Canadian Food Inspection Agency | Agence canadienne d'inspection des aliments

# Report on the Investigation of Notifiable Avian Influenza (H5N2) in the Fraser Valley of British Columbia, Canada

January 2009

Version 4

**Prepared by**

Krista J Howden DVM MSc
Epidemiologist & Scientific Advisor
Animal Health and Welfare Management Section
Programs and Policies Branch
Canadian Food Inspection Agency

Canada

***IMPORTANT DISCLAIMER***

Every effort has been made to ensure the information in this report is accurate.

CFIA Terrestrial Animal Health Division does not accept any responsibility or liability whatsoever for any error of fact, omission, interpretation or opinion that may be present, however it may have occurred.

**TABLE OF CONTENTS**

**FIGURES**



**TABLES**



**APPENDIX**

## Report Objective

This investigative report was prepared to communicate with the Canadian public that a reportable disease event has occurred and that appropriate disease control measures have been implemented. In addition, this report provides information to trading partners that Canada has controlled a reportable disease and has met all international trading obligations in accordance with current World Organisation for Animal Health (OIE) guidelines.

## Summary

- Low pathogenicity notifiable avian influenza (LPNAI) was identified on a turkey meat production operation in the Fraser Valley of British Columbia (BC) on January 21, 2009. All birds on this premises (IP#1) and one epidemiologically and geographically linked premises (IP#1a) were humanely destroyed and composted on-site.
- The virus was identified as an H5N2, the same virus subtype identified during the avian influenza outbreak in the Fraser Valley in 2005. The virus sequence identified during this outbreak was most closely related to an H5 virus identified from a wild bird in California in 2007.
- Movement restrictions were placed on an additional 24 commercial poultry premises located within 3 km of the infected premises.
- A complete epidemiological investigation was undertaken into potential sources of avian influenza and opportunities for further spread of disease. This resulted in the quarantine of an additional 10 premises located in the Fraser Valley.
- Epidemiologically and statistically valid active surveillance was completed for all premises under quarantine. Notifiable avian influenza was detected on one additional poultry operation (IP#2) on February 10. All birds on this premises were humanely destroyed and composted on site.
- All commercial poultry operations within a 3 km radius of IP#2 were identified, and movement restrictions were placed on an additional 10 poultry premises. Some of the premises under movement restriction within 3 km of IP#1 were included in the 3 km perimeter established around IP#2.
- Movement restrictions on poultry and poultry products within the first 3 km perimeter, except for IP#1/IP#1a, were eligible for removal on March 5. Movement restrictions on poultry and poultry products within the second 3 km perimeter, except

for IP#2, were eligible for removal on March 19. Restrictions were removed 21 days after completion of biological heat treatment of compost on infected premises and following negative test results for NAI from the final on-farm surveillance sampling.

- Restrictions on the first infected premises were released on March 17 and for the second on April 1. This occurred 21 days following the completion and Canadian Food Inspection Agency (CFIA) approval of cleaning and disinfection.
- Introduction of the virus to IP#1 is believed to have resulted from contact with wild birds, emphasizing the importance of biosecurity in preventing the introduction of avian influenza viruses into commercial poultry operations.
- An epidemiological link between IP#1 and IP#2 was not established. The source of virus onto the second infected premises was not determined.

# 1. British Columbia Poultry Industry

The poultry industry in BC is highly integrated, both structurally and economically. Each supply-managed sector is represented by a separate organization, and marketing boards are in place for each of the following: chicken meat, turkey meat, table egg, and hatching egg. These groups work closely together to address biosecurity issues, premises identification, and to motivate producers to cooperate with disease surveillance and control programs. Other smaller sectors outside the supply managed sectors include layer breeders and turkey breeders. Ducks, geese, squab, pheasant, quail, and specialty chickens are also produced.

BC has the third largest poultry industry in Canada, with total farm gate receipts of over $400 million annually. Eighty percent of production is located in the lower Fraser Valley. There are approximately 550 regulated commercial poultry producers in the province.

