
**Final Report for the 2014–2015 Outbreak
of Highly Pathogenic Avian Influenza (HPAI)
in the United States**

Revised August 11, 2016

Public Version

***Veterinary Services
Surveillance, Preparedness, and Response Services
Animal and Plant Health Inspection Service***



**United States
Department of
Agriculture**

This page is intentionally blank.

Handling Instructions

1. The title of this document is *Final Report for the 2014–2015 Outbreak of Highly Pathogenic Avian Influenza (HPAI) in the United States*, also referred to as “this document”.
2. Reproduction of this document, in whole or in part, without prior approval from Animal and Plant Health Inspection Service (APHIS) Veterinary Services (VS) National Preparedness and Incident Coordination is prohibited.

For more information, please consult the following point of contact:

National Preparedness and Incident Coordination
Surveillance Preparedness and Response Services
U.S. Department of Agriculture APHIS VS
4700 River Road, Unit 41
Riverdale, MD 20737

Version Control

This document was first released in May 2016. The August 2016 update includes the following changes:

- Corrections to identified errors in figures, legends, and text.
- Revisions and clarifications based on comments received.
- Revised tables and figures based on updated EMRS data (including, but not limited to depopulation method, disposal method, disinfection method and others). These changes were the result of ongoing data-cleaning processes and did not result in significant changes. In many cases, the handful of “not reported” premises (usually 3-6 premises) were identified and subsequently placed into the appropriate category.
- New information on laboratory messaging during the outbreak.
- Slightly adjusted flock numbers (50.4 million to 50.5 million).
- Updated information on financial obligations.

This page is intentionally blank.

Executive Summary

Incident Overview

In December 2014, highly pathogenic avian influenza (HPAI) was detected in the United States for the first time in 10 years. From December 11, 2014 to January 16, 2015, the U.S. Department of Agriculture (USDA) received a total of seven reports of HPAI H5N2 or H5N8 in captive wild birds and backyard flocks from the northwestern United States. Additional detections occurred in wild birds. The first infected commercial flock was identified on January 23, 2015, in California. From January to March, the disease spread slowly to multiple states, including Minnesota, Missouri, Arkansas, and Kansas. A significant increase in HPAI H5N2 in turkey flocks occurred through early April in Minnesota, followed by a rapid increase in Iowa in late April and throughout May, where large numbers of chicken layer flocks were affected. The last case of HPAI was confirmed, in a commercial flock, on June 16, 2015.

In total, during the 2014–2015 outbreak, there were 211 detections on commercial operations and 21 detections on backyard premises (including those premises designated as a Dangerous Contact Premises). HPAI was detected in commercial premises, backyard flocks, wild captive birds, and/or wild birds in 21 States (Arkansas, California, Iowa, Idaho, Indiana, Kansas, Kentucky, Michigan, Minnesota, Missouri, Montana, North Dakota, Nebraska, New Mexico, Nevada, Oregon, South Dakota, Utah, Washington, Wisconsin, and Wyoming). Approximately 7.4 million turkeys and 43 million egg-layers/pullet chickens, as well as a limited number of mixed poultry flocks, were affected by HPAI and died from the disease or were depopulated as part of the response. This outbreak was the largest HPAI outbreak ever recorded in the United States and arguably the most significant animal health event in U.S. history.

Summary of Response Activities

In response to the outbreak, USDA Animal and Plant Health Inspection Service (APHIS) Veterinary Services (VS) coordinated the national response to HPAI, in support of State and local government efforts. The response to the outbreak included the following activities at the national and/or field levels:

- Updating disease etiology and ecology information.
- Revising laboratory definitions and case definitions.
- Planning and conducting disease surveillance.
- Performing sample collection and diagnostic testing.
- Planning and carrying out epidemiological investigations and tracing.
- Conducting information management in the field and at the national level.
- Coordinating and communicating with State, local, and industry stakeholders.
- Providing guidance on personal protective equipment and responder health and safety, and ensuring Safety Officers were deployed.
- Providing guidance and supervision on biosecurity measures.
- Conducting quarantine and movement control activities.
- Supporting continuity of business and issuing permits.
- Providing information and documentation for regionalization for international trade.
- Conducting and providing resources and guidance for mass depopulation and euthanasia.
- Conducting and providing subject matter expertise for disposal.
- Providing guidance, options, and contracted support for cleaning and disinfection (virus elimination).
- Performing logistics activities, particularly surge contracting, through the National Veterinary Stockpile.
- Safeguarding animal welfare during response operations.

- Conducting modeling and assessments to support response and recovery.
- Providing personnel dedicated to appraisal and compensation and processing indemnity payments.
- Ensuring the availability of financial resources for the response effort.
- Providing overall incident management, support, and objectives.

Depopulation, disposal, and virus elimination activities posed significant challenges due to the number of affected premises and birds. Foaming was the most common method of depopulation for turkeys, while carbon dioxide was used for chickens. Composting was the most common method of disposal, and wet disinfectant the most common mode of virus elimination. On average, it took commercial premises about 111 days from National Veterinary Services Laboratories confirmation of HPAI on the premises to being granted approval for restocking.

Organizational Response

APHIS personnel deployed to the first HPAI cases in December 2014, and continued deploying throughout the response effort. A National Incident Coordination Group (ICG) was also established in December 2014. This ICG was scaled up significantly in April, reflecting the increasing number of detections and broadening response requirements. At this time, APHIS was also placed on Mobility Level 2, meaning that VS initiated mandatory deployments for employees. The number of APHIS responders and contractors dedicated to the response continued to increase as the outbreak grew in scale. At the height of response operations, more than 3,400 personnel were deployed: approximately 250 APHIS personnel, 180 State responders, and over 3,000 support contractors. Over the course of the outbreak, there were over 1,200 total deployments by APHIS personnel. Approximately 300 additional employees were deployed or worked at an APHIS headquarters location to support the outbreak as part of the ICG.

End of Outbreak and Cost

While HPAI detections ended in mid-June 2015, many response operations—including virus elimination, environmental sampling, and restocking—continued throughout the fall. On November 18, 2015, the United States sent a final report to the World Organization for Animal Health (OIE); at that time, the 2014–2015 outbreak in the United States was considered closed. For the 2014–2015 outbreak, nearly \$850 million was obligated for response activities (including personnel support) and indemnity payments. Another \$100 million was made available for further preparedness activities: it was the most expensive animal health incident recorded in U.S. history. Extensive planning and preparation efforts continued to prepare for the possible reemergence of HPAI in the fall of 2015 and spring of 2016.

There are many individuals and groups that contributed data or information to this report and deserve recognition, including—but not limited to—the National Animal Health Laboratory Network Coordinator, Center for Epidemiology and Animal Health Information Management and Analytic Services, Surveillance Preparedness and Response Services Logistics Center, Resource Ordering and Status System Dispatch, Poultry Commodity Staff, Incident Coordination Group Finance/Admin Section, and APHIS Contracting Officers. A special thanks to the Emergency Management Response System (EMRS) Specialists, EMRS Network Associates, APHIS VS National Incident Management Teams, and the National Preparedness and Incident Coordination Situation Unit for information management activities for the outbreak.

Contents

Handling Instructions	iii
Version Control.....	iii
Executive Summary	v
Section 1. Background	1
Purpose.....	1
Nature of Disease	1
Prior Outbreaks in the United States	1
The Foundation of Preparedness	2
Section 2. Characteristics of the 2014–2015 Outbreak.....	3
Scope of the Outbreak.....	3
Disease Incidence and Epidemiology.....	5
Viral Traits	8
Transmission	9
Section 3. Overview of Response Effort.....	9
Regulatory Intervention	9
Financial Resources.....	10
Economic and Trade Impact	10
Personnel.....	11
Section 4. Incident Management	12
Overview	12
National Incident Coordination Group and APHIS Multiagency Coordination Group.....	14
APHIS Multiagency Coordination Group.....	15
National Incident Coordination Group	16
APHIS VS National Incident Management Teams	18
APHIS VS National Incident Management Team Rotations	18
Deployments for APHIS VS National Incident Management Teams	19
Contractors.....	19
Section 5. Incident Coordination Group Response and Support Activities	20
Overview	20
Reporting and Communicating Information	21
Deployment/Personnel Management.....	22
Policy and Guidance	22
Health and Safety	25
Section 6. Highlights of Response Activities	25
Overview	25

Surveillance and Epidemiology.....	27
Summary	27
Incident Coordination Group and National Incident Management Team Activities.....	27
Surveillance Conducted	27
Diagnostics.....	28
Quarantine, Movement Control, and Continuity of Business.....	29
Depopulation.....	32
Disposal.....	36
Virus Elimination (Cleaning and Disinfection)	38
Biosecurity	40
Health and Safety	41
Appraisal and Compensation	41
Logistics	42
Restocking.....	42
Communications.....	43
Regionalization for International Trade.....	45
Section 7. Preparedness and Future Planning.....	45
Section 8. Conclusion.....	46
Section 9. Abbreviations	48
Section 10. List of Appendices	50

Tables

Table 1. HPAI Outbreaks in the United States.....	2
Table 2. Summary of All Affected Premises by State	4
Table 3. Approximate Percentage of U.S. Poultry Affected in Outbreak.....	5
Table 4. HPAI Outbreak Response Testing Summary (Number of Samples)	28

Figures

Figure 1. Number of Affected Commercial Premises by State	3
Figure 2. Number of Commercial Birds Affected by State.....	4
Figure 3. First Detection by Flock Type in each State by NVSL Confirmation Date'	6
Figure 4. Map Illustrating HPAI Detections in the United States	7
Figure 5. Total Incidence of HPAI in the United States by Week.....	8
Figure 6. Total Number of APHIS Personnel Deployed by State of Incident	12
Figure 7. Overview of USDA APHIS Organizational Structure for Incident	13

Figure 8. Incident Management Structures and Key Events during the 2014–2015 Outbreak.....	14
Figure 9. Details of the USDA APHIS Organizational Structure for Incident.....	15
Figure 10. Total Number of APHIS Personnel Assigned to Support the Incident at APHIS Hub or Home Location, by Organizational Unit	16
Figure 11. National Incident Coordination Group Structure from Incident.....	17
Figure 12. APHIS VS National Incident Management Team Rotations	18
Figure 13. Total Number of APHIS Deployments by Organizational Unit	19
Figure 14. Number of Contractors Deployed, by Week, during Outbreak	20
Figure 15. Timeline of Public Release of Policy Documents	24
Figure 16. A Guide to Help You Understand the Response Process.....	26
Figure 17. Length of Quarantine on All Premises (Frequency Count).....	29
Figure 18. Number of Control Areas Released by Month for All Premises	30
Figure 19. Number of Permits Issued by State of Origin for Movement Into, Within, or Out of a Control Area	31
Figure 20. Number of Permits Issued by Item Permitted.....	31
Figure 21. Primary Depopulation Method for All Premises	33
Figure 22. Primary Depopulation Method by Flock Type for Commercial Premises.....	33
Figure 23. Time to Depopulation (Average Days) from NVSL Confirmation for All Premises, excludes Dangerous Contacts	34
Figure 24. Time to Depopulation (Average Days) from NVSL Confirmation for Commercial Premises by Flock Type, excludes Dangerous Contacts.....	35
Figure 25. Time (Days) to Depopulation from NVSL Confirmation, excludes Dangerous Contacts.....	36
Figure 26. Primary Disposal Method for Carcasses for All Premises	37
Figure 27. Time to Disposal Complete (Average Days) from NVSL Confirmation, excludes Dangerous Contacts	38
Figure 28. By Method of Disposal, Time to Disposal Complete (Average Days) from NVSL Confirmation, excludes Dangerous Contacts	38
Figure 29. Disinfection Method Used for All Premises.....	39
Figure 30. Average Time to Virus Elimination/C&D Complete (in Days), excludes Dangerous Contacts.....	40
Figure 31. Average Time to Restock Approval for Commercial Premises (in Days), excludes Dangerous Contacts	43
Figure 32. HPAI Stakeholders	44
Figure 33. Summary of Key Events during the 2014–2015 HPAI Outbreak.....	47

Section 1. Background

Purpose

This report serves as a historical summary and overview of the 2014–2015 high pathogenicity avian influenza (or highly pathogenic avian influenza) (HPAI) outbreak in the United States. It is not intended to be an after action or systemically identify corrective actions. Instead, this document focuses on the characteristics of the outbreak, organizational structure employed in the response, activities of the Incident Coordination Group (ICG), and summarized highlights of the field activities that occurred.

Nature of Disease

Avian influenza (AI) is a viral respiratory disease that infects all avian species. AI is a common disease, but the virus frequently changes or mutates. Based on the severity of illness, the AI is classified as either HPAI or low pathogenicity avian influenza (LPAI). AI viruses are named by two groups of proteins, hemagglutinin ([HA] ranging from H1–H17) and neuraminidase (ranging from N1–N9), e.g., H5N2 or H5N8.

In natural environments, HPAI viruses have always contained an H5 or H7. However, there are rare examples of situations where other viruses could technically be considered HPAI; these viruses have not shown pathogenicity in poultry. HPAI tends to cause high mortality in domestic gallinaceous species (e.g., turkeys and chickens). It may or may not cause severe illness in wild birds, depending on the species and subtype of the virus. Some HPAI viruses also cause illness in humans and other mammals. Common AI signs in birds include decreased food and water consumption, coughing, sneezing, and decreased egg production. HPAI infections may also cause sudden death, lack of energy, the production of soft or deformed eggs, swelling (of head, eyelids, comb, wattles, and/or hocks), purple discoloration (of wattles and/or comb), nasal discharge, loss of coordination, and/or diarrhea. Transmission of HPAI typically occurs through direct contact with infectious respiratory secretions and feces. Viral spread via indirect contact with contaminated equipment and supplies (also known as fomites) is also common.

Prior Outbreaks in the United States

LPAI is commonly found in wild birds with occasional introductions into domestic poultry flocks. For example, in the United States, serious H7N2 and H5N2 LPAI outbreaks in 2002 and 2007 resulted in the destruction of 4 million and 25,600 commercial birds, respectively. In many parts of the world, HPAI is also common. However, in the United States—and other countries considered to have developed veterinary infrastructure and advanced animal agriculture industries—HPAI is not frequently detected in commercial poultry.

A summary of AI outbreaks in the United States is provided in Table 1. It is important to note that during the development of this report, another HPAI outbreak occurred in Indiana in January 2016; it is also included in Table 1. However, this outbreak is not further discussed in this document.

Table 1. HPAI Outbreaks in the United States

Year(s)	Strain	Locations	Impact
1924	H7	East Coast live bird markets	Not available
1927	Unknown	NJ	Not available
1983–84	H5N2	Northeastern U.S.	17 million chickens, turkeys, and guinea fowl destroyed
2004	H5N2	Southern U.S.	Destruction of 1 flock
2014–15	H5N8, H5N1 (wild bird only), H5N2	AR, CA, IA, ID, IN, KS, KY, MI, MN, MO, MT, ND, NE, NM, NV, OR, SD, UT, WA, WI, WY (includes wild bird detections)	50.5 million commercial birds affected (including dangerous contacts)
2016	H7N8	IN	>400,000 commercial birds affected (including dangerous contacts)

The Foundation of Preparedness

APHIS Veterinary Services (VS) is continuously preparing for significant animal disease incidents and emerging disease events. Prior to the 2014–2015 outbreak, APHIS VS personnel had planned and coordinated emergency management activities, trained and exercised emergency management functions, written response plans and procedures, and built critical relationships between the headquarters and field-level operations.

In particular, before the 2014–2015 outbreak, APHIS VS personnel had done the following:

1. Wrote and updated multiple versions of the *Foreign Animal Disease Preparedness and Response Plan (FAD PReP) Highly Pathogenic Avian Influenza Response Plan: The Red Book*.
2. Written numerous FAD PReP procedures and guidelines on critical activities like biosecurity, cleaning and disinfection, and disposal.
3. Conducted National Animal Health Laboratory Network (NAHLN) exercises for HPAI; over 38 tabletop exercises were conducted to examine the relationship between field actions and laboratory responses.
4. Completed outbreak investigation training for approximately 40 District Epidemiology Officers from 2013–2014, including 8 online learning modules, webinars, and a classroom workshop.
5. Collaborated and supported to create the Secure Poultry Supply Plans for Eggs, Turkeys, and Broilers. These public-private-academic partnerships provide specific science- and risk-based recommendations that emergency decision makers can use to rapidly decide how to permit poultry products during an HPAI outbreak.
6. Participated in multiple exercises conducted by industry and academia, including the 2014 Broiler Movement Field Exercise & Emergency Disease Management Committee Tabletop Exercise to discuss continuity of business and product flow during an outbreak.
7. Conducted over 30 training courses for disease management and preparedness capabilities in fiscal year (FY) 2014.

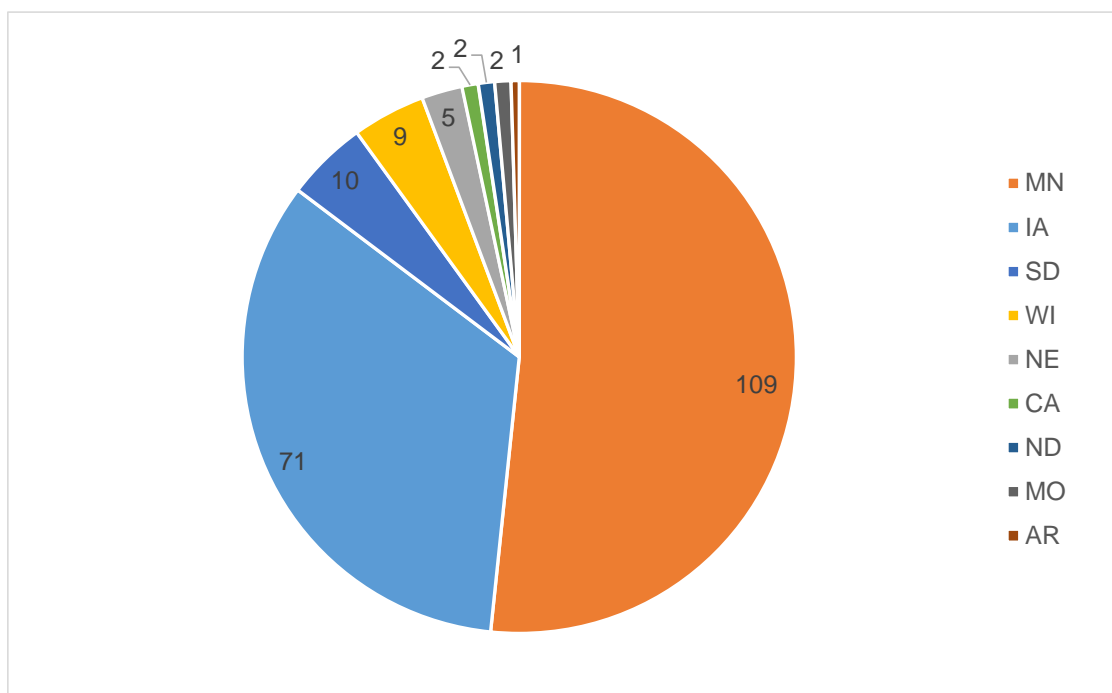
Section 2. Characteristics of the 2014–2015 Outbreak

Scope of the Outbreak

HPAI viruses were detected in commercial poultry, backyard flocks, captive wild birds, and wild birds in 21 States during the outbreak. There were 211 commercial premises affected in 9 States (Figure 1); 11 States had infections in backyard flocks, with 21 affected premises (these numbers include Dangerous Contact (DC) Premises that were depopulated).¹

In total, for both commercial and backyard premises, approximately 43 million chickens (primarily layers or pullets), and 7.4 million turkeys died from the disease or were depopulated as part of the response and eradication effort.² Table 2 illustrates the number of premises affected (commercial and backyard) by State. Figure 2 illustrates the 50.5 million commercial birds affected by State. The outbreak primarily impacted turkeys, layer chickens (and pullets), and a limited number of game fowl; broiler chickens were negligibly affected. Most of these birds were affected by the HPAI H5N2 virus.

