



Avian (Zoonotic) Influenza H5N1

February 27, 2025

Julie Breher, DVM MPVM

County of San Diego

Public Health Laboratory Veterinarian



Presentation Goals



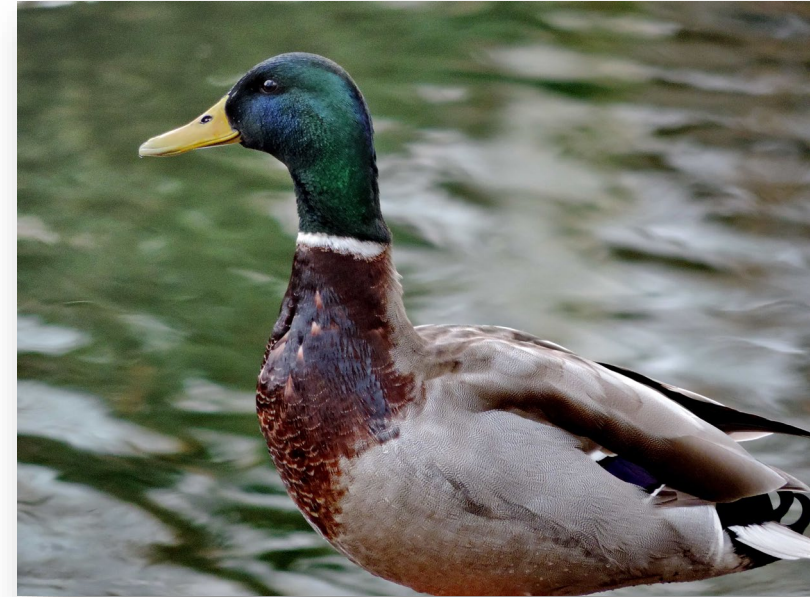
AI generated image of “avian” + “influenza” + “goals”

- History of Avian Influenza
- Overview of situation in U.S.
- National Milk Testing Strategy Summary
- Recent D1.1 genotype spillover events
- Domestic Cats
- County of San Diego Influenza Project



Avian Influenza Virus: General Overview

- 4 types
 - A, B, C, & D
- Flu A subtypes (e.g., H1N1, H3N2, H5N1, etc.)
 - H (18 total)
 - N (11 total)
 - Human seasonal subtypes: A(H1N1) & A(H3N2)
- Further subdivision
 - Clades or groups (e.g., 2.3.4.4b)
 - Genotypes (e.g., B3.13, D1.1, D1.2, etc.)
- Numerous different H & N subtype combinations
 - >130 have been identified
 - Primarily from wild birds (endemic in waterfowl)
- Highly Pathogenic (HPAI) vs. Low Pathogenic Avian Influenza
 - Describes domestic poultry pathogenicity only (of great animal welfare & economic concern)
 - Not relevant to severity of human disease
 - Globally, LPAI viruses have caused the greatest number of human infections



Avian Influenza A (H5N1) - History

- 1996: Influenza A H5N1 (A/goose/Guangdong/1/1996) first detected in Southern China
 - Domestic waterfowl, poultry outbreaks
 - 18 cases in people (associated with infected birds) with 6 deaths in Hong Kong in 1997
 - 1997-present: Sporadic human infections globally (China, Vietnam, Ecuador, Cambodia, and others)
- 2021-2022: New H5N1 virus belonging to clade 2.3.4.4b emerged in Canada and the United States in wild birds
 - February 2022: Virus started causing outbreaks in US backyard poultry and commercial flocks
 - 2021-present: Spillover has occurred to numerous wild mammal species including bears, marine mammals, wild carnivores (foxes, racoons, mountain lions, bobcats), squirrels, mice, and more
- 3/2024: H5N1 clade 2.3.4.4b genotype B3.13 reported in dairy cows & farm cats in Kansas & Texas
- 4/2024: First cow-to-human spread of H5N1 B3.13 documented in farmworker (dairy)
- **2/5/2025: Announcement of first spillover detection of H5N1 D1.1 in Nevada dairy cattle**
- **2/10/2025: Announcement of first human detection of H5N1 D1.1 in Nevada dairy worker**
 - **Mild conjunctivitis, not hospitalized, confirmed recovered**
- **2/13/2025: Announcement of second spillover detection of H5N1 D1.1 in Arizona dairy cattle**
 - **Unrelated to both the 3/2024 B3.13 AND 2/5/2025 D1.1 spillover event**



