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

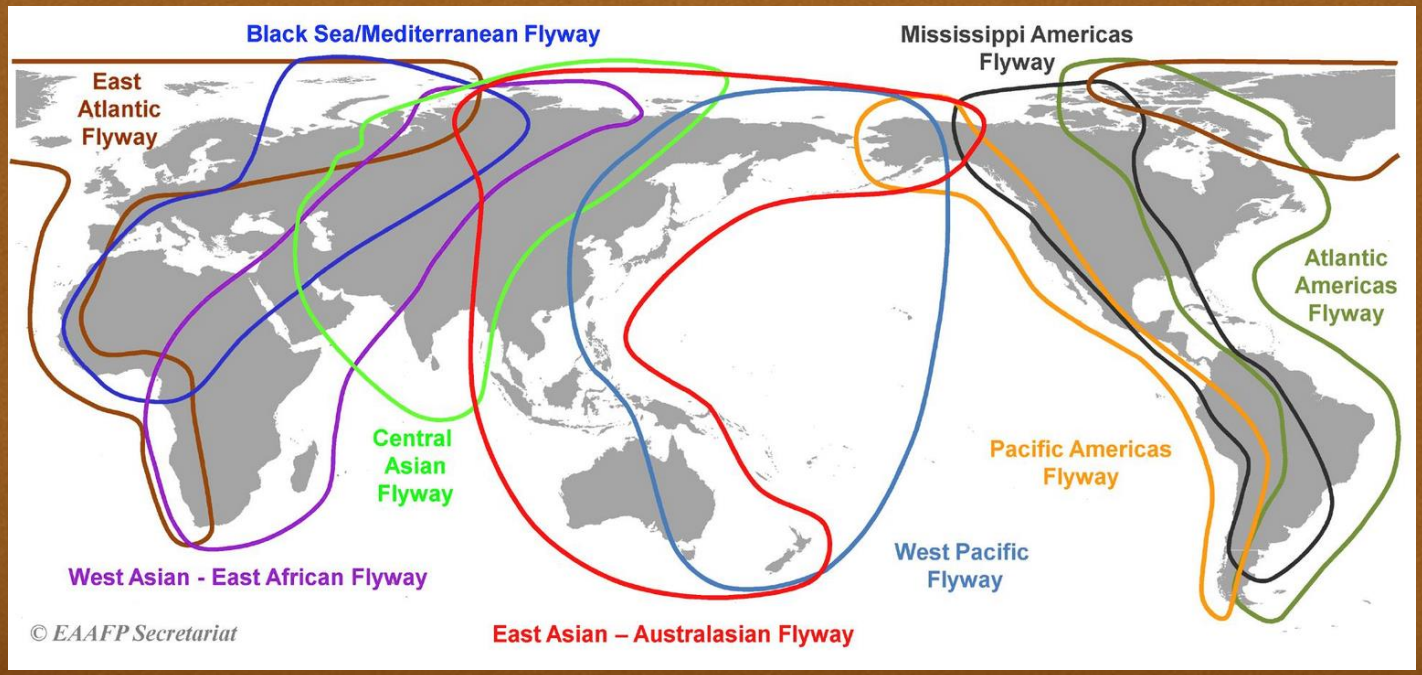
- Jan. 15, 2016
- Indiana
- 1 turkey farm with HPAI
- 8 turkey farms with LPAI
- 1 egg layer facility (dangerous contact premises)
- > 415,000 birds
- ~ $4 million indemnity payments