Figure 1. Number of Affected Commercial Premises by State



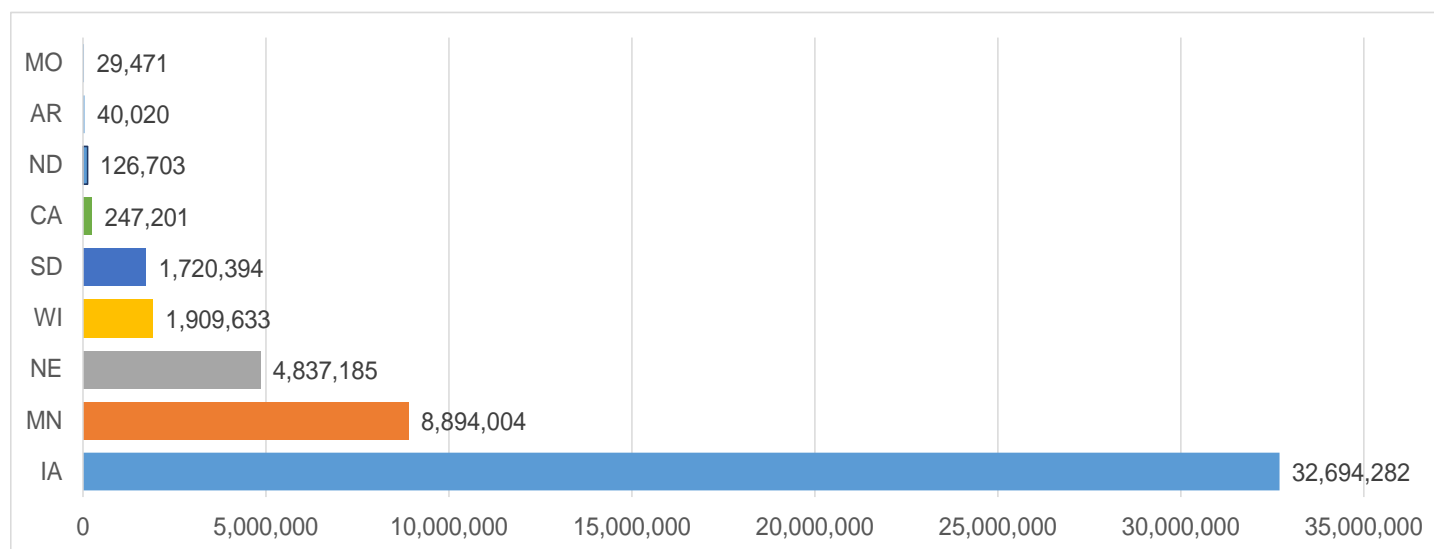
¹ For more information on premises statuses used in an outbreak, please see the *HPAI Response Plan: The Red Book* which is available at www.aphis.usda.gov/fadprep.

² In addition to the 7.4 million turkeys and 43 million chickens, flocks identified as mixed poultry, numbering just over 120,000 in total, were also depopulated or died as a result of the disease.

Table 2. Summary of All Affected Premises by State

State	Total Commercial H5 Positive HPAI Premises	Species (Commercial Premises)			Total Backyard H5 Positive HPAI Premises	Total by State
		Turkey	Chicken-Layer	Other		
Minnesota	109	104	5	0	1	110
Iowa	71	35	36	0	6	77
South Dakota	10	9	1	0	0	10
Wisconsin	9	6	3	0	1	10
Nebraska	5	0	5	0	1	6
California	2	1	0	1	0	2
Missouri	2	2	0	0	1	3
North Dakota	2	2	0	0	0	2
Arkansas	1	1	0	0	0	1
Kansas	0	0	0	0	1	1
Washington	0	0	0	0	5	5
Oregon	0	0	0	0	2	2
Montana	0	0	0	0	1	1
Idaho	0	0	0	0	1	1
Indiana	0	0	0	0	1	1
Total	211	160	50	1	21	232

Figure 2. Number of Commercial Birds Affected by State



The impact of the outbreak in terms of commercial inventories is illustrated in Table 3. The losses in layer chickens, pullets, and turkeys were substantial. This was the most significant HPAI outbreak in U.S. history.

Table 3. Approximate Percentage of U.S. Poultry Affected in Outbreak³

Flock Type ^a	Percent Losses
Layer Chickens ^b	10.01% avg. U.S. inventory
Pullet Chickens	6.33% avg. U.S. inventory
Broiler Chickens	<0.01% avg. U.S. inventory
Turkeys	3.16% annual production; 7.46% avg. U.S. inventory

^a Flocks identified as “mixed poultry” were not included in bird counts.

^b This includes flocks that were identified as “chickens” and or “layer breeder.”

Disease Incidence and Epidemiology

In December 2014, HPAI H5N2 was identified in commercial poultry in the Fraser Valley region of southern British Columbia, Canada. Soon after, samples were collected from wild birds in the United States. Combined with mortality events associated with captive wild raptors, this revealed that there were at least two HPAI virus strains in circulation: H5N2 and H5N8. For these first detections, migratory birds from the Pacific Flyway were the most likely source of introduction. The H5N2 virus was a reassortment of the Eurasian H5N8 HPAI virus (that also was detected) and a North American LPAI strain.

On December 11, 2014, HPAI H5N8 was detected in a captive wild bird. The first HPAI detection in a wild bird was on December 14, 2014. From December to the end of March 2015, 82 wild bird samples tested positive for H5 HPAI. Additionally during this same time period, 14 backyard flocks or captive wild birds tested positive for H5 HPAI in six States (ID, KS, MO, MT, OR, and WA). Evidence suggested that these detections were point-source introductions.

In commercial birds, the first occurrence of HPAI was of the H5N8 virus in a California turkey operation on January 23, 2015. From January to the end of March, nine (8 infected and 1 DC) commercial premises of turkey or mixed poultry were found positive for H5 HPAI in four States (AR, CA, MO, and MN). Again, these introductions are believed to be point-source. However, by mid-April 36 additional HPAI-Infected Premises (or DC Premises) were detected; 26 of these were in Minnesota and hypothesized to be infected due to lateral spread of the virus. Other States affected by mid-April were Iowa, North Dakota, South Dakota, and Wisconsin. Figure 3 illustrates the first detection, by flock type, in each State (e.g., first commercial detection in the State and first backyard detection in the State; captive wild bird detections are also illustrated). This is by the date of National Veterinary Services Laboratories (NVSL) confirmation.

³ Please note, these percentages were calculated by the Center for Epidemiology and Animal Health at the end of the outbreak (late June, early July), based on nationally reported inventory and currently reported flock numbers for affected flocks. These percentages may not reflect final or corrected appraisal numbers which were revised later in the response; these adjustments could change the percentage of U.S. poultry affected very slightly.

Figure 3. First Detection by Flock Type in each State by NVSL Confirmation Date^{4,5}

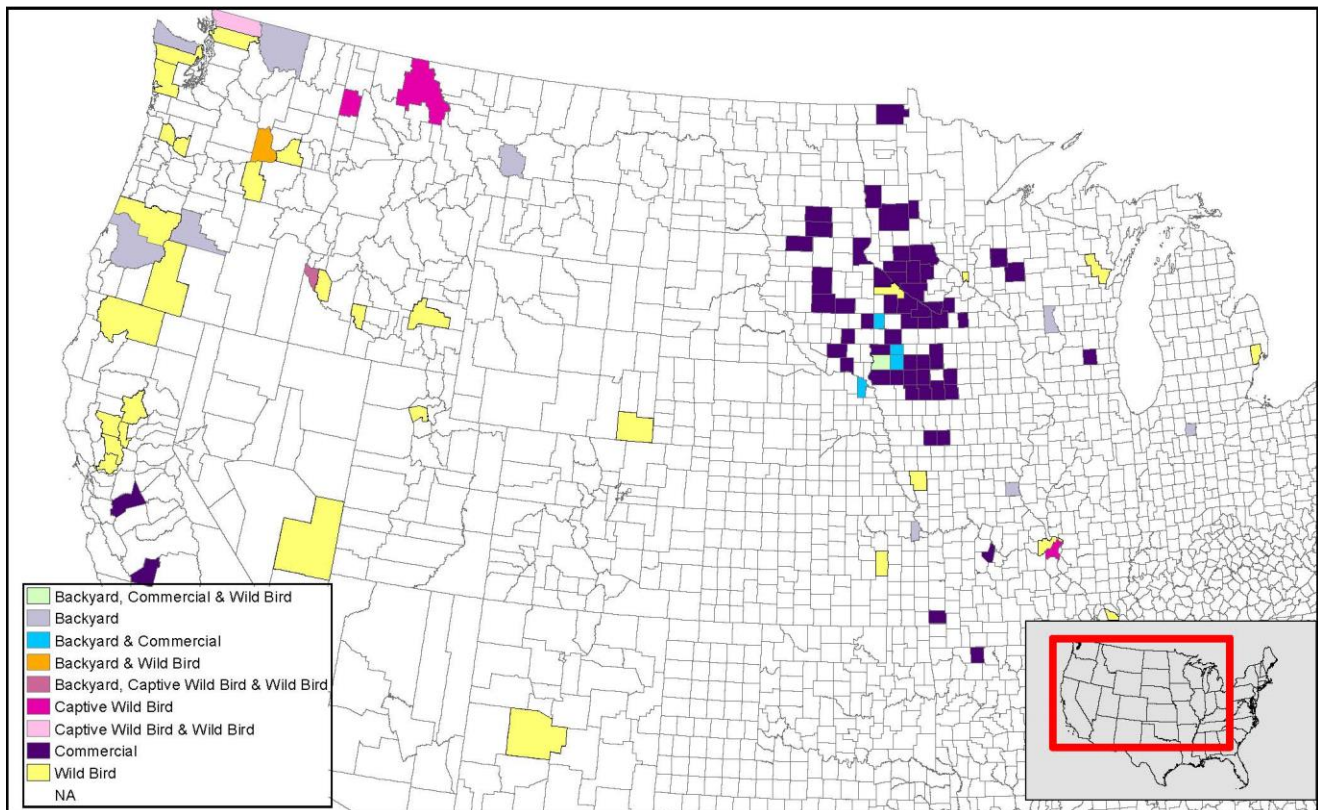


On April 11, 2015, HPAI was detected on a chicken layer premises in Wisconsin. Then, on April 18, 2015, the first chicken layer premises in Iowa—the leading egg producer in the United States—was identified as H5N2 HPAI positive; this premises housed over 4 million birds. At this point, detections increased dramatically: 188 of the 211 total commercial detections occurred in the upper Midwest in April and May. All 2014–2015 HPAI detections are illustrated, by bird type, in Figure 4. Please note that a county may have one or more detections.

⁴ NVSL confirmation date is when a “confirmed status” was placed on the premises in the Emergency Management Response System (EMRS), based on a positive diagnostic test result at NVSL. In some cases, particularly at the height of the outbreak, this may have been a confirmed H5 result prior to further subtyping results: an NVSL confirmed H5 result is considered a confirmed positive date.

⁵ There was a captive wild bird detected in MO that was not entered into EMRS and is not illustrated here.

Figure 4. Map Illustrating HPAI Detections in the United States



Note: Map produced during the incident by USDA APHIS VS Center for Epidemiology and Animal Health, showing all detections December 2014 to June 2015.

For wild birds, between December 2014 and June 2015, there were 98 detections of H5 influenza (65 of these were sequenced; 33 were based on molecular detection though no virus was isolated). For further details on these detections, please click [here](#).⁶ As part of this collaborative surveillance effort, over 7,000 birds were sampled, predominately in the Mississippi and Pacific flyways (29 percent and 48 percent of total samples, respectively). However, samples were also collected from the Atlantic flyway, Central flyway, and American Oceania.

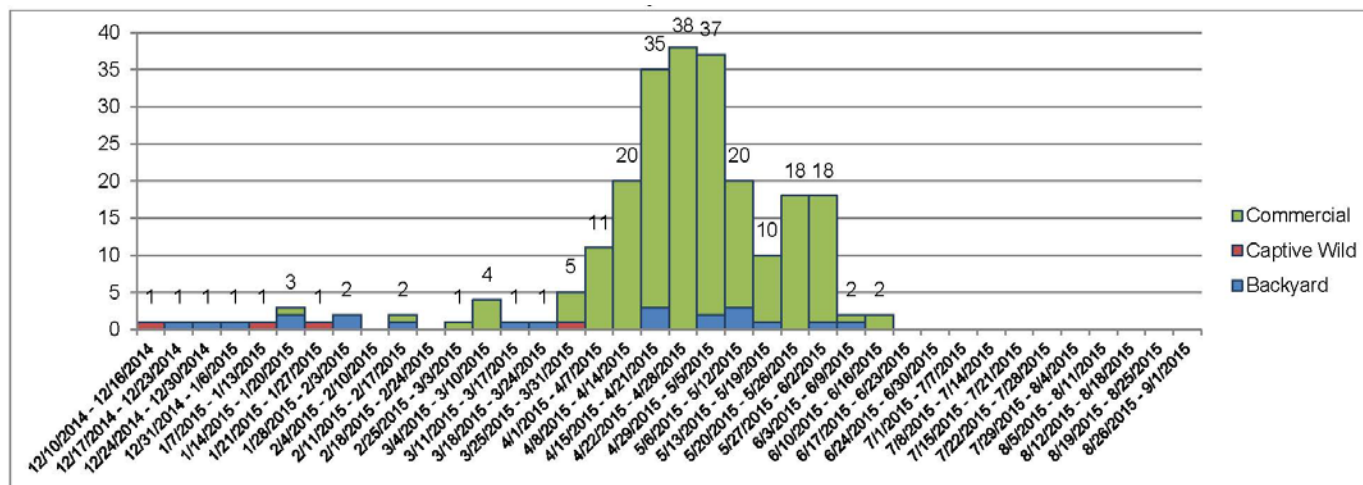
Disease detections are illustrated in Figure 5 in an epidemiological curve.⁷ This epidemiological curve was fairly typical for a highly contagious disease outbreak. As seen in Figure 5, there were few detections each week until an increase in cases starting in early April. Cases spiked the week of April 22, with 38 detections that week and 37 detections the following week (April 29, 2015). After this, cases fell significantly though there continued to be more than 10 detections per week for 4 additional weeks. The last case was detected as a presumptive positive on June 15, 2015, confirmed to be an H5 by NVSL on June 16, and sequenced as H5N2 on June 17, 2015. The

⁶ Hyperlink is https://www.aphis.usda.gov/wildlife_damage/downloads/DEC%202014%20-%20JUNE%202015%20WILD%20BIRD%20POSITIVE%20HIGHLY%20PATHOGENIC%20AVIAN%20INFLUENZA%20CASES%20IN%20THE%20UNITED%20STATES.pdf.

⁷ This figure was the epidemiological curve produced and distributed during the outbreak. It shows all data available in EMRS as of September 1, 2015. Additional data may have been added to EMRS after this time.

reduction in cases was presumed due to both control measures and the onset of summer heat, which helps to inactivate AI viruses.

Figure 5. Total Incidence of HPAI in the United States by Week



Note: Date pictured is earliest available date indicating clinical signs. This is a clinical sign date if known, a suspect status, or a presumptive positive status. Some premises may only have a confirmed positive status date.

Viral Traits

The traits of this HPAI H5N2 virus that spread throughout the Midwest was in many ways consistent with the typical profile of HPAI. This virus was highly pathogenic in poultry and caused signs consistent with the generic profile of an HPAI virus. However, a few unique characteristics have been identified via investigations and research. For instance, based on the epidemiological investigation, incubation periods were estimated at between 3 to 11 days for this outbreak (3 to 5 days is typical with HPAI viruses). Additionally, the H5N2 virus circulating in the 2014–2015 outbreak appeared to be more virulent and better adapted to infect turkeys than chickens.⁸

Phylogenetic studies conducted by the USDA APHIS NVSL, the USDA Agricultural Research Service Southeast Poultry Research Laboratory (SEPRL), and the Influenza Division of the Centers for Disease Control and Prevention (CDC) indicated that this H5N2 virus was genetically very similar to other HPAI strains circulating in the United States and had an HA protein derived from the HPAI Eurasian H5N8 virus.⁹ Thus, as previously mentioned, this specific H5N2 virus represents a reassortant combination of that H5N8 virus and an LPAI virus of North American origin. According to this research, the virus did not contain molecular markers commonly associated with antiviral resistance or increased transmission and virulence

⁸ Bertran, K., Swayne, D.E., Pantin-Jackwood, M.J., Kapczynski, D.R., Spackman, S.E., & Suarez, D.L. (2016). Lack of chicken adaptation of newly emergent Eurasian H5N8 and reassortant H5N2 high pathogenicity avian influenza viruses in the U.S. is consistent with restricted poultry outbreaks in the Pacific flyway during 2014-2015. *Virology*, 494, 190-197. DOI: 10.1016/j.virol.2016.04.019.

⁹ Lee, D.H., Torchetti, M.K., Winker, K., Ip, H.S., Song, C.S., & Swayne, D.E. (2015). Intercontinental Spread of Asian-origin H5N8 to North America through Beringia by Migratory Birds. *Journal of Virology*, epub before print. DOI: 10.1128/JVI.00728-15.

in mammals, which indicated that this virus likely posed a low risk to humans. Tests to monitor genetic changes continued during the outbreak.¹⁰

Transmission

USDA APHIS coordinated field-based survey instruments and interviews, as well as a layer-farm case-control study. The epidemiological investigations and other analyses conducted by USDA APHIS advised that there were multiple pathways of introduction and HPAI transmission. Sharing equipment between farms, entry of wild birds into barns, and farm workers/visitors all likely contributed to virus spread. Other possible pathways included short-distance aerosol spread, carcass disposal techniques, and other biosecurity breaches. The NVSL, SEPRL, and CDC analysis also suggested that both common source exposures and independent introductions were contributing to the spread of the H5N2 in the United States.

While specific risk factors for infection were identified, “there is not substantial or significant enough evidence to point to a specific pathway or pathways for the current spread of the virus.”¹¹ Anecdotally, there was much discussion over whether aerosolized virus and airborne spread was responsible for virus transmission. While it is possible that aerosol transmission was responsible for disease spread, the USDA APHIS epidemiological analysis was “not able to determine with certainty whether aerosol transmission was responsible for a farm becoming infected.”¹² That said, “results obtained to date indicate that HPAI can be aerosolized from infected flocks and remain airborne.”¹³ For further information, please refer to the USDA APHIS analyses.

Section 3. Overview of Response Effort

Regulatory Intervention

Under the Animal Health Protection Act and Code of Federal Regulations, USDA APHIS has the authority to respond to and eradicate foreign animal diseases (FAD) in the United States. Accordingly, USDA APHIS responded to HPAI, working in close coordination with State and local governments to eradicate the disease. USDA APHIS worked operationally, in the field, as part of unified State-Federal Incident Commands (IC) and established a National ICG at APHIS headquarters to provide national policy and coordinate strategic guidance. An APHIS Multiagency Coordination (MAC) Group was also established to coordinate resources; the VS

¹⁰ United States Animal Health Association Committee on Transmissible Diseases of Poultry and Other Avian Species. 2015. *Report of the Committee*. <http://www.usaha.org/Portals/6/Reports/2015/report-pad-2015.pdf>.

¹¹ For more information on transmission and epidemiology, please refer directly to the *Epidemiologic and Other Analyses of HPAI-Affected Poultry Flocks: September 9, 2015*.

https://www.aphis.usda.gov/animal_health/animal_dis_spec/poultry/downloads/Epidemiologic-Analysis-Sept-2015.pdf.

¹² Please see p.1: *Epidemiologic and Other Analyses of HPAI-Affected Poultry Flocks: September 9, 2015*. https://www.aphis.usda.gov/animal_health/animal_dis_spec/poultry/downloads/Epidemiologic-Analysis-Sept-2015.pdf.

¹³ Please see p.47: *Epidemiologic and Other Analyses of HPAI-Affected Poultry Flocks: September 9, 2015*. https://www.aphis.usda.gov/animal_health/animal_dis_spec/poultry/downloads/Epidemiologic-Analysis-Sept-2015.pdf.

Executive Team (VSET) coordinated VS resources and elevated issues to the APHIS MAC Group as required.

At the State level, four States declared a State of Emergency: Iowa, Minnesota, Nebraska, and Wisconsin. As a result, these States received additional assistance and resources from partnering State agencies and State departments of homeland security to respond to the outbreak. The State of Iowa also requested a Stafford Act declaration from the Department of Homeland Security, which was denied. For further information on the State responses to the HPAI outbreak, please refer to their websites or State Departments of Agriculture.

