

# An Introduction to Avian Influenza



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# Geographic Distribution

- Worldwide distribution
- Reservoir
  - Free flying aquatic birds: Ducks, geese, shorebirds, gulls, terns, auks
- Recent outbreaks
  - Canada, Mexico, U.S., The Netherlands, Australia, SE Asia, Eurasia
- Similarity to Newcastle Disease makes actual distribution difficult to define
- Altered avian ecosystems have created new niche for AI viruses; domestication, intensive agriculture



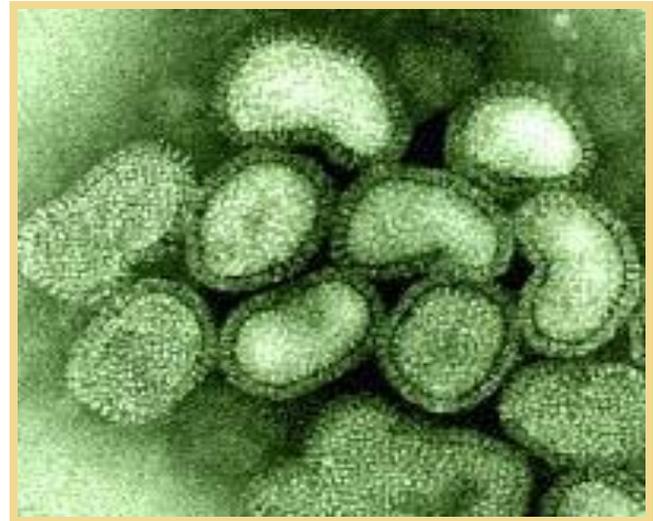
# Virus Transmission

- Direct contact between healthy and infected birds
- Infected fecal material or oral/nasal secretions
- Can be found on surface of unwashed egg shells from infected birds
- Usually no clinical signs in waterfowl
- Wild waterfowl and shorebirds serve as natural reservoir
- Domestic poultry less resistant to clinical infection



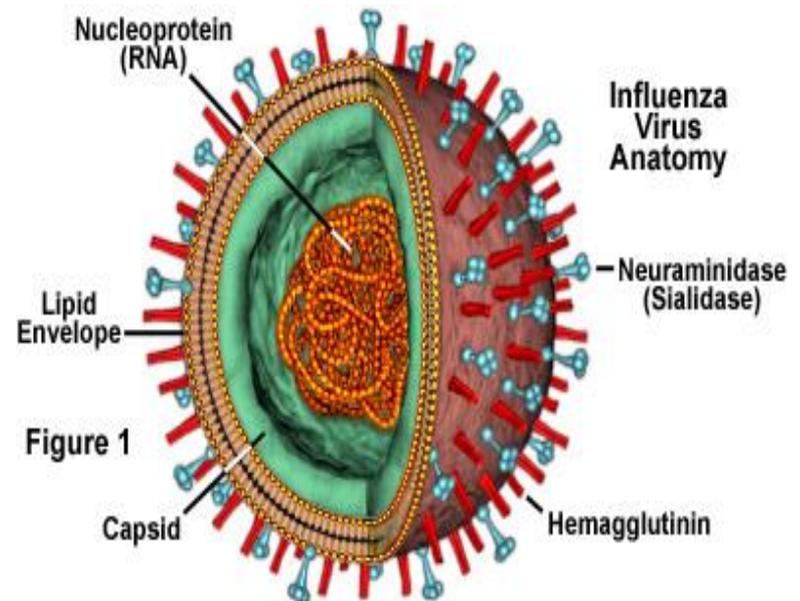
# Influenza Virus

- Family Orthomyxoviridae
- Three main types – based on Neucleoprotein and Matrix antigens
  - Type A
    - Multiple species
  - Type B and C
    - Humans and swine



# Influenza A

- Classification by surface antigens into subtypes:
  - Hemagglutinin (H or HA)
  - Neuraminidase (N or NA)
- Most human influenzas are H1,H2, H3
- All serious avian viruses have been H5 and H7



# Surface Antigens and Subtypes

- 16 HA and 9 NA for influenza A
  - All have been isolated from birds
  - 144 possible combinations
- Hemagglutinin (HA)
  - Responsible for attachment to cell surface
- Neuraminidase (NA)
  - Responsible for release from infected cell

# Influenza A Viruses

- Mutate frequently
  - Antigenic drift
    - Point mutations accumulated during virus replication
    - RNA polymerase has no proofreading
  - Antigenic shift
    - Hybrid virus emerges when cell infected with two different influenza viruses
      - Human, avian, swine, equine
    - Exchange of gene segments between viruses creates reassortant viruses

# Avian Influenza

- Pathogenicity based on genetic features and/or severity of disease **in poultry**
  - Low pathogenic AI (LPAI)
    - H1 to H16 subtypes
    - Mild disease in poultry
    - Most AI strains are LPAI
  - Highly pathogenic AI (HPAI)
    - Some H5 or H7 subtypes
    - LPAI H5 or H7 subtypes can mutate into HPAI

# Pathogenicity of Avian Influenza

- HPAI viruses have an intravenous pathogenicity index (IVPI) in 6-week-old chickens greater than 1.2 or, cause at least 75% mortality in 4- to 8-week-old chickens infected intravenously.
- H5 and H7 viruses which do not have an IVPI greater than 1.2 or cause less than 75% mortality in an intravenous lethality test should be sequenced. This will determine whether multiple basic amino acids are present at the cleavage site of the hemagglutinin molecule: if the amino acid motif is similar to that observed for other HPAI isolates, the isolate being tested should be considered as HPAI.
- Low pathogenicity notifiable avian influenza (LPNAI) are all influenza A viruses of H5 and H7 subtype that are not HPAI viruses.

# Clinical Signs of AI in Poultry

- Incubation period: 2-14 days
- Drop in egg production
- Depression, anorexia, ruffled feathers
- Conjunctivitis and respiratory signs
- Birds found dead
- Combs swollen, cyanotic
- Neurological signs



# Gross signs of HPAI that can be recognized by without a necropsy



Blue comb edema of the neck



Hemorrhagic shank



Sudden death



Swelling in waddles and throat latch

# Signs of HPAI Infection in Birds



# Notifiable Avian Influenza

- H5 and H7 viruses are considered **notifiable** avian influenza viruses, because of their documented ability to mutate from LPAI to HPAI.
- Confirmed infection of domestic poultry with H5 or H7 subtypes requires notification to the OIE (*Office International des Epizooties* ) or the World Organization for Animal Health.
- Nationwide, the US has a zero tolerance policy for H5 or H7 viruses in domestic poultry. All H5/H7 viruses are quarantined and removed.

# Why are we so concerned about H5 and H7 Viruses?

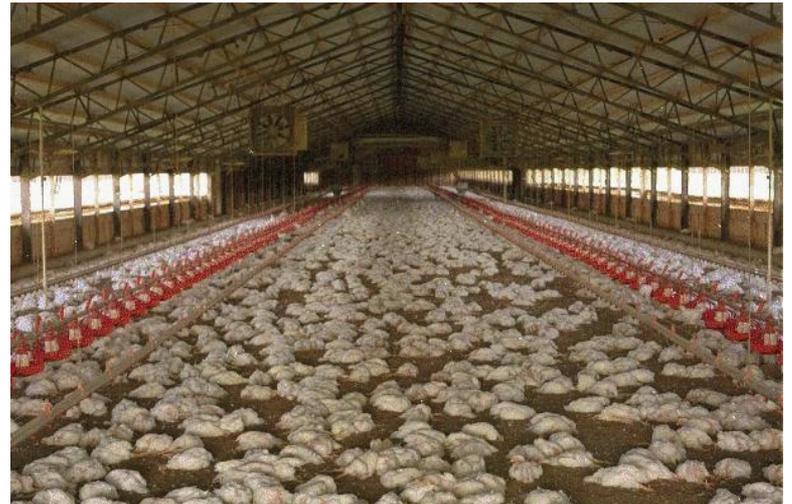
- Direct losses from mortality and morbidity with HPAI
- History of viruses pathogenic to humans (H5N1, H7N9 in Asia)
- Significant losses in trade and exports
- Food security issues, especially in developing countries

# The US Poultry Industry

- The United States is the world's largest poultry producer.
- In 2013, the total export value of broilers, turkeys, eggs, and egg products was estimated at \$6.1 billion.
- Exports of broiler meat alone were valued at \$3.6 billion. The U.S. broiler industry—the largest in the world—provides an estimated 1 million jobs, \$17.2 billion in government revenue, and \$197 billion in economic activity (according to the National Chicken Council).
- Overall, the United States exports approximately 20 percent of its total domestic poultry production. This includes over 20 percent of broilers, approximately 13 percent of turkeys, as well as 4 percent of eggs produced. Additionally, much of the world's poultry genetics (breeding stock) originates in the United States.

