



Guidelines for In-House Composting Poultry Mortality as a Rapid Response to Avian Influenza



¹Gary A. Flory, Agricultural and Stormwater Program Manager, Virginia Department of Environmental Quality

²Robert W. Peer, Agricultural Program Coordinator, Virginia Department of Environmental Quality

³George W. Malone, Consultant, Malone Poultry Consulting

⁴Eric S. Bendfeldt, Extension Specialist, Department of Crops and Soil Environmental Sciences, Virginia Cooperative Extension

⁵Robert A. Clark, Senior Extension Agent, Agriculture and Natural Resources, Virginia Cooperative Extension

Summary of the Method

Composting is a biological heating process that results in the natural degradation of organic resources (such as poultry carcasses) by microorganisms. Composting has been successfully used throughout the United States for nearly two decades to control outbreaks of avian influenza. Composting can be effective with most bird types and poultry house designs. In 2007, composting was used to dispose of more than 2,000,000 pounds of carcasses on 2 turkey farms exposed to Low Pathogenic Avian Influenza (LPAI) in Virginia and West Virginia.



Microbial activity within a well-constructed compost windrow can generate and maintain temperatures sufficient to inactivate the avian influenza virus. Lu et al.(2003) reported the avian influenza virus (AIV) is sensitive to heat and can be inactivated in 10 minutes at 140°F (60°C) or 90 minutes at 133°F (56°C). The effectiveness of this virus inactivation process can be assessed by evaluating compost temperatures, the shape of the time and temperature curve, visual observation of carcass decomposition and the homogeneity of the compost mix.

Advantages of In-House Composting

- Contains the disease and limits off-farm disease transmission

- Limits the risks of groundwater and air pollution
- Inactivates pathogens in carcasses and litter
- Limits public concerns over disease exposure
- Composting equipment and supplies are readily available
- Minimizes delays, environmental impacts and process disruptions due to severe weather (precipitation, temperature fluctuation, etc.)

Key Elements for Successful Composting

- Windrows (6 to 8 feet high and 12 to 15 feet wide) are constructed on an adequate and uniform base layer (10 to 15 inches thick) of sufficiently porous carbon material;
- The base layer and windrow are not compacted with equipment;
- Ensure good carcass to carbon contact, by creating a core with a minimum 1:1 mix by volume of carcasses, carbon and other infected material (manure, egg shells, feed, etc.). With good carcass to carbon, the carcasses will break down during composting. **There is no need to grind, crush, or macerate the carcasses during the construction process!**
- Windrows should be constructed to ensure adequate distribution of moisture throughout; and
- The windrows are capped with carbon material (8 to 12 inches thick) to ensure that no carcasses are exposed and odors are minimized.

Labor, Equipment and Supplies

- Skilled equipment operators and general laborers
- Skid loader(s), pay loaders, dump trucks, rakes and scoops
- Carbon material such as sawdust, litter, wood shavings, active compost, seed & nut hulls, woodchips, or other carbonaceous materials
- Compost thermometers (36" or 48" stem length)

Protocols

Prior to Windrow Construction

- Ensure all personnel have appropriate personal protective equipment and training.
- Minimize ventilation in the poultry house.
- Raise poultry feeders and waterers to the ceiling so they are out of the way.
- Effective in-house composting must have a minimum of 1 and 1/2 pounds of carbon material per 1 pound of bird (based on a bulk density (mass per volume) of 30 lbs/cubic foot of carbon material).
- During the mixing process, use 1 pound of carbon per pound of bird in the mix. Use the remaining carbon material for a base layer and to cap the windrow.
- Determine total pounds (lbs.) of birds in the poultry house (Equation 1)
 - Total lbs. of birds = Number of birds in house X average weight of one bird in pounds (lbs.)

- Determine total pounds (lbs.) carbon needed (Equation 2)
 - Total pounds (lbs.) of carbon = Total lbs. of birds in house (from Equation 1) X 1.5 lbs. of carbon per pound of bird
- Determine cubic feet of poultry litter in house (Equation 3)
 - Cubic feet of litter = Length of house (ft.) X Width of house (ft.) X Depth of litter (in feet)
- Determine pounds of poultry litter in house (Equation 4)
 - Pounds (lbs.) of poultry litter in house = Cubic feet (ft³) of poultry litter X Weight of a cubic foot of poultry litter (Average weight = 30 lbs; Range = 25 to 35 lbs.)
- Determine amount of additional carbon needed in cubic yards (Equation 5)
 - Cubic yards of additional carbon needed = ((Total lbs. carbon needed -- Total lbs. of poultry litter in house) divided by (weight per cubic foot of carbon material)) and then divided by (27) (Note: 27 cubic feet equals one cubic yard)
 - Average bulk density of woodchips, litter or wet sawdust = 30 lbs./cubic foot, while the average bulk density of dry sawdust = 15 lbs./cubic foot
- Mobilize depopulation, composting, and sanitation crews.