https://www.cdc.gov/bird-flu/avian-timeline/2020s.html?CDC_AAref_Val=https://www.cdc.gov/flu/avianflu/timeline/avian-timeline-2020s.htm

<https://www.aphis.usda.gov/sites/default/files/dairy-cattle-hpai-tech-brief.pdf>

<https://www.centralnevadahd.org/community-alerts-2/>

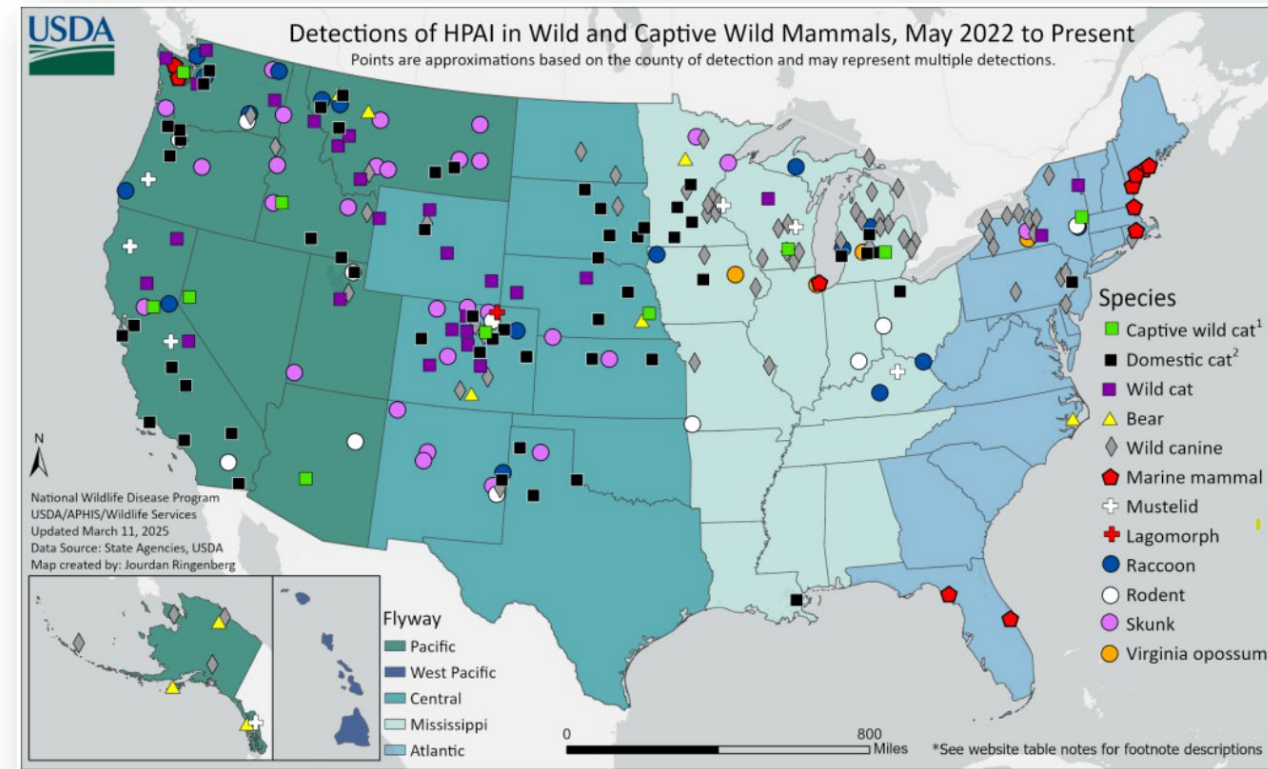
<https://www.aphis.usda.gov/news/program-update/aphis-identifies-third-hpai-spillover-dairy-cattle>



LIVE WELL
SAN DIEGO

Avian Influenza A (H5N1) – Current Situation in U.S.