# Economic Impact

- Direct losses:
  - Depopulation and disposal
  - High morbidity and mortality
  - Quarantine and surveillance
  - Indemnities
- Almost 1 BILLION in 2014 - 2015 outbreak



# Veterinary Services

## Overview of U.S.A. HPAI Outbreak and Response, and Ongoing Surveillance

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*National Epidemiology Officer – Avian Health  
Surveillance, Preparedness and Response Services (SPRS)  
Avian, Swine, and Aquatic Animal Health Center (ASAAHC)*

**U.S. Department of Agriculture (USDA)  
Animal and Plant Health Inspection Service (APHIS)  
Veterinary Services (VS)**



# USDA HPAI Outbreak Objectives

- Ensure Responder safety is the first priority at all times. This will be the first consideration for all field activities.
- Detect, control and contain HPAI in susceptible species.
- Immediately establish a control zone around each infected premises and conduct surveillance testing for avian influenza as resources allow
- Provide educational information and outreach regarding AI and biosecurity to stakeholders in the AI affected areas

# USDA HPAI Outbreak Objectives

- Uphold prescribed biosecurity standards for responding personnel to avoid the spread of AI
- Conduct operations in a manner that ensures humane animal treatment, minimizes production loss and protects the environment.
- Use science and risk based approaches/systems to facilitate continuity of business for non-infected premises/animals.
- Establish Permitted Movement of low risk product according to USDA Secure Poultry/Product Movement guidelines and sound epidemiology

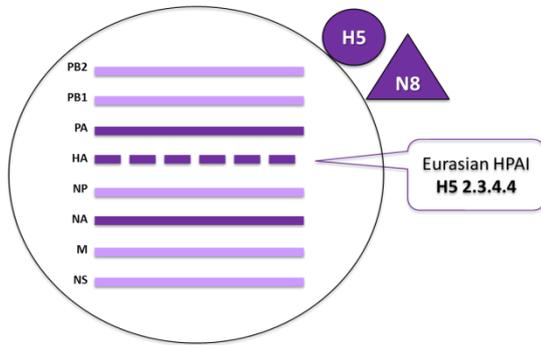
## Source of the Outbreak(s) or Origin of Infection

- Novel avian influenza virus of Eurasian origin (EA-H5N8 clade 2.3.4.4) spread rapidly along wild bird migratory pathways during 2014.
- Introduction of this EA-H5N8 virus into the Pacific Flyway sometime during 2014 has allowed mixing with North American (AM) lineage viruses and generated new combinations with genes from both EA and AM origin (or “reassortant” viruses) such as the EA/AM H5N2-reassortant detected in the United States.
- In addition, overlap of the Pacific, Central, and Mississippi Americas flyways has resulted in movement of the virus to the central part of the country. The EA-H5 clade 2.3.4.4 viruses are highly pathogenic for poultry.

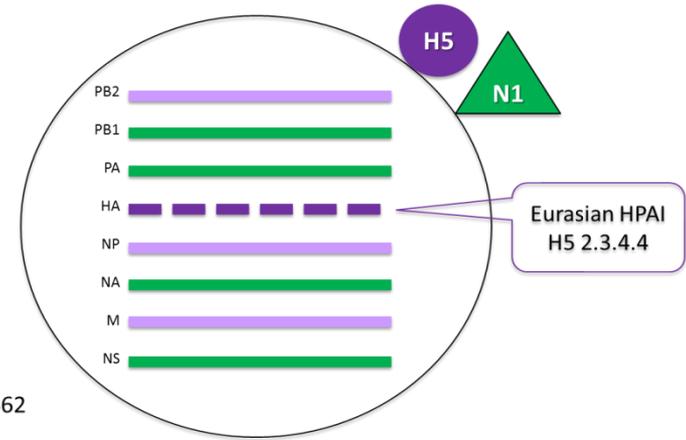
# EA-H5 2.3.4.4\* reassortants in North America (AM)

\*All H5 2.3.4.4 viruses to date are considered **highly pathogenic** in poultry

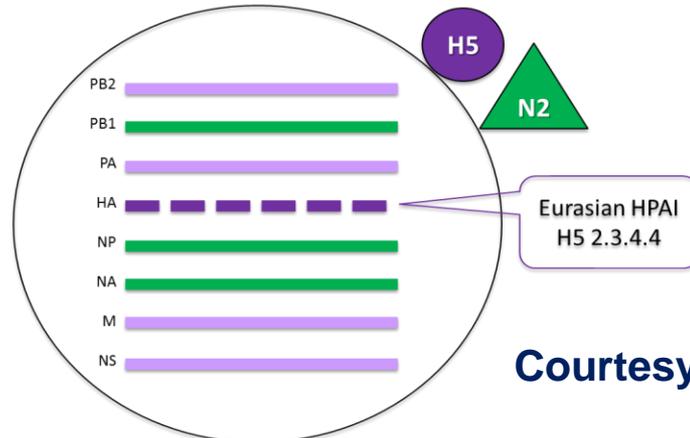
Eurasian H5N8 clade **2.3.4.4**  
aka "Transcontinental" EA-H5N8



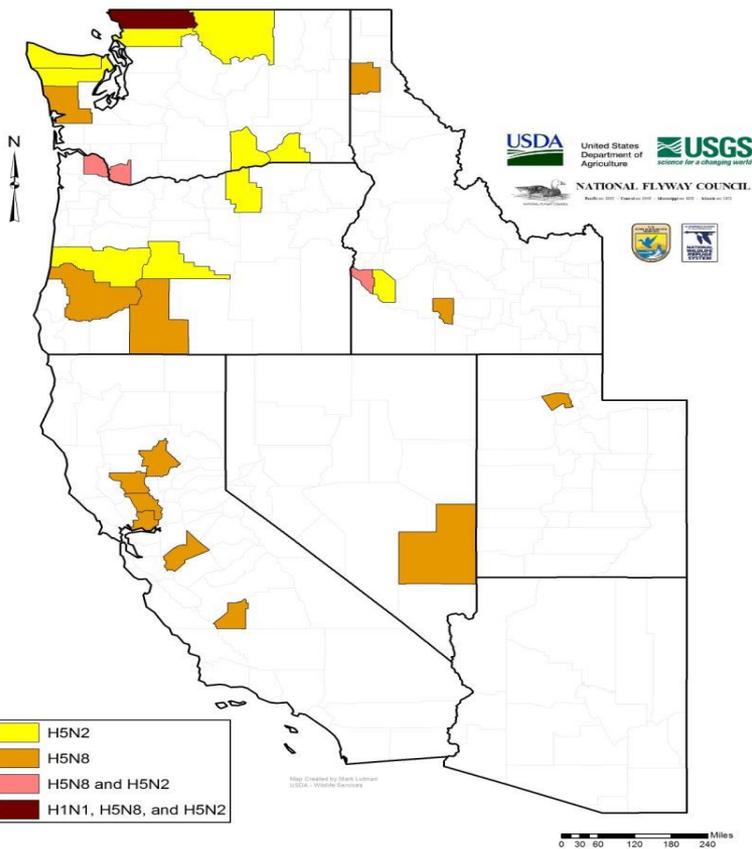
EA/AM H5N1-reassortant  
**EA-H5N8 (4 genes) / AM (4 genes)**  
A/American green winged teal/195750/Washington/2014(H5N1)