2016 US LPAI outbreak H5N1

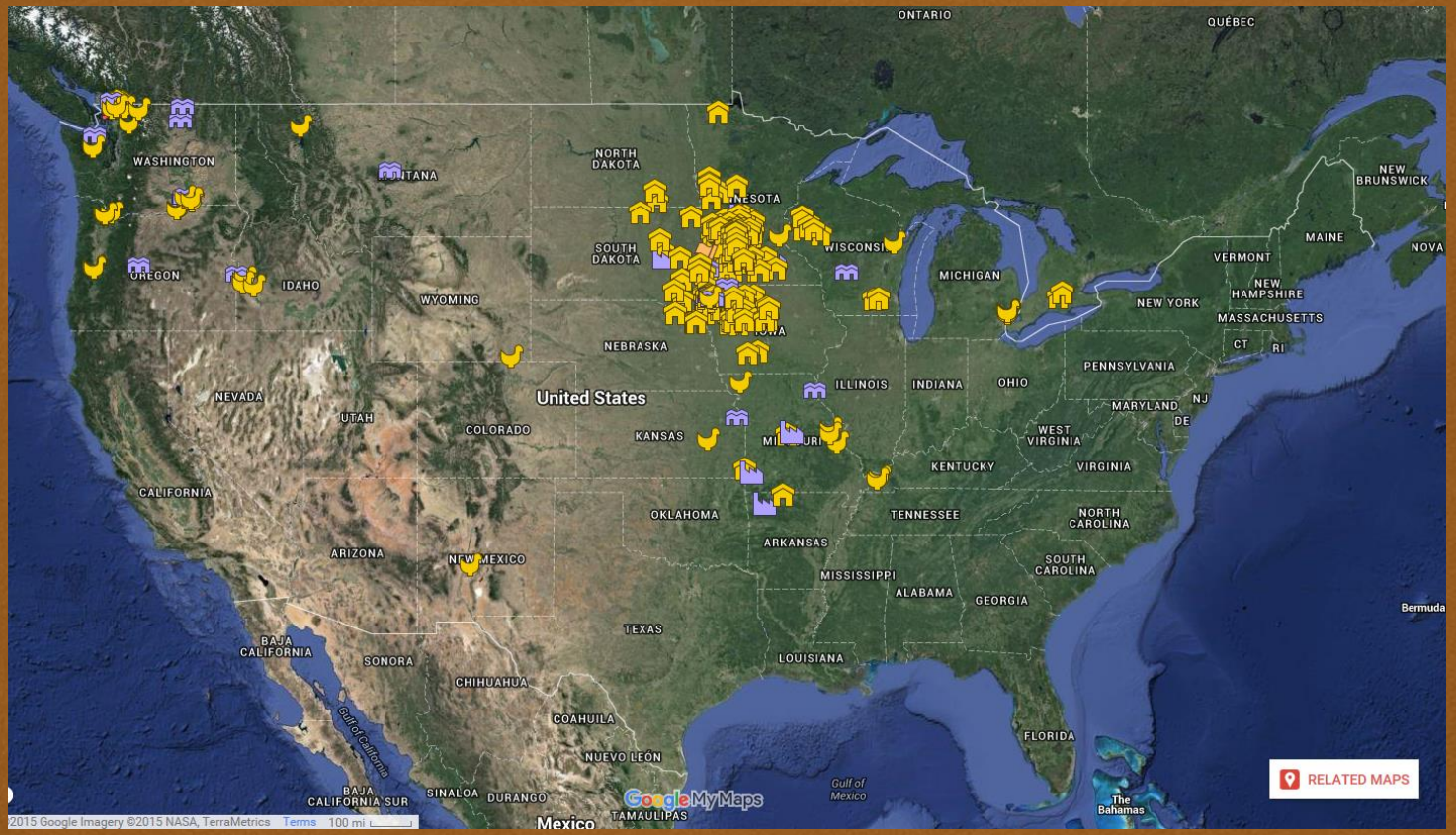
- May 1, 2016
- Missouri
- 1 turkey farm with LPAI
- 37,000 birds
- 44 lbs

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

Foam

Common Disposal Options

- Burial
- Landfills
- Incineration
- Rendering
- Composting

Burial

- Requires acceptable land mass
- Site assessment required
- Proper environmental guidelines must be followed
- Examples:

