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MASS DEPOPULATION AND CATASTROPHIC MORTALITY COMPOSTING

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Introduction

In the event of a highly infectious disease outbreak such as avian influenza (AI) the decision may be made to depopulate the flock in an effort to contain and eradicate the disease outbreak. Being prepared to respond swiftly and effectively to such an event is essential. Preparedness involves having knowledge of options for humane depopulation and environmentally sound disposal procedures that can be implemented in a biosecure manner. Other events that mandate mass depopulation of poultry include flocks contaminated with a chemical residue and structurally damaged houses due to fire and natural disasters such as hurricanes.

Mass Depopulation Considerations

There is a distinction between euthanasia and depopulation! The USDA, APHIS recently defined euthanasia as; "involves transitioning of an animal to death as painlessly and stress-free as possible" while mass depopulation: "is a method by which large number of animals must be destroyed quickly and efficiently with as much consideration given to welfare of the animals as practical, but where circumstances and task facing those doing the depopulation are understood to be extenuating". In the event of an AI outbreak or natural disaster, the options for mass depopulation have been limited. Mass depopulation of broiler flocks in the U.S.A. has been limited to cervical dislocation (not a real option for large numbers of poultry) and the use of carbon dioxide (CO2). The recent conditional approval of water-base foam by the USDA and endorsement by AVMA gives the poultry industry another option for **mass depopulation** of flocks. All methods used for mass depopulation, particularly for zoonotic diseases, must take into consideration, and balance, poultry welfare and human health; and must minimize biosecurity risk and logistical challenges.

Mass Depopulation Methods Using Carbon Dioxide

There are four basic methods of using CO2 gas for mass depopulation of floor-reared poultry flocks. They include whole or partial house gassing, livehaul cage cabinets or other types of containerized gassing systems, and two methods of gassing birds under polyethylene sheeting.

Whole house gassing with CO2 has been used with varying degrees of success. This procedure works best in totally enclosed environmental houses and requires sealing off all openings to minimize gas leakage. Since this method does not have a large manpower requirement, it minimizes the number of workers involved in a response to AI. However, it requires significant amounts of gas, some support equipment, and can be very costly. Achieving the desired gas concentration in a timely manner has been an issue with this method. It is not an option for structurally damaged houses and would be difficult to implement in curtain-sided houses. Partial house gassing has been used successfully for breeder houses. Birds are confined to one end of the house (usually 20% of floor space) or to the scratch area. Poly sheeting is used to seal-off the ends of the house or to pull overlapping layers of poly over the breeders in the scratch area. Carbon dioxide is immediately introduced into these enclosures.

A procedure that greatly reduces the volume of space to gas birds is the livehaul cage cabinet method. Steel cabinets designed to fit over livehaul cages have been used in previous AI events. Broilers are caught, placed in cages, moved outside the house and the cabinets placed

over the cages for gassing. Although death is rapid with this method, it is very labor-intensive to catch birds, place in cages and remove the dead from cages. In a disease situation, it also creates a potential biosecurity risk since infected carcasses are removed from the houses. Preventing feathers and dust from contaminating the landscape is a concern. Gaining access to catch birds in a structurally damaged house can be limited, if not impossible.

Gassing birds under a poly tent has been used successfully during several recent AI outbreaks. For turkeys, a procedure was developed using solid portable panels placed near the end doors to form an enclosure. Turkeys were driven into the enclosure, poly pulled across and secured to the panels, and the gas introduced. Another procedure used for mass depopulation of broiler flocks involved placing CO2 cylinders in the center of the house, sealing one edge of 40 foot wide poly with litter near each sidewall, and pulling overlapping layers of poly over the birds. The CO2 gas is released under the overlapping layers of poly. This method tends to be labor intensive, has the potential of exposing numerous workers to a virus in a disease situation, requires trained personnel to execute properly, requires disposal of the contaminated poly and is not an option for pole houses. One major advantage is materials needed for this procedure are often readily available and thus, can be implemented in an emergency situation.