EA/AM H5N2-reassortant  
**EA-H5N8 (5 genes) / AM (3 genes)**  
A/Northern pintail/Washington/40964/2014 (H5N2) Genbank 1589662



Courtesy- Dr. Mia Torchetti USDA, NVSL



NOPI with aspergillosis  
Courtesy of  
V. Shearn-Bochsler,  
NWHC

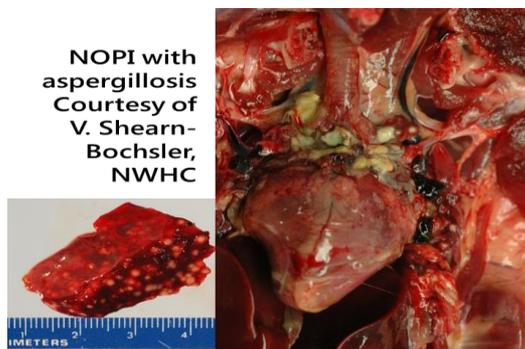
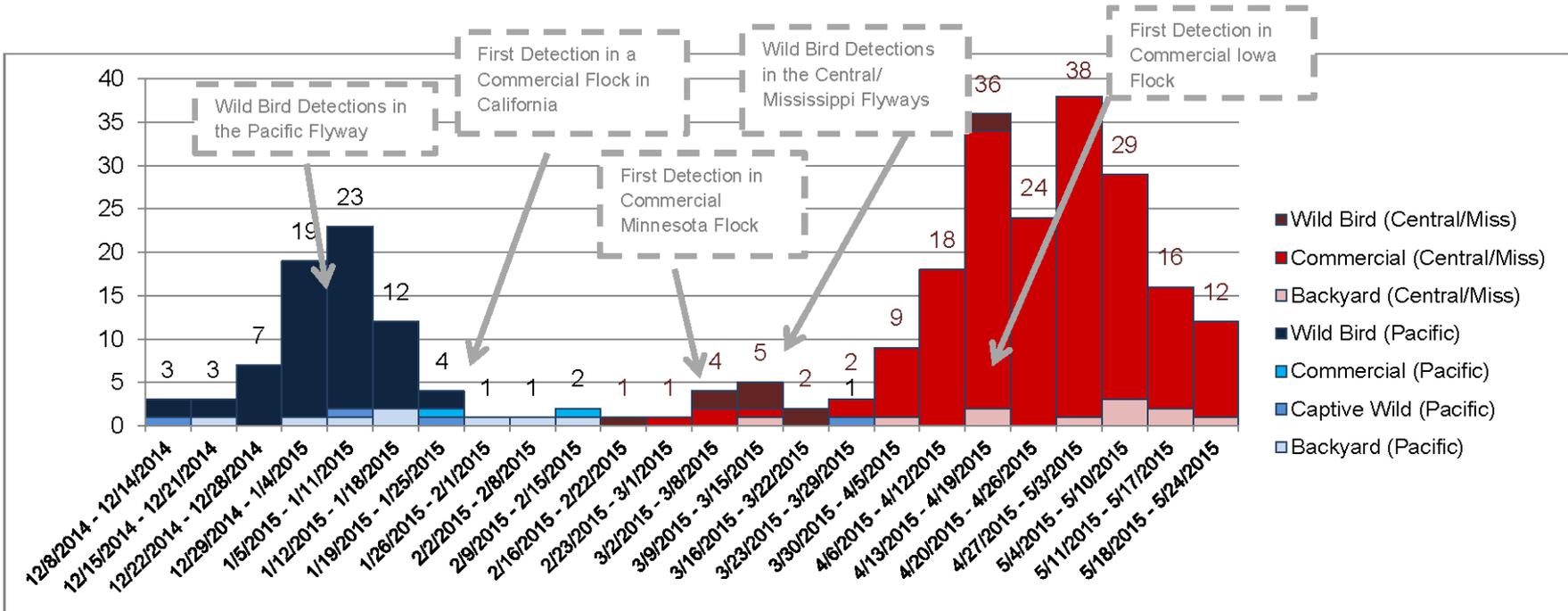


Photo Credit – Dr. L. Badcoe, WSDA

- 8 December 2014: H5N2, Northern Pintail (WA)
- 14 December 2014: H5N8 in captive reared Gyr Falcon (WA)
- 19 Dec 2015: H5N8, backyard flock (OR); H5N2 in 4 additional backyard flocks (ID, WA)
- 23 January 2015: H5N8, turkeys (CA)
- 4 March 2015: H5N2, turkeys (MN)
- 20 April 2015: H5N2, 3.8m table egg laying chickens (IA)