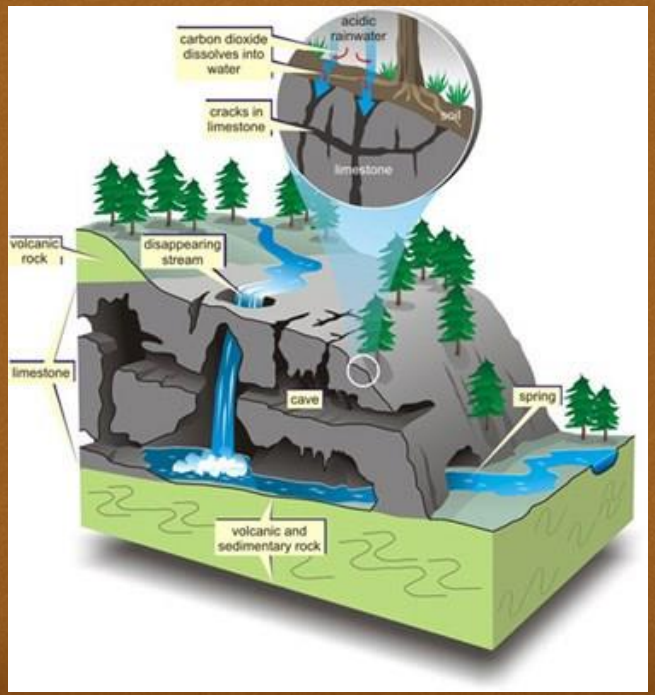
  -Depth to groundwater

  -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



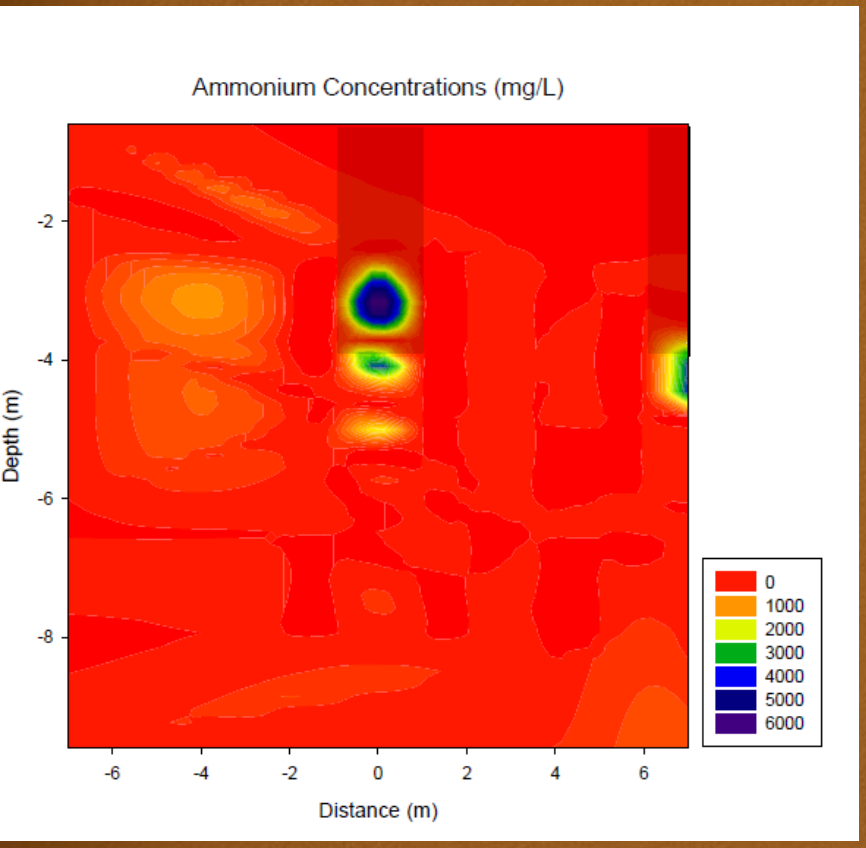
Burial considerations

- 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

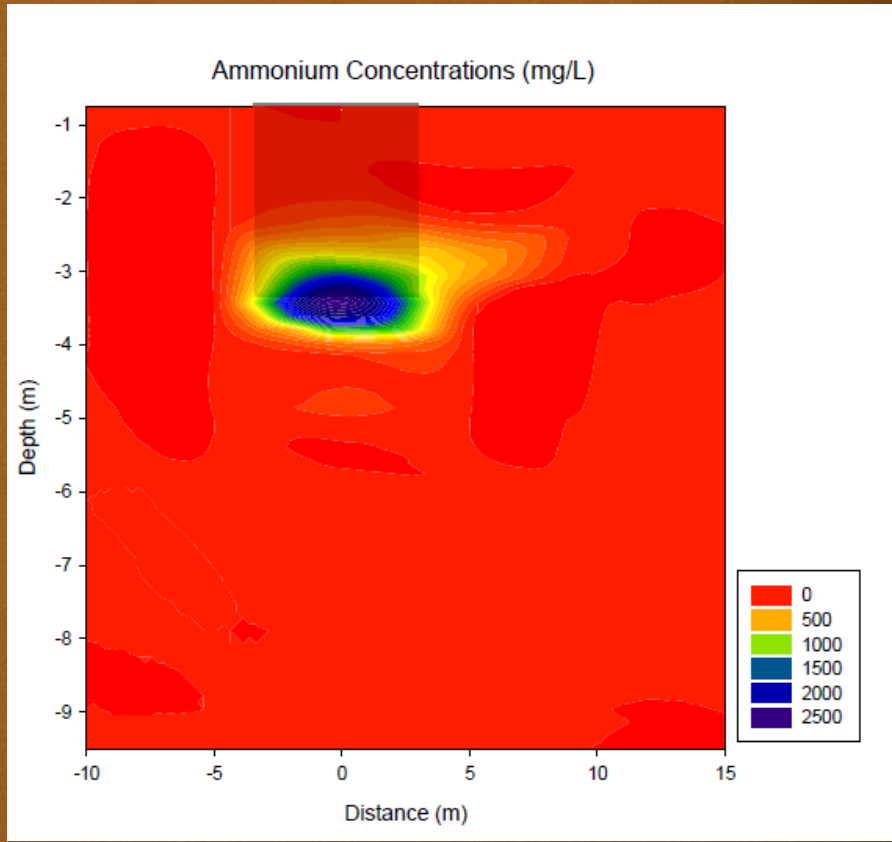
3 month old buried carcasses