Financial Resources

When the outbreak began in late 2014, APHIS utilized its appropriated Avian Health funds to address the initial cases. As the outbreak expanded in early spring 2015, the Secretary of Agriculture began transferring Commodity Credit Corporation (CCC) funds to support the response including transfers in April and May totaling \$393 million, \$305 million in July, and \$291 million on September 4, 2015. A total of \$989 million in CCC funds were transferred for the response. APHIS obligated nearly \$850 million to respond to the 2014–2015 HPAI outbreak; additional funds were made available for HPAI preparedness (and subsequent HPAI/LPAI outbreaks). Funding provided for response activities supported payments to affected producers for depopulation, disposal, and cleaning and disinfection activities conducted on their premises (and to contractors that supported these activities). Response funding also supported indemnity payments to flock owners; as of May 2016, all indemnity commitments had been paid, equaling just over \$200 million.

Economic and Trade Impact

In addition to response and indemnity payments, the HPAI outbreak had a very significant economic impact. To provide perspective to the overall magnitude of this outbreak: early estimates suggest the 2014–2015 HPAI incident resulted in approximately \$1.6 billion in direct losses from turkeys and chicken layers that had to be depopulated. When accounting for factors like restocking and lost future production, the impact to the U.S. economy is thought to be closer to \$3.3 billion.¹⁴

As a result of HPAI, consumers experienced wholesale egg prices reaching nearly \$2.80 per dozen, more than doubling the previous 3-year average cost of large eggs. Prices continually decreased throughout the remainder of 2015, but costs sustained above the 3-year average.¹⁵

In part, the economic impact is related to trade bans imposed by trading partners as a result of the HPAI outbreak. While the United States lost 18 trading partners—including China, Russia, and South Korea—valued at \$898 million in 2014 (or 13.9 percent of the year’s total trade revenue), USDA APHIS National Import Export Services (NIES) worked with remaining trading partners

¹⁴ Greene, Joel L. 2015. Update on the Highly-Pathogenic Avian Influenza Outbreak of 2014–2015. Congressional Research Service.

¹⁵ Green, Joel L. 2015; 2016. Egg Market News Report. USDA Agricultural and Marketing Service. Volume 63(10). <https://www.ams.usda.gov/mnreports/pybshelllegg.pdf>.

to continue or resume trade. Thirty-eight trading partners regionalized the United States during the outbreak, which allowed trade to continue from areas of the United States that were not affected. This helped to preserve 86 percent of the value of traded U.S. poultry and poultry products (including eggs), based on 2014 values.

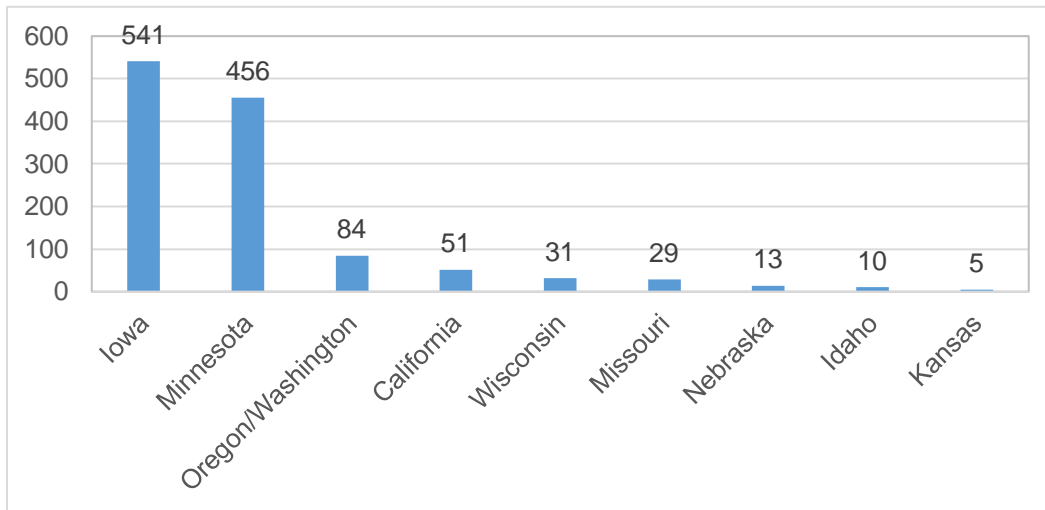
Personnel

USDA APHIS VS employees from standing APHIS VS National Incident Management Teams (NIMT) were deployed to Oregon in December 2014, as part of a unified State-Federal IC to support State and local personnel in their response to the HPAI detections. Later in the outbreak, APHIS was placed on Mobility Level 2 and VS initiated mandatory deployments for personnel; employees were deployed from all APHIS programs. The number of APHIS responders and contractors dedicated to the response continued to increase as the outbreak grew. The National Animal Health Emergency Response Corps (NAHERC) was also activated during the outbreak; after undergoing training in Ames, IA, 69 NAHERC members deployed during the incident. Additionally, over 200 term employees were also hired in 2015 for future outbreak response and ongoing preparedness.

At the height of response operations in June 2015, more than 3,400 personnel were deployed: approximately 250 APHIS personnel, 180 State responders, and over 3,000 support contractors. Over the course of the entire outbreak, there were 1,220 deployments by APHIS personnel, with 773 total individuals deployed. Many APHIS personnel deployed twice, and some deployed three or four times. An additional 300 APHIS employees were deployed to or stationed at an APHIS headquarters location to support the outbreak as part of the ICG; between 3–8 contractors also augmented the ICG for additional support during and after the outbreak.¹⁶ Figure 6 illustrates the number of APHIS deployments by State of deployment for the entire outbreak.

¹⁶ These contractors that augmented the ICG were hired as a result of HPAI, and were not existing APHIS contractors.

Figure 6. Total Number of APHIS Personnel Deployed by State of Incident



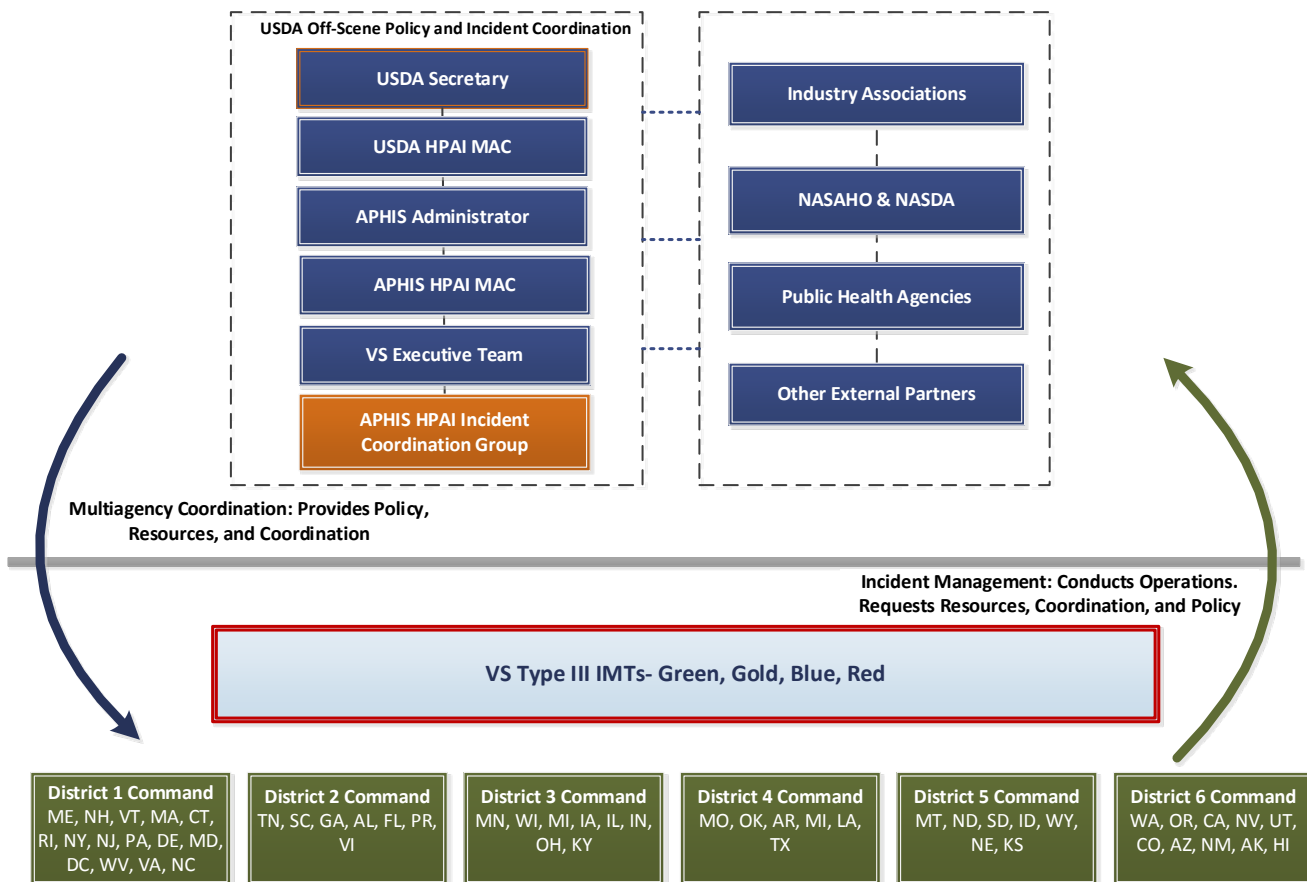
Section 4 provides additional information on the organizational structure and command and control structure of the field responders and headquarters personnel.

Section 4. Incident Management

Overview

Effective incident management was critical to respond and eradicate HPAI. Figure 7 illustrates an overview of the organizational structure from June 2015 that was used during the 2014–2015 HPAI outbreak. The HPAI incident was managed through use of the National Incident Management System (NIMS) to include the Incident Command System (ICS), which provided a flexible and scalable organizational approach throughout the response.

Figure 7. Overview of USDA APHIS Organizational Structure for Incident



Note: This figure depicts four APHIS VS NIMTs; a fifth team, Indigo, was added as a result of this incident.

At the top of Figure 7, the USDA Secretary was the highest official involved in off-scene policy and incident coordination in 2014–2015; the USDA HPAI MAC Group elevated issues to the Secretary for resolution as needed. Below the USDA HPAI MAC Group was the APHIS Administrator, who led APHIS policy. The APHIS MAC Group, which took over from the Emergency Management Leadership Council (EMLC) on June 23rd, coordinated resources and resources requests, making requests to the APHIS Administrator as appropriate. The VS Executive Team took recommendations from the National Incident Coordinator and Deputy Coordinator, and handled strategic policy and procedures. The VS Executive Team also provided assistance as requested by the APHIS HPAI ICG.

These groups interfaced at appropriate levels with industry associations, States (both directly and through the National Assembly of State Animal Health Officials [NASAHO] and National Association of State Departments of Agriculture), public health agencies, including the CDC and State agencies, as well as other external partners. Overall, the HPAI MAC Group, VSET, and National ICG provided the policy, resources, and coordination for the duration of the incident.

At the field or operational level, APHIS VS NIMTs were deployed to incident sites. When the outbreak started, USDA APHIS VS had four standing NIMTs: Green, Blue, Red, and Gold (it

has since added a fifth team, Indigo). Because the outbreak was so large, some NIMTs actually had to be split and supplemented with contractors during the 2014–2015 response. The NIMTs used the National ICG to request policy guidance, additional or new resources, and coordination for incident response activities.

Figure 8 illustrates the approximate timeline of key events with incident management structures during the outbreak.

Figure 8. Incident Management Structures and Key Events during the 2014–2015 Outbreak

December 2014	January 2015	February 2015	March 2015	April 2015	May 2015	June 2015
<p>Dec 14 HPAI first detected in the United States</p> <p>Dec 19 First backyard flock tests positive for HPAI National ICG established</p> <p>Dec 24 First personnel deployed to the field</p>	<p><i>EMLC engaged</i></p> <p>Jan 23 HPAI confirmed in a commercial flock in California</p>		<p>March 5 First detection in Minnesota</p>	<p>Apr 13 First detection in Iowa</p> <p>Apr 22–28 Week with the most new cases (38)</p>	<p><i>Green IMT split into 2 teams</i></p>	<p><i>Blue IMT split into 2 teams</i></p> <p>Jun 17 Last HPAI-confirmed premises</p> <p>Jun 23 APHIS MAC replaces the EMLC</p>

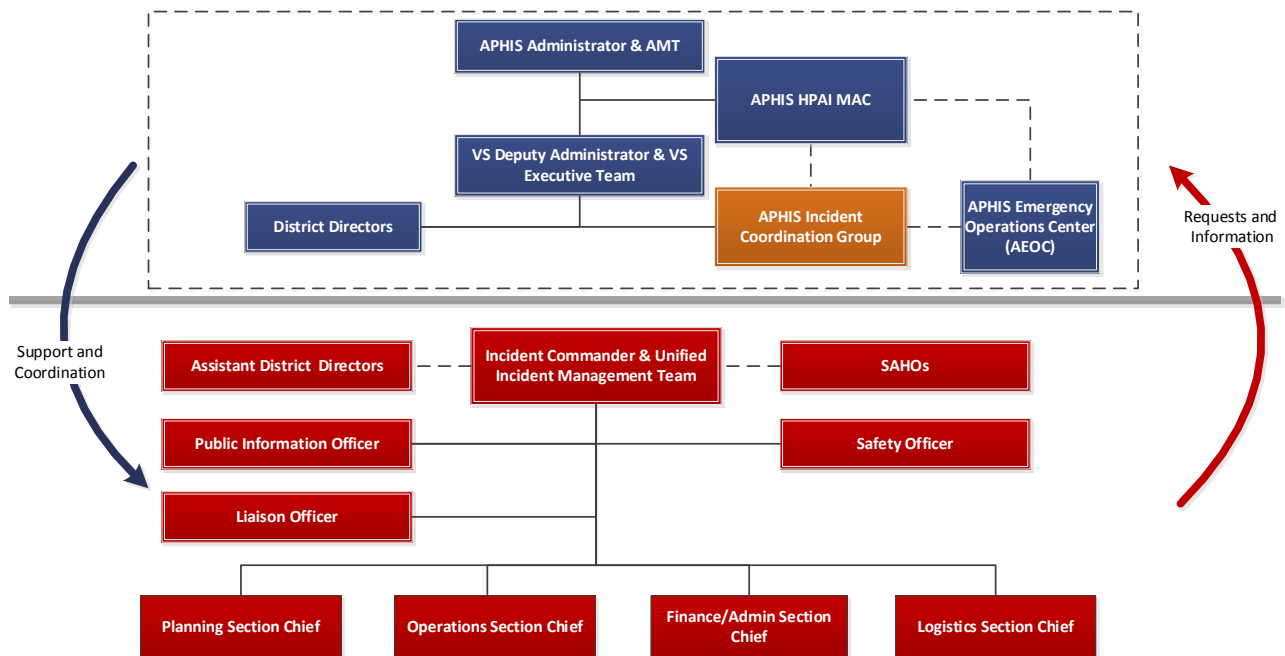
National Incident Coordination Group and APHIS Multiagency Coordination Group

On December 19, 2014, the National ICG was established just before the first APHIS employees were deployed to the field. Then, in January 2015 after additional HPAI detections, the APHIS EMLC was engaged as a de facto MAC Group to coordinate APHIS resources. The ICG provided Area Command functions and policy support to all APHIS VS NIMTs that were deployed to impacted states. ICG leadership deployed to the APHIS Emergency Operations Center in Riverdale, MD, on April 13, 2015—coinciding with a rapid increase in cases.

However, at the height of response operations, it was recognized that the EMLC did not possess the authority to provide APHIS-wide support and make APHIS-level decisions during the emergency. As such, the EMLC was replaced on June 23, 2015, by an APHIS HPAI MAC Group. This APHIS MAC Group was established to provide additional, higher-level APHIS policy, resource, and coordination support given the scope of the outbreak.

These structures are shown in Figure 9.

Figure 9. Details of the USDA APHIS Organizational Structure for Incident



APHIS Multiagency Coordination Group

The APHIS HPAI MAC Group was created to provide immediate leadership and authority for resolving issues during the emergency and to develop needed policies and processes for the future. This group did the following:

- Provided overall coordination and management of the emergency response;
- Provided cross-unit leadership, coordination, and direction (including coordination of resources to the Incident Commanders); and
- Brought standardization and uniformity to the response operation.

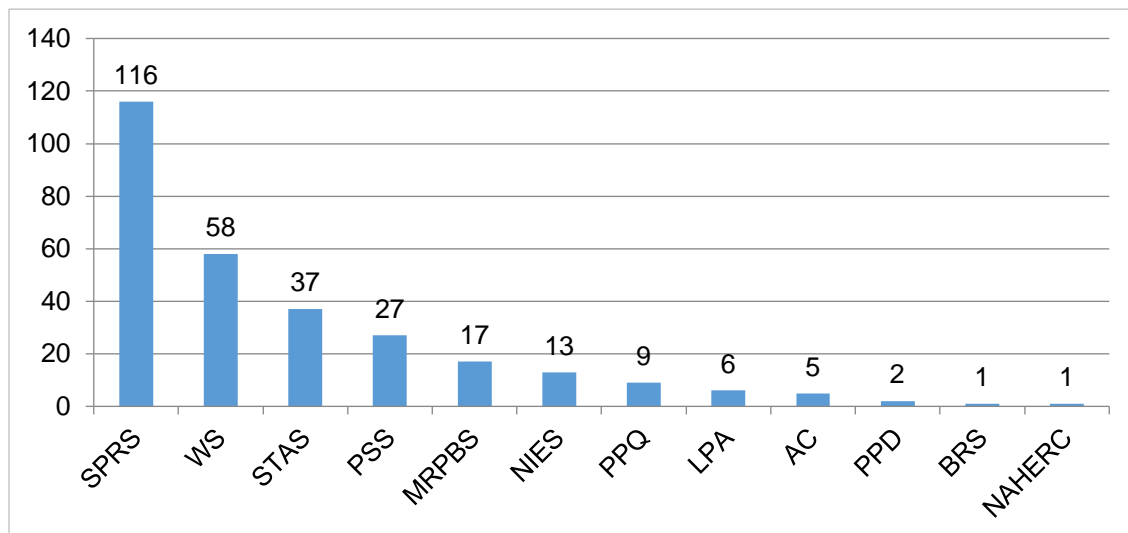
The APHIS HPAI MAC Group consisted of senior-level representatives and subject matter experts (SMEs) from across the agency. Members included representatives with the authority to make decisions from the following offices, program units, and support units:

- Chair: Office of the Administrator
- Executive Secretariat
- VS
- Marketing and Regulatory Program Business Services (MRPBS)
- Legislative and Public Affairs (LPA)
- Plant Protection and Quarantine (PPQ)
- Animal Care
- Wildlife Services (WS)
- Ad hoc SMEs as needed.

National Incident Coordination Group

As the response effort grew, so did the National ICG. Established just prior to the first deployment of VS personnel, the ICG's primary purpose was to support the APHIS VS NIMTs in acquiring resources and formulating policy options, and to assist in developing and implementing response and recovery strategies. While the ICG started as a handful of individuals, ultimately approximately 300 APHIS employees were supporting the National ICG from the Riverdale headquarters or Ft. Collins and Raleigh hubs; some personnel were also virtual. Contractors augmented the ICG in support roles. These ICG personnel predominately came from Surveillance, Preparedness, and Response Services (SPRS), but included individuals from across the agency (Figure 10); they were assigned for extended periods of time, usually exceeding 30 days. Many personnel served in their role for the entire incident; response activities extended through November 2015.