Windrow Base Construction

- Before in-house composting, clear carcasses and poultry litter from the middle of the poultry house down to the floor to create a 12 to 15 foot wide work area for construction of the windrow base(s). Distribute the carcasses and poultry litter material on either side of the middle pathway toward the sidewalls.



Figure 1. Preparation of work area for windrow construction in center of poultry house.

- Using the largest skid or pay loader possible, begin building the windrow base in the middle of the house.





Figure 2. Beginning actual construction of windrow and direction of progress in a typical free-span house.

- The windrow base should be constructed 12 to 15 feet wide to a depth of 10 to 15 inches.
 - Carbon material for the base should be porous and bulky enough to allow adequate air flow into and through the windrow. Ideal materials for the base include bark mulch or coarse wood chips. Other acceptable carbon materials include: straw, wood shavings, active compost, small grain hulls, and corn stover. Coarse woody material in excess of 2 inches in size should be avoided to ensure the resulting compost can be land applied as a soil amendment.
 - If these materials are not available, poultry litter may be used for the windrow base if it is sufficiently dry, porous and bulky.
 - To maintain the base's porosity and to avoid compaction, do not drive equipment on the base.

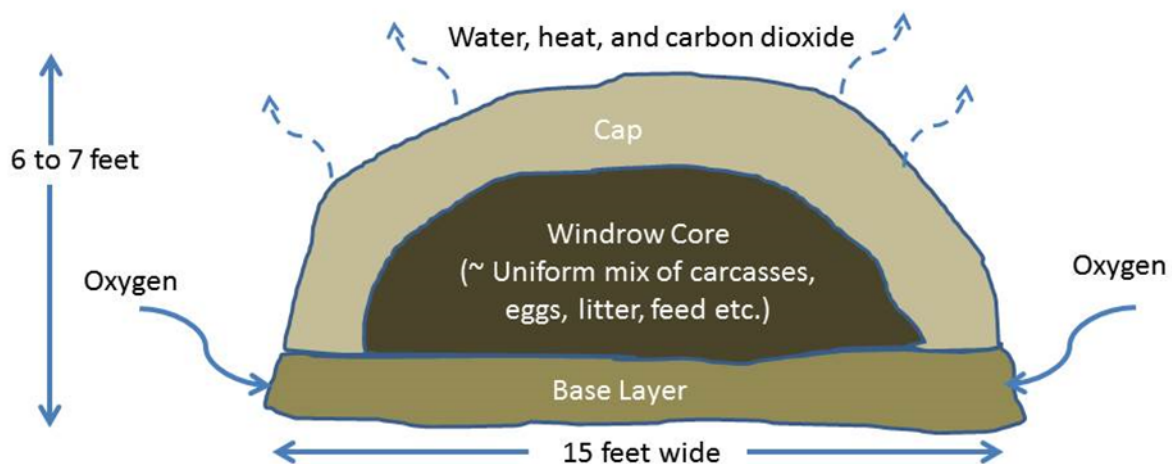


Figure 3. Cross-section of a Compost Windrow.

Construction of the Core of the Windrow

- The windrow core should consist of a uniform mix of carcasses and poultry litter. The easiest way to get a uniform mix throughout the windrow is to scoop litter and birds together in each bucket load and add it to the windrow in a manner that thoroughly mixes the contents of the bucket. If additional carbon material is needed, the material should support air flow, microbial activity and heat generation (i.e.,

composting). Suitable carbon-based materials include fresh wood shavings, active compost, poultry litter, straw, corn stover, and small grain hulls. In many instances, this carbon material may need to be blended with the existing litter and carcasses to be suitable.

- Any remaining feed – that may be in feed lines or bins -- should be blended and mixed with the carcasses and poultry litter before windrow construction. Be sure to move infected material as little as possible.
- The mix of carcasses and litter should be added from both sides of the windrow. This allows the operators to reach the center of the windrow and to not compact the base with the tires or tracks of the loader.
- The windrow core should be constructed and added to the top of the base. A 1 foot buffer area and edge of base material should be maintained on each side of the windrow.
- The core should be dome or mound-shaped and of sufficient height to include the litter and carcass mix from the areas adjacent to the windrow. At this stage, the height of the windrow should not exceed 6 feet.
- Continue building the core until all of the litter and carcasses have been placed on the base. Most well-constructed windrows will run the full length of the poultry house, while also maintaining enough room for operating skid loaders and other equipment.