Photo courtesy of Bud Malone

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

Landfills

- 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

Rendering

- 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

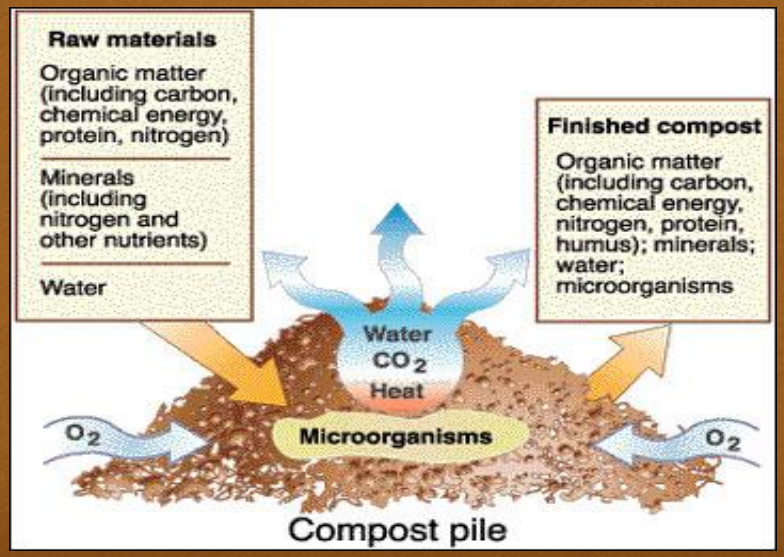
Heat inactivation using composting methods

- Objective:

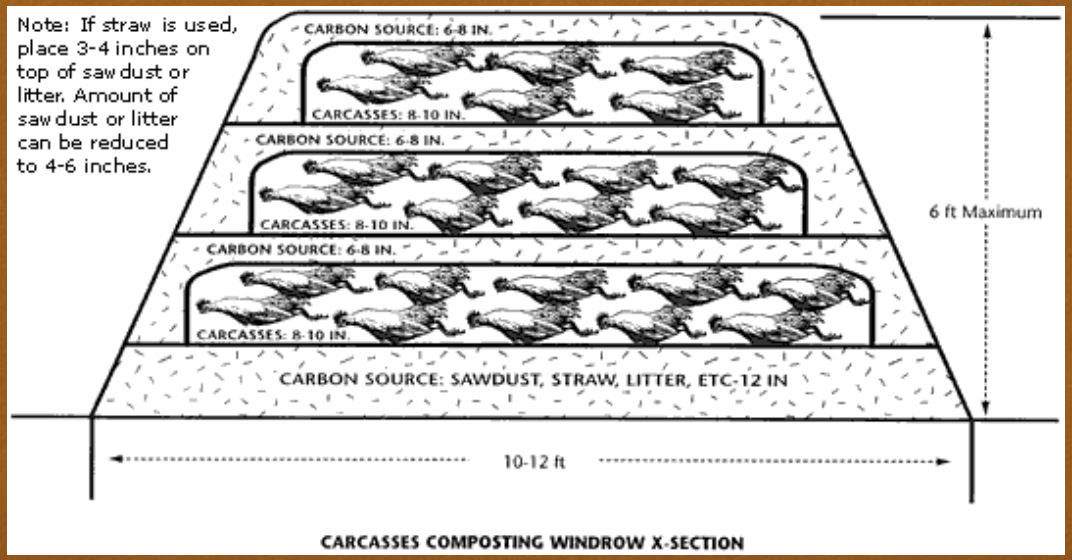
  - Utilize biological heat treatment methods to degrade poultry carcasses, inactivate HPAI virus, control odors and reduce fly exposure in a safe, biosecure and environmentally sustainable manner.

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



CARCASSES COMPOSTING WINDROW X-SECTION

Building a Twinkie

Additional carbon

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

Carbon sources

Source	C:N ratio
Softwood shavings	641:1
Hardwood chips	560:1
Sawdust	442:1
Wheat Straw	127:1
Rice hulls	121:1
Straw (general)	80:1
Corn stalks	67:1
Hay (general)	24:1
Turkey litter	16:1
Broiler litter	14:1
Cottonseed meal	7:1
Soybean meal	5:1
Animal carcasses	5:1

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"