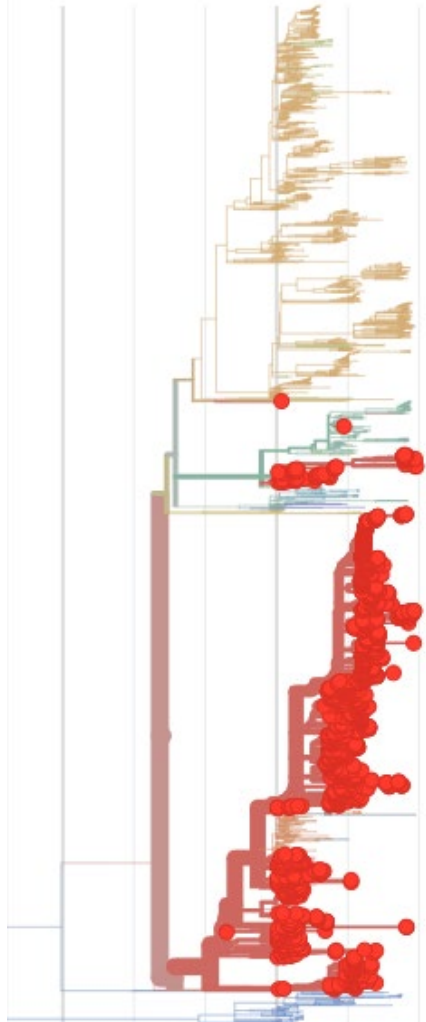
- As of 3/18/2025:
- Dairy cattle: **989** confirmed positive herds across 17 states (755 in California)
- Poultry: Over **166** million commercial poultry have died/been culled since 2/8/2022
- Wild birds: **12,581** confirmed detections across all 50 states
- Other mammals: Numerous detections in multiple species (domestic cats and wild mammals) in most states (see map)
- Human cases: **70** identified human infections; **1** death associated w/ H5N1 (Louisiana)
- Wastewater: Numerous H5 detections across the country



LIVE WELL
SAN DIEGO

<https://www.aphis.usda.gov/livestock-poultry-disease/avian/avian-influenza/hpai-detections/mammals>
<https://www.aphis.usda.gov/livestock-poultry-disease/avian/avian-influenza/hpai-detections/commercial-backyard-flocks>
<https://www.aphis.usda.gov/livestock-poultry-disease/avian/avian-influenza/hpai-detections/wild-birds>
<https://www.aphis.usda.gov/livestock-poultry-disease/avian/avian-influenza/hpai-detections/hpai-confirmed-cases-livestock>
<https://www.cdc.gov/bird-flu/situation-summary/index.html>

Avian Influenza A (H5N1) – Note About Genotype



- B3.13 is responsible for
 - Infections in dairy cattle prior to 2/5/2025
 - The infections in poultry in facilities close in proximity to infected dairy cattle operations
 - The infections in humans exposed to those infected poultry and dairy cattle
- D1.X (D1.1, D1.2, and D1.3) is responsible for
 - The severe infection and death of the Louisiana human case (D1.1)
 - The severe infection in the now-recovered British Columbia human case (D1.1)
 - Several poultry outbreaks and humans exposed to poultry and wild birds
 - Two backyard pigs in Oregon (D1.2)
 - ***Infection in at least 2 Nevada dairy herds and at least 1 farmworker on one of the infected dairies (D1.1)***
 - ***Infection in one (1) Arizona dairy herd (D1.1)***
 - ***Infection in an Ohio poultry worker (D1.3)***