In addition to the commodity specific groups, there is a joint producer association, the BC Poultry Association (BCPA), comprised of representatives from each sector. The BCPA concentrates on issues of joint concern and has taken an active role in the development and implementation of a biosecurity program. The biosecurity program was made mandatory by the commodity marketing boards, and certification was completed in December 2008 for all supply-managed poultry operations in BC.

The BCPA has also developed an emergency response strategic plan. There have been numerous training initiatives and outbreak simulation sessions conducted with a focus on interaction between industry and the various government organizations to ensure cooperation and a unified approach to managing outbreaks of NAI.

Subsequent to previous avian influenza events, the poultry industry and the British Columbia Ministry of Agriculture and Lands (BCMAL) have worked collaboratively to improve premises identification. All regulated commercial poultry operations have been geo-referenced and a database is available, which assists the CFIA to locate poultry premises during an outbreak response.

## 2. Overview of Disease Control Actions

The response undertaken during this disease occurrence was guided by the CFIA's *Notifiable Avian Influenza Hazard Specific Plan* (NAIHSP). This plan outlines the disease control actions taken, under the authority of the *Health of Animals Act* (1990), when NAI is suspected or confirmed. It is part of an overall management plan used by the CFIA to respond to an incursion of any federally reportable animal disease requiring an emergency response in Canada.

In accordance with the OIE *Terrestrial Animal Health Code (2008)*, all low-pathogenicity avian influenza viruses of the H5 or H7 subtypes are notifiable and hence termed low pathogenicity notifiable avian influenza (LPNAI). The pathogenicity of avian influenza viruses is defined according to criteria that are detailed in this code: high pathogenicity viruses are those that have an intravenous pathogenicity index (IVPI) greater than 1.2 in 6 week-old chickens, or as an alternative, cause at least 75 percent mortality in 4- to 8-week old chickens infected intravenously.

LPNAI are all influenza A viruses of the H5 and H7 subtype that are not HPNAI viruses. In Canada, all cases of H5 and H7 are reported to the CFIA for further characterization, regardless of apparent pathogenicity. Background on the laboratory diagnosis of avian influenza is available on the OIE Web site.

During this occurrence of LPNAI, the CFIA's disease control actions were based on four major disease control principles:

1. rapidly detecting newly infected flocks (surveillance);
2. halting the spread of the disease through movement controls and rapid destruction of infected flocks;
3. organizing movement controls and surveillance on high-risk flocks that are epidemiologically linked to an infected flock and flocks in proximity to an infected (within 3 km); and
4. preventing further spread through the effective biocontainment of potentially infective material (carcasses, manure, and feed) and cleaning and disinfection on infected premises.

All commercial poultry, both regulated and non-regulated, were subject to disease control actions as a result of this outbreak response. Commercial poultry are those raised under Canada's supply management (quota) system or for the

purpose of selling their products and by–products for financial gain outside the quota system. Poultry raised on a premises as pets, including show birds and rare breeds, or raised for the owner's consumption and use only were not subject to disease control actions during this response.

# 3. Summary of Findings and Response on Infected Premises

## 3.1 Summary of Findings and Response on IP#1 and IP#1a

On January 20, 2009, a poultry consultant attended a premises located in BC's Fraser Valley that had reported increased mortality associated with respiratory illness in a group of 86 day-old meat turkeys. This group was housed in an open-sided multi-stage barn that contained a total population of about 30,000 birds. Samples from this flock were submitted to the Animal Health Centre at the British Columbia Ministry of Agriculture and Lands (BCMAL) laboratory and tested for Newcastle disease, avian influenza, *Bordetella avium,* and *Ornithobacterium rhinotracheale.* The BCMAL laboratory is a member of the Canadian Animal Health Surveillance Network and the National Avian Influenza Laboratory Network.