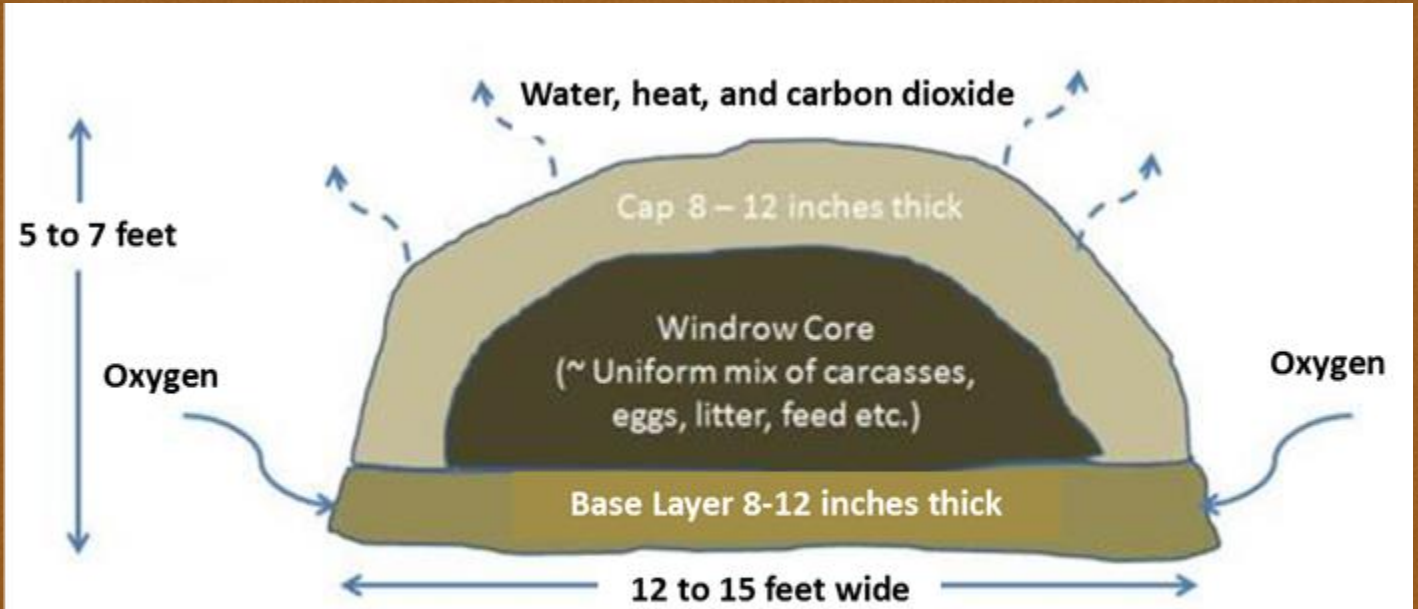


Figure 1. Cross Section of Compost Windrow

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

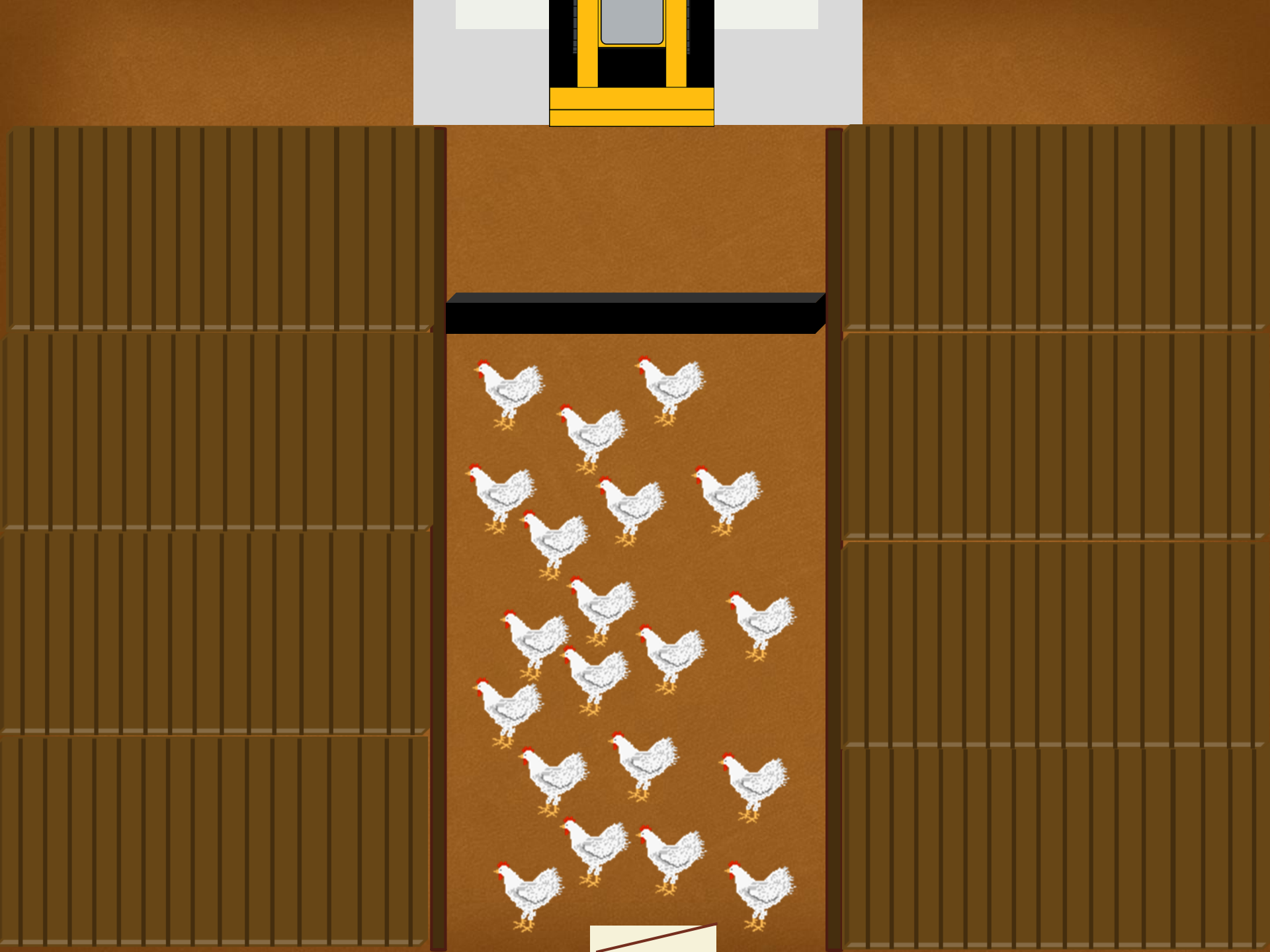


Photo credit: Canadian Food Inspection Agency

Photo credit: Canadian Food Inspection Agency

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

United States Department of Agriculture

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. Bendfeldt, Mark L. Hutchinson, Mark A. King, Bill Seekins, George W. Malone, Joshua B. Payne, Jerry Floren, Edward Malek, Mary Schwarz, and Jean Bonhotal

Completed windrow (photo by Gary Flory)

Oklahoma Cooperative Extension Service ANSI-8218

Mortality Management Options During an Avian Influenza Outbreak

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State Poultry Specialist

The highly pathogenic avian influenza (HPAI) outbreak has become the largest animal health emergency in U.S. history. As of August 2016, the USDA reported 233 detections (212 commercial facilities and 21 backyard flocks) affecting approximately 50 million birds in 22 states. Impacted farms have remained out of production for several months and trade restrictions have been imposed resulting in economic hardships to both growers and the poultry industry. To date, more than $950 million federal dollars have been spent on disease control efforts and indemnities. The last confirmed case of HPAI occurred in January, 2016; however, there is concern of future outbreaks due to the continued migration of waterfowl, which serve as a reservoir for avian influenza viruses. In fact, recent cases of low pathogenic avian influenza have been detected on commercial turkey operations.