<https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Bird-Flu.aspx>

https://www.cdfa.ca.gov/AHFSS/Animal_Health/HPAI.html

https://www.cdfa.ca.gov/ahfss/Animal_Health/Avian_Influenza.html

<https://lacounty.gov/2024/12/24/public-health-warns-against-feeding-pets-raw-food-following-h5-bird-flu-virus-detection/>

<https://www.cdph.ca.gov/Programs/OPA/Pages/NR24-044.aspx>

https://nextstrain.org/avian-flu/h5n1/ha/2y?dmin=2019-03-25&f_country=Usa

CDC A(H5N1) Bird Flu Response Update March 19, 2025 | Bird Flu | CDC



LIVE WELL
SAN DIEGO

National Milk Testing Strategy (NMTS)

- Both D1.1 spillover events detected via NMTS program
- USDA Federal Order announced on 12/6/2024:
 - Mandates that any entity that sends or holds milk for pasteurization (such as a dairy farm, bulk milk transporter, bulk milk transfer station, or dairy processing facility) provide raw (unpasteurized) milk samples for influenza A testing to USDA's Animal and Plant Health Inspection Service (APHIS), upon request.
- Therefore, NMTS does **not** cover milk for use in raw consumer products (e.g., raw milk, raw cheese, etc.).
- State departments of agriculture can mandate raw milk dairy farm testing (e.g., California Dept. of Food and Agriculture mandates weekly testing)
- Built on the backbone of the long-standing and pre-existing drug residue testing system



<https://www.aphis.usda.gov/livestock-poultry-disease/avian/avian-influenza/hpai-detections/livestock/nmts>

<https://www.aphis.usda.gov/sites/default/files/20241205-federal-order-final.pdf>

[https://www.cdfa.ca.gov/AHFSS/Animal Health/docs/hpai h5n1 in livestock questions and answers.pdf#:~:text=Are%20raw%20milk%20dairies%20required%20to%20test%20cattle%3F,regular%20intervals.%20Follow%20the%20testing%20protocol%20located%20here](https://www.cdfa.ca.gov/AHFSS/Animal%20Health/docs/hpai_h5n1_in_livestock_questions_and_answers.pdf#:~:text=Are%20raw%20milk%20dairies%20required%20to%20test%20cattle%3F,regular%20intervals.%20Follow%20the%20testing%20protocol%20located%20here)

[0dairies%20required%20to%20test%20cattle%3F,regular%20intervals.%20Follow%20the%20testing%20protocol%20located%20here](https://www.cdfa.ca.gov/AHFSS/Animal%20Health/docs/hpai_h5n1_in_livestock_questions_and_answers.pdf#:~:text=Are%20raw%20milk%20dairies%20required%20to%20test%20cattle%3F,regular%20intervals.%20Follow%20the%20testing%20protocol%20located%20here)



National Milk Testing Strategy (NMTS)

- Five (5) Stage Strategy:
 - **Stage 1 - National Plant Silo Monitoring**: Conducting nationwide testing of milk silos at dairy processing facilities to identify where the disease is present, monitor trends, and help States identify potentially affected herds.
 - **Stage 2 - Determining State Status**: Working with States to stand up bulk milk sampling programs to identify herds that are affected with H5 or demonstrate an unaffected status.
 - **Stage 3 - Detecting and Responding to the Virus in Affected States**: Identifying specific cases and implementing rapid response measures, including enhanced biosecurity, movement controls, and contact tracing, in States with H5 detections.
 - **Stage 4 - Demonstrating H5 Absence in Unaffected States**: Continuing and progressively reducing sampling of bulk milk as the State demonstrates continual unaffected status.
 - **Stage 5 - Demonstrating H5 Freedom in U.S. Dairy Cattle**: Conducting periodic sampling and testing to illustrate long term absence from the national herd.