BCMAL notified the CFIA on January 21 that samples submitted had tested positive for influenza A on agar gel immunodiffusion (AGID) and matrix real time polymerase chain reaction (RT-PCR). RT-PCR results were positive for notifiable avian influenza (H5) and negative for H7. Results for Newcastle disease were negative. Samples were forwarded to CFIA's National Center for Foreign Animal Disease Laboratory (NCFAD) in Winnipeg for confirmatory testing and to further characterize the strain and pathogenicity of the virus.

On January 21, this premises (IP#1) was declared an "Infected Place" under Section 22 of the *Health of Animals Act.* In addition, a co-located poultry operation, geographically and epidemiologically linked to the first premises, was identified as a high risk contact and placed under quarantine. This premises also housed approximately 30,000 turkey meat type birds housed in a four-staged open-sided barn. The avian disease premises investigation questionnaire (ADPIQ) was completed during an on-site visit for both premises, and information was collected to initiate tracing activities.

To prevent spread of disease, no movements of poultry, poultry products, or things exposed to poultry or poultry products were allowed on or off either premises. All regulated commercial poultry operations located within a 3 km (1.86 mile) radius of the infected premises were identified on January 22. Quarantines were placed on 22 poultry premises that were identified within this geographic area. Additional samples from IP#1, and the co-located operation under quarantine, were submitted to CFIA's National Centre for Foreign Animal Disease (NCFAD) for further testing. A total of 24 quarantines were in place by this date.

On January 23, the NCFAD confirmed positive serological results for NAI (H5), using hemagglutinin inhibition (HI) testing, for samples received from the co-located operation. On January 24, positive results for H5 on both conventional and RT-PCR were reported for IP#1 confirming an active infection in this flock. Additional laboratory testing, including virus isolation, pathogenicity testing and strain identification, were conducted. Results of gene sequencing indicated a low pathogenicity cleavage site.

The CFIA declared an outbreak of LPNAI and the World Organisation for Animal Health (OIE), Central Bureau, was advised of these findings on January 24. A joint emergency operations center (JEOC) was established in accordance with the agreement between the CFIA and the province of BC – as described in the *Foreign Animal Disease Emergency Support Plan* (FADES) for British Columbia.

The high risk contact operation co-located with IP#1 was confirmed RT-PCR positive (H5) by NCFAD on January 26. As this operation was considered an extension of IP#1, it was referenced as IP#1a. The initial investigation and movement tracing revealed multiple contact premises which were epidemiologically linked to IP#1 and IP#1a. These were each investigated and an additional 10 premises were placed under movement restrictions as a result of qualitative risk assessments on the potential for spread of NAI, bringing the total number of quarantines to 34.

The CFIA investigated the possibility that there may have been unidentified, non-regulated commercial poultry operations located within 3 km of IP#1/IP#1a. Orthophotography (Fraser Valley Airphoto Mosaic 200 mm, 2004; Abbotsford.ecw Airphoto Mosaic 500 mm, 2007) was used to locate any previously unidentified poultry barns located within the movement-restricted perimeter. Two additional premises were identified and placed under quarantine on January 30 and 31. These consisted of a small non-supply managed layer operation and a specialty bird farm. The total number of quarantines in place on January 31, including IP#1 and IP#1a, was 36.

Destruction of all birds was completed on IP#1 on January 26, and on January 27 for IP#1a. The CFIA approved cleaning and disinfection (C&D) on February 21 for IP#1/IP#1a, and the quarantine was released on March 17.

### 3.2 Summary of Findings and Response on IP#2

On February 10, a sample collected from a premises under quarantine, and subject to active surveillance as a result of its location (i.e. within 3 km of IP#1/IP#1a), was

identified as being positive for NAI (H5) on RT-PCR. This premises contained approximately 12,000 24 week-old specialty chicken breeding birds housed in a closed two-storey barn. This was one of the two non-regulated commercial poultry operations identified within the 3 km perimeter of IP#1/IP#1a. A review of flock records did not reveal any increase in mortality over what was expected, and all production parameters were within normal limits on this date.