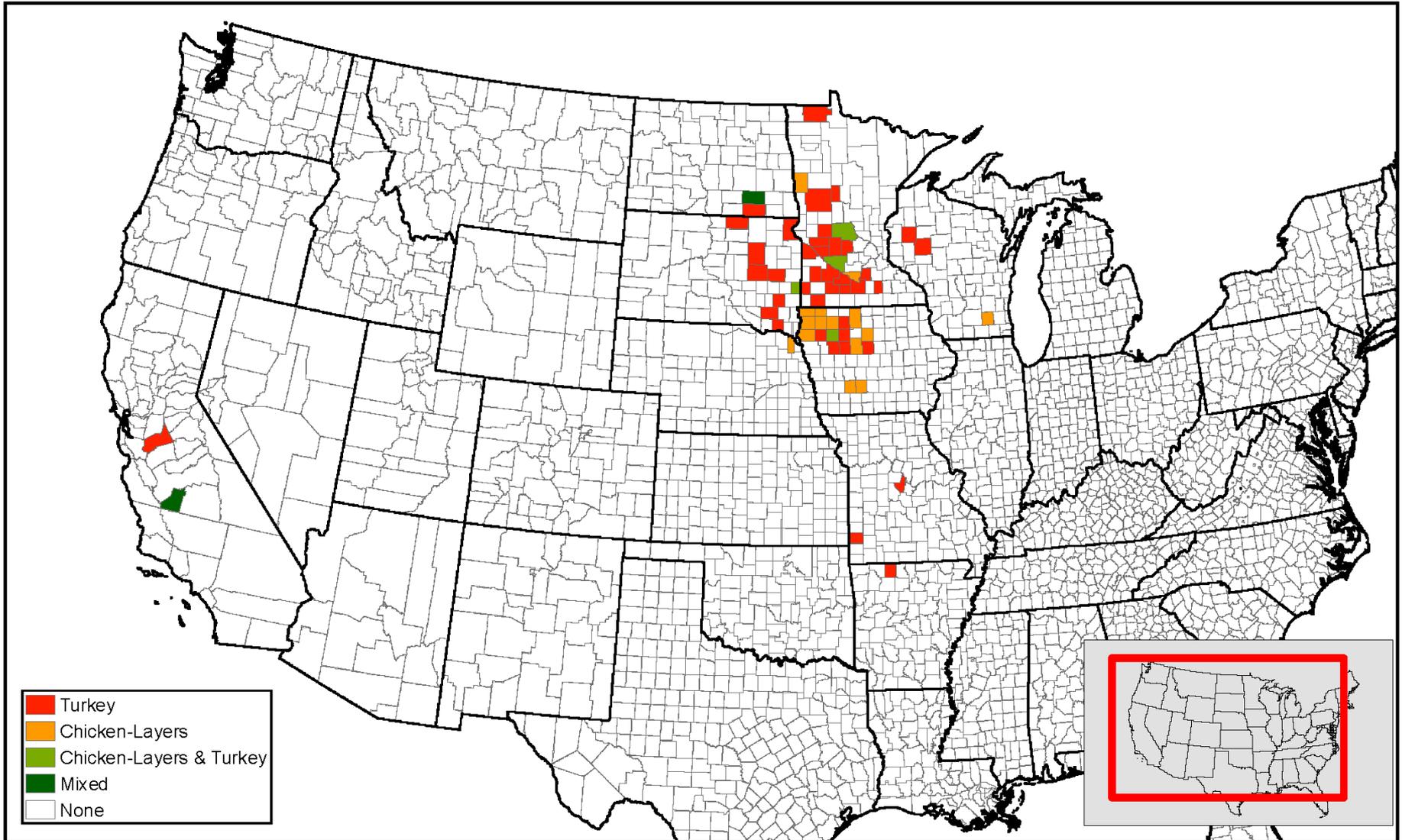


# 12/08/2015 – 6/17/2015 – H5 HPAI in Commercial Poultry, Backyard, Captive wild birds & Wild birds



- 232 HPAI H5 detections (211 commercial poultry premises, & 21 backyard flocks)
  - 211 commercial premises in 9 States = MN-109, IA-71, SD-10, WI-9, NE-5, CA-2, MO-2, ND-2, and AR-1
  - 21 Backyard Infected HPAI Premises in 11 States (ID-1, IN-1, IA-6, KS-1, MO-1, MT-1, MN-1, NE-1, OR-2, WA-5, & WI-1)

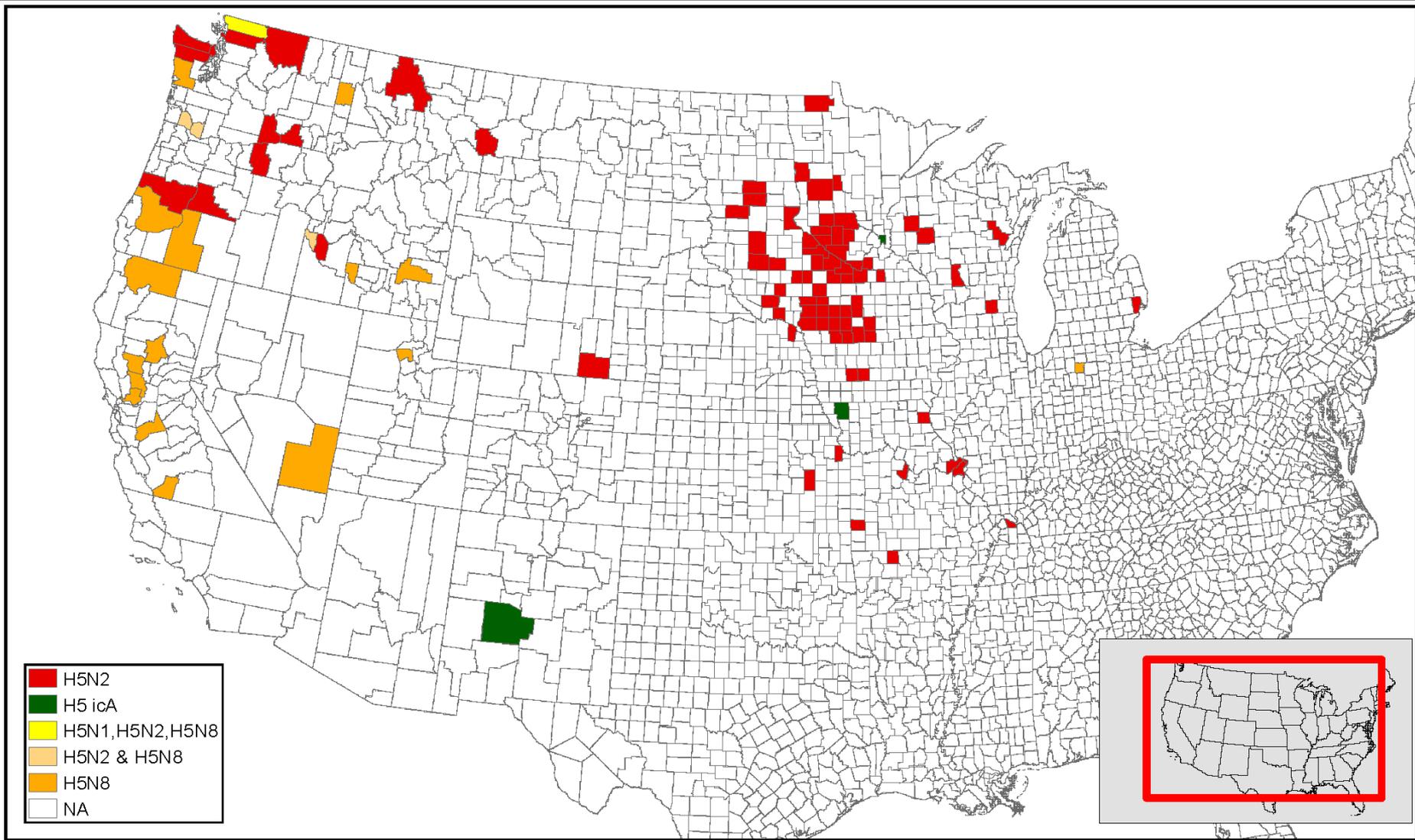
**Figure 8. HPAI Detections in Commercial Poultry, by Species, as of 8/6/2015**  
(as reported on [www.aphis.usda.gov](http://www.aphis.usda.gov)) \*one or more detections may have occurred in county



<span style="color: red;">■</span>	Turkey
<span style="color: orange;">■</span>	Chicken-Layers
<span style="color: green;">■</span>	Chicken-Layers & Turkey
<span style="color: darkgreen;">■</span>	Mixed
<span style="color: white;">■</span>	None



**Figure 9. HPAI Detections by Subtype in All Birds, as of 8/6/2015**  
(as reported on [ww.aphis.usda.gov](http://ww.aphis.usda.gov)) \*one or more detections may have occurred in county



- H5N2
- H5 icA
- H5N1, H5N2, H5N8
- H5N2 & H5N8
- H5N8
- NA





# Summary of 2014/2015 Positive HPAI Detections

*Table 1. Status of NVSL-confirmed positive and presumptive positive premises*

State	Total Commercial H5 Pos. HPAI Premises	Flock Type			H5 Pos. HPAI Backyard Premises
		Turkey	Chicken Layer-Type	Other	
Minnesota	109	104	5	0	1
Iowa	71	35	36	0	6
South Dakota	10	9	1	0	0
Wisconsin	9	6	2	1	1
Nebraska	5	0	5	0	1
California	2	1	0	1	0
Missouri	2	2	0	0	1
North Dakota	2	2	0	0	0
Arkansas	1	1	0	0	0
Kansas	0	0	0	0	1
Washington	0	0	0	0	5
Oregon	0	0	0	0	2
Montana	0	0	0	0	1
Idaho	0	0	0	0	1
Indiana	0	0	0	0	1
<b>Totals</b>	<b>211</b>	<b>160</b>	<b>49</b>	<b>2</b>	<b>21</b>

- There have been 5 detections in captive wild birds. There have been no new captive wild bird detections since 3/27/2015.
- There have been 100\* wild bird detections. The latest, confirmed on 11/18/2015, was collected from a Mallard duck in Oregon on 11/7/2015.