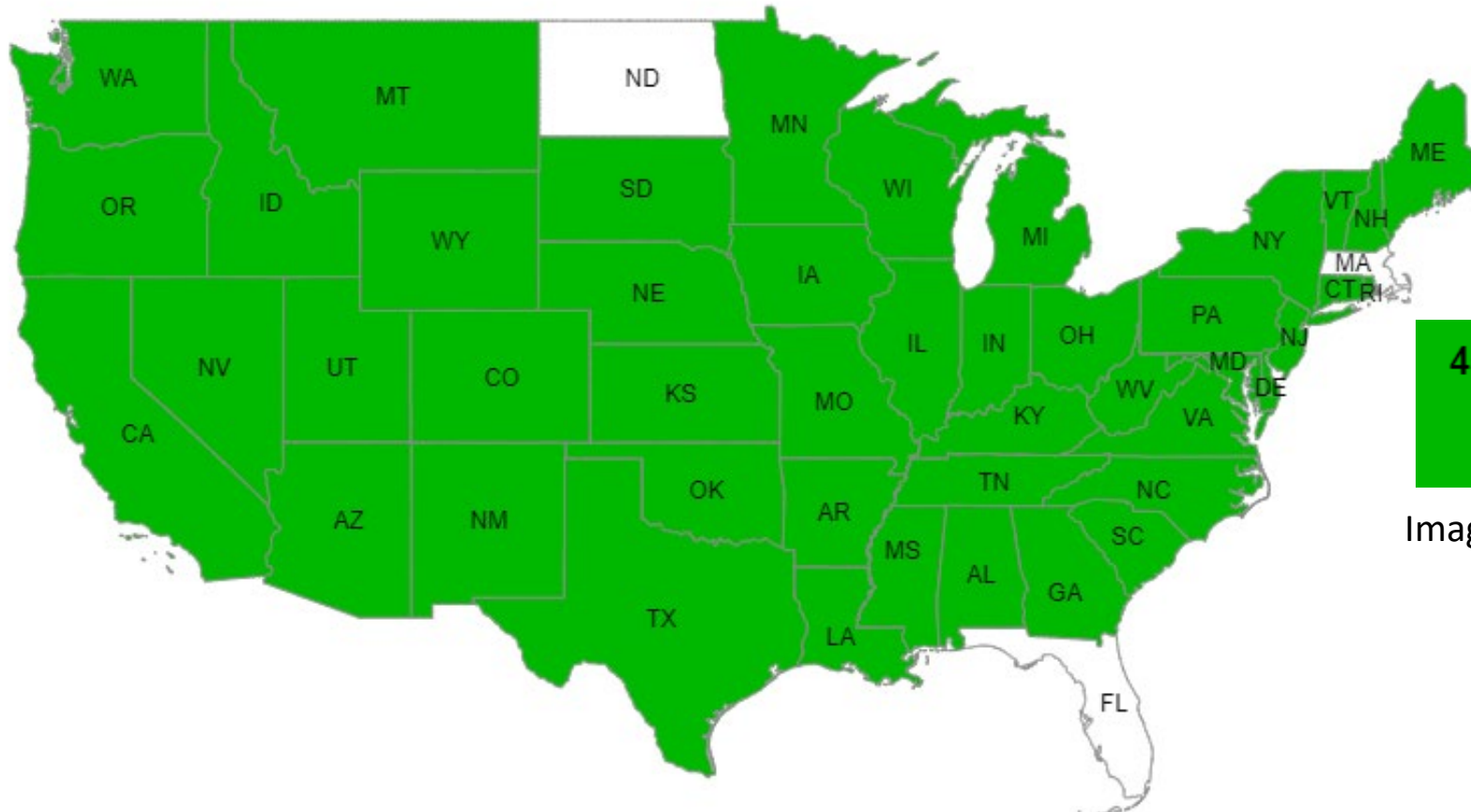


National Milk Testing Strategy

Map Legend

□ Not Enrolled in NMTS

■ Enrolled in NMTS



**45 States Enrolled in the
NMTS and Performing
Active Surveillance**

Image Dated March 14, 2025



LIVE WELL
SAN DIEGO

National Milk Testing Strategy (NMTS)