A 3 km (1.86 miles) radius was established around IP#2. This second 3 km perimeter overlapped approximately 50 percent of the initial 3 km perimeter. On February 11, 10 additional quarantines were placed on premises as a result of their geographical proximity to IP#2. The total number of quarantines in place on this date was 46.

The ADPIQ was completed during an on-site visit, and information was collected in order to initiate tracing activities. The initial investigation and movement tracing revealed multiple epidemiologically linked contact premises. Each was investigated, and two premises, located beyond the perimeters of both 3 km radii, were quarantined on February 12, 2009. The total number of quarantines in place on this date was 48.

An investigation into non-regulated commercial poultry operations located within 3 km of IP#2 was undertaken. Orthophotography (Fraser Valley Airphoto Mosaic 200 mm, 2004; Abbotsford.ecw Airphoto Mosaic 500 mm, 2007) was used to locate any previously unidentified poultry barns located within the 3 km perimeters. Eight barns were identified as potentially housing birds. Door-to-door visits confirmed that none of these barns housed poultry. The total number of additional quarantines issued as a result of the findings of NAI on IP#2 was 12.

Destruction of all birds on IP#2 was completed on February 12. Cleaning and disinfection was approved by the CFIA on March 11, and the quarantine was released on April 1.

**Note:** During the period between February 13 and February 25, an additional four quarantines were issued as a result of CFIA-licensed movements of leghorn pullets from quarantined premises located within 3 km of IP#1/IP#1a (3) or IP#2(1). Quarantines were issued to maintain control over the pullets until such time as their source flock underwent the final round of surveillance testing with negative results for NAI and movement restrictions were released.

The total number of quarantines issued as a result of the outbreak investigation associated with IP#1/IP#1a and IP#2 was 52. Figures 1 and 2 summarize the distribution

of reason for quarantine issuance and production type for the 52 movement-restricted premises identified during the outbreak response.