Figure 10. Total Number of APHIS Personnel Assigned to Support the Incident at APHIS Hub or Home Location, by Organizational Unit

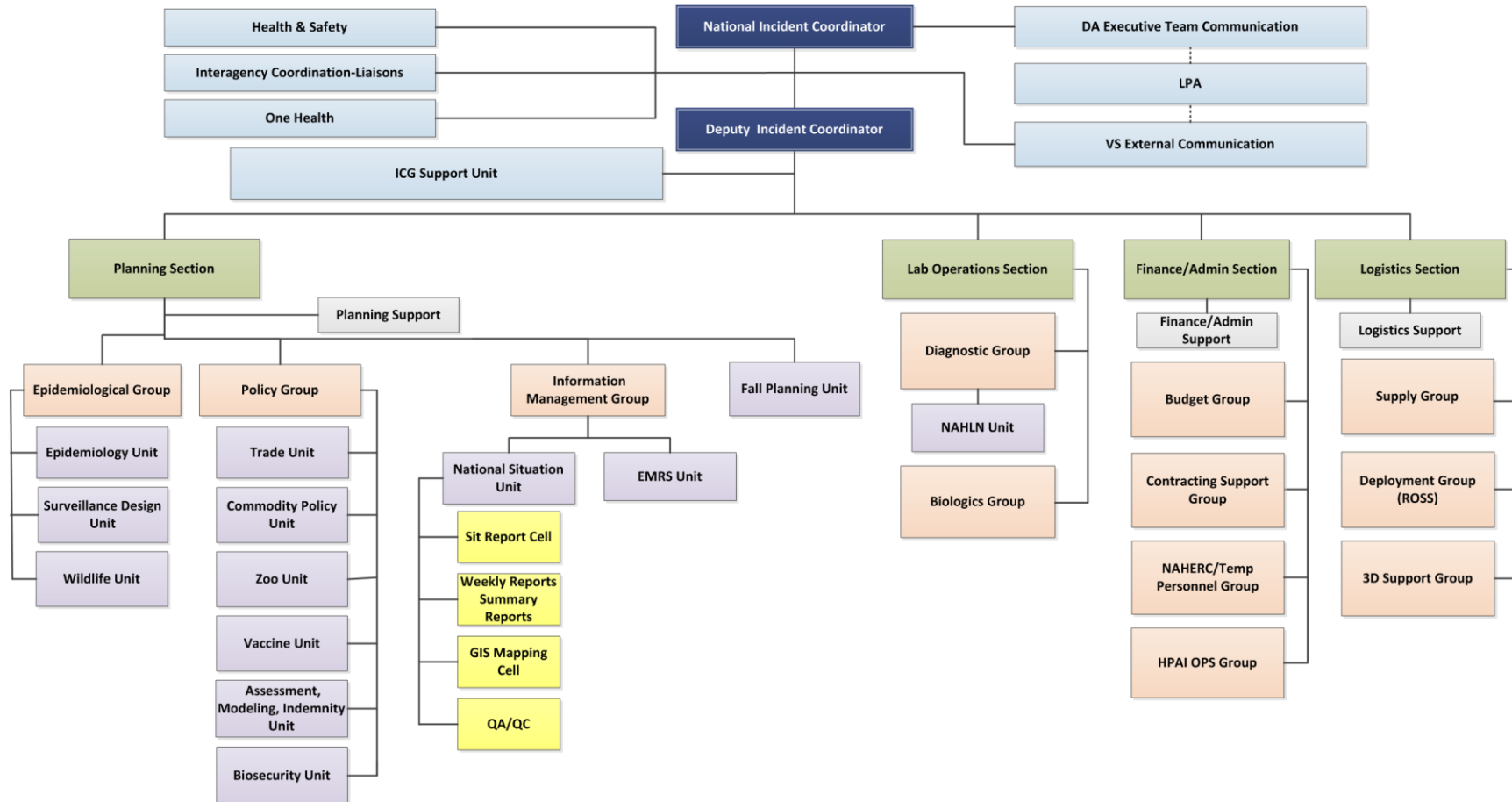


Note: PSS = Program Support Services, STAS = Surveillance, Technology, and Analysis Services, PPD = Policy and Program Development, BRS = Biotechnology Regulatory Services.

Key activities performed by the ICG included: policy development, coordination of epidemiological investigations and studies, facilitation of national resource deployments via the National Veterinary Stockpile (NVS), indemnity payment processing, coordination of modeling and preparedness work, coordination of national laboratory services, contracting support, development of daily and weekly situation reports and maps, and coordination with national-level stakeholders. ICG command and control was accomplished via regular meetings and the Incident Action Planning (IAP) process.

Figure 11 illustrates the ICG structure that was used to respond to the HPAI outbreak; flexible and scalable to the incident, this structure evolved multiple times throughout the 2014–2015 outbreak to adjust to the needs of the incident and the response efforts.

Figure 11. National Incident Coordination Group Structure from Incident



Note: DA = Deputy Administrator; QA/QC = quality assurance/quality control; OPS = operations; ROSS = Resource Ordering and Status System.

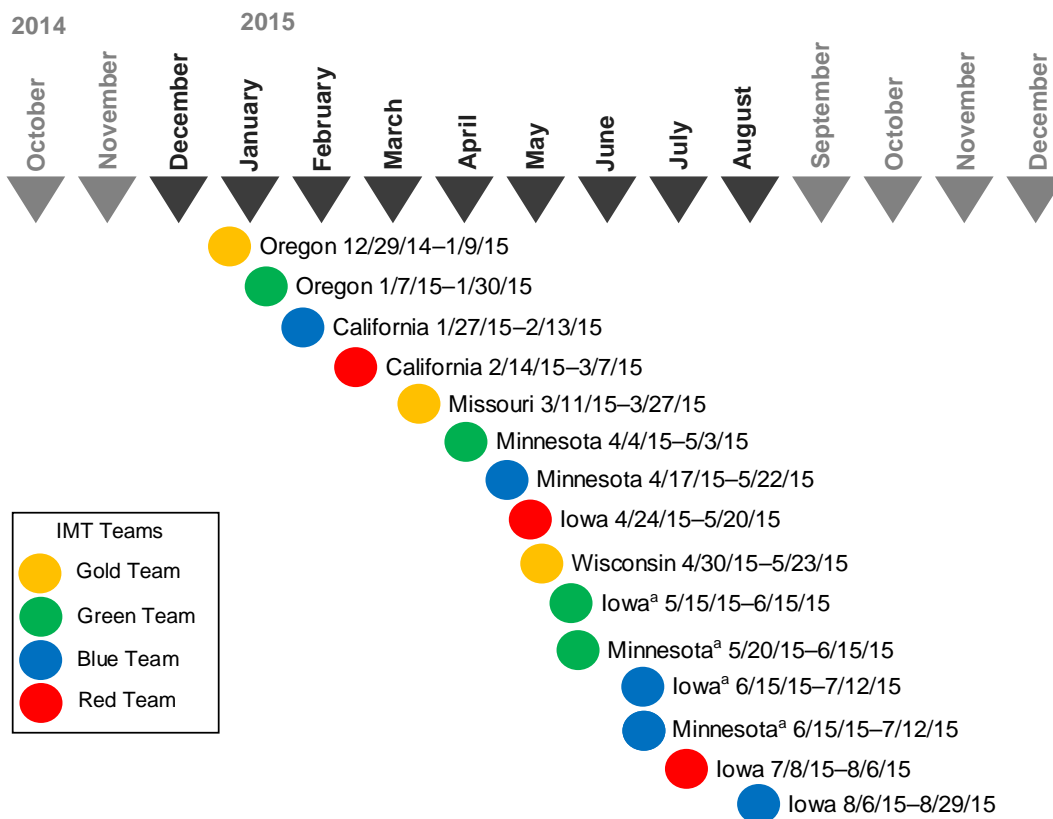
APHIS VS National Incident Management Teams

Beginning in December 2014, APHIS VS NIMTs were deployed to support State responses to HPAI detections. NIMTs were deployed to Incident Command Posts (ICP), to create a unified IC with State responders. During the 2014–2015 HPAI incident, the organizational structure of each unified IC was consistent with NIMS/ICS but varied slightly, based on the specific needs of the State and ICP. APHIS VS NIMTs were not deployed to every State during the incident; the integration and number of Federal personnel in a unified IC depended on the capabilities and resources of the State. The IC was responsible for executing field activities, including depopulation, disposal, disinfection, and diagnostic testing activities.

APHIS VS National Incident Management Team Rotations

USDA APHIS VS started the incident with four NIMTs: Gold, Green, Blue, and Red. Additional NIMTs were created by splitting both the Green Team and Blue Team into two separate teams, each augmented with contractors to meet staffing requirements. This was necessary to address growing response demands. A rotation system was used, whereby one team replaced another team after an allotted deployment time. Figure 12 illustrates these rotations. Oregon, California, Minnesota, and Iowa all had multiple NIMT rotations; at the height of the response, Minnesota, Iowa, and Wisconsin all had an NIMT at the same time.

Figure 12. APHIS VS National Incident Management Team Rotations



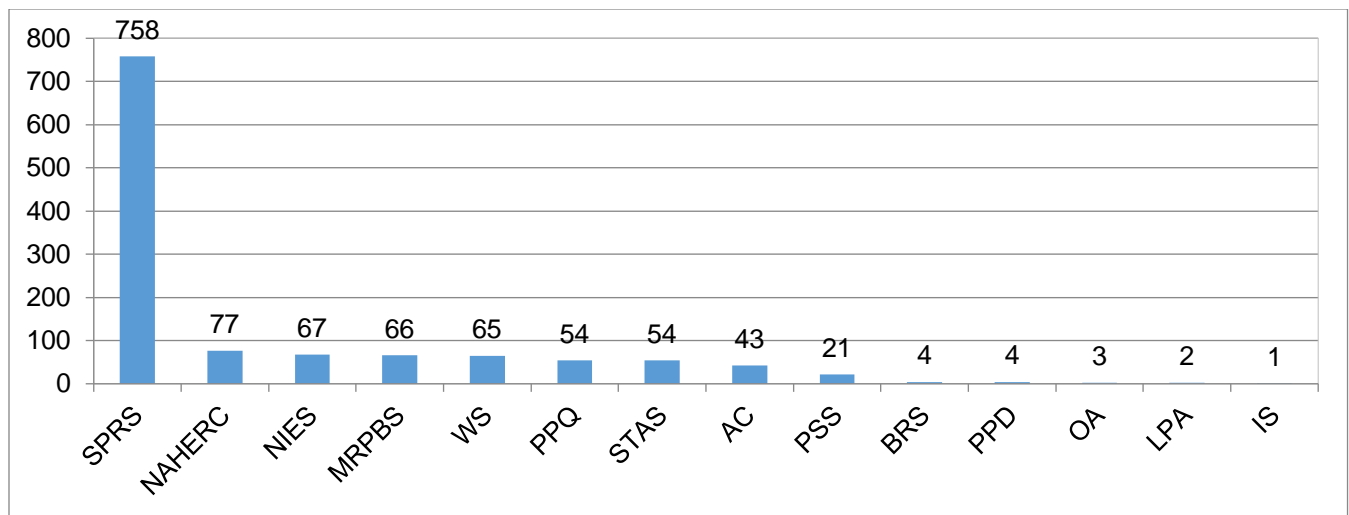
^a Teams split and augmented with contractors due to the scope of the incident.

Deployments for APHIS VS National Incident Management Teams

During the response effort, deployed APHIS personnel filled over 60 different positions, ranging from Incident Commander and Deputy Incident Commander to Planning Section Chief and Safety Officers. The most frequently deployed positions were Veterinary Medical Officers (278 deployments), followed by Animal Health Technicians (263 deployments), and Team Technicians (76 deployments).

SPRS had the most deployments, by a significant margin. There were also deployments from NIES, MRPBS, WS, PPQ, and STAS. The total number of deployments by organizational unit is provided in Figure 13.

Figure 13. Total Number of APHIS Deployments by Organizational Unit



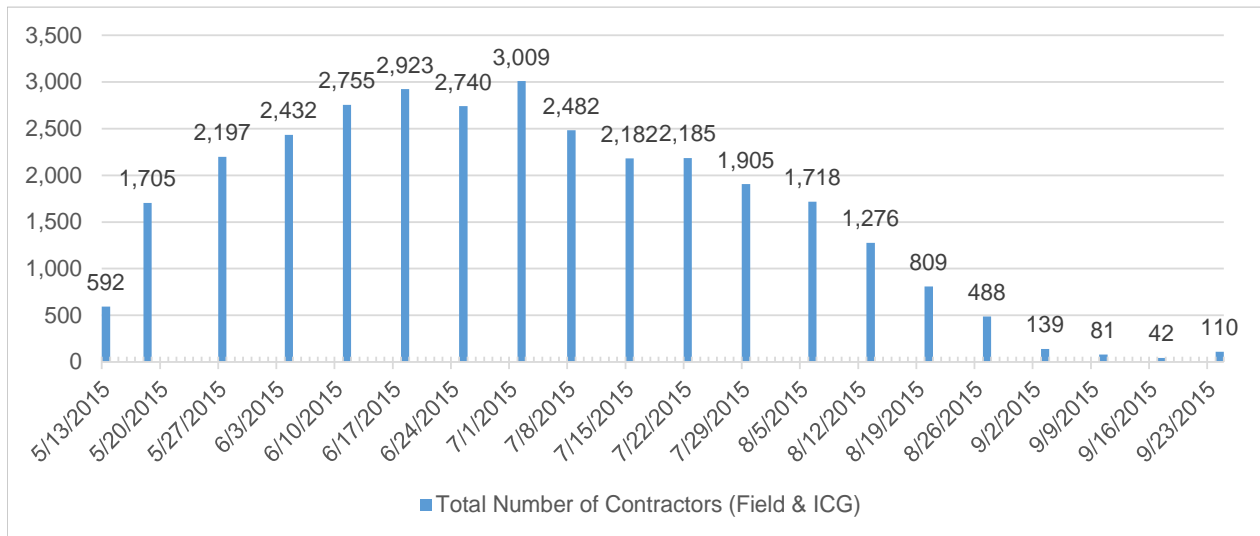
Note: IS = International Services.

Contractors

The response to the outbreak quickly outpaced available resources once the outbreak accelerated in the Midwest, both at the ICG and NIMT levels. Contractors augmented both ICG and field responses. The SPRS Logistics Center, through the ICG, played a key role in coordinating and tracking the contractors both at headquarters and in the field. APHIS Contracting Officers also played a critical role in executing contracts. USDA APHIS contracted with a number of companies, large and small, to effectively execute response operations. Contractors worked in the field not only to deliver services and materials related to depopulation, disposal, and disinfection, but to provide premises physical security services, credentialing assistance, and equipment rentals. In all, USDA APHIS contracted with more than 90 companies, individuals, and organizations to complete response operations successfully.

Figure 14 shows the total number of contractors that were working, by week, during the course of the response; it includes both headquarters ICG support and field support contractors, though the maximum ICG support during any week was eight personnel/full-time equivalents.

Figure 14. Number of Contractors Deployed, by Week, during Outbreak



Section 5. Incident Coordination Group Response and Support Activities

Overview

The ICG worked with other Federal, State, local, stakeholder, and industry partners during the outbreak to achieve control and eradication of HPAI. The ICG supported and provided policy guidance to the APHIS VS NIMTs at ICPs and incident sites while they were conducting key activities including depopulation, disposal, and virus elimination.

This list is not exhaustive but provides an overview of the many tasks that the ICG completed during the incident:

- Updated disease etiology and ecology information.
- Revised laboratory definitions and case definitions.
- Designed disease surveillance and sampling schemes.
- Planned diagnostic testing requirements.
- Coordinated epidemiological investigations.
- Carried out information management, coordinated mapping, and produced reports.
- Communicated with stakeholders.
- Facilitated responder health and safety and provided guidance on personal protective equipment (PPE).
- Provided guidance on biosecurity measures.
- Assisted with quarantine and movement control issues.
- Supported permitting and continuity of business activities.
- Provided information and documentation for regionalization for international trade.
- Provided resources and guidance for mass depopulation and euthanasia.
- Conducted and provided subject matter expertise for disposal activities, particularly composting.
- Provided options and policy for cleaning and disinfection (virus elimination).

- Supported logistics activities through the NVS.
- Safeguarded animal welfare during response operations.
- Conducted modeling and assessments to support response and recovery.
- Provided personnel dedicated to appraisal, compensation, and payment processing.
- Prescribed guidance for restocking and environmental sampling for recovery.
- Ensured the availability of financial resources.
- Provided overall incident management, support, and objectives.

Reporting and Communicating Information

Information management is a challenge in any large incident, and many individuals in both the ICG and NIMTs were responsible for data entry, analysis, and reporting. Communication of this information both internally and externally is critical for effective coordination and communication; this was a daunting task as the number of cases increased dramatically, outpacing available resources.

At the VS and APHIS MAC level, the following were conducted at routine intervals:

- VSET meetings (as needed).
- APHIS MAC Group meetings (as needed).

At the ICG level, the following were conducted/completed at routine intervals:

- Conference calls between the ICG Deputy Incident Coordinator and the NIMT Incident Commanders (daily).
- Conference calls between the ICG, deployed VS NIMTs, and affected States (daily).
- ICG HPAI Status Reports to APHIS staff, Administrator, and to NASAHO (daily).
- Stakeholder announcements and/or GovDelivery notices (daily or as needed).
- ICG-all conference calls (3 times per week).
- Reports distributed widely to States and USDA (weekly or biweekly):
 - National Situation Report (Appendix 2a and 2b)¹⁷
 - National Infected Premises List (Appendix 3)¹⁸
 - National Incident Maps (Appendix 4)¹⁹
 - National Control and Containment Maps (Appendix 5a and 5b)
 - Epidemiological Curve (Appendix 6)
 - Deployment Report (for APHIS Personnel) (Appendix 7)
 - Permit and Movement Report (Appendix 8).
- IAPs and corrective action reports (3 times per week) (Appendix 9a and 9b).

¹⁷ Appendices are not publicly available.

¹⁸ A public version is available here:

https://www.aphis.usda.gov/animal_health/emergency_management/downloads/hpai/infectedprems.pdf.

¹⁹ A public version is available here:

https://www.aphis.usda.gov/animal_health/emergency_management/downloads/hpai/premstatusdetailstate.pdf.

At the VS NIMT level (in the ICP), the following were completed as specified:

- NIMT SitReps (daily) (Appendix 10)
- IAPs (daily)
- Other ICS specific forms like incident logs (daily).

In addition to the accompanying document to this report that contains these Appendices, the reports listed above were (and continue to be) stored on a Sharepoint site that is internal to APHIS.

In addition to this list of reports that were produced at frequent intervals, ICG personnel fulfilled requests for information for both internal partners and external stakeholders as they were received. This included requests for information from the Office of the Secretary in the Department of Agriculture to specific industry groups. Fulfilling these requests in an accurate and timely manner was a critical task of the ICG.

Deployment/Personnel Management

Management of personnel and personnel deployments for this incident was conducted through the ICG using the APHIS ROSS. ROSS is an information management system that is used to identify and track qualified emergency response personnel. ROSS facilitates the rapid dispatch of appropriate personnel through the use of position descriptions and ordering; ROSS was used throughout the 2014–2015 outbreak for personnel requests.

In addition, during the incident, APHIS revised its *Emergency Mobilization Guide*, which provides guidance to facilitate the cost-effective and timely dispatch of emergency management resources for incidents in which APHIS would respond. In conjunction with this document, APHIS identified a trained dispatch community, which was critical to manage resources effectively during the outbreak. During 2014–2015, there were 4 full-time Logistics Management Specialists devoted to personnel deployments and another 30 dispatchers trained for surge capacity.

Policy and Guidance

While the *HPAI Response Plan: The Red Book* provided overarching policy throughout the response effort, specific activities required further guidance. As such, a template was developed for policy guidance documents. These national-level policies were developed by the ICG and distributed widely to all affected States, APHIS VS NIMTs, and stakeholders before being posted publicly at www.aphis.usda.gov/fadprep. In particular, additional guidance was requested on activities like appraisal and indemnity, restocking, and virus elimination—activities that had never been conducted on the scale required in the 2014–2015 outbreak. Providing policy guidance in this manner ensured that guidance was available and could be easily updated as required.

For example, the following policies and guidance were provided during the 2014–2015 HPAI outbreak (in alphabetical order); the approximate timeline of these policies (when they were issued) is pictured in Figure 15.

- Cleaning and Disinfection (C&D) Basics: Virus Elimination

- Contact Premises
- Control Area Release
- Financing the Response: State/Tribal Information
- General Resources and Information
- H5/H7 Avian Influenza Case Definition
- HPAI in the Live Bird Marketing System
- HPAI Response Goals
- HPAI Zones and Premises
- Indemnity Procedures
- Landfill Disposal Guidance—Recommended Waste Acceptance Practices for Landfills
- Mortality Composting Protocol for AI Infected Flocks
- Movement Control
- New State Checklist
- Post C&D Environmental Sampling Guide
- PPE Recommendations for HPAI Responders
- Processing Indemnity Payments
- Restocking Criteria for Previously Infected Premises
- Stamping Out and Depopulation Policy
- Surveillance Activities around HPAI Infected Backyard Flocks
- Surveillance Sampling for Commercial Premises in Control Area
- Testing Requirements for Movement from the Control Area
- Timeline to Restocking and Environmental Sampling Procedures
- Use of the Antigen Capture Immunoassay
- Using Heat Treatment for Virus Elimination.

