Avian Influenza Mortality Management Options, Composting Procedures and Lessons Learned

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2015 US HPAI outbreak H5 strains

- **US:**
  - December 2014 – June 2015
  - 233 premises (212 commercial; 21 backyard)
  - ~50 million birds
  - ~$1 billion spent by USDA-APHIS
  - Trade restrictions in place for US poultry exports
  - Economic hardships to poultry producers

- **Turkeys:**
  - 7.5 million
  - 7% of avg US inventory

- **Chickens:**
  - 42.1 million
  - 10% of avg US layer inventory
  - 6% of avg US pullet inventory
2016 US HPAI outbreak
H7N8

- Jan. 15, 2016
- Indiana
- 1 turkey farm with HPAI
- 8 turkey farms with LPAI
- 1 egg layer facility (dangerous contact premises)
- > 415,000 birds
- ~ $4 million indemnity payments
2016 US LPAI outbreak
H5N1

- May 1, 2016
- Missouri
- 1 turkey farm with LPAI
- 37,000 birds
- 44 lbs
Transmission

- Migratory waterfowl (geese, ducks)
- Avian influenza as common as human influenza
- Low pathogenic vs high pathogenic
- Re-assortment of Asian high pathogenic strains with N. American low pathogenic viruses
Map of outbreak 2015 HPAI
Euthanasia methods during outbreak

- Gas
- Foam
- Ventilation shutdown
Common Disposal Options

- Burial
- Landfills
- Incineration
- Rendering
- Composting
Burial

- Requires acceptable land mass
- Site assessment required
- Proper environmental guidelines must be followed
- Examples:
  - Depth to groundwater
  - Distance from waterways
  - Soil type
Burial considerations

- Poor site selection, sandy soils, areas with high water tables and karst topography may pose threat to groundwater contamination
Carcass leachate components can move from burial pits to groundwater (Ritter and Chirnside, 1995; Myers et al., 1999; Glanville, 2000, Pratt and Fonstad, 2009)

H7N1 has survived >1 yr in manure amended soil at 34°F (Elving et al., 2012)

LPAI viruses have survived for weeks in water (Brown et al., 2009)

Carcass may not fully degrade

Photo courtesy of Bud Malone

3 month old buried carcasses

Photo courtesy of Bud Malone
Leachate below burial sites

Elk w/ CWD buried in 2001
Soil cores from 2008

Dairy cattle w/ FMD buried in 1952
Soil cores from 2010

Pratt and Fonstad, 2012
Burial

- **Pros:**
  - Fast
  - On-site

- **Cons:**
  - Weather constraints
  - Environmental risk
  - Public perception
  - Record on deed, future land use?
  - Not a pathogen inactivation procedure
Landfills

- Some licensed landfills accept animal mortalities
- Requires notification prior to delivery
- Tipping fees may range from $20-40/ton
- Requires biobags in roll-off containers
Pros:
- Fast

Cons:
- Privately owned (may shut gates during outbreak)
- Not a pathogen inactivation procedure
Incineration

- Requires large closed air unit
- May require air quality permit

Pros:
- Pathogen inactivation procedure
- On-site

Cons:
- Requires several units
- Consider carcass throughput
- Maintenance can be issue
Cooks the carcass
Meat and bone meal and fat are by-products
Requires biobags in roll-off containers

Pros:
- Pathogen inactivation procedure

Cons:
- Availability limited
- Private business may not want risks
Composting

- Carcass is surrounded by carbon material
- Microbial breakdown of carcass
- Converts carcass into stable, humus-like product
- Thermophilic temperatures destroy pathogens
- Proper construction is key for effectiveness!
Composting

- **Pros:**
  - On-site
  - Pathogen inactivation procedure
  - Environmentally sustainable
  - Produces valuable soil amendment and fertilizer

- **Cons:**
  - Requires more time (28 days)
  - Requires space for windrows
  - Proper construction, maintenance and monitoring are *fundamental!*
Regardless of method.....Plan ahead!