Mass Depopulation Using Water-Base Foam

In the midst of responding to a low pathogenic AI outbreak on the Delmarva Peninsula in 2004, the author proposed using foam (like that used by fire companies) as an alternative method for mass depopulation of broiler flocks. Over the past two years a team of researchers at the University of Delaware (E. Benson, B. Malone, B. Alphin, G. VanWicklen and C. Pope) have conducted numerous experiments to validate and develop this method for mass depopulation. Additional equipment development and validation work has been done by North Carolina department of agriculture personnel. Similar to chemical-induced hypoxia with CO2, when broilers are submerged in the **proper consistency** of foam, there is a rapid physically-induced hypoxia via airway obstruction. The **initial** starting conditions under which USDA, APHIS has conditionally approved foam for **emergency mass depopulation** include; floor-reared poultry, poultry with a potentially zoonotic disease, poultry experiencing rapid spreading disease that state or federal officials feel can not be contained by other means, and poultry in damaged buildings that does not allow human entry. Furthermore, USDA, APHIS has drafted performance standards for the water-base foam technology that includes specifications for foam type, consistency, bubble size, fluidity, coverage, application procedure, residence time, time to achieve death, and reproducibility under various operating conditions.

To date, compressed air foam, aerated foam nozzles and modified high expansion foam generator systems have been used successfully. The foam technology has many potential advantages over current depopulation methods. They include: significant reduction in the number of workers and their potential exposure to a zoonotic disease, less physical activity which can be a major issue when having to conform to the personal protection equipment required in a disease situation, suppression of airborne particulates when the house is blanketed with a layer of foam, potential enhancement of the carcass composting process, and greater flexibility of use in various style houses and those structurally damaged. This method does require a significant quantity of water, foam concentrate, and an investment in foaming equipment that is dedicated for this purpose. In the U.S.A. there are two major types of foaming equipment being marketed, a nozzle and generator system. There is a move by some poultry companies, state agencies, and contractual emergency management firms to secure this technology for future mass depopulation response needs.

Disposal Options for Catastrophic Mortality Events

Like mass depopulation, there are situations that can cause catastrophic mortality events such as disease, heat, chemical residue and natural disaster (floods, damaged houses). Every poultry farm should have a disposal plan to deal with a catastrophic event. This plan should include mass disposal option(s) and procedures, a list of materials and contact people. The

disposal method must be economical and environmentally and socially acceptable. There have been several recent instances in which there was uncertainty and lack of knowledge on methods of mass disposal, lack of preparation to deal with a catastrophic event and perhaps more important, not having procedures pre-approved by local and state regulatory authorities. The consequence of these situations has been conflict, delays in responding to the emergency at the most critical time period and added overall cost to deal with the crisis.

For many catastrophic mortality events on-farm burial has historically been the predominant disposal option. This practice is one of the simplest and most cost-effective ways to deal with many types of mass mortality losses. Although some states relax environmental standards for burial when dealing with an emergency, this situation is changing due to increasing water quality and public perception concerns.

The use of sanitary landfills has been used extensively for mass disposal of AI flocks. It may also be one of the few options for disposal of some types of chemical residue contamination in poultry carcasses. However, not all landfills accept carcasses; there can be logistical challenges when coordinating the transportation and deposition of large volumes of carcasses to these sites and the costs associated with transportation and tipping fees can be significant.

For some geographic areas that have plants capable of processing mortalities, rendering may be a viable and cost-effective option for non-disease and residue-free carcasses. The coordination of known tonnage of non-deteriorated carcasses is a requirement and can be a logistical challenge.

Portable incineration units have been used during recent AI outbreaks. Although the end product is very biosecure there can be a number of logistical and environmental issues with this procedure. Incineration is a slow process and based on past experience, may be the least preferred option for a catastrophic mortality event.

There has been increasing acceptance of composting as a practical, economical and environmentally sound method for disposal of many types of catastrophic mortality losses. Implemented properly, this method avoids many of the water and air quality issues associated with burial and incineration, respectively. On-farm mass mortality composting eliminates costs related to transportation (landfill, rendering, incineration) and tipping fees (landfill). For a disease outbreak such as AI, in-house composting is one of the most biosecure disposal methods since the virus is inactivated in the carcass and litter prior to removal from the house. However, composting must be implemented correctly and knowledge of the procedures is essential! Windrow composting inside poultry houses can be a challenge in pole and low ceilings houses. Depending on the cause and extent of the catastrophic loss, resources available, production schedule, and applicable regulations; mass mortality composting can be implemented inside the poultry house or manure storage structures or in outside windrows.