# 2014/2015 U.S.A. HPAI Outbreak

## Commercial poultry depopulated

	Commercial
<b>Turkeys</b>	<b>7.5 million</b>
<b>Egg Layers &amp; Pullets</b>	<b>42.1 million</b>
<b>Estimated Total</b>	<b>49.6 million</b>

### These depopulation losses represent:

- 3.16% of U.S. annual turkey production (7.46% of average U.S. turkey inventory)
- 10.01% of U.S. average layer inventory
- 6.33% of U.S. average pullet inventory
- Less than 0.01% of U.S. broiler inventory (broiler infection has been limited).

# Previous U.S. Wild Bird HPAI Surveillance

- **Samples Collected (for all agencies)**
  - U.S.D.A. Wildlife Services (WS)
  - U.S. Department of Interior (USDOI)
  - U.S. Fish and Wildlife Services (USFWS)
  - U.S. Geological Survey (USGS)



- **1 April 2006 – 31 March 2011**

- **Live and Dead bird: >390,000    Environmental (Fecal) Samples >101,500**

**Grand Total >491,500**



Courtesy- Dr. Tom Deliberto



# Summary of Detections in Wild Birds

**HPAI Strains detected: H5N8, EA/AM H5N2, EA/AM H5N1**

<b>Flyways</b>	<b>Dec 2014-June 2015</b>
<b>Atlantic</b>	<b>1,000</b>
<b>Mississippi</b>	<b>2,079</b>
<b>Central</b>	<b>539</b>
<b>Pacific</b>	<b>3,374</b>
<b>American Oceania*</b>	<b>92</b>
<b>Total Birds Sampled</b>	<b>7,084</b>
<b>Total HPAI positive cases/icA Molecular detection **</b>	<b>98 (65/33)</b>

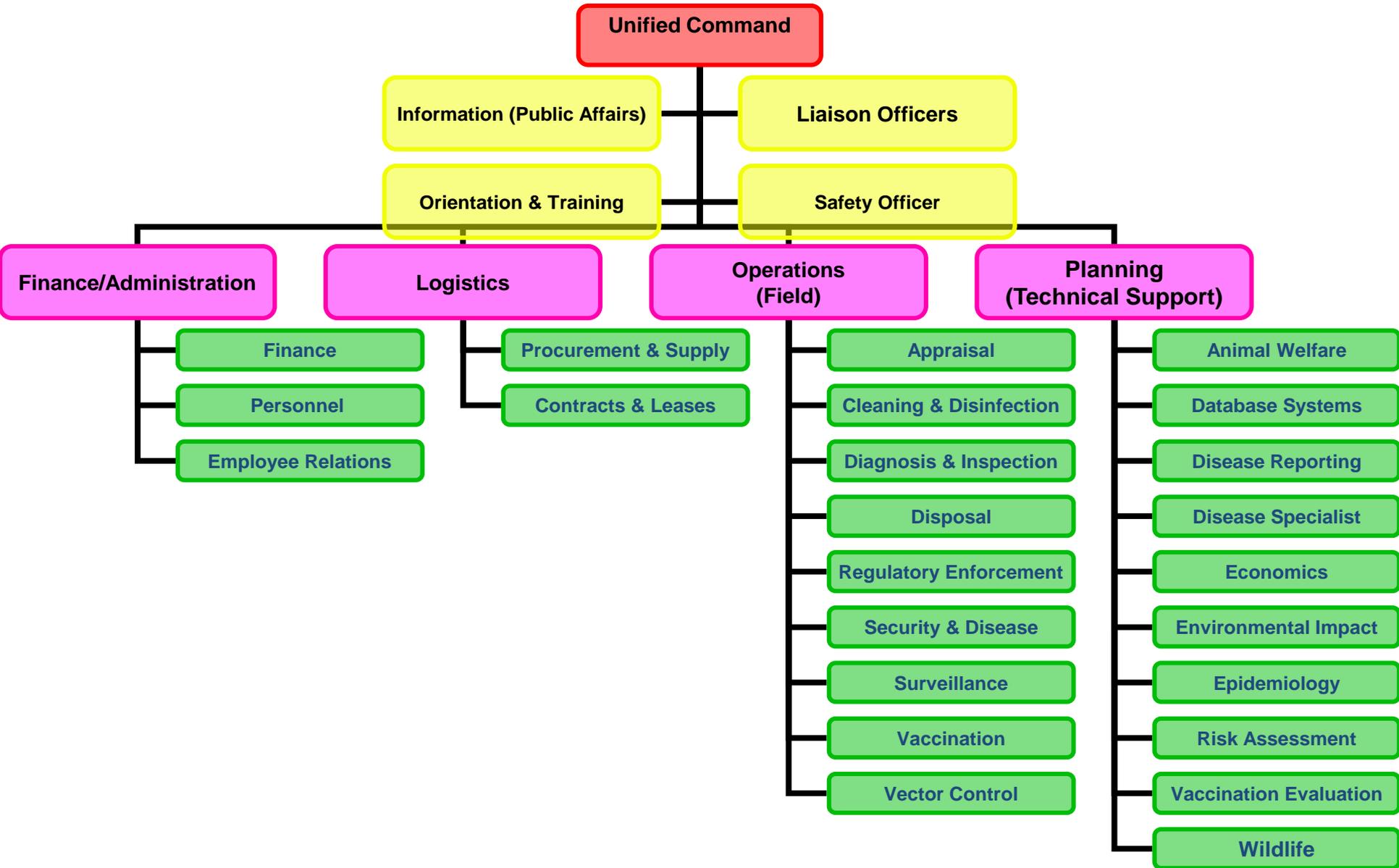
**\*American Oceania flyway consists of Hawaii, Guam, Marshall Islands, and American Samoa.**

**\*\*65 cases with HA gene sequence confirmed and 33 cases - icA molecular detection only-HA gene sequence unsuccessful/no virus isolated**



# United States – HPAI Response

## Typical Animal Emergency Response Organizational Structure at an Incident Command Post



# United States – HPAI Response

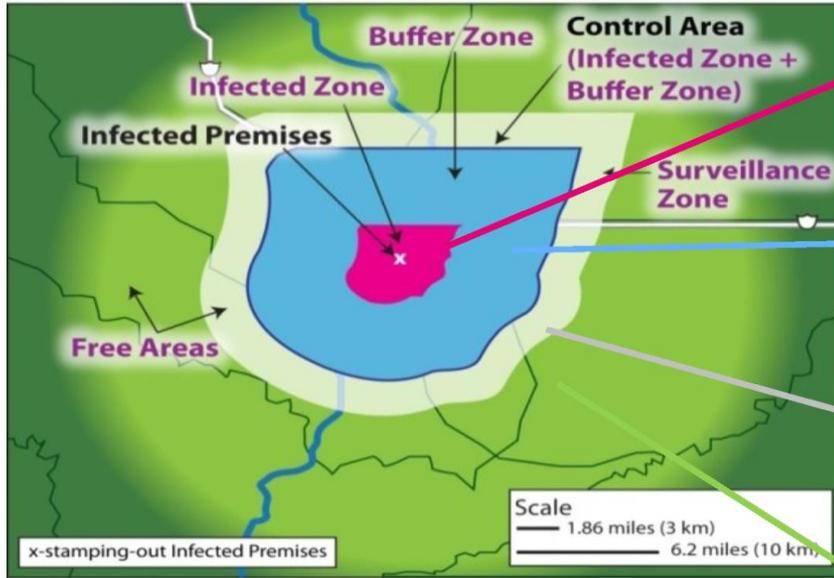
- **Rapid Diagnosis and Reporting of Confirmed Positive Premises:**
  - National Veterinary Services Laboratories (NVSL)
    - Must confirm all H5 and H7 IAV subtypes
    - OIE reference lab
  
- National Animal Health Laboratory Network (NAHLN)
  - **56** USDA approved labs across the United States Conduct initial IAV screening tests
  - Presumptive positives are sent to NVSL for confirmation



# United States – HPAI Response

## Effective Quarantine and Movement Control Measures:

- The quarantine is initiated based on presumptive positive results from the NAHLN lab
- Quarantine- Infected Premises (IPs) and Contact Premises (CPs) for backyard findings.
- Quarantine each IPs with movement controls in the 10-km control area
- **Infected Zone (IZ)**: The 3 km radius of the infected premises will be considered the infected zone
- **Buffer Zone (BZ)**: The area between 3 km and 10 km of the infected premises will be considered the buffer zone
- **Control Area (CA)**: 3-km infected zone + buffer zone
- **Surveillance Zone (SZ)**: The zone at least 10 km wide outside the border of the Control Area, extending 20 km from IP



In the **Infected Zone** (which is *part of the Control Area*), there are movement controls and surveillance activities. Infected Premises are quarantined.