Figure 15. Timeline of Public Release of Policy Documents

April 2015	May 2015	June 2015	July 2015	August 2015	September 2015	January 2016
<p><i>Indemnity Procedures</i> new financial guidance released Feb 2016</p>	<p><i>New State Checklist</i> previously <i>First HPAI Confirmation in a New State</i> updated Feb 2016</p> <p><i>Restocking Criteria for Previously Infected Premises</i></p> <p><i>Timeline to Restocking and Environmental Sampling Procedures</i> updated Mar 2016</p> <p><i>Processing Indemnity Payments</i> new financial guidance released Feb 2016</p> <p><i>Control Area Release</i> updated Sept 2015</p>	<p><i>Cleaning and Disinfection Basics: Virus Elimination</i> updated Feb 2016</p>		<p><i>Post Cleaning and Disinfection Environmental Sampling Guide</i></p>	<p><i>Stamping Out and Depopulation Policy</i></p> <p><i>Testing Requirements for Movement from the Control Area</i></p>	<p><i>Using Heat Treatment for Virus Elimination</i> updated Feb 2016</p>

Since the 2014–2015 outbreak concluded, these policies have continually been refined and revised; new policies have also been added. Please visit www.aphis.usda.gov/fadprep for the complete list and titles of HPAI policy guidance documents currently available. [Section 6](#), which reviews critical activities conducted during the outbreak, also highlights the events that resulted in critical policy updates.

The FAD PReP *HPAI Response Plan: The Red Book* was also updated in August 2015 based on lessons learned. APHIS Animal Care and APHIS VS also worked together to develop HPAI preparedness and response plans for zoos.

Health and Safety

APHIS proactively supported personnel to mitigate health and safety issues through the establishment of Safety Officers embedded within each APHIS VS NIMT; there was also a Health & Safety Unit embedded into the ICG. This Unit, staffed by individuals from VS Safety, Health, and Environmental Protection (SHEP), finalized health and safety protocols, provided guidance to Safety Officers deployed to ICPs or incident sites, and communicated frequently with State agriculture and public health agencies on the incident. VS SHEP coordinated closely and followed any applicable guidance laid out by the APHIS Emergency Management Safety and Security Division (EMSSD). In addition to EMSSD, VS SHEP also worked closely with supporting Federal authorities such as the CDC, Occupational Safety and Health Administration (OSHA). Collaboratively, these entities did the following:

- Identified procedures to create site-specific health and safety plans.
- Provided details of hazard analysis, necessary training, and medical surveillance requirements.
- Managed a PPE program, including the provision OSHA respirator fit testing.
- Provided PPE guidance for field activities.
- Provided pre-deployment information and guidance.
- Developed protocols for safety in the field.
- Coordinated any responder monitoring required.

Finally, the Health & Safety Unit worked with ROSS Dispatch to locate Certified Safety Officers and Safety Coordinators, finalized the document *PPE Recommendations for HPAI Responders* (www.aphis.usda.gov/fadprep), and authored a *Quick Response Card* for responder safety.

Section 6. Highlights of Response Activities

Overview

To effectively respond to and recover from the HPAI outbreak, APHIS staff, industry partners, State officials, and contractors worked together to complete the following 10 steps per Infected Premises, as outlined in Figure 16 (a higher resolution copy of this figure is available [here](#)). This figure was developed for producers to facilitate understanding of the response process. In practice, many of these steps were complex, and other activities like permitting and information management continued throughout the HPAI outbreak.

Figure 16. A Guide to Help You Understand the Response Process

USDA
United States Department of Agriculture

Highly Pathogenic Avian Influenza

A Guide To Help You Understand the Response Process

- 1 Detect**
You see unusual signs of illness or sudden deaths in your flock. You report it to your private or State veterinarian. Samples are taken and tested. You find out your flock is positive for HPAI.
- 2 Quarantine**
USDA and State personnel come to your farm. We assign you a caseworker, who will be your main point of contact onsite, answer your questions, and guide you through the needed paperwork. We will also place your operation under quarantine, meaning only authorized workers are allowed in and out, and movement restrictions for poultry, poultry products, and equipment go into effect. We contact neighboring poultry farms and start testing their birds to see if they've been affected, too.
- 3 Appraise**
We work with you to create a flock inventory. This lists how many birds you have, what species they are, their age, and other key details that will help us give you 100 percent of fair market value for your birds.
- 4 Depopulate**
Infected flocks are depopulated as quickly as possible—ideally within 24 hours of the first HPAI detection—to get rid of the virus.
- 5 Compensate**
You receive your first indemnity payment early on in the response process. We also pay you a standard amount for virus elimination activities (cleanup work).
- 6 Manage Disposal**
USDA will help you dispose of the dead birds safely. Disposal methods include composting, burial, incineration, rendering, or landfilling. The options you'll have depend on several things: what type of farm you have, the specific conditions there, State and local laws, and what you prefer.
- 7 Eliminate Virus**
The next step is to wipe out all traces of the virus at your property. To kill the virus, thoroughly clean and disinfect the barn, equipment, and all affected areas of your farm. You can do this work yourself or hire contractors to handle it.
- 8 Test**
As soon as you're ready, let your caseworker know you're finished with cleanup. Your site must then stay empty for at least 21 days. During this time, we'll return to collect and test environmental samples. We need to confirm that your property is completely virus-free.
- 9 Restock**
Once USDA and the State both approve, you can restock your facilities and start production again. State officials will release your farm from quarantine after all required testing and waiting periods are done.
- 10 Maintain Biosecurity**
After restocking, you'll need to continue maintaining the highest biosecurity standards to keep the virus from coming back. For biosecurity tips, go to www.aphis.usda.gov/publications and download the factsheet "Prevent Avian Influenza at Your Farm."

How Long Does the Process Take?
Ideally, this entire process could be completed in as soon as 60–120 days. However, the timeframe varies depending on many things (for example, flock size, depopulation and disposal methods used, test results, farm's location). We're committed to restoring production as fast as we can while also protecting poultry health.

Questions?
Talk with your caseworker or the State or Federal officials responding to the disease event in your area.

For general information and contacts, visit:
www.usda.gov/avian_influenza.html
www.aphis.usda.gov/fadprep

USDA is an equal opportunity provider and employer.

Animal and Plant Health Inspection Service • APHIS-91-05-005 • Issued September 2015

The next sections highlight the key points of critical response activities that were conducted during the outbreak.

Surveillance and Epidemiology

Summary

Routine surveillance and the FAD investigations led to the initial detection of HPAI in December 2014 and January 2015. When a positive HPAI flock was detected, a 10 kilometer Control Area was established around the premises.

Granted, many of these Control Areas overlapped in States with many detections, such as Iowa and Minnesota. As part of the epidemiological investigation, all movements onto and off of Infected Premises (known as trace-backs and trace-forwards) were identified and evaluated for the possibility of HPAI transmission. Additionally, after a Control Area was established, active surveillance of flocks—both backyard and commercial—occurred within this zone.

Incident Coordination Group and National Incident Management Team Activities

Surveillance and epidemiological activities were coordinated at both the NIMT and ICG levels. At the ICG, response activities focused on the design of surveillance sampling guidance and development of epidemiological questionnaires to understand outbreak characteristics, identify risk factors, and examine how the HPAI virus was transmitted throughout the outbreak. Within the first 6 months of the outbreak, field-based observational studies of farm biosecurity, management practices, and exposure risks were conducted. There were also geospatial analyses examining correlations between wind patterns and disease spread as well as phylogenetic analyses. Reports summarizing these results were released on June 5, 2015, and again on July 1, 2015. The last version was released on September 9, 2015.²⁰

Based at the ICP, NIMT epidemiologists led and coordinated the survey and interview process in the field to gather information from the premises. In addition, they conducted diagnostic sampling for disease detection on both commercial and backyard operations. The ICG and NIMTs included personnel with expertise in wildlife to coordinate wild bird surveillance sampling and analyze the role of wild birds in the outbreak/transmission.

Surveillance Conducted

During the outbreak, additional clarification was requested from the APHIS VS NIMTs and States regarding the active and passive surveillance required. As such, the ICG produced two policy documents, which prescribed surveillance of backyard flocks around Infected Premises and surveillance for commercial premises that were in the Control Area (these documents are now called *Surveillance of Backyard Flocks Around Infected Premises* and *Surveillance Sampling for Commercial Premises in Control Area* and are available at www.aphis.usda.gov).

²⁰ For more information on transmission and epidemiology, please refer directly to the *Epidemiologic and Other Analyses of HPAI-Affected Poultry Flocks: September 9, 2015*. https://www.aphis.usda.gov/animal_health/animal_dis_spec/poultry/downloads/Epidemiologic-Analysis-Sept-2015.pdf.

These documents provide specific guidance for an HPAI outbreak, above and beyond routine or National Poultry Improvement Plan (NPIP) surveillance that is conducted in flocks.

The following data (Table 4) was collected by NVSL and NAHLN during the outbreak. It provides summary information regarding the number of samples tested for both commercial and backyard flocks as well as additional surveillance that was conducted during the outbreak in wild birds. Sixteen different NAHLN laboratories (in addition to NVSL) were involved in testing samples. Fourteen NAHLN laboratories tested commercial and backyard flock samples during the outbreak response, with over 88,000 samples being tested. In addition, NVSL and 9 NAHLN laboratories also tested wild birds, with over 57,000 samples tested during the outbreak response.

Table 4. HPAI Outbreak Response Testing Summary (Number of Samples)

Domestic Bird Testing (Commercial and Backyard)	Matrix PCR [polymerase chain reaction] Tested	H5 PCR Tested	H7 PCR Tested	Virus Isolation Tested	Total Tests
14 NAHLN Labs	72,314	2,772	2,675	1,366	79,127
NVSL	2,825	4,688	1,149	1,105	9,767
Total	75,139	7,460	3,824	2,471	88,894
Wild Bird Testing	Matrix PCR [polymerase chain reaction] Tested	H5 PCR Tested	H7 PCR Tested	Virus Isolation Tested	Total Tests
9 NAHLN Labs	42,259	6,234	6,138	0	54,631
NVSL	252	1,407	650	797	3,106
Total	42,511	7,641	6,788	797	57,737

Note: Table courtesy of the VS NAHLN Coordinator.

Diagnosics

As seen by the number of samples tested, laboratory services were a major component of the HPAI response. Critical field activities—like depopulation—relied on diagnostic laboratory test results as triggers, per the *HPAI H5/H7 Case Definition*. Laboratory services in support of the incident were divided between the APHIS NVSL and State-operated, USDA APHIS approved and proficiency tested NAHLN laboratories. In total, there are 56 NAHLN labs approved to test for AI. Each of the states with positive commercial flocks had at least one NAHLN lab capable of testing for AI. NAHLN laboratories in affected States were also able to provide surge support to each other, in cases where a specific network lab became overwhelmed with samples.

In total, 16 NAHLN laboratories (in addition to NVSL) were involved in testing in support of the HPAI outbreak. Of these laboratories, 13 NAHLN laboratories (and NVSL) electronically messaged test results during the HPAI outbreak; 4 of these laboratories started messaging during the outbreak itself to improve timely and accurate information management of laboratory accessions and results.

Depopulation decisions were made based on the criteria provided in the *H5/H7 Avian Influenza Case Definition*. As was stated in the *HPAI Response Plan: The Red Book*, premises classified as Infected Premises—and Contact Premises, as appropriate—were depopulated as quickly as possible. As the outbreak spread, further clarification was requested by States on the trigger for depopulating flocks: when the criteria for a presumptive positive had been met, APHIS personnel—in conjunction with State and Tribal officials—initiated depopulation, disposal, and virus elimination procedures on the premises. NVSL continued to receive samples for confirmation, as well as subtyping, from all Infected Premises for the duration of the outbreak. NVSL sequenced HPAI samples and tracked genetic variations over the course of the outbreak.

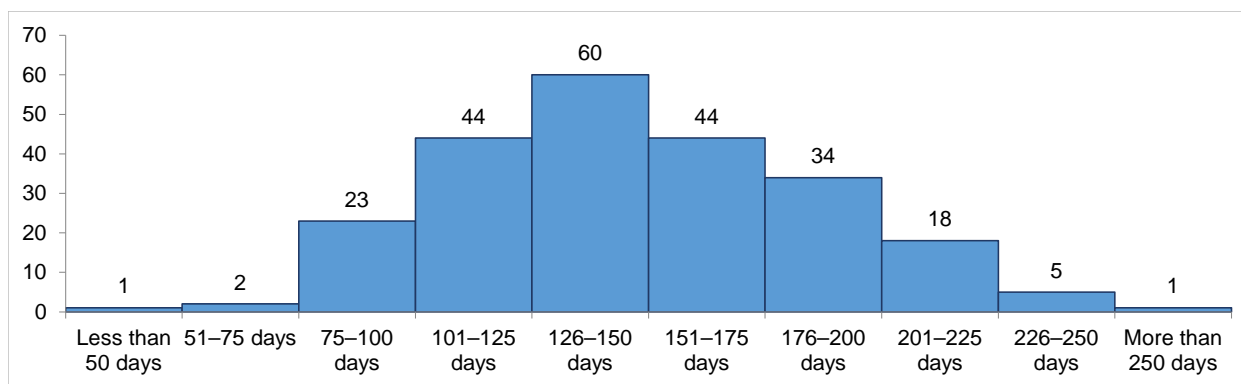
Quarantine, Movement Control, and Continuity of Business

State quarantines were placed on all Infected Premises and DCs. The date the State quarantine was first placed on the premises was recorded in EMRS; in some cases, State quarantines were also frequently placed on premises inside an Infected Zone as a preventive measure to halt the spread of the virus, even if that premises was not infected.

- The average length of these quarantines on Infected Premises and DCs was 149 days for all premises (commercial and backyard).
 - For commercial premises, the average length was 147 days.
 - For backyard premises it was 157 days.

Figure 17 illustrates the length of the quarantines placed on premises during the outbreak. As it shows, the majority of the premises had quarantines lasting between 100 and 175 days.

Figure 17. Length of Quarantine on All Premises (Frequency Count)

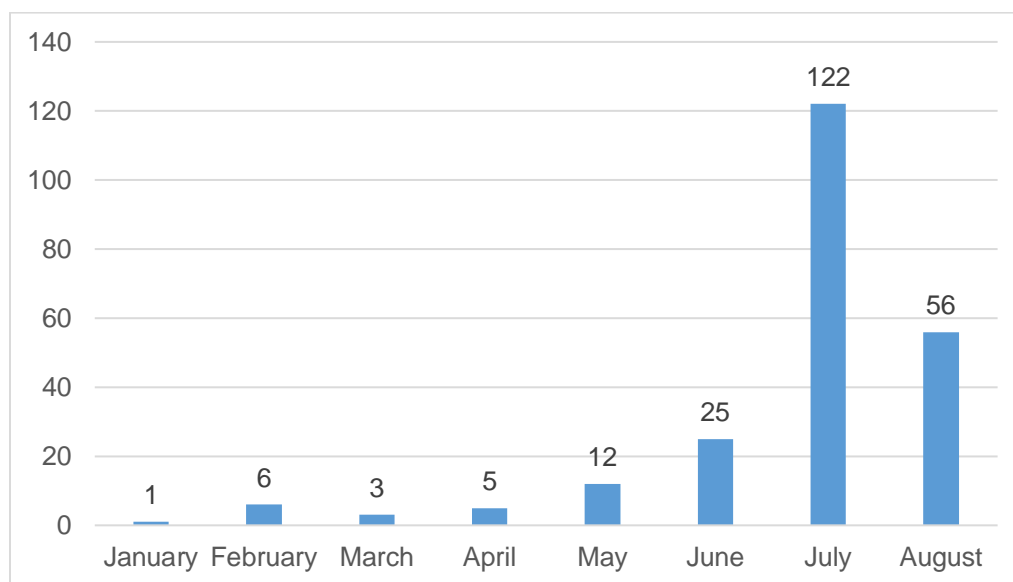


Regulatory Control Areas were also established under the jurisdiction of the unified IC. This continued throughout the outbreak; each Infected Premises was the epicenter of an individual 10 kilometer Control Area.²¹ Figure 18 identifies the number of Control Areas that were released each month, based on date of official release.

²¹ At the time of the outbreak, Control Area placement and release was not accurately captured in EMRS across all States. Procedures have since changed to record this information successfully; Control Area release dates were available, and documented by hand (as seen in Figure 18).

Guidance on the release of Control Areas was provided in a policy guidance document *Control Area Release*. Release of the Control Area requires specific criteria, including that all birds on Infected Premises in the Control Area were depopulated and disposal completed or compost piles set. Required surveillance must be completed; release can occur prior to the date on which restocking is allowed. The delay of most of the Control Area releases into July and August 2015 was the result of the ongoing and widespread cases in Iowa and Minnesota in late spring.

Figure 18. Number of Control Areas Released by Month for All Premises



Note: All Control Area releases were in 2015. Three DC Premises had no Control Area placed on them; they fell within existing Control Area perimeters.

In a regulatory Control Area, permits are required for movement into, within, and out of a Control Area to prevent the spread of HPAI to non-infected premises. Items permitted during the outbreak included poultry products, based on the Secure Food Supply Plans for eggs, broilers, and turkeys, as well as items for normal operations (e.g., the movement of feed or manure). Permitted movements were to processors, landfills, slaughter establishments, renderers, and other destinations.

During the outbreak, over 7,500 permits were issued (not including any revoked permits), which resulted in approximately 20,000 permitted movements. Most of these permits had origin premises in Minnesota (36 percent) and Iowa (52 percent) (Figure 19). Many items moved under permit (Figure 20). The resources required for rapid permitting and data entry into the EMRS overwhelmed the States and APHIS VS NIMTs; as such, a successful National Permitting Unit was staffed in Ft. Collins, CO. This unit was responsible for rapid and accurate data entry of permits and permitted movements throughout the outbreak, for all States requiring permitted movement. EMRS was used successfully to issue and record these permits.