**Figure 1: Number of Premises Quarantined by Reason for Quarantine Issuance**

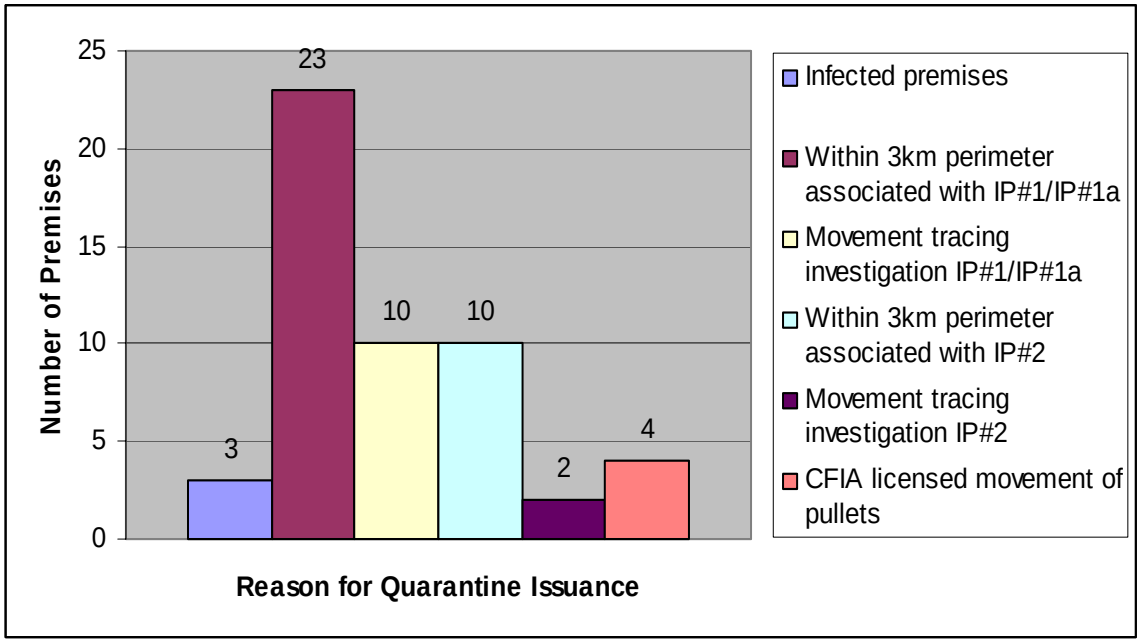
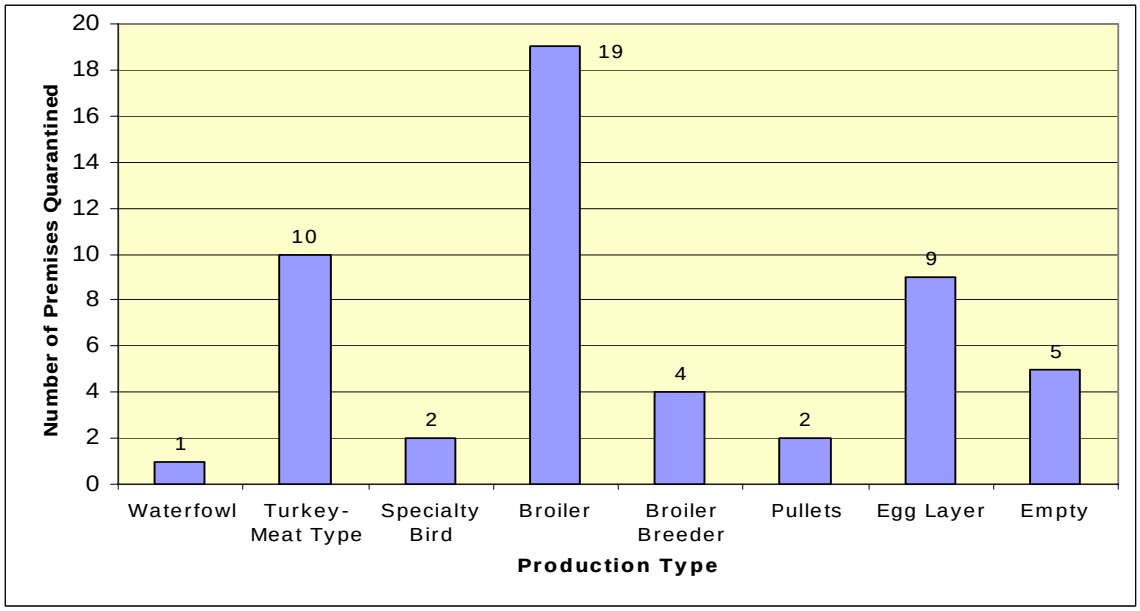



**Figure 2: Number of Premises Quarantined by Production Type**



# 4. Epidemiological Tracing

In accordance with CFIA's NAIHSP and the OIE's *Terrestrial Animal Health Code* (2008), movement tracing of all poultry, poultry products, and things exposed to poultry or poultry products associated with an infected premises during the 21 day period prior to the onset of clinical signs of avian influenza was undertaken. The 21 day period prior to the development of clinical signs is considered epidemiologically significant, as it provides for three cycles or more of the virus in the infected flock.

The purpose of this epidemiological tracing is to:

1) identify premises at risk of having been exposed to NAI virus by either direct or indirect contact with an infected premises; and

2) identify potential sources of introduction of NAI virus to infected premises.

All direct movements of poultry, either onto (trace-in) or off (trace-out) an infected premises within the identified critical period, were investigated and epidemiologically evaluated in consideration of the stage in the course of the outbreak. Trace-in and trace-out premises for which there was no confirmed poultry movement (direct contact) underwent a qualitative risk assessment as to the potential for transmission by indirect (fomite) contact. This indirect movement was classified as negligible, moderate, or high risk. Decisions concerning the disposition of traced premises were made by the Planning Chief with input from the National, Area, and Regional Planning Sections.