- **State Status Definitions**

- **Provisional Unaffected:** As each State phases into the NMTS, the State's status will be Provisional Unaffected, unless a new case of HPAI in dairy cattle has been confirmed in the State within the last 30 days or testing and surveillance activities demonstrating disease absence of H5 in dairy cattle herds in the State have not yet been completed.
- **Unaffected:** Ongoing testing and surveillance activities demonstrate absence of disease in dairy cattle in the State.
- **Affected:** Ongoing testing and surveillance activities demonstrate presence of disease in dairy cattle in the State.



LIVE WELL
SAN DIEGO

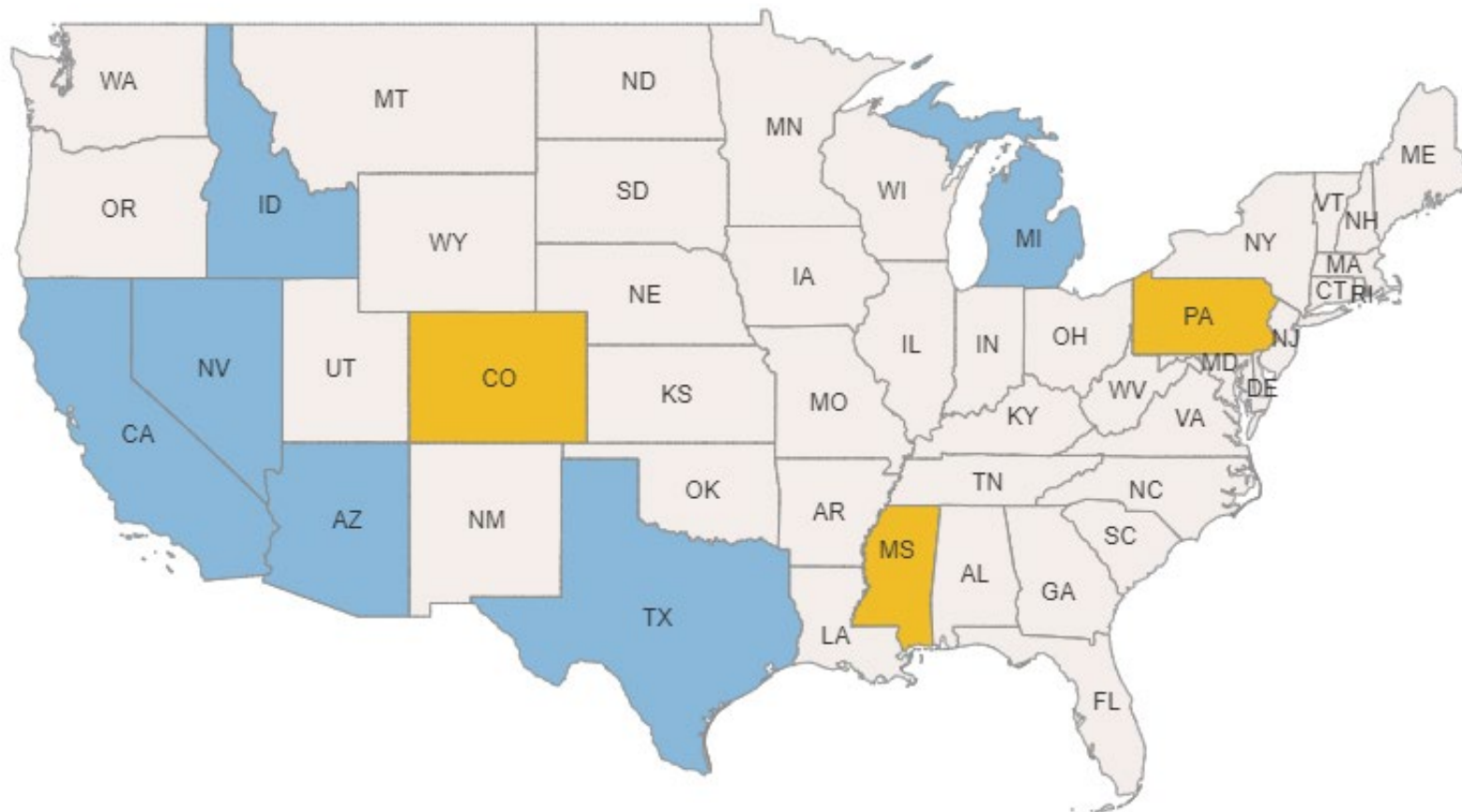
National Milk Testing Strategy



☐ Provisional Unaffected

■ Affected

■ Unaffected



3 States are Unaffected

39 States are Provisionally Unaffected

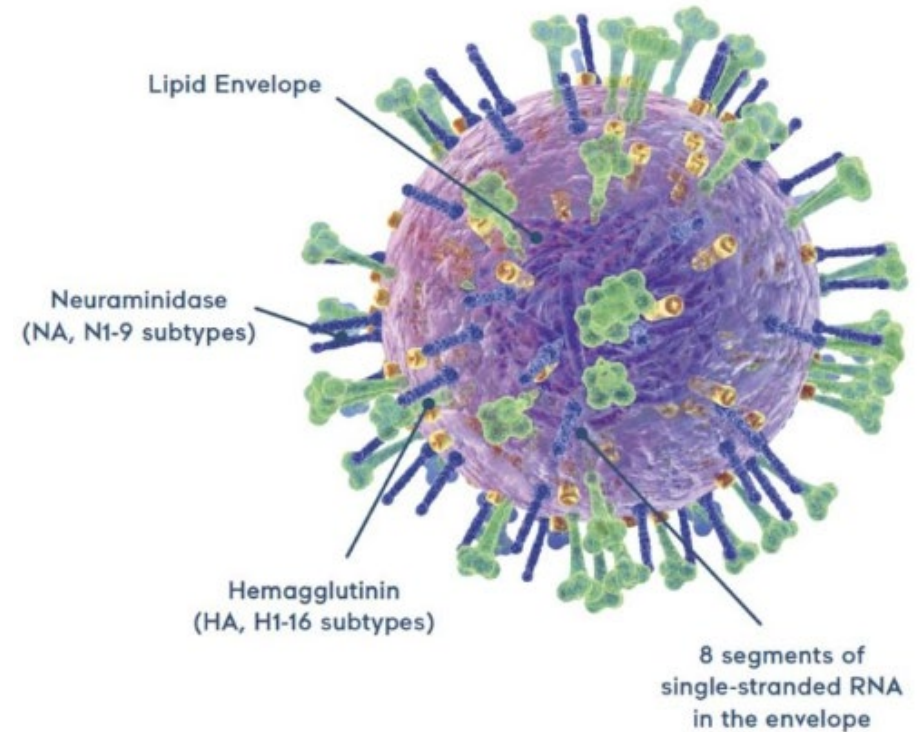
Image Dated March 14, 2025



LIVE WELL
SAN DIEGO

Avian Influenza D1.1 Spillover into Cattle – What We Know

- USDA Technical Brief on Nevada D1.1 Dairy Cattle Spillover Event:
 - [The Occurrence of Another Highly Pathogenic Avian Influenza \(HPAI\) Spillover from Wild Birds into Dairy Cattle](#)
 - Analysis of HA gene did not identify changes predicted to impact infectivity or adaptation to mammalian hosts
 - Analysis of polymerase gene (PB2 D701N) did reveal a change associated with improved replication efficiency in mammalian cells – this has also been described in some previous HPAI H5 human cases
 - No evidence of person-to-person transmission at this time
- 2/13/2025: USDA APHIS NVSL confirmed by WGS detection of HPAI H5N1 clade 2.3.4.4b, genotype D1.1 in dairy cattle in AZ