Figure 19. Number of Permits Issued by State of Origin for Movement Into, Within, or Out of a Control Area

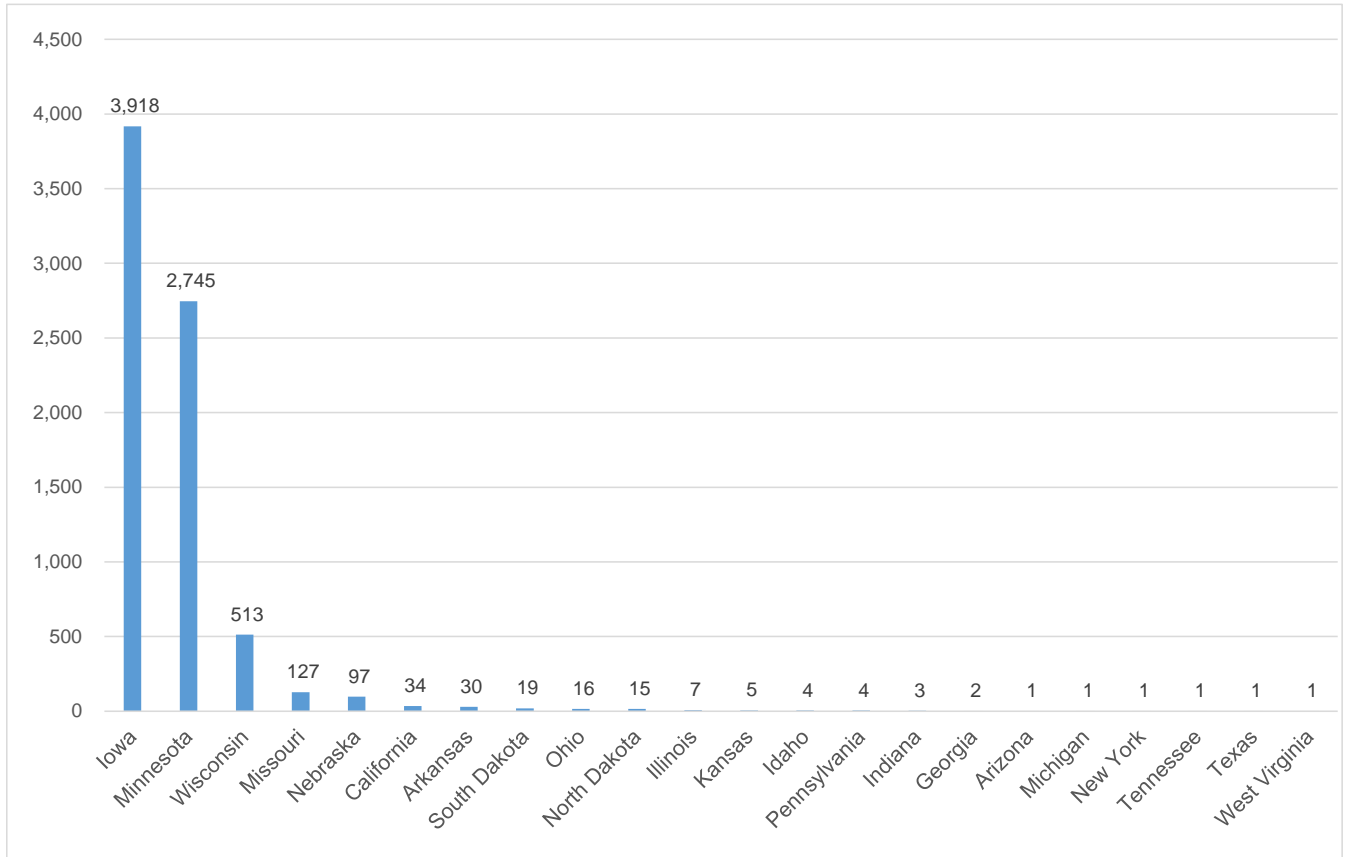
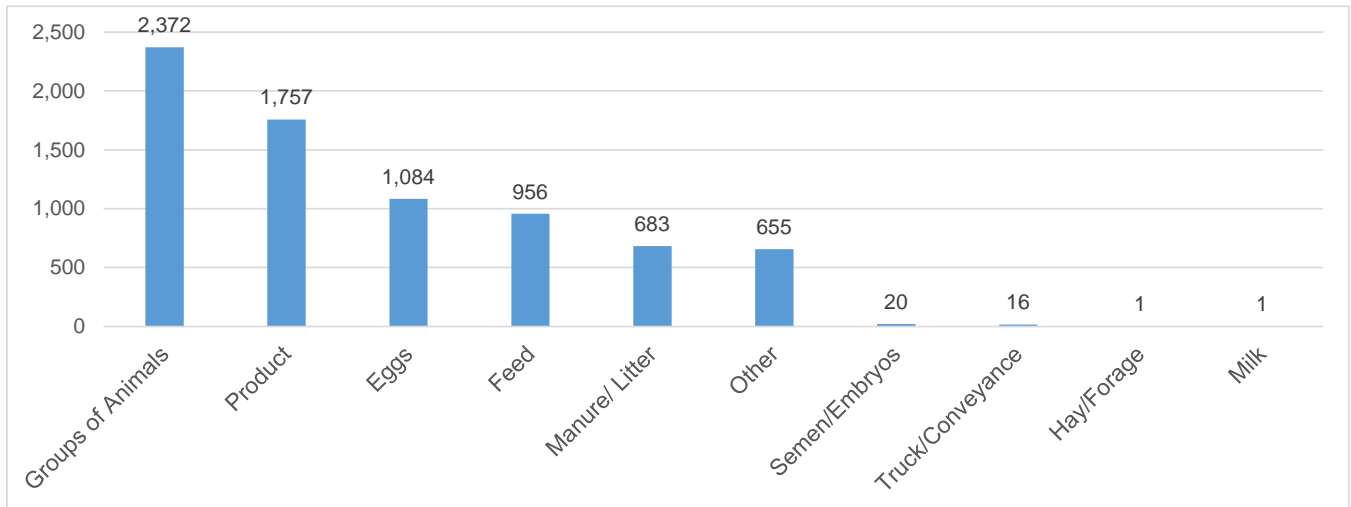


Figure 20. Number of Permits Issued by Item Permitted



A large percentage of these permitted movements were for continuity of business. In all, nearly 50 percent of total permitted movements were either out of the Control Area or into commerce. The Secure Food Supply Plans successfully helped animals and products keep moving during the

outbreak, demonstrating successful collaboration between States (both sending and receiving product), the unified IC, and APHIS. Typically, depending on the movement, two negative rRT-PCR tests were required, with one test within 24 hours of movement. Clarifications made to EMRS data entry for permits will help to capture further information on permitted movements in the future.

An example of a *Permitting and Movement Report*, which will indicate States of origin, destination, and volume of permits and movements, is provided in Appendix 8.

Depopulation

Depopulation (also known as stamping-out) was implemented throughout the 2014–2015 HPAI outbreak to prevent or mitigate the spread of disease. Depopulation was applied immediately after the first premises was detected and continued throughout the outbreak. As a direct result of the 232 Infected Premises detections (211 commercial and 21 backyard), more than 50 million birds were depopulated (including birds that succumbed to HPAI prior to depopulation). This includes seven DCs that were also depopulated.

There were significant challenges in rapidly depopulating flocks in a timely manner as the outbreak progressed. At the height of the backlog from late-April to mid-May, there was a depopulation delay of at least 7 days for newly detected premises. APHIS worked to address this shortage by deploying additional personnel and resources, with employees and equipment from the States of North Carolina, Georgia, and Virginia volunteering to assist in the response effort. Additional contractor support was also rapidly obtained.

The primary methods used for depopulation during the response included the application of foam or carbon dioxide (CO₂) gas. Foam was the preferred method to depopulate turkeys. In many chicken layer houses, the use of foam was problematic and other measures had to be employed. Techniques for CO₂ “whole house” gassing had not yet been developed, requiring smaller CO₂ gas carts to be used for chicken layer depopulation, which is an extremely slow process on premises with hundreds of thousands or millions of birds.

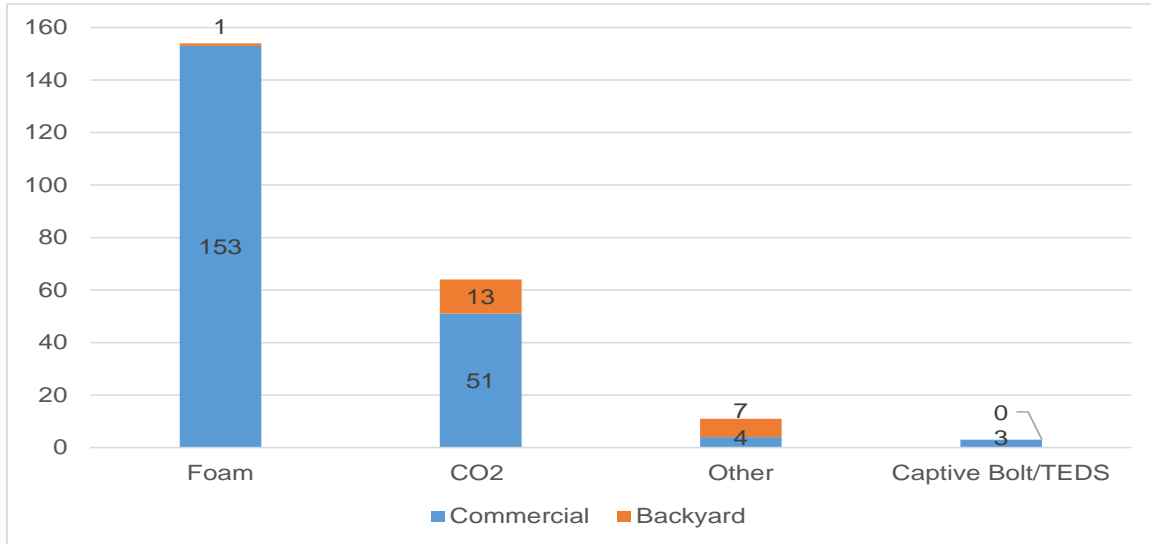
As a result of the depopulation delays experienced in this outbreak, APHIS issued policy guidance *Stamping-Out and Depopulation Policy* which explicitly states that the goal is to depopulate all Infected Premises within 24 hours. As it states “due to the risk of virus amplification in infected poultry, poultry that meet the HPAI presumptive positive case definition will be depopulated as soon as possible, with the depopulation goal of 24 hours or less.” This policy guidance clarified that this may also apply to Contact Premises or those meeting the suspect case definition as determined by State/Tribal and APHIS officials.

The 2014–2015 outbreak clearly demonstrated that to meet this goal, existing depopulation methods may not be sufficient. As such, USDA APHIS released the policy guidance *Ventilation Shutdown Evidence & Policy*, which states that the use of ventilation shutdown may be considered as an alternative, on a premises by premises basis, with close coordination and collaboration by State and APHIS officials to meet the 24-hour goal. Factors to be evaluated include epidemiological information, housing and environmental conditions, currently available

resources and personnel, and other relevant factors. Please see that document for further guidance on ventilation shutdown.

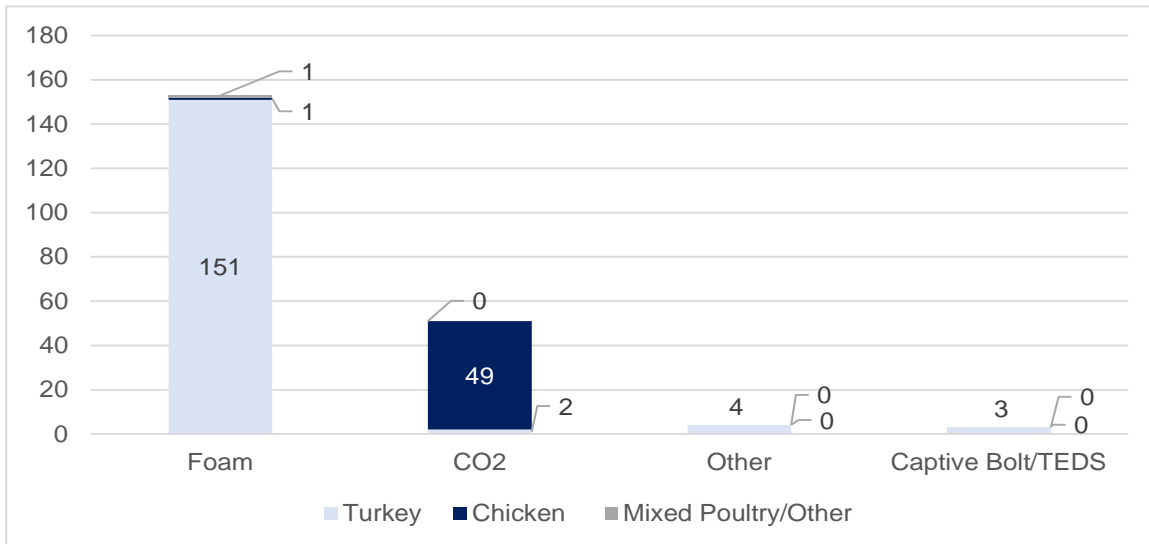
Figure 21 shows the primary depopulation methods used in the outbreak. Foam was the predominate method—66 percent of premises used foam; 28 percent used CO₂. For backyard premises specifically, CO₂ was more common: 62 percent of backyard premises used CO₂. Figure 22 shows disposal method by flock type for commercial flocks. As mentioned, foam was used predominately in turkey flocks, while chicken layer flocks elected CO₂.

Figure 21. Primary Depopulation Method for All Premises



Note: The “Other” category represents those premises that were depopulated using a combination of methods or other approved method, typically cervical dislocation.

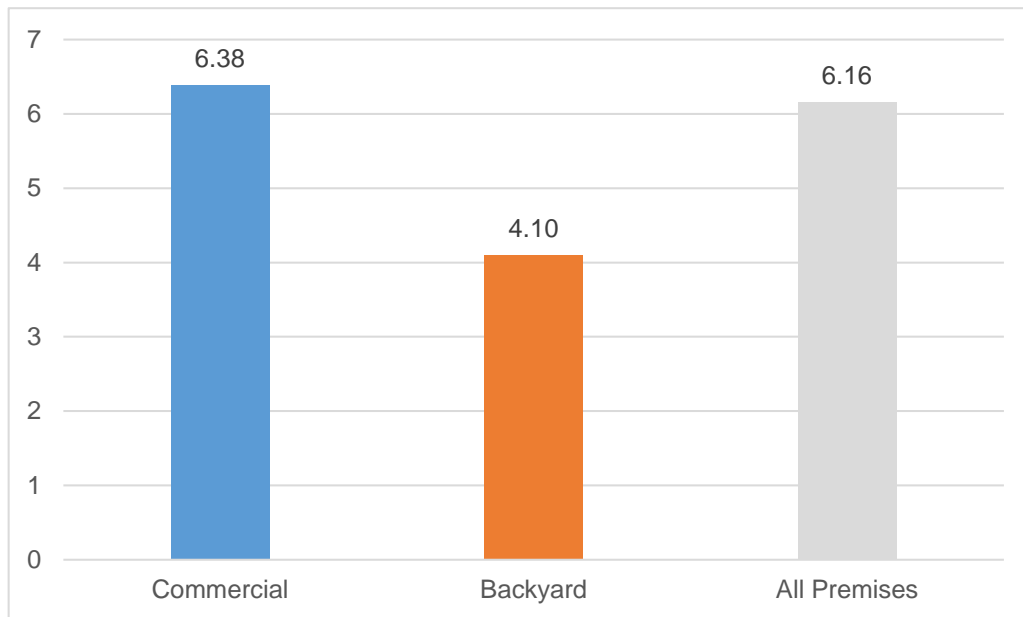
Figure 22. Primary Depopulation Method by Flock Type for Commercial Premises



Note: The “Other” category represents those premises that were depopulated using a combination of methods or other approved method, typically cervical dislocation.

Figure 23 illustrates the average time to depopulation for Infected Premises. The average time from NVSL confirmation to depopulation complete for all premises was approximately 6.2 days; 6.4 days for commercial premises and 4.1 days for backyard premises. Figure 24 illustrates the average time to depopulation from NVSL confirmation for commercial flocks, split between chickens, turkeys, and mixed poultry. Due to flock size and difficult conditions, on average, it took 15.4 days to depopulate commercial chicken layer flocks compared to only 3.5 days for commercial turkey premises.²²

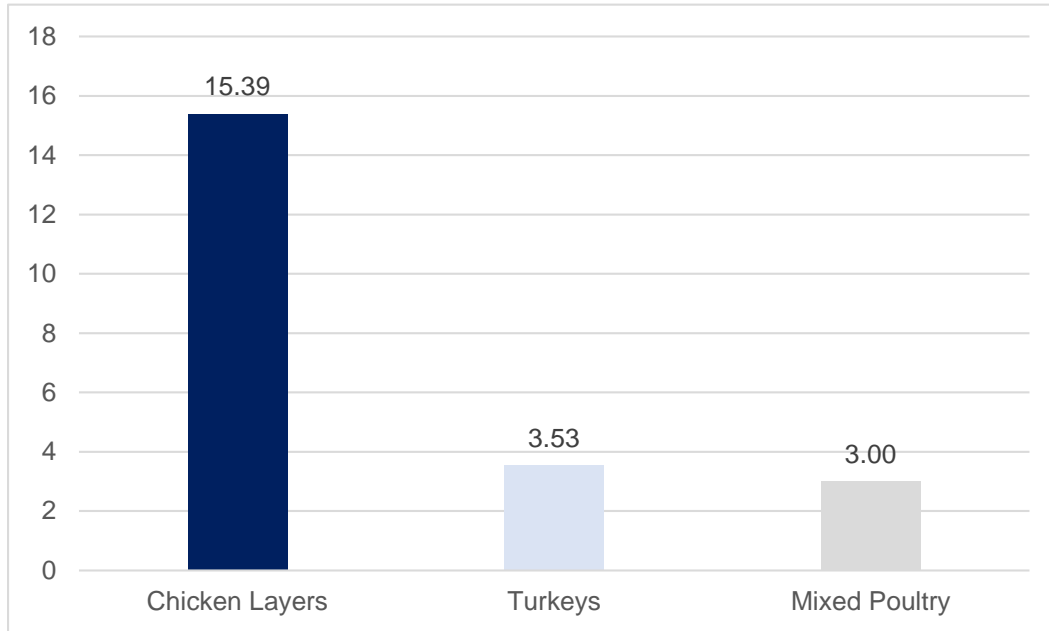
Figure 23. Time to Depopulation (Average Days) from NVSL Confirmation for All Premises, excludes Dangerous Contacts



Note: Excludes DCs because these premises may not have had an NVSL confirmation date before depopulation.

²² NVSL confirmation date is when a “confirmed status” was placed on the premises in EMRS, based on a positive diagnostic test result at NVSL. In the graphs throughout this document, a confirmed H5 result date is used if available prior to full subtyping results.

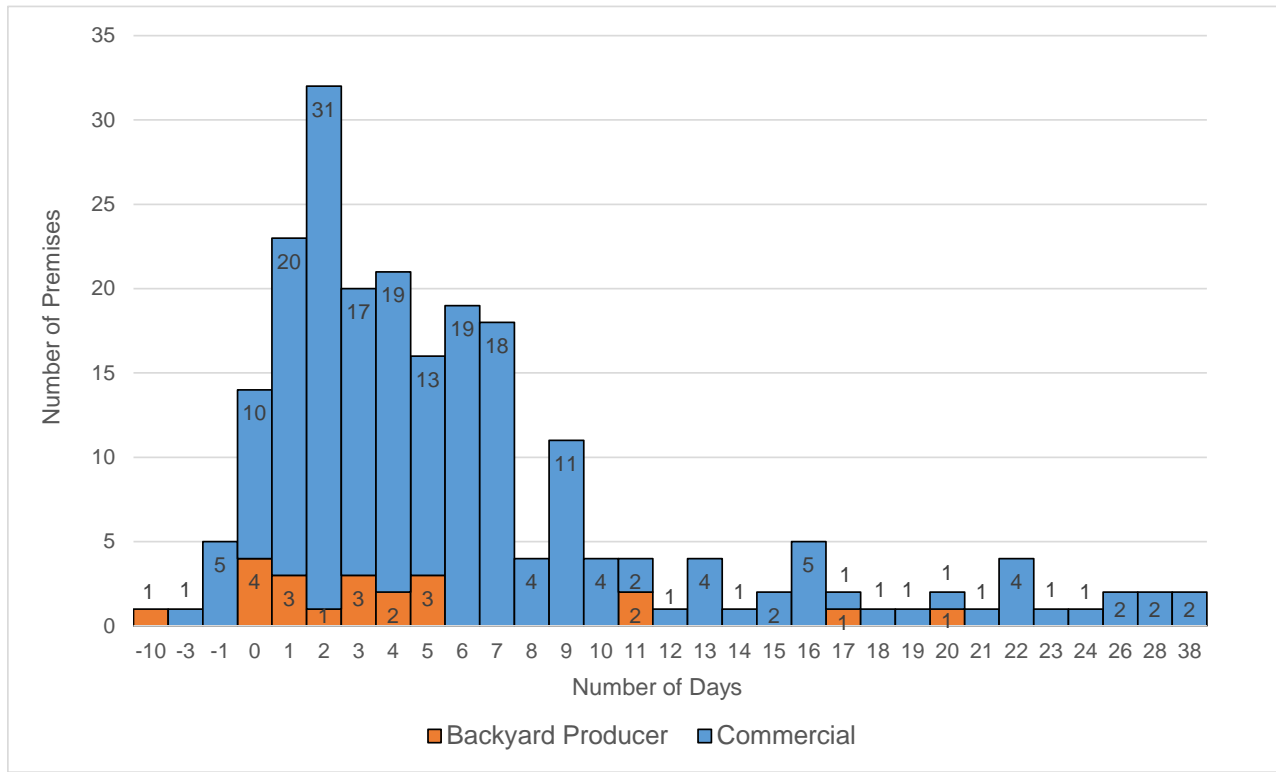
Figure 24. Time to Depopulation (Average Days) from NVSL Confirmation for Commercial Premises by Flock Type, excludes Dangerous Contacts



Note: Excludes DCs because these premises may not have had an NVSL confirmation date before depopulation. There were a negligible number of broilers affected during the outbreak; these are included in the “Chicken Layer” category in this figure (which also includes layer pullets and a breeder flock).

Figure 25 illustrates, for all premises, the amount of time it took to depopulate the premises from the NVSL confirmation date. **Please note that depopulation can be conducted from a presumptive diagnosis, and based on APHIS/State official recommendation, the suspect case definition, so some premises were depopulated prior to the NVSL confirmation date.** Figure 25 subsequently shows the majority of the premises (75 percent) were depopulated before or within a week of NVSL confirmation. As the outbreak exploded in the Midwest, there were some significant delays from NVSL confirmation to depopulation.