In the **Buffer Zone** (which is *part of the Control Area*), there are movement controls and surveillance activities.

In the **Surveillance Zone** (which is *part of the Free Area*), targeted poultry surveillance may be conducted (i.e. commercial premises).

In the **Free Area** (which *includes the Surveillance Zone*), routine or program surveillance may occur (i.e. NPIP and wild birds).

■ Infected Zone     ■ Buffer Zone     ■ Surveillance Zone  
■ + ■ = Control Area     ■ + ■ = Free Area

Zone/Area	Definition
Infected Zone (IZ)	Zone that immediately surrounds an Infected Premises.
Buffer Zone (BZ)	Zone that immediately surrounds an Infected Zone or a Contact Premises.
Control Area (CA)	Consists of an Infected Zone and a Buffer Zone.
Surveillance Zone (SZ)	Zone outside and along the border of a Control Area.
Free Area (FA)	Area not included in any Control Area.

- Movement restrictions on all birds within 10 km around IP
- Educational materials distributed with guidance and contacts
- Owner implements enhanced biosecurity
- Strict biosecurity for truck and driver
- Strict product-specific biosecurity at origin, destination, and in transit
- Ongoing enhanced surveillance for disease within Control Zone
- Sampling continues until the control zone is released
- **Movement is by permitting only**





# United States – HPAI Response

- **9CFR Part 53- Appraisal/Indemnity/Compensation**

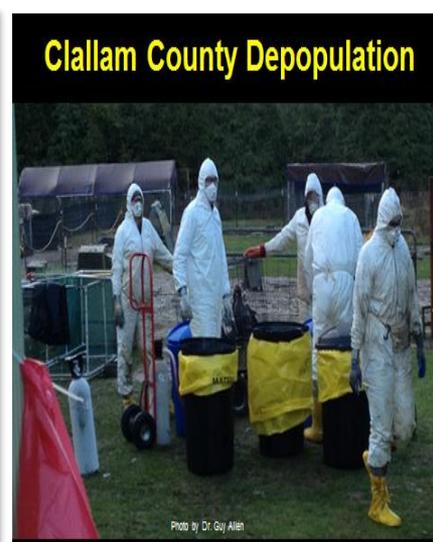
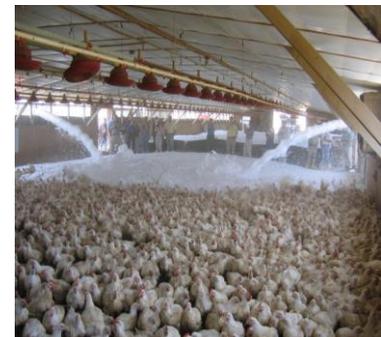
- APHIS is authorized to pay 100 percent of eligible costs:
  - Poultry or other animals infected or exposed
  - Conveyances and materials
  - Destruction of Eggs
  - Depopulation
  - Disposal
  - Cleaning & Disinfection (C&D)
  - Enhanced surveillance



# United States – HPAI Response

## Depopulation:

- Foam remains the preferred method for turkeys
- Mobile MAK Cart CO2 - depopulation was used for layers



# Kifco Foam Operations-Video



# United States – HPAI Response

## Disposal Options:

- **211 commercial premises**
  - MN-109 – 108 composting, 1 burial
  - IA-71 - composting, burial, landfill, and incineration
  - SD-10 - Burial
  - WI-9 – composting
  - NE-5 - composting
  - CA-2 - composting
  - MO-2 - composting
  - ND-2 - composting
  - AR-1 - burial



Courtesy: Ms. Lori Miller – PE/APHIS

Photo- Courtesy:  
Dr. Melissa Mase – WI DATCP

# United States – HPAI Response

## ■ Cleaning and Disinfecting:

- Dry cleaning (the removal of contaminated materials without the use of water)
- Wet cleaning (washing) - use of water and soap or detergent
- Houses and equipment inspected and documented by the State and/or Veterinary Services (VS) to ensure that cleaning removed all contaminated materials or substances and that houses and equipment are completely dry before applying disinfectant
- Disinfectants approved by Environmental Protection Agency (EPA) and selected by the State and/or VS
- **Focus on Virus Elimination = C&D**
  - 100°F and 120°F for 7 days; with at least 3 consecutive days of heating to this temperature



# United States – HPAI Response Education and Outreach



## Biosecurity for Birds Campaign

- Aimed at backyard flock and pet bird owners
- Reaches diverse audience through print materials, website, radio and local cooperative
- Don't wait. If your birds are sick or dying
- Report Sick Birds To:
  - Your local cooperative extension office/agent
  - Your veterinarian
  - The State veterinarian or State animal/poultry diagnostic laboratory
  - Or, call USDA's Animal and Plant Health Inspection Service (APHIS) toll free at [1-866-536-7593](tel:1-866-536-7593), and we'll put you in touch with a local contact. There is no charge for a disease investigation, if one is needed.



**LOOK**  
for Signs



**REPORT**  
Sick Birds



**PROTECT**  
Your Birds

# United States – HPAI Response

- **Logistics and Mobilization of Resources - National Veterinary Stock (NVS) Pile - 24 Hour Push Pack:**
  - Contains PPE and decontamination supplies.
  - Deploys within 24 hours of APHIS' approval.
  - Each push packs contains sufficient personal protective equipment and decontamination supplies to support 10 responders changing protective suits 6 times per day for 10 days.
  - Arrival will precede additional items necessary to continue supporting the response.
  - NVS contracts for emergency transport of samples, supplies, anti-virals, vaccines onsite in 24 hours



# Movement Controls Measures For Poultry and Poultry Products - Continuity of Business

- **Secure Poultry Supply Plans**
- Plans have strict requirements for moving ALL products including hatching eggs and chicks
  - Epidemiology
    - Complete assessment of premises of origin
    - No clinical signs of illness can be present in the flock of origin
    - No dangerous contacts/No epidemiological link
  - Testing
    - Multiple negative RRT-PCR tests
    - At least one RRT-PCR test on day 2 or later of the movement hold period
  - Traceability
    - Know where the hatching eggs or chicks or poults are going (premises ID, GPS coordinates, etc.)
    - Known movement route (ensure no movement within specified distance of infected premises)