 - Followed an initial detection on silo testing under the [USDA's National Milk Testing Strategy](#) (NMTS)
 - Confirmation was a result of state tracing and investigation



LIVE WELL
SAN DIEGO

<https://www.aphis.usda.gov/sites/default/files/dairy-cattle-hpai-tech-brief.pdf>

<https://www.centralnevadahd.org/community-alerts-2/>

<https://www.aphis.usda.gov/news/program-update/aphis-identifies-third-hpai-spillover-dairy-cattle>

Avian Influenza D1.1 Spillover into Cattle – What We Don't Know

- Is D1.1 more pathogenic in cattle, humans, other animals?
 - Scant evidence in cattle and humans – is following similar pattern as B3.13, so far
 - D1.1 is current predominant genotype in migratory wild birds
- [Studies](#) show that cattle have the potential to generate good immunity to B3.13:
 - Will any existing immunity prove protective for the D1.1 genotype?
 - Will this trigger a new outbreak?
 - Will vaccines for cattle (+/- birds) induce immunity for both genotypes? Future new genotypes? Clades? Subtypes?
- Two independent D1.1 spillovers in dairies in under a month (D1.1 is predominant genotype in migratory birds at present):
 - Is there something about D1.1 that is more likely to jump to mammals or is it just the current high quantity in the avian reservoir?
 - Will there be additional spillovers in the future?
- What effect will this have on the poultry and other animal industries?



H5N1 and Cats

- Early in dairy outbreak, cats were recognized to have severe illness concurrently with affected cattle
- Cats are highly susceptible to Influenza A (H5N1) - typically obvious signs
 - Severe neurologic abnormalities
 - Severe respiratory abnormalities