Figure 25. Time (Days) to Depopulation from NVSL Confirmation, excludes Dangerous Contacts²³



Note: Excludes DCs because these premises may not have had an NVSL confirmation date before depopulation.

Disposal

There are many options for disposing of animal carcasses and materials; effective disposal is a key component of a successful response to an FAD outbreak. During the 2014–2015 outbreak, the use of composting as a disposal method was critical (see Figure 26). Composting, though it requires a composting SME, trained equipment operators, and sufficient carbon and water, was the most effective and efficient way to dispose of carcasses from the HPAI outbreak.

APHIS deployed its first disposal expert on January 23, 2015, to address the initial H5N2 positive commercial turkey flock in California. As the outbreak escalated in April, contractors were also deployed to support large-scale disposal operations. APHIS deployed composting SMEs to assist with disposal of depopulated poultry. More than 15 composting SMEs were used during the response to aid producers with disposal. The last composting SME was deployed to Iowa on June 29, 2015. Disposal SMEs wrote a comprehensive guidance document *Mortality Composting Protocol for Avian Influenza Infected Flocks* to provide further information on composting.

²³ The premises that was depopulated 10 days before NVSL confirmation was identified as a trace-forward premises from an Infected Premises, and depopulated based on meeting the suspect case definition.

As with depopulation, disposal requirements outpaced available resources at the height of the outbreak. Other options were considered and used to a lesser extent in the outbreak, including landfill, incineration, and burial (Figure 26). In mid-April, while composting proved to be problematic in some areas, APHIS initiated negotiations with landfills and State agencies regarding the transportation and disposal of material. Identifying landfills proved problematic due to apprehension from State government agencies and landfill operators. The routing of material to the landfills and concern about environmental contamination were significant hurdles. However, APHIS eventually obtained agreements with two landfills that would accept material in Iowa. As an additional option, APHIS acquired four incinerators to augment disposal operations; however, incinerators could not keep pace with the capacity required.

Figure 26. Primary Disposal Method for Carcasses for All Premises

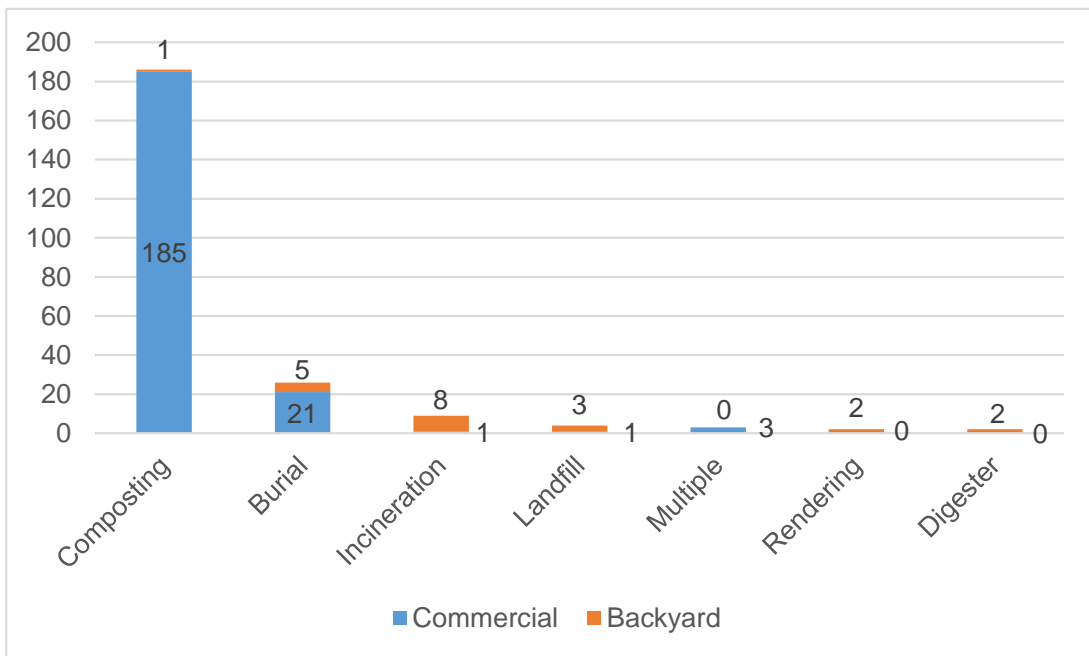
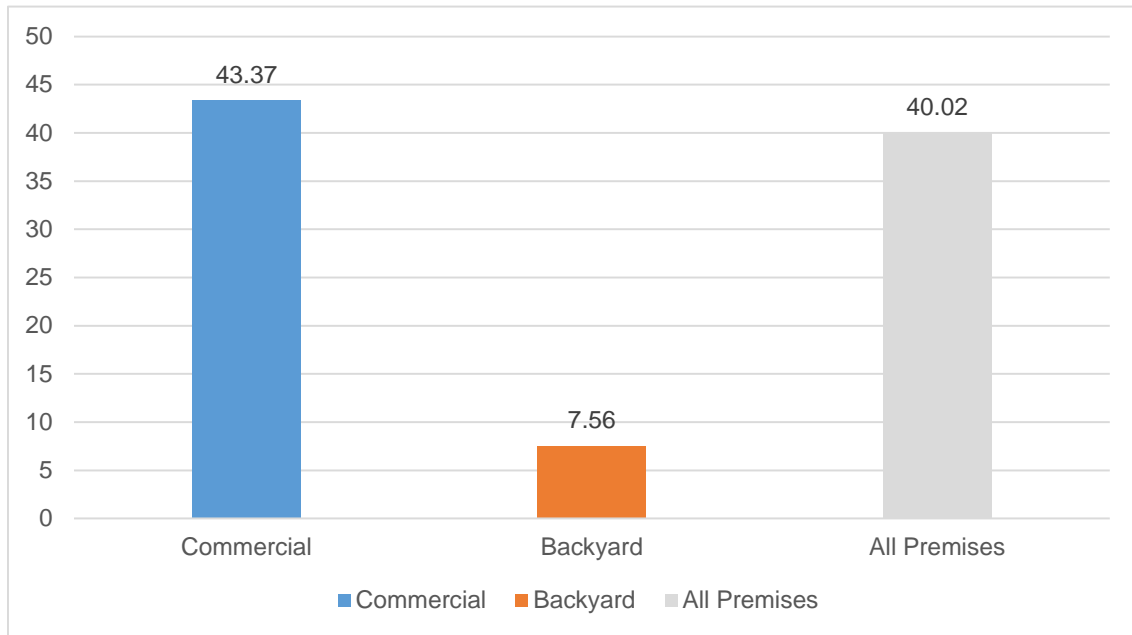


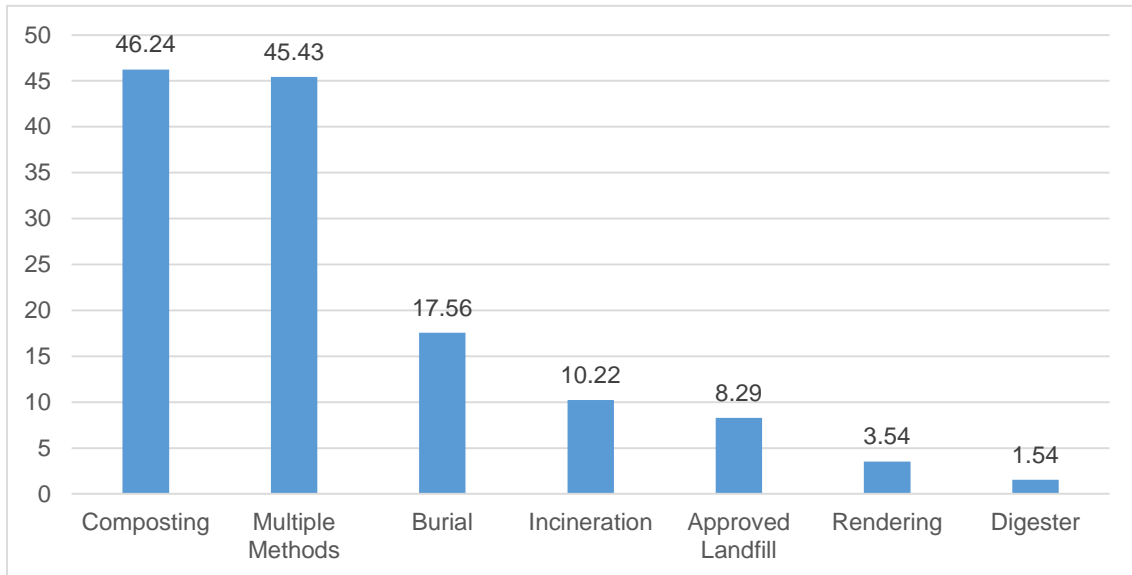
Figure 27 illustrates the average number of days from NVSL confirmation to the completion of disposal. For commercial premises, disposal was complete in approximately 43 days. For backyard premises, the average was 7.6 days. In large part, this is due to the different methods selected for disposal—most commercial premises elected to compost carcasses, which increased the amount of time until disposal is considered to be “complete” on a premises. This is illustrated in Figure 28, which shows the average time (in days) from NVSL confirmation to completion of disposal by the method of disposal.

Figure 27. Time to Disposal Complete (Average Days) from NVSL Confirmation, excludes Dangerous Contacts



Note: Excludes DC Premises as they may not have had an NVSL confirmation date.

Figure 28. By Method of Disposal, Time to Disposal Complete (Average Days) from NVSL Confirmation, excludes Dangerous Contacts



Note: Excludes DC Premises as they may not have had an NVSL confirmation date.

Virus Elimination (Cleaning and Disinfection)

The HPAI virus survives for extended periods in organic material and under certain environmental conditions. As such, virus elimination activities—to get rid of the virus on Infected Premises—were critical for an effective response effort. While traditionally wet

cleaning and disinfection has been performed in most disease incidents, this incident showed that dry cleaning and subsequent heat treatment of the affected facility was a cost effective method to ensure the elimination of the virus.

To explain these options for virus elimination, a policy guidance document *Cleaning & Disinfection Basics (Virus Elimination)* was developed. This document clearly states the options for both cleaning (wet or dry) and disinfection (wet, heat treatment, or fumigation with chlorine dioxide) to eliminate the HPAI virus from a previously Infected Premises. It also prescribes guidance for premises that opt for an extended fallow period. The virus elimination method selected should be a premises by premises decision, and consider cost effectiveness.

As with depopulation and disposal, virus elimination activities required rapid contracting to obtain additional personnel for the response efforts. The majority of C&D field work was performed by contracted teams and coordinated by C&D personnel incorporated into the NIMTs organizational structures. However, after the peak of the outbreak, like with depopulation and disposal, there were associated delays in virus elimination activities: by July 17, 2015, only 85 of the 211 commercial premises had completed virus elimination. By the end of October 2015, virus elimination had been completed on 206 of 211 commercial premises. The five remaining commercial premises had completed virus elimination by November 13, 2015.

As seen in Figure 29, application of wet disinfectant was by far the most common method of virus elimination, used by 81 percent of commercial premises, followed by heat treatment which was used by 11 percent of premises. Of the backyard flocks, 12 of 21 flocks (57 percent) elected to complete an extended fallow period instead of other virus elimination procedures.

Figure 29. Disinfection Method Used for All Premises

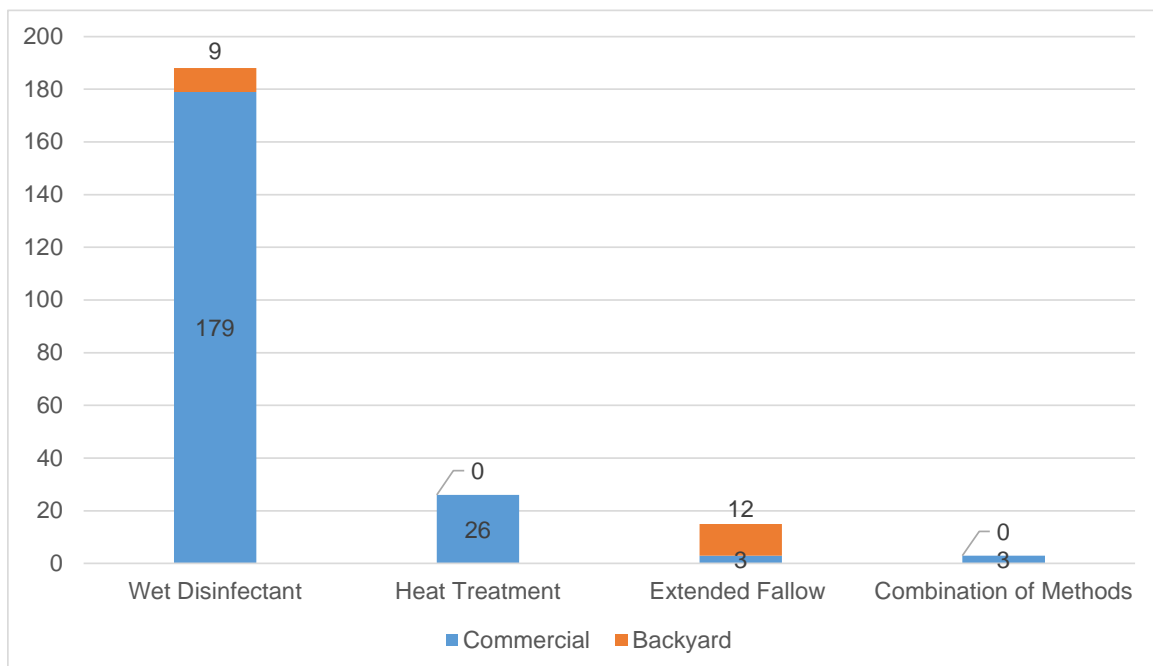
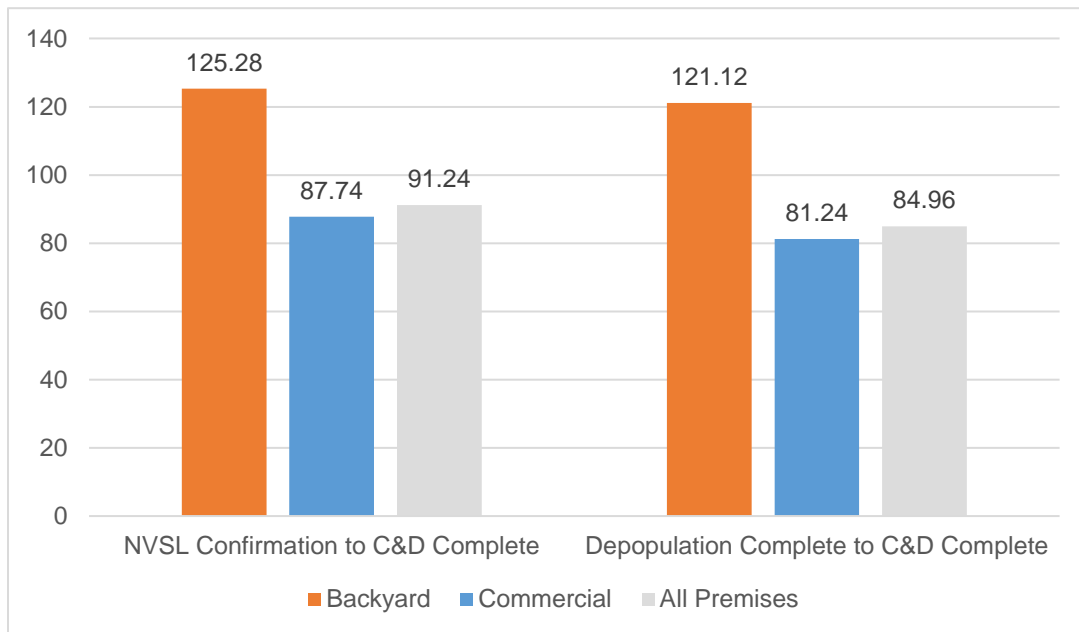


Figure 30 shows the average time to completion of virus elimination activities (C&D) from both NVSL confirmation and depopulation complete. For commercial premises, virus elimination was typically completed, on average, about 88 days after NVSL confirmation of HPAI on the premises, and 81 days after depopulation. Backyard premises differed in part because more of these premises elected to use the extended fallow period for virus elimination resulting in an average of approximately 125 days lapsed from NVSL confirmation to the completion of virus elimination and 121 days lapsed from the completion of depopulation.

Figure 30. Average Time to Virus Elimination/C&D Complete (in Days), excludes Dangerous Contacts



Note: Excludes DC Premises as they may not have had an NVSL confirmation date before depopulation, disposal, and virus elimination activities.

Biosecurity

One of the greatest concerns and a probable contributing factor to the spread of HPAI was the lack of effective farm biosecurity measures. Stringent biosecurity, especially during a large-scale response, remained one of the most challenging aspects of the response effort. Written guidance and materials were provided to affected owners and producers on proper biosecurity practices. An *HPAI Biosecurity Checklist* was developed and distributed along with FAD PReP biosecurity guidance to premises in Control Areas. A focus was placed on ensuring farm-specific and flock-specific biosecurity plans, with adequate compliance checks.

However, in May 2015, USDA APHIS recognized that additional biosecurity personnel were required and assigned Site Managers who were specifically responsible for biosecurity to Infected Premises in Iowa and Minnesota. APHIS contractors helped to fill this role, carefully monitoring and auditing biosecurity on premises where response operations were underway. In addition, all States that were affected by the 2014–2015 HPAI outbreak implemented one or more changes at the State-level to increase biosecurity.

As a result of the 2014–2015 outbreak, many new biosecurity materials were developed for the poultry industry to support implementation of revised biosecurity recommendations. These materials are available from www.poultrybiosecurity.org. Additionally, a survey was distributed in July 2015 to gauge industry preparedness and increase producer awareness about the critical importance of biosecurity.

Health and Safety

In addition to the ICG activities already discussed, and Safety Officers embedded in the APHIS VS NIMTs to ensure proper use of PPE and facilitate appropriate health and safety measures and plan development, USDA APHIS also coordinated with CDC on the One Health aspect of the event. Due to the zoonotic potential of HPAI, a CDC liaison was embedded with USDA personnel (USDA already had a veterinary officer at the CDC).

At the NIMT level, Liaison Officers helped to coordinate between the APHIS VS NIMT and State and local Departments of Health. Although there was no evidence that this strain of H5N2 was zoonotic, research suggests that those in prolonged contact with infected birds or contaminated environments—like HPAI responders—are at increased risk. CDC and APHIS coordinated to develop occupational guidance and protocols for monitoring responders for influenza like illness during and after mobilization. USDA and CDC also shared information and materials during the outbreak and worked together when Influenza B (a seasonal influenza virus) was detected in deployed HPAI responders during the outbreak.

Appraisal and Compensation

Existing appraisal and compensation processes used by USDA APHIS were not suited to a large-scale outbreak and there were delays in processing and payment of indemnity and other compensation to affected producers. For indemnity, presumptive positive results triggered an appraiser (either a State or Federal official) to inventory the living birds and collect associated barn records. A VS 1–23 form was then created to provide indemnity values for producers. To support the compensation process, APHIS maintained (and continues to maintain) three poultry appraisal calculators: table egg layers, broilers—meat and breeders, and turkeys—meat and breeders.

Cost and productivity information are annual data from Agri Stats, a benchmarking company with expertise in poultry. At the beginning of the outbreak the calculators were updated monthly. Additional adjustments were made as needed. For example, the table egg industry expressed concern over layer values, specifically in regard the length of the first laying cycle. After USDA APHIS evaluation, the length of the first laying cycle was revised, and the calculator updated. By August 1, all calculators were updated with 2014 Agri Stats data. Moving forward, the indemnity calculators will be updated quarterly. Additionally, USDA maintains and updates a list of indemnity values for other species not covered by the calculators (i.e., pheasants, quails, ducks, etc.).

The first commercial appraisal was conducted on January 23, 2015, in Stanislaus County, CA. In total, 232 appraisals and 44 trace outs were completed, with approximately \$200 million paid for indemnity. Producers also received compensation for the activities they conducted on their

premises to eliminate the HPAI virus. Cooperative Compliance Agreements were used as the mechanism to pay producers for work they performed on their premises—such as disposal and virus elimination procedures. In total, including indemnity, nearly \$850 million was obligated for response activities on Infected Premises.

As a result of the challenges during the 2014–2015 outbreak, new finance and administration processes were defined (and are available at www.aphis.usda.gov/fadprep). These new procedures are streamlined, require less paperwork, and are consistent with the 24-hour depopulation goal, which requires rapid depopulation, appraisal, and indemnity procedures.