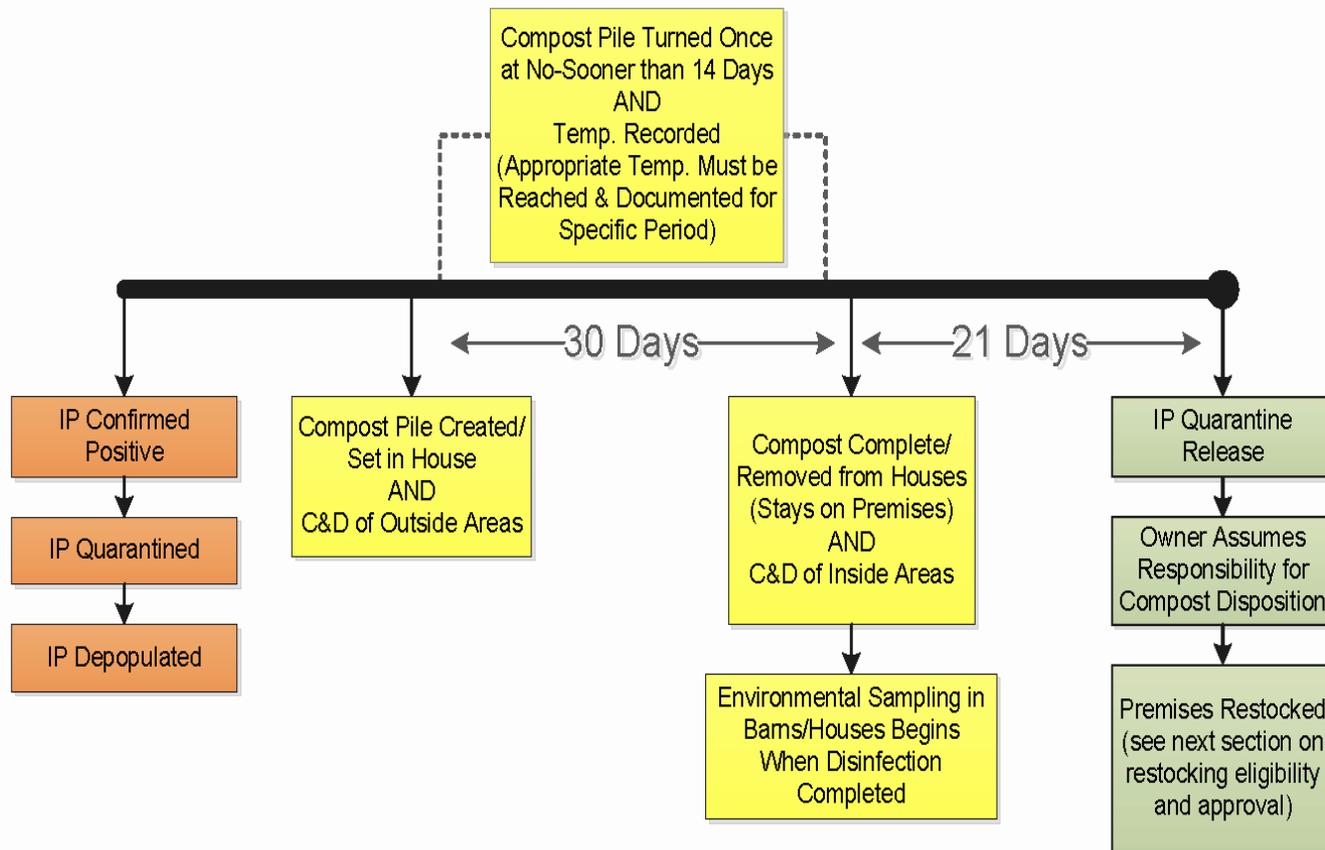


# Movement Controls Measures For Poultry and Poultry Products - Continuity of Business

- **Secure Poultry Supply Plans**
- Biosecurity
  - Strict biosecurity for truck and driver
  - Strict product-specific biosecurity at origin, destination, and in transit
  - Standard operating procedures (SOPs)
    - Regulations (NPIP, FDA, FSIS, APHIS)
    - Good manufacturing practices
  - All steps must be followed
- Permitting
  - All other conditions met
  - Permitting officials satisfied no risk exists
- Movement delay with testing
  - Minimum of two day hold after permit issued
  - Additional RRT-PCR negative test

# United States – HPAI Response - Restocking

Figure 1. Timeline for Disposal & Premises Restocking:  
IN-HOUSE COMPOSTING



# Epidemiology

- Initial introduction - wild birds (waterfowl)
- Maintenance
  - Fomites
    - People, equipment, feed
      - Lapses in biosecurity
  - Other possible contributors
    - Rodents
    - Wind



▪ While there does not seem to be a single source of transmission, there is a common solution:

## ▪ **Better and Stringent Biosecurity**

- Premises, Equipment, Personnel, Visitors, Vehicles

# Emergency Funding, Cost and Impacts on Trade

- **Economic Losses:**
  - Direct: \$1.6 billion.
  - Economy-wide: \$3.3 billion.
- **Federal taxpayer:**
  - ~\$990 Million (\$200 M indemnity; \$600 M other response costs).
- **Trade Impact:**
  - **Entire US restricted**
    - 18 trading partners
    - Valued at \$898 million in 2014 – about 14 percent of trade
    - China (\$391 million), Russia (\$153 million), and South Korea (\$123 million)
  - **Accept zones/regions**
    - State, county, zone
    - 38 trading partners
    - Valued at \$4.5 billion in 2014 – about 69 percent of trade
  - **No restrictions (?)**
    - 100 other trading partners
    - 17 percent of the value of 2014 exports.



# USDA ARS Preliminary Research Studies

- Chickens and turkeys infected with these viruses might not die for several days but they are still shedding virus.
  - Longer time of death than historic H5N1 HPAIV
- Initially the early two H5 strains (2.3.4.4 HPAIV) were not well adapted to gallinaceous birds but later the H5N2 HPAI viruses are more adapted to chickens and turkeys
- These viruses are well adapted to Mallards and most likely to other wild domestic waterfowl
- These viruses do not produce the respiratory clinical signs seen with other HPAIVs
- More restricted virus replication and lesions
- Susceptibility:
  - **Guinea fowl > Mallards > Pheasants, Partridge, Pekin ducks > Japanese Quail > Turkeys > Chickens**
- Virus is being moved through wild waterfowl
  - With domestic ducks likely asymptomatic carriers

# Veterinary Services

## Overview of 2016 H7N8 HPAI/LPAI Incident

U.S. Department of Agriculture  
Animal and Plant Health Inspection Service  
Veterinary Services



# 2016 Confirmed HPAI Detection

- APHIS confirmed H7N8 HPAI in a turkey flock in Indiana on January 15, 2016
- First commercial HPAI detection since June 2015
- The total number of confirmed premises for highly pathogenic avian influenza (HPAI) is one