 - Death in many/most cases
- Exposure routes
 - Contaminated raw milk
 - Contaminated raw food (i.e., poultry cat food or food intended for human consumption)
 - Unknown cat-to-cat transmission risk
- Appropriate to consider cats potential sentinel cases
 - Environmental risks may first be seen in cats (before humans)
 - Enhances ability for surveillance in humans
- Candidacy for testing
 - Clinical signs and epidemiology link
 - Submitted specimens for rabies testing



A County of San Diego One Health Response

- COSD Animal Influenza A Virus Pilot Program:
 - Strategic IAV testing of pets & wildlife with history of human contact (passive surveillance)
 - Wildlife rehabilitation facility (Project Wildlife – centralized county hub)
 - Rabies submissions (wildlife and cats)
 - Additional sources
 - Collaborating with a commercial veterinary diagnostic laboratory (Antech)
 - Pan-flu A, H5, and N1 PCR testing
 - Coordinating with Epidemiology Unit for submissions and reporting
 - Non-negative samples are forwarded directly to the National Veterinary Services Laboratories (NVSL)
 - Humans with exposure to Flu A positive animals will be monitored and managed as per CDC/CDPH guidelines (10 days)
 - Close collaboration and data-sharing with our state and national partners (CDPH, CDFA, CDFW, USDA/NVSL, etc.)
 - 7/9/2024 – 3/18/2025: Total specimens tested – 491; total IAV detections – 19



Identifying potential spillover events will create an opportunity for enhanced surveillance of humans who come in contact with zoonotic disease carrying animals.



Thank You



Dutch Belt Cow

Contact information:

Julie Breher, DVM MPVM

julie.breher@sdcounty.ca.gov

(619) 366-4863