Infected birds have either died from the disease or been euthanized to control disease spread. Proper carcass management is vital for both controlling disease and managing nutrients. Improper disposal may cause odor nuisance and spread disease, and the resulting leachate (carcass fluids) could negatively impact water sources. The avian influenza virus may still be present within the carcass, litter, feed or eggs and could be spread by insects, rodents, predators and subsurface or aboveground water movement, as well as through direct contact with other birds, leading to increased disease transmission risks. For these reasons, proper mortality management practices must be implemented immediately following a disease outbreak. Strict biosecurity measures must be followed to prevent disease transmission from human activity.

Figure 1. Turkey mortality resulting from highly pathogenic avian influenza. Photo courtesy Josh Payne.

Oklahoma Cooperative Extension Fact Sheets are also available on our website at: **http://osufacts.okstate.edu**

Mortality management options that were used during recent avian influenza outbreaks include:

- Composting
- Burial
- Incineration
- Landfilling

The most commonly implemented option was mass mortality composting, which will be discussed later.

Burial

Burial is a disposal method in many states that may be conducted on-site and quickly, if acceptable land mass is available. A site assessment is required to ensure local environmental guidelines are followed. Common considerations include location, soil type, depth to groundwater and distance to waterways. Sandy soils, karst topography or areas with a high water table pose a risk of contaminating groundwater supplies. Researchers have demonstrated the potential transport of carcass leachate components, such as nutrients and bacteria, from burial pits to groundwater. Avian influenza has been reported to survive for weeks in water, depending on variables such as temperature, salinity and pH, and has

Figure 2. Poultry carcasses being buried. Photo courtesy Rodney White/Des Moines Register.