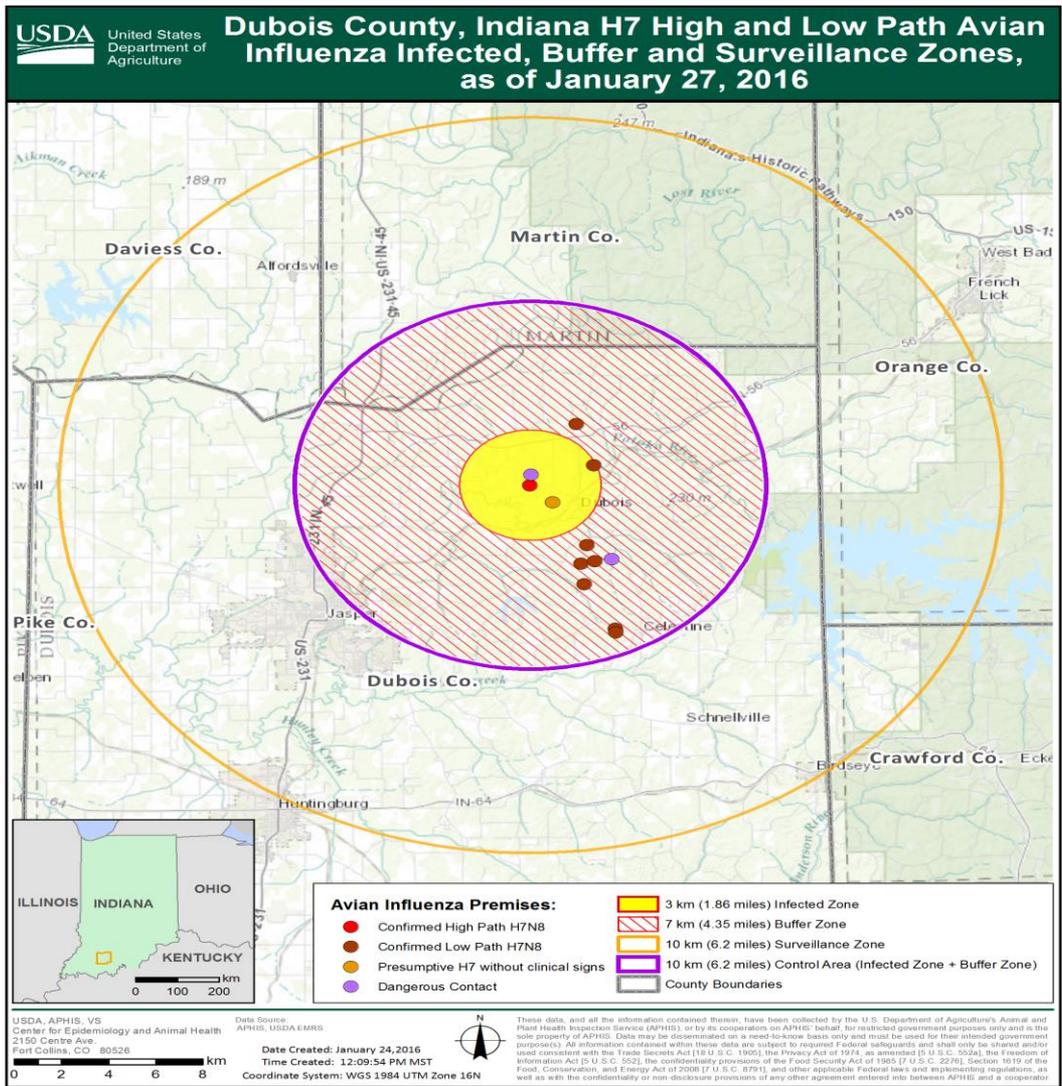
# LPAI Cases



- Nine LPAI cases in the surveillance area without clinical signs detected January 16, 2016
  - Eight of these confirmed to have H7N8 LPAI
- All cases depopulated as quickly as possible as of 1/20/2016

# 2016 HPAI/LPAI Detections

- The index case of H7N8 HPAI and subsequent detection of H7N8 LPAI, are of North American wild bird lineage with high similarity to other wild bird viruses from Midwest and western states between 2011 and 2013 available in the public database.
- The LPAI and HPAI viruses are nearly identical (>99%) across all eight genes excluding the 9nt insertion at the cleavage site. Both the H7N8 HPAI and LPAI are also highly similar across 6 of 8 gene segments to a recent wild bird detection H7N8 LPAI in Kentucky
- North American H7N8 LPAI virus has been detected previously in wild bird surveillance in the United States, but this is the first instance of H7N8 HPAI virus detection in any species.



**No positive or presumptive positive premises have been identified since January 16, 2016**

# Lessons Learned - Diagnostics



- The challenges related to diagnostics for HPAI are greater than they may be for other diseases because the disease is so virulent.
- Diagnostic infrastructure was straining to keep up with the demand for results.
  - Trained Technicians
- **Initiate depopulation based on positive pen-side testing result (Implementing antigen capture immunoassay) and meeting HPAI case definition - if clinical signs are present**



# Lessons Learned - Depopulation

- Logistically we were not prepared for depopulating so many birds at so many premises in such a short time.
- Often, depopulation took longer than 24 hours and in a few instances as long as 10 days.
- Need to Look at new methods for table-egg layers
  - 1,000 to 10,000 times more virus when bird are allowed to die before they are killed vs were birds are killed before they die or have any mortality to speak off (Dr. Dave Halvorson)
- **Foam Unit Enhancements: 55 Gallon Heating Blankets, 400,000 BTU heaters, Magnetic Block heaters, 55-Gallon Drum Agitator Insulation Wrap**



# Lessons Learned - Depopulation

## MAK Trailer - Prototype

*Coming Soon*



- Portable gassing system for small flock capacity
- 300 broilers; 440 layer hens; 80 turkey (hens)
- Stainless steel construction
- Transport by half-ton vehicle
- Dynamic top loading
- Dumping capability for easy disposal

# Lessons Learned - Depopulation

## Whole House CO2



### Distribution Manifold

- Liquid CO2 delivered from tanker to this manifold
- Connects to 4 dosing manifolds



### Dosing Manifolds

- Deliver CO2 gas to poultry barn
- Four manifolds spaced at the ends of the barn

# Lessons Learned - Depopulation

- Implement 24 hour performance measure for depopulation.
  - **Goal is to depopulate within 24 hours**
  
- Explore additional options for depopulation and determine levels of support
  - It is our responsibility to at least explore the possibility of new methods.
    - **Ventilation shutdown/ heat-assisted depopulation**
  
- Inventory equipment for depopulation and disposal and consider re-positioning based on results.
  - Companies with the equipment
  - Expertise to use foaming techniques.
  - Determining what resources are needed and available to depopulate large numbers of birds and where the additional resources can be obtained.

# Lessons Learned - Disposal

- Composting
  - Not enough Foaming Units
  - Water
  - Training
- Landfill
  - Producers and growers were sometimes unable to execute disposal plans
    - Due to changes in the attitude of local landfills
    - Due to issues around transporting infected materials to local landfills
    - Attitudes/Lack of understanding/ Fear/Business Model
- Incineration
- Burial
- **Rendering!!!!**
- Need additional methods





# Lessons Learned Cleaning and Disinfection



- A lack of definitive guidance about the best way to clean and disinfect a building after depopulation
- Easy to clean a commercial turkey production facility - we can dry clean it, wash it, and disinfect it.
- A layer facility is a whole different story.
  - Proper dry cleaning may not be possible
  - Too expensive
  - Wet cleaning could damage equipment?
- What is clean
  - Rather than focusing on cleaning, we should focused on the end result: **focus on virus elimination = C&D**
  - Environmental testing will ensure that the virus has been eliminated before any operation is approved to restock.



# Lessons Learned

## Cleaning and Disinfection – Backyard Premises



- Follow the facility for 120-180 days
  - Allow time for the virus to be eliminated by sun light and a lack of hosts

# Final notes...

- **There have been no human illnesses associated with the H5N8 or H5N2 viral strains of avian influenza anywhere in the world, to date.**
- We have no Avian Influenza viruses circulating in commercial poultry.
- There has never been a documented case of anyone contracting an influenza virus from a commercial poultry product.
- Poultry products in the US continue to be safe to eat.

# Internet Resources

- FAD PReP
  - Google it!
  - All HAPI resources, forms and SOPs
- World Organization for Animal Health (OIE)
  - [www.oie.int](http://www.oie.int)
- USAHA Foreign Animal Diseases – “The Gray Book”
  - [www.vet.uga.edu/vpp/gray\\_book/index](http://www.vet.uga.edu/vpp/gray_book/index)
- World Health Organization
  - [www.who.int](http://www.who.int)
- CDC – Centers for Disease Control and Prevention
  - Avian influenza (bird flu) home page
    - [www.cdc.gov/flu/avian](http://www.cdc.gov/flu/avian)
- U.S. Department of Agriculture
  - Biosecurity for the birds
    - [www.aphis.usda.gov/vs/birdbiosecurity](http://www.aphis.usda.gov/vs/birdbiosecurity)
  - Avian influenza
    - [www.aphis.usda.gov/vs/birdbiosecurity/hpai.html](http://www.aphis.usda.gov/vs/birdbiosecurity/hpai.html)

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[www.aphis.usda.gov](http://www.aphis.usda.gov)

Thank you for your attention!

Questions?