## 4.1 Epidemiological Tracing Associated with IP#1 and IP#1a

Upon review of the flock records for IP#1, it was determined that the first signs of respiratory disease manifested on approximately January 12. The diagnosis of NAI on IP#1 was made on January 21. Subsequently, the critical date to initiate movement tracing was determined to be December 22. At the time tracing was initiated, IP#1a birds had not shown clinical signs of respiratory disease. As IP#1 and IP#1a were co-located and epidemiologically linked, the same critical period for tracing was applied to both.

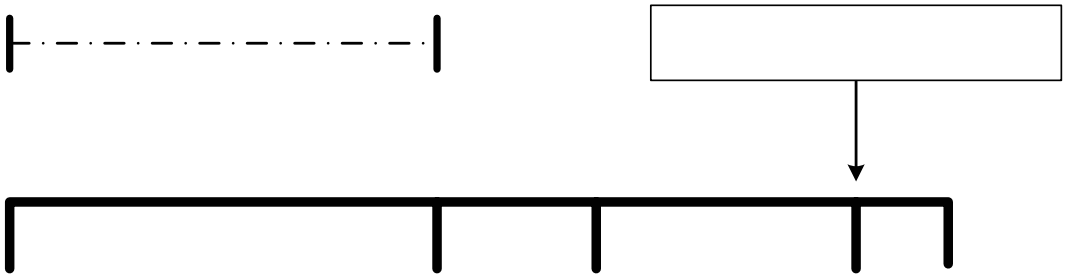
Additional diagnostic testing for poultry respiratory disease pathogens was completed by BCMAL. Necropsy results and bacteriology confirmed a necrotizing pneumonia/pleuritis and acute bacterial septicaemia, caused by *Escherichia coli* in submitted birds. These

results support the hypothesis that the respiratory clinical signs observed in turkeys on IP#1 were primarily attributable *to E. coli* rather than to the concurrent infection with NAI.

In consideration of this, the posterior window for the trace-in investigations was extended to include all movements between December 22 and January 15. January 15 was chosen as the latest date that the initial exposure to NAI could have occurred. This considered the finding of H5 positive serology on IP#1 and IP#1a from samples taken on January 22. The minimum time period between exposure to NAI virus and the ability to detect antibodies to NAI via serology (AGID) was assumed to be seven days.

Epidemiological tracing related to trace-out activities focused on the period of time between December 22 and January 21, when the premises was declared an infected place and movement restrictions were applied.

**Figure 3: Epidemiological Tracing Information for IP#1 and IP#1a**



Trace-out investigation of IP#1 and IP#1a

Epidemiological **trace-outs** were identified for the following:

1. The owner/operators of IP#1 and IP#1a were interviewed using CFIA's ADPIQ. Personal biosecurity breaches were not identified for off-farm movement of these individuals. No staff members were employed in the barns. Based on a review of the information provided, the risk of indirect spread of NAI to another poultry operation via the movement of the owners/operators was deemed to be negligible.

2. A poultry-catching company provided catching and moving services to turkey and chicken producers within the Fraser Valley. This catching crew was on IP#1 on January 5 and 7. Movement of the catching crew was traced for the remainder of this day and three days subsequent to contact with the infected premises. During this time period, three additional poultry operations were serviced by the catching crew.

On IP#1a, the catching crew was on-site January 8, 19, and 20. Again, movement of the catching crew was traced for the remainder of the day and for three days post-contact with this infected premises. During this period, seven additional poultry operations were serviced. One of these trace-out premises was also epidemiologically linked to IP#1 as a result of the catching crew activities.