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

Capping windrow

Final windrow

Snow blower theory

Proof of concept

Snow blower skid steer attachment

Capping with snow blower

Final windrow “twinkie”

Day 28

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

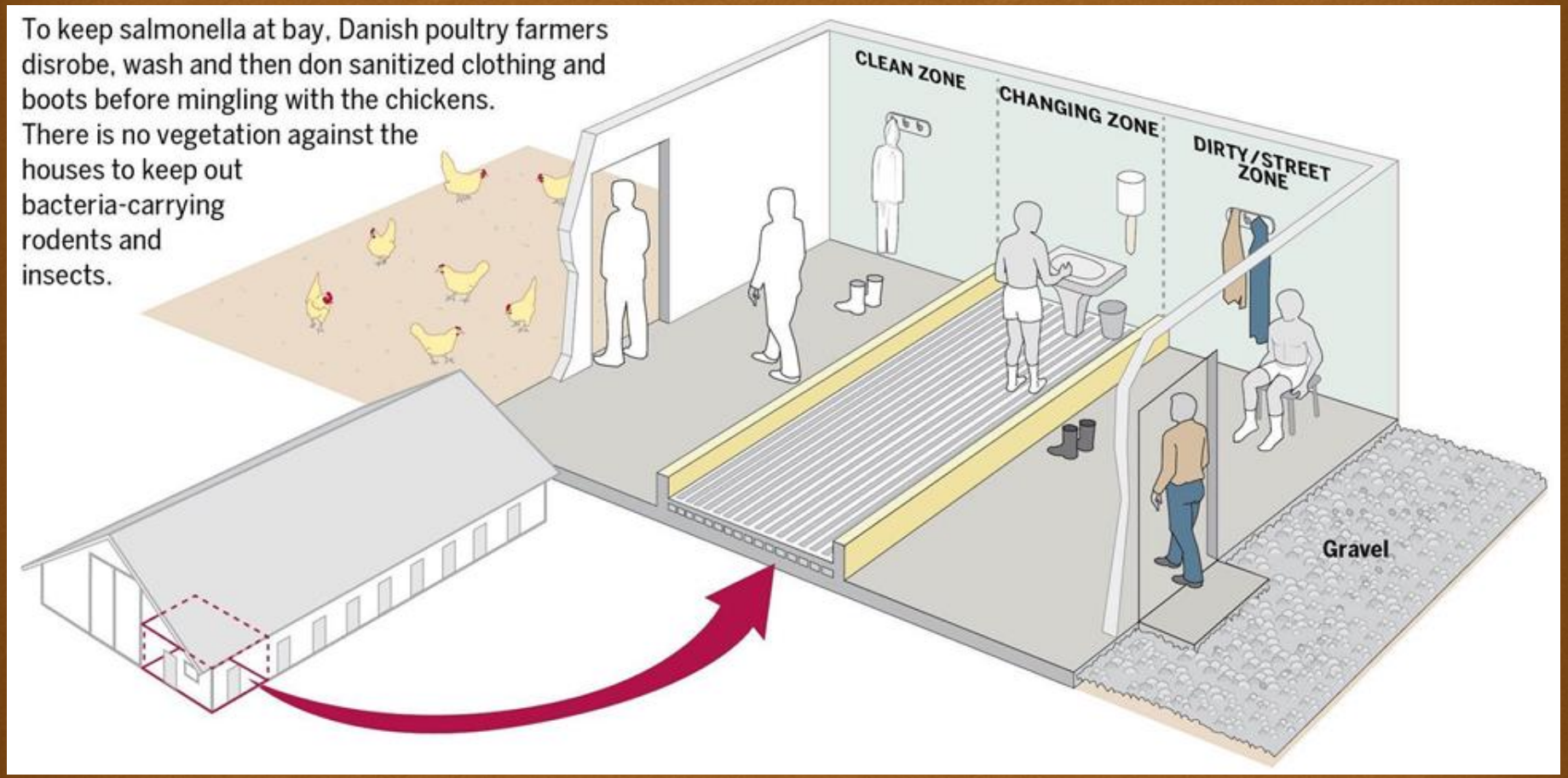
Biosecurity, Biosecurity, Biosecurity!

- Poor biosecurity can spread disease to neighboring farms

Biosecurity changes

Biosecurity for each house

Danish entry system



Danish entry system

Thank you!