 4.5 lbs and 3.5 inches of litter base. This is a total of 126,000 lbs of meat in 20,000 ft<sup>2</sup> for a total of 6.3 lbs of meat/ft<sup>2</sup>. This requires 5.04 inches of litter. Then 1.54 additional inches or 2567 ft<sup>3</sup> [20,000 ft<sup>2</sup> x 0.128 (1 inch/12 inches)] of additional carbon material would be required.

The composting method should be selected based on depopulation procedure. If the depopulation procedure concentrates the carcasses in a small section of the house, the layering option may be appropriate. Where carcasses are distributed more evenly over the litter surface, the mix and pile option is recommended. If carcasses are confined to a portion of the house and caking is extensive, tilling litter may enhance the composting process.

**a. In-House Composting – Layering Method** (Four people and 6-7 hours/house)

1. Create a litter windrow that has a 10 to 12 feet wide base
2. Scoop the dead birds with the loader and lay them on top of the litter windrow base
3. Spread the carcasses evenly with a rake or pitchfork until they are about 8 to 10” thick
4. Repeat the layering procedure as needed until the pile is 6 feet high. If the height of the poultry house prevents a 6 foot high windrow, make only two layers which will be approximately 3 to 4 feet high.
5. Deposit a 6 to 8 inch layer of litter/sawdust “cap” over the birds with a foot overlap on the sides. Don’t leave carcasses or bird parts exposed.

**b. In-House Composting – Shredding and Piling Method** (Breeders and Turkeys) – (6 h/house)

1. Remove carcasses one bucket-width wide from along the side walls and spread them evenly in the center of the house.
2. Shred the carcasses using a tiller attached to a skid steer loader or a 3-point hitch, PTO driven unit for farm tractor. Make at least 2 passes to ensure adequate shredding.
3. An alternative to shredding is crushing carcasses with a rubber tire loader
4. Roll the carcasses into the litter/sawdust windrow
5. Pile the shredded carcass/litter mixture into a properly shaped windrow (12 to 14 ft wide and 3 to 5 ft high). Cap the windrow with litter to cover exposed carcasses.

**c. In-House Composting – Mixing and Piling Method** (4 hours per house)

1. Remove carcasses one bucket-width wide from along the sidewall and spread them evenly in the center of the house
2. Starting with a 3 inches minimum litter base, use the feed line as a guide and mix the carcasses with the litter to start the formation of the windrow. Continue to roll the materials from along the sides together to form a windrow 10-12 feet wide in the center of the house.
3. The pile and all carcasses must be covered with a layer of litter or sawdust 4 to 6" thick.

All methods of composting require temperature monitoring. The temperature should be a minimum of 135 °F (57 °C) within 5 days after compost formation. After 10 to 14 days the compost temperature will decline. As it drops below 125 °F (52 °C) turn the windrows. The turning options are inside of the house or relocating the stockpile outside. After turning is necessary to scrape along the edges and deposit covering material on the pile with at least 4 inches of litter or sawdust. The compost material may be land-applied after 2 to 3 weeks.

Recently some forced aeration composting methods has been evaluated to handle poultry mortalities. The composting bins with use of force aeration can keep higher temperatures (> 140 °F) during several weeks of composting minimizing turning process and reducing odors during composting. The closed-loop system provides superior leachate control through filtered leachate collection and recirculation.

**2. Incineration.** Incineration of large numbers of birds would be extremely difficult, sometimes impractical, and objectionable due to the emissions and odor and public perception issues. Even though the end product is biosecure, it is not recommended. In case that incineration has to be considered an option, make arrangements and pre-approved list of units, site, loading/unloading equipment and trucks for transportation.

**3. On-site Burial** is a cost effective method and eliminates on-road transport. Regulations require that the site have the type of soil that allows for proper drainage. If a waste management plan has already been completed, the local NRCS office can update

the current plan to include burial site information. Mortalities must be covered with at least 3 feet of soil to avoid predators. The site will be contaminated for a long period of time. The disadvantage of this method is a higher potential for spillage and contamination outside of the house. Burial can be done not closer than 300 feet to a flowing stream or public body of water. Should be at least three feet above water table.

**4. Landfill.** When on-site burial is not possible, local landfills should be considered. It is important to have available a list of dumpsters, trucks and landfills available in the area. All the municipal landfills are approved to handle dead animals, but specific landfills may have capacity limits, so prior contacts are advisable. Tipping prices vary, so check prices. There is a larger risk to spread the disease. It is recommended to cover the containers or trailers used for transportation with double lined polypropylene. Sawdust or any other absorbent material should be placed in the floor of the trailer to soak liquids. After the mortality is placed in the vehicle, it must be covered with a polypropylene tarp, and the vehicle sanitized.

**5. Rendering.** Rendering is an approved method of mortality disposal. Rendering indicates cooking the product to destroy all pathogens and converting it into an animal feedstuff. However, the transport to the rendering plant is a risk for disease dissemination. Freezing mortality prior to rendering is allowed. This procedure can be a satisfactory method anywhere in the state.

**6. Digestion.** It is not a recommended method in case of catastrophic losses. Digestion of poultry carcasses requires permit from the NCDA. Permits are limited to one year, but can be extended.

## **V. Prepare Personnel, Material, and Supplies**

The number of people and time needed will depend on the number, size, age, and weight of the birds (Table 3). The personnel include: depopulation team, skilled skid steer loader operator; state, poultry and company personnel and the poultry producer, crew for the disposal procedure, personnel for cleaning and disinfecting poultry house and equipment.

The supplies include biosecurity supplies as personal protective equipment for the depopulation, disposal and disinfection crews (Tyvek suits, boots, gloves, dusk mask or respirators, safety goggles), disinfectant (sprayer, bucket, brush), heavy gauge plastic bags, and dumpster. A high pressure washer must be on site to clean and disinfect equipment and premises. Additionally, plan for all necessary biosecurity supplies for the grower if he is required to enter or monitor the composting site or the house.

It is necessary to have available an adequate supply of some hand tools (square point long handle shovels, pitchforks, long handle rakes and hoes, stick broom, drill with feeder winch attachment, ladder, hammer, crowbar and cutting pliers, duct tape, and flashlight).

**Table 3. Minimum requirements of personnel to compost in-house market-age broilers in 8 hours\***

No. Houses	No. skid-steer	No. workers
2	2	4
4	3	6
6	4	8
8	5	10

\*Requires 1 midsize skid-steer loader and skilled operator (1.25 and 1.5 cubic yard bucket) and 1.5 hours/house to turn and cap.

**Source:** Tablante and Malone, 2005. Mass Euthanasia and Disposal Options for Catastrophic Poultry Disease Events.

The personal will need toilet facilities, food, drinks, first aid kit, paper towels and disinfectant hand wipes, communication devices (cell phone, radio, etc.). It is important to have available some warning signs to identify the different areas and avoid cross contamination.

Some materials should be prepared with anticipation. As part of the biosecurity a rodenticide and insecticide plan should be strengthen. Suppliers of adequate products should be identified. If the method of disposal chosen is composting, then carbon sources (litter, sawdust, etc.), and composting thermometers should be prepared. It is necessary to identify, and coordinate skid-steer loaders, trucks and operators willing to deal with contaminated material.

Every poultry company should develop an emergency response plan. This plan should include training of live production personnel and growers in practices related to control outbreaks. It is advisable to create and use a check list to verify that each resource is identified. Record phone numbers of institutions, personnel and providers of materials and equipment.