- Keep all options on the table
- Each method has pros and cons
- Have a disposal plan for each farm
- Site assessment, severity of outbreak and available resources are key variables
- Coordinate between depop and disposal crews!
- Have a crew and equipment ready
- If composting, have carbon material in route
Heat inactivation using composting methods

- Objective:
  - Utilize biological heat treatment methods to degrade poultry carcasses, inactivate HPAI virus, control odors and reduce fly exposure in a safe, biosecure and environmentally sustainable manner.
Science of animal composting

- Controlled biological decomposition process
- Requires:
  - Nitrogen (carcass, manure)
  - Carbon (wood shavings, rice hulls, corn stover, etc.)
  - Airflow
  - Proper moisture content
Above ground degradation

Note: If straw is used, place 3-4 inches on top of saw dust or litter. Amount of saw dust or litter can be reduced to 4-6 inches.
Building a Twinkie
Additional carbon

- Amount depends on: house size, litter depth, litter age, and amount of carcass material
## Carbon sources

<table>
<thead>
<tr>
<th>Source</th>
<th>C:N ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Softwood shavings</td>
<td>641:1</td>
</tr>
<tr>
<td>Hardwood chips</td>
<td>560:1</td>
</tr>
<tr>
<td>Sawdust</td>
<td>442:1</td>
</tr>
<tr>
<td>Wheat Straw</td>
<td>127:1</td>
</tr>
<tr>
<td>Rice hulls</td>
<td>121:1</td>
</tr>
<tr>
<td>Straw (general)</td>
<td>80:1</td>
</tr>
<tr>
<td>Corn stalks</td>
<td>67:1</td>
</tr>
<tr>
<td>Hay (general)</td>
<td>24:1</td>
</tr>
<tr>
<td>Turkey litter</td>
<td>16:1</td>
</tr>
<tr>
<td>Broiler litter</td>
<td>14:1</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>7:1</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>5:1</td>
</tr>
<tr>
<td>Animal carcasses</td>
<td>5:1</td>
</tr>
</tbody>
</table>
Consider porosity

- Bulky enough to allow airflow but less than 2”
Broiler or Turkey House Procedures
Foam euthanasia:
Goal 24 hr completion
Process starts during euthanasia
Post Euthanasia
Post Euthanasia
Post Euthanasia
Slick litter!
Prepping house

- Raise or remove feed and water lines
- Secure any loose cables and hoses so they will not be entangled by equipment
- Equally distribute carcasses throughout house
Forming jellyrolls
Forming windrows

- Using skid steer, remove litter and carcasses along each sidewall forming 2 windrows
Forming windrows

- Remove litter and carcasses from center forming 2 windrows
Forming windrows

House with 1 ft. litter depth
Forming windrows

- Remove litter down to dirt floor
- Use shovels to clean sidewalls
- Don’t forget about feed!
- Empty feed bins and cap windrows with feed
Assess moisture content

- If carcasses are desiccated, may need to add water
- Tank sprayers work best
- Waterers can be turned upside down
Form Base

- Add 8-12 inch carbon base to center of house
- Base should be no more than 12-15 feet wide
- Don’t drive skid steer on pad! Causes compaction.
Final windrow

- Combine 2 small windrows into 1 final windrow
Cap windrow

- Add 8-12 inches of carbon
Mix and pile method

- Form a path in center of house
Mix and pile method
Final windrow

- 5-7 ft high
- 12-15 ft wide
“Chimney effect”

Figure 1. Cross Section of Compost Windrow

- Water, heat, and carbon dioxide
- Cap 8 – 12 inches thick
- Windrow Core (~ Uniform mix of carcasses, eggs, litter, feed etc.)
- Base Layer 8-12 inches thick
- 5 to 7 feet
- Oxygen
- 12 to 15 feet wide
Pole barns

- 2 windrows work best inside poles
Broiler breeder houses
Floor challenges

- 12’ center scratch area
- 14’ manure and slat area
- 1 – 2’ drop off
Ceiling challenges
Outdoor composting
Layer houses
Monitoring and turning

- Flag piles and monitor temps daily
- Phase 1 composting
  - 14 days
  - Target of 131°F for 3 days
- Phase 2 composting
  - 14 days
  - Target of 131°F for 3 days
- Subject Matter Expert approves pile turning and release
- Compost stockpiled on farm until quarantine is lifted
- Compost may be moved off-site if permitted under USDA APHIS or state authority
Turning
Turning
End of phase 1 composting (14 days)
End of phase 1 composting
Final compost/soil amendment
Great fertilizer!!