Logistics

The SPRS Logistics Center and the NVS led logistics for the 2014–2015 HPAI outbreak at the ICG-level, and also deployed personnel to support the APHIS VS NIMTs as required by the incident. First activated on December 19, 2014, the NVS had over 2,700 requests for supplies from January 2015 to June 2015, at a cost of over \$2.9 million. Transportation costs, including for extraordinary rapid transit of diagnostic samples, totaled approximately \$350,000. Contractor support peaked in June, when over 3,000 personnel in the field were responding to the incident.

NVS responded to all support requests through the unified IC. Throughout the outbreak, the NVS coordinated and documented contractor support for depopulation, disposal, and virus elimination activities (also known as 3D activities). NVS also contracted access to supplies and equipment, including PPE, decontamination supplies, depopulation units, and animal handling equipment.

The NVS worked closely with the STAS disposal lead/SME, to identify and contract with composting SMEs throughout the outbreak. Additionally, NVS/STAS SME conducted work with other States to pre-identify disposal sites and options in case of more HPAI detections. Based on the experiences during this incident, the NVS also planned to acquire additional equipment for depopulation and offer further training for employees and contractors. Additional CO₂ carts were procured, and acquisitions for whole house CO₂ systems were initiated.

Restocking

During the outbreak, additional policy guidance was provided and published on restocking, prescribing the timeline, eligibility, and approval requirements for restocking birds on previously Infected Premises. Premises that are approved to restock means that the premises/flocks

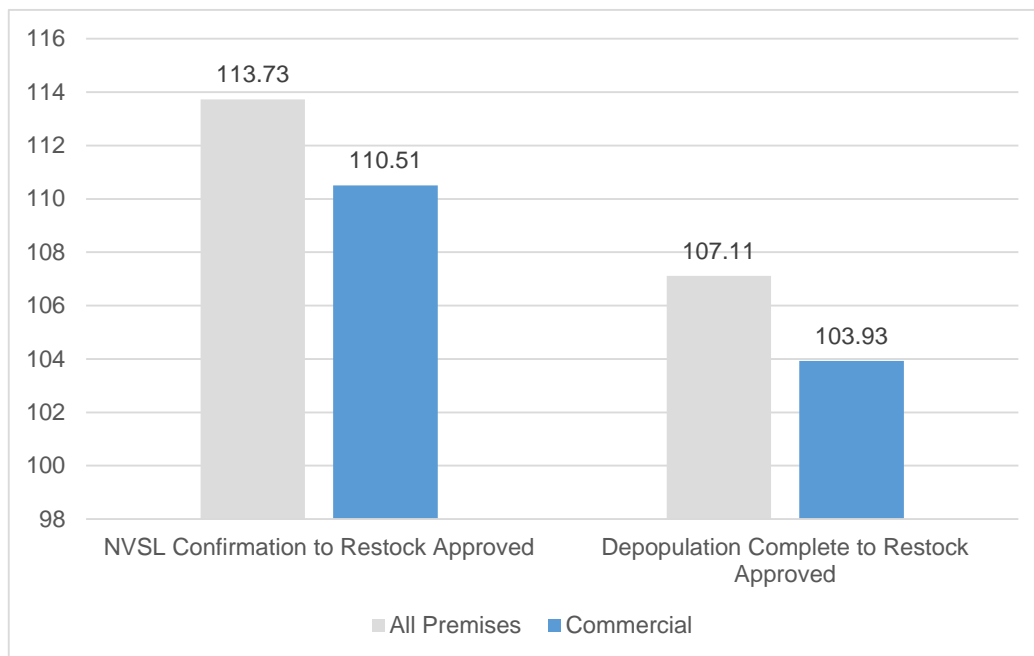
- are 21 days post completion of C&D/virus elimination,
- finished with environmental sampling with no signs of HPAI,
- have met all requirements per the USDA Flock Plan, State Quarantine Notice/Hold Order, and USDA Cooperative Compliance Agreement, and
- are approved by State and APHIS officials, in writing, to restock.

Twelve backyard premises and three commercial premises elected to do an extended fallow period for virus elimination, which lengthened their time to restocking. By the end of October 2015, of the 202 commercial premises (including dangerous contacts) with restock dates reported in EMRS, 196 had completed all necessary steps and were approved to restock. By December 5,

2015, all 211 premises (202 commercial and 9 backyard premises) with restock dates in EMRS were approved to restock.²⁴

Figure 31 shows the average time to restock approval for commercial premises with data in EMRS; from NVSL confirmation, on average, premises were approved to restock about 111 days later. From completion of depopulation, commercial premises, on average, were able to restock in 104 days. The average increases slightly when backyard premises are included (the grey bar of “all premises”), in part because more backyard premises elected to complete an extended fallow period for virus elimination.

Figure 31. Average Time to Restock Approval for Commercial Premises (in Days), excludes Dangerous Contacts



Note: All premises includes backyard premises; excludes DC Premises as they may not have had an NVSL confirmation date.

Communications

Public information, outreach, and active coordination with stakeholders played a large part in USDA APHIS transparency and accountability both internally and externally: please see Figure 32 for a list of stakeholders involved in this outbreak. USDA APHIS LPA was primarily responsible for public information and outbreak; LPA personnel were integrated into the ICG and also deployed to ICPs as Public Information Officers. LPA was responsible for all public information and messaging regarding the HPAI incident, such as press releases about new cases, which were often coordinated with the affected State(s). Additionally, LPA kept the USDA

²⁴ The premises that elected to do an extended fallow period did not typically report restock dates; additionally, restocking data was not entered for some premises and no documentation is available.

APHIS HPAI website page up to date, with information on the situation and confirmed positive cases.

Although LPA had primary responsibility for providing public information on behalf of USDA for the H5N2 response, the USDA Office of Communications had ultimate authority for evaluating and approving information that was released. The Office of Communications also relayed to LPA the Secretary of Agriculture’s priorities related to information needs and information for external audiences.

Figure 32. HPAI Stakeholders

Examples of groups contacted during the incident (in alphabetical order):

- Agricultural shows and fairs
- American Association of Veterinary Laboratory Diagnosticians
- Backyard flock owners
- Birdwatching and conservation groups
- Community media events
- Cooperative extension agents, 4-H leaders, agricultural educators
- County departments of natural resources, game wardens
- Facilities regulated by APHIS Animal Care
- Farmers markets, flea markets, swap meets
- Federal, State, and local elected officials
- Federal, State, and local public health officials
- Feed stores, including farm/garden stores, and bird supply stores
- International trade partners
- Live bird markets: tourists, consignors, and buyers
- NAHLN labs
- Poultry industry workers
- State and local emergency responders (emergency management, law enforcement, etc.)
- State and local poultry associations
- Tribal liaisons
- U.S. Customs and Border Protection
- U.S. Fish and Wildlife Service
- USDA Food and Safety and Inspection Service
- Veterinarians and veterinary associations
- Zoos

LPA proactively adapted to feedback and the growing response effort throughout the spring of 2015. For example, it launched a new version of the website in June, enabling easier navigation and an interactive map for readers. It also provided active outreach to key audiences, including the media and industry groups. Specific materials, like the illustration in Figure 16, were developed. LPA also leveraged social media and conducted weekly teleconferences with NASAHO and industry stakeholders. LPA also supported meetings for the USDA Office of the Secretary and APHIS Office of the Administrator by preparing talking points and messaging.

Also in early June, a Joint Information Center (JIC) was created in response to discussions among ICG members that information and messaging needed to be streamlined in support of expanding the scope of operations. The purpose of the JIC was to improve information transparency and ensure a unified message across all responders and stakeholders.

In addition to website content and outreach efforts, LPA managed an increase in media inquiries. Through the first 6 months of the incident, media inquiries were steady, and in response, LPA

assigned dedicated personnel to oversee all media-related activities. From January through June 2015, LPA responded to a total of 422 media inquiries. These media inquiries typically requested general information on HPAI and about USDA APHIS response operations. LPA also coordinated requests for interviews and media briefings by identifying APHIS SMEs to serve as spokespersons. A national media briefing hosted by APHIS on April 22, 2015 was attended by 90 reporters representing 80 media organizations.

Outreach for the 2014–2015 outbreak culminated with a large stakeholder planning workshop from June 30 to July 1, 2015, which included APHIS personnel, State officials, and industry representatives. Lessons learned were discussed and recommendations for the future were developed.

Regionalization for International Trade

Staff from VS NIES was incorporated into the ICG group to report on the trade impacts of the HPAI outbreak, and to coordinate information from the APHIS VS NIMTs and States as requested by trading partners. While 18 countries did ban the trade of poultry and poultry products from the United States, 38 countries regionalized the United States, which enabled the continued movement of poultry and poultry products from non-affected areas.

Other coordination activities involving trade staff/NIES included:

- ongoing negotiations with countries that have banned all poultry and poultry products from the U.S.;
- technical discussions with South Korea progressing toward a regionalization protocol;
- negotiations with Mexico to reduce regionalization zones from the State to the county level;
- assistance to allow poultry exports entry at foreign ports; and
- collaboration with state officials to implement a strong surveillance component that supports regaining HPAI-free status as soon as possible.

APHIS actively worked throughout and after the outbreak with trading partners, the poultry industry, trade associations, and other stakeholders to reduce or eliminate unjustified trade restrictions and mitigate the impact of these detections on exports.

Section 7. Preparedness and Future Planning

The last HPAI positive premises of the 2015 HPAI outbreak was confirmed by NVSL on June 16, 2015. However, given the migratory patterns in the United States, there was significant concern that HPAI would reemerge in fall 2015, though it did not. APHIS continued to work with all stakeholders to prepare for another outbreak of HPAI, using the lessons learned during the 2014–2015 outbreak to improve operations at the ICP and in the field as well as coordination at the ICG and MAC levels.

APHIS actively engaged domestic and international stakeholders on the HPAI threat, and co-hosted the International Conference on Avian Influenza and Poultry Trade in late June 2015. Here participants discussed the worldwide HPAI threat and the need for multiple strategies and approaches to AI prevention and control. In early July, another planning workshop was hosted at

APHIS headquarters in Riverdale, MD, focusing on preparing for worst-case scenarios for future HPAI outbreaks. In late July, APHIS also participated in an industry-sponsored meeting to focus on lessons learned.

In addition, USDA APHIS authored a document entitled the *HPAI Preparedness and Response Plan* (initially known as the “Fall Plan”) to identify specific items that required review and improvement. This plan was released in August 2015 and updated again in January 2016.²⁵ The response plan that governed the general response to the outbreak—the FAD PReP *HPAI Response Plan: The Red Book*—was also updated in August 2015 with lessons learned and necessary adjustments.

Additionally, USDA APHIS procured HPAI vaccine (which has been added to the NVS) and offered additional guidance on the triggers that would be required to vaccinate in a new outbreak. Further information on vaccination is available in the document *Policy and Approach to HPAI Vaccination*.²⁶ Vaccine was not used in the 2014–2015 HPAI outbreak.

Finally, USDA APHIS continued to revise and improve policy guidance documents available on the www.aphis.usda.gov/fadprep website. Many of these documents incorporated lessons learned from the 2014–2015 outbreak to facilitate rapid depopulation, indemnity payment processing, and cost-effective virus elimination efforts.

Section 8. Conclusion

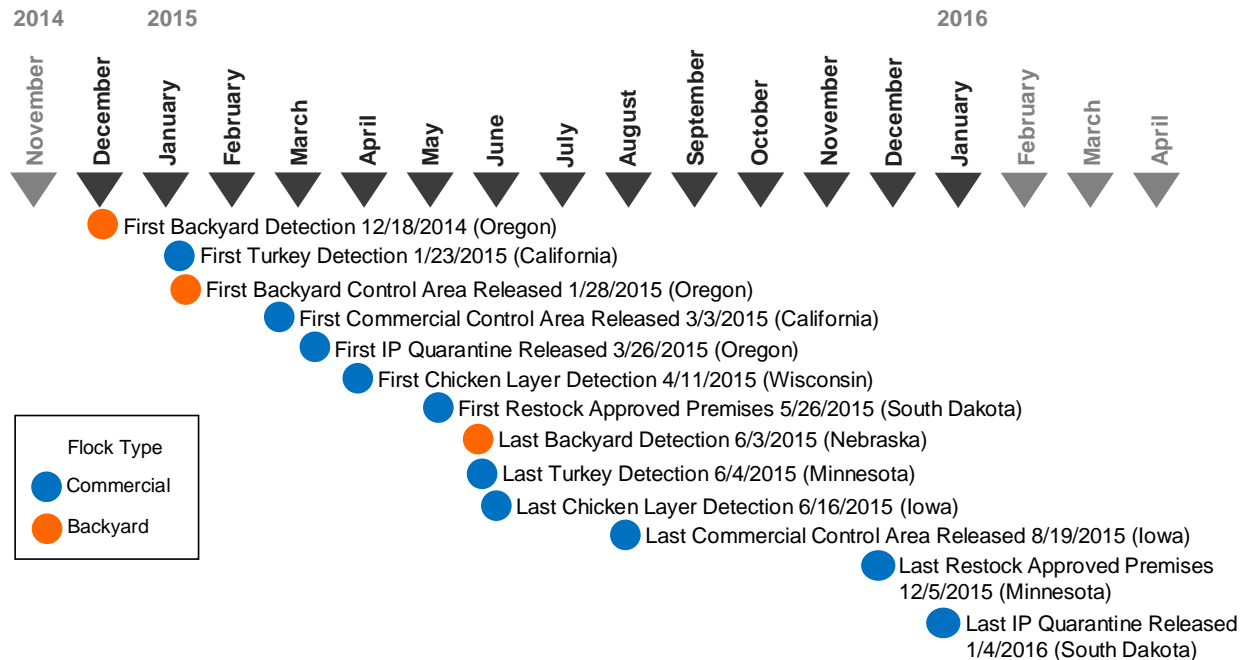
With over 50 million birds and 232 affected premises, the scale of the December 2014 to June 2015 HPAI outbreak was unprecedented in U.S. history; response operations continued well into the late fall of 2015. Despite the application of quarantine and movement control, depopulation, disposal, and biosecurity measures, HPAI continued to spread. With about 50 million commercial birds affected, the impact of the incident in the billions of dollars makes it the worst documented animal health incident in the United States. The response effort involved over 3,000 Federal, State, and contracted personnel, with nearly \$850 million obligated for indemnity payments and response activities. Control measures, coupled with an increase in warm weather, ultimately interrupted HPAI transmission leading to a halt of new cases in June 2015.

Figure 33 provides an overview of the key events during the outbreak, from first detection in a backyard flock and first detection on a commercial premises, to the last detection, first Control Area released, first premises restocked, and last premises quarantine released. The HPAI outbreak had a lengthy impact on USDA APHIS and all affected stakeholders.

²⁵ USDA APHIS VS. (2016). HPAI Preparedness and Response Plan. Retrieved January 11, 2016 from https://www.aphis.usda.gov/animal_health/downloads/animal_diseases/ai/hpai-preparedness-and-response-plan-2015.pdf.

²⁶ USDA APHIS VS. (2016). Policy and Approach to HPAI Vaccination. Retrieved January 13, 2016 from https://www.aphis.usda.gov/animal_health/animal_dis_spec/poultry/downloads/hpai_policy.pdf.

Figure 33. Summary of Key Events during the 2014–2015 HPAI Outbreak



APHIS had prepared the organization and employees for HPAI through training, exercises, and FAD PReP. However, the scale of this outbreak grew rapidly; response activities—in particular depopulation and disposal—could not keep pace with new HPAI detections during the height of the incident. An ICG was rapidly established at the start of the outbreak to coordinate resources and provide policy guidance; it was significantly expanded to handle the requirements of the outbreak. APHIS HPAI MAC and VSET were engaged to support the ICG and provide higher level coordination and support. Simultaneously, at the field level, USDA APHIS NIMTs were deployed in rotations from December 2014 to August 2015. These NIMTs worked in unified ICs with State responders to effectively conduct response activities on premises.

While this report summarizes what occurred, many lessons were learned during the outbreak, in particular that depopulation needed to occur more rapidly to stop the amplification of virus and ongoing HPAI transmission. Financial processes were cumbersome and time consuming. Additionally, biosecurity measures must be improved on premises to not only stop HPAI transmission during an outbreak, but prevent HPAI introductions into commercial poultry flocks in the future. Accordingly, policy guidance documents on issues like ventilation shutdown, heat treatment for virus elimination, and financial processes were developed and released to address the issues that occurred during the response to the incident. New biosecurity guidance was developed collaboratively by the industry, State, and Federal officials for implementation by producers (www.poultrybiosecurity.org). These documents are all available at www.aphis.usda.gov/fadprep.

USDA APHIS continues preparedness for HPAI and other FADs. For more information on corrective actions, lessons learned, and steps forward, please see the *USDA APHIS HPAI Response After-Action Report*.

Section 9. Abbreviations

Abbreviation	Term
AI	avian influenza
APHIS	Animal and Plant Health Inspection Service
BRS	Biotechnology Regulatory Services
C&D	cleaning and disinfection
CCC	Commodity Credit Corporation
CDC	Centers for Disease Control and Prevention
CO ₂	carbon dioxide
DA	Deputy Administrator
DC	Dangerous Contact
EMLC	Emergency Management Leadership Council
EMRS	Emergency Management Response System
EMSSD	Emergency Management Safety and Security Division
FAD	foreign animal disease
FAD PReP	Foreign Animal Disease Preparedness and Response Plan
FY	fiscal year
HA	hemagglutinin
HPAI	high pathogenicity avian influenza
IAP	Incident Action Plan
IC	Incident Command
ICG	Incident Coordination Group
ICP	Incident Command Post
ICS	Incident Command Structure
IS	International Services
JIC	Joint Information Center
LPA	Legislative and Public Affairs
LP AI	low pathogenicity avian influenza
MAC	Multiagency Coordination
MRPBS	Marketing and Regulatory Program Business Services
NAHERC	National Animal Health Emergency Response Corps
NAHLN	National Animal Health Laboratory Network
NASAHO	National Assembly of State Animal Health Officials
NIES	National Import Export Services
NIMS	National Incident Management System
NIMT	National Incident Management Team
NVS	National Veterinary Stockpile
NVSL	National Veterinary Services Laboratories
OIE	World Organization for Animal Health
OPS	operations

Abbreviation	Term
OSHA	Occupational Safety and Health Administration
PCR	polymerase chain reaction
PPD	Policy and Program Development
PPE	personal protective equipment
PPQ	Plant Protection and Quarantine
PSS	Program Support Services
QA/QC	quality control/quality assurance
ROSS	Resource Ordering and Status System
rRT - PCR	real time reverse transcription - polymerase chain reaction
SEPRL	Southeast Poultry Research Laboratory
SHEP	Safety, Health, and Environmental Protection
SME	subject matter expert
SPRS	Surveillance, Preparedness, and Response Services
STAS	Science, Technology, and Analysis Services
USDA	U.S. Department of Agriculture
VS	Veterinary Services
WS	Wildlife Services

Section 10. List of Appendices

This section contains a list of appendices; these appendices are not publicly available.

Appendix 1. Abbreviations for the Appendices

Appendix 2a. Highly Pathogenic Avian Influenza Outbreak Weekly Situation Report (June 11, 2015)

Appendix 2b. Final Highly Pathogenic Avian Influenza Outbreak Weekly Situation Report (December 18, 2015)

Appendix 3. Infected Premises from 2014–2015 Outbreak²⁷

Appendix 4. Mapbook Weekly Report (August 31, 2015)²⁸

Appendix 5a. National Control and Containment Map (June 25, 2015)

Appendix 5b. Final National Control and Containment Map (November 19, 2015)

Appendix 6. Epidemiological Curve (September 1, 2015)

Appendix 7. Summary Deployment Report (October 8, 2015)

Appendix 8. Permitting and Movement Report (September 8, 2015)

Appendix 9a. APHIS Incident Coordination Group Incident Action Plan (June 15, 2015)

Appendix 9b. Final APHIS Incident Coordination Group Incident Action Plan and Completed Assignments (September 9, 2015)

Appendix 10. Minnesota HPAI 2015 Incident—SitRep #64 (June 12, 2015)

²⁷ A public version is available here:

https://www.aphis.usda.gov/animal_health/emergency_management/downloads/hpai/infectedprems.pdf.

²⁸ A public version is available here:

https://www.aphis.usda.gov/animal_health/emergency_management/downloads/hpai/premstatusdetailstate.pdf.