Capping the Windrow

- Prior to capping the windrow, move any carcasses that are near the edge of the windrow base and include them in the core of the windrow.
- Cap the windrow with 8 to 12 inches of a suitable carbon material. Carbon material for the cap should prevent flies from contacting carcasses; serve as an insulating blanket; and allow air exchange in and out of the windrows. This material may be finer in texture than the base. Suitable materials include poultry litter, small grain hulls, sawdust, new poultry house bedding and wood chips.
- Ensure the entire core is uniformly covered with cap material and no carcasses are exposed.
- Do not compact the windrow when adding cap material. Do not operate the loader's tires or tracks onto the sides of the windrow while capping.

Temperature Monitoring

- Temperatures of the windrows should be monitored daily at 18" and 36" depths at 50 foot intervals the length of the windrow and charted. (See Table 1.)
- The temperatures of the windrows should reach and maintain average daily thermometer readings of between 120° F and 150° F for an extended period of time. These temperatures indicate thermophilic microbial activity within the windrow. The longer time these temperatures are sustained during the first 14 days of the composting process the quicker the carcasses will decompose and the virus be inactivated.

Table 1. COMPOSTING TEMPERATURE LOG

County:	Site Number:										
Street address, City											
Farm Name:											
House Number:							Date Windrow Started:				

Use the cells below to record the temperatures each day at 18 inches and at 36 inches.

Date	Depth	1	2	3	4	5	6	7	8	9	10	Avg																																																																																																																																																																																																			
	18"													36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"											
	36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"																								
	18"													36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"																																					
	36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"																																																		
	18"													36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"																																																															
	36"													18"													36"													18"													36"													18"													36"													18"													36"													18"													36"																																																																												
	18"													36"													18"													36"													18"													36"													18"													36"													18"													36"																																																																																									
	36"													18"													36"													18"													36"													18"													36"													18"													36"																																																																																																						
	18"													36"													18"													36"													18"													36"													18"													36"																																																																																																																			
	36"													18"													36"													18"													36"													18"													36"																																																																																																																																
	18"													36"													18"													36"													18"													36"																																																																																																																																													
	36"													18"													36"													18"													36"																																																																																																																																																										
	18"													36"													18"													36"																																																																																																																																																																							
	36"													18"													36"																																																																																																																																																																																				
	18"													36"																																																																																																																																																																																																	
	36"																																																																																																																																																																																																														

Troubleshooting

Table 2 below describes the most common composting problems and solutions.

Problem	Issue	Solution
Excessive flies or odor	Exposed carcasses	Add additional cap material
Leachate from windrow	Mixture too wet	Add additional carbon material, mix and cap
Temperature does not reach 131°F	Mixture too dry (< 40% moisture)	Add water to pile, mix if necessary
Temperature does not reach 131°F	Mixture too wet (> 60 % moisture)	Add additional carbon material, mix if necessary
Temperature drops early	Not enough oxygen	Aerate or mix pile

List of References

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.

Additional Contact Information

¹ Agricultural and Stormwater Program Manager, Virginia Department of Environmental Quality, Valley Regional Office, P.O. Box 3000, Harrisonburg, Virginia 22801 Phone: (540) 574-7840 Email: gary.flory@deq.virginia.gov

² Agricultural Program Coordinator, Virginia Department of Environmental Quality, Valley Regional Office, P.O. Box 3000, Harrisonburg, Virginia 22801 Phone: (540) 574-7866 Email: robert.peer@deq.virginia.gov

³ Malone Poultry Consulting, 13713 Allen Road, Princess Anne, Maryland 21853 Phone (443) 944-6910 Email: malonepoultryconsulting@gmail.com

⁴ Extension Specialist, Community Viability, Department of Crop and Soil Environmental Sciences, Virginia Tech/Virginia Cooperative Extension, 2322 Blue Stone Hills Dr., Ste. 140, Harrisonburg, VA 22801 Phone: (540) 432-6029 Ext. 106. Email: ebendfel@vt.edu

⁵ Extension Agent, Agriculture and Natural Resources, Virginia Tech/Virginia Cooperative Extension, 600 North Main St., Ste. 100, Woodstock, VA 22664 Phone: (540) 459-6140 Email: raclark@vt.edu