N – P – K (lbs/ton)
Farm A: 60 – 46 – 36
Farm B: 40 – 27 – 17
Farm C: 60 – 16 – 37
FY2016 HPAI Response
Mortality Composting Protocol for Avian Influenza Infected Flocks
February 5, 2016

Please note: These procedures may be revised as the situation develops.

EXECUTIVE 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 low pathogenicity avian influenza (LPAI) and highly pathogenic avian influenza (HPAI). Composting can be effective with most bird types and poultry house designs.

Microbial activity within a well-constructed compost pile can generate and maintain temperatures sufficient to inactivate the avian influenza virus. The effectiveness of this virus inactivation process can be assessed by evaluating compost temperatures and the shape of the time and temperature curve, visual observation of carcass decomposition, and the homogeneity of the compost mix.

Successful mortality composting requires the following:

1. A qualified composting expert to guide windrow construction.
2. Trained equipment operators.
3. Sufficient carbon, water, and space.

If any of these components is lacking, composting is NOT recommended.

Prepared by members of the USDA Composting Technical Committee: Lori P. Miller, Gary A. Flory, Robert W. Peer, Eric S. Benfield, Mark L. Hutchinson, Mark A. King, Bill Seekins, George W. Malone, Joshua B. Payne, Jerry Floren, Edward Malek, Mary Schwarz, and Jean Bonfotál

Completed windrow (photo by Gary Flory)
Lessons learned
Supplies, Labor and Equipment

- PPE
- Portable pressure washers
- Hand pump sprayers
- Disinfectant
- Skid loaders
- Pay loaders
- Skilled equipment operators
- General laborers
- 36” thermometers if composting
- Landscape rakes if composting
Challenges with litter moisture content
Challenges with carcass distribution
Pole barns

- Create maneuvering challenges
Brooder houses

- Create maneuvering challenges
Lesson 1:
Don’t flood house with foamer
Lesson 2: Don’t leave carcasses uncovered for several days
Lesson 3:
Have a fly control plan
Not forming windrows quickly = Maggot infestation
Maggot exodus = Pile avalanche
Lesson 4: Request properly sized equipment
Lesson 5:
Most producers were more efficient operators compared to contractors IF they don’t become overwhelmed.
Lesson 6:
If using biobags, have somewhere to dispose of them
Lesson 7: Buyer beware!

- Quality control important!

Some carbon suppliers
Lesson 8:
Store carbon near each house

- Less time spent hauling carbon
Lesson 9: Equally distribute carcasses

- Leachate from unequal distribution
Lesson 10:
Don’t drive on piles

- Compressed windrow
Lesson 11:
Don’t overlook mortality compost bins and feed bins

This material should be composted
Lesson 12: Don’t be afraid to think outside of the box... or bag

Pallets of bagged shavings strategically placed
441 cubic yards per compressed load

vs

145 cubic yards bulk load
Laborers distribute shavings
Forming compost windrow base
Leveling base
Constructed base

- Litter and carbon added to base
- Bagged shavings around windrow
Snow blower theory
Proof of concept
Snow blower skid steer attachment
Capping with snow blower
Final windrow 
“twinkie”
Limit traffic

- Road blocks help limit traffic
- Be mindful of animal rights groups, media, neighbors, etc.
Biosecurity

- Strictly adhere to protocol!
- Producers are a big biosecurity challenge
Worker safety

- Contractor PPE differs from USDA PPE and can affect labor hours
- Ventilate houses before entering due to ammonia build-up!
Worker needs

- Porta potties
- Food
- Water
- On site shelter (tent)
- Roll-off container
- Hotels
Thoughts for improvement

- Euthanasia that doesn’t crowd birds to one end
- Remove equipment that may be damaged by loader
- 2 skid loaders per house
- Choose labor based on the situation at hand
  - Producer/Contractor/USDA
- Complete windrows within a few days
Biosecurity, Biosecurity, Biosecurity!

- Poor biosecurity can spread disease to neighboring farms
Biosecurity changes

Biosecurity for each house
To keep salmonella at bay, Danish poultry farmers disrobe, wash and then don sanitized clothing and boots before mingling with the chickens. There is no vegetation against the houses to keep out bacteria-carrying rodents and insects.
Danish entry system
Thank you!