Catastrophic Mortality Composting Programs

In a low pathogenic AI outbreak on Delmarva in 2004, in-house composting was used successfully to contain and inactivate this heat-sensitive virus in the carcasses and litter. Using a *mix and pile* procedure, the litter and carcasses were mixed, placed in a windrow and all exposed carcasses on the surface of the pile covered with sawdust. A single windrow was formed down the length of the house. This procedure requires a *minimum* of 0.8 inches of litter or carbon material per pound of carcass per square foot floor space. After ~2 weeks the windrows were turned inside the house, capped with sawdust to cover exposed tissue, and allowed to continue composting for an additional two weeks prior to removal. Crushing or shredding carcasses prior to windrowing reduces the carbon requirement to compost large carcasses (i.e. roasters and turkeys) and speeds up the composting process. These procedures tend to work best with a mass depopulation method that distributes the mortalities evenly throughout the house. If the carcasses are concentrated to a small portion of the house, a *layering* method similar to that used to compost daily mortality in bins may be appropriate. Detailed procedures for these in-house composting methods are located at: http://www.rec.udel.edu/Poultry/poultryindex.htm.

For a limited loss, non-disease mortality event, composting in a manure or dry stack shed using the *layering* or *mix and pile* procedures may be an option. Limitations of loaders used for material handling may dictate the height and dimensions of windrows inside sheds when using the layering method. Since this method is more labor and material intensive and less likely to be implemented properly, the *mix and pile* procedure has become the most acceptable mass composting method and results in better tissue degradation. If the layout time between flocks is not an issue, the in-house *mix and pile* procedure can be used for heat losses. To avoid taking a house out of production for prolonged period of time, the compost can be removed from the house at the first turn (~2 weeks).

Outside windrow composting has been used for disposal of catastrophic heat losses. This procedure involves placing a layer of carbon material (e.g. sawdust, wood chips, litter, etc.) on a well drained site. Starting with a 12 foot wide base, the windrow is constructed in alternate layers of carcass (3 to 6 layers of carcass, each carcass layer not exceeding 10 inches depth) and carbon (6 to 8 inch thick layers). The final windrow is capped with a carbon material and height should not exceed 7 feet. Windrows constructed in this manner will accommodate ~300 pounds of mortality per linear foot. Ideally, the windrow should be turned to aerate the mixture when the temperatures decline below 115º F or in about two to four weeks. If the farm situation permits, an alternative method is to remove the litter and carcasses from the house and construct windrows using the mix and pile method. When litter from the farm is used as the carbon source, the windrows should be covered with polyethylene, tarpaulin or compost fleece. These covered piles have been allowed to "age" for various durations of time before turning. Although the tarpaulin and compost fleece are more expensive, they are reusable and allow moisture and gases to escape from the pile yet shed rainfall. A wet condensate layer will often form under windrows covered with polyethylene or other impervious vapor barriers.

Carcass disposal for houses that have been flooded is a *very unpleasant task*! Decomposition of carcasses and litter are often advanced since it may require days, even weeks before gaining access to the house. As with any catastrophic mortality event, each house and farm will need to be assessed to determine the most appropriate composting method. If carcass decomposition is not advanced, one option is to skim-off carcasses from the litter surface and use the layering or mix and pile methods in outside windrows or inside a manure shed. In all situations, large amounts of dry carbon or litter will be required to blend into the "soupy" litter/carcass mixture to facilitate material handling and removal from houses. This blended mixture is placed on a carbon base in outside windrows or in manure sheds. Whether using the layering or mix and pile procedure, additional dry carbon materials or litter will be required to facilitate the composting process and to cap the finished windrow. One state requires a 3 foot mound of dry shavings around uncovered outside windrows to contain runoff. Additional requirements and considerations for composting flooded houses include; using track-type skid loaders, a need for an all-weather roadway to an approved windrow site, having an adequate quantity of trucks and equipment to load and transport carbon materials and compost mixtures, increasing the frequency of turning piles to facilitate drying, and it may require using chemicals for odor and fly control. In some situations in-house composting using the mix and pile method may be required to address sensitive environmental and neighbor relations concern.

Summary

Mass depopulation of floor-reared poultry flocks is a difficult task! Realizing there is no ideal or best depopulation method for all situations, it is important we have options. Mass depopulation using water-base foam is an emerging technology that offers great potential, particularly for flocks with a zoonotic disease. Similarly, there are many causes of mass mortality losses that mandate having disposal options. Composting is becoming one of the most accepted disposal methods for many types of catastrophic mortality events. For flocks with a zoonotic disease, such as AI, if applicable, in-house composting is now the preferred method of disposal.