A total of nine premises were identified as a result of movement tracing associated with the catching crew activities on IP#1 and IP#1a. Of these, one premises was already quarantined as a result of its location (i.e. within 3 km of an infected premises), and one premises had no birds on-site. The epidemiological link, established because of movement of the catching crews between poultry operations, was considered high risk for spread of NAI. This was due to the CFIA's inability to verify effective biosecurity measures were employed by the catching crew on each in-contact poultry operation and the considerable amount of time the catching crew staff spent inside the barns. Seven new quarantines were issued as a result of the catching crew trace-out investigation.

All information available indicated that no member of the catching crew owned poultry or was involved in other poultry-related activities. A questionnaire was administered to each member to assess whether there had been subsequent contact with any other poultry operations not already identified upon review of the work logs. Of the 16 staff employed by the catching crew, 10 verified having had no contact with birds, other than through their employer, and 6 were untraceable.

3. The transport and use of manure/litter off IP#1 and IP#1a was investigated. On January 19, two conveyances transported manure/litter from IP#1 to a dairy operation located outside the initial 3 km perimeter for future use as a soil amendment (compost). The potential risk of indirect spread of NAI via the movement of manure/litter was considered high, due to the propensity for virus to be shed in the feces of infected birds. Although no poultry were located on the receiving premises, a quarantine was issued to maintain control of the litter/manure. Additional risk mitigation steps were undertaken to prevent potential exposure of wild birds and other potential vectors to NAI in the manure/litter. This was accomplished by covering and securing the litter/manure.

An investigation into the conveyances used to transport manure/litter from IP#1 revealed that these same conveyances, along with the associated equipment used for loading manure, visited two additional poultry operations after being on IP#1 prior to being washed. The potential for spread of NAI from IP#1 to another of these premises was identified as a moderate risk for one poultry operation and high risk for the other. The distinction between moderate and high risk was made: on the high risk premises, the loading equipment used on IP#1 entered the barns on the trace-out premises, whereas on moderate risk premises, it did not.

A total of three trace-out premises were identified as a result of movement tracing associated with the transport of litter/manure from IP#1. None of these premises were previously under quarantine. No manure/litter was removed from IP#1a during the critical period. Three new quarantines were issued as a result of the trace-out investigations into the movement of manure/litter.

4. The movement of conveyances used for delivery of shavings to IP#1 and IP#1a was also traced to investigate the potential for indirect spread of NAI via the conveyances. On January 19, a shavings conveyance delivered a load to IP#1. No additional deliveries were completed on this date, and the conveyance was cleaned out at the end of the day. On January 20, this same conveyance delivered shavings to a dairy farm that was 16 kms away. This dairy farm also had a small number of chickens. The conveyance then returned to IP#1, and this was its last load for the next three days, as the mill was closed. Considering that the conveyance was cleaned after being on IP#1, and the number of birds on the dairy farm was minimal, the potential for indirect spread of NAI via the movement of the shavings conveyance was categorized as negligible. Contact was maintained with the owner of the dairy farm with respect to the health status of his birds, and no increase in morbidity or mortality was observed. No shavings were delivered to IP#1a during the critical period.

5. A family member of the owner and operators of IP#1 & IP#1a also owns a transport company that hauls birds to slaughter. This transport company owns seven trailers. All transport of birds to slaughter off IP#1 and IP#1a was completed by this company, and all slaughter occurred at one establishment. When not in use, the trailers are stored in a holding area associated with the slaughter establishment. After each load, conveyances are immediately cleaned and disinfected. There are two drivers who work exclusively for this company and have no outside contact with poultry.

All seven conveyances were utilized to transport birds to slaughter from either IP#1 or IP#1a during the critical period. Movement of these conveyances was traced for three days following a visit to an infected premises. During the investigation into the potential for indirect spread of NAI via the movement of conveyances associated with this transport company, three poultry premises were identified as having an epidemiological connection. These trace-out premises were considered negligible risk, as no conveyance movements occurred on the same date as the visit to an infected premises, and all conveyances were cleaned and disinfected at the end of each day. All poultry premises epidemiologically linked to IP#1 or IP#1a as a result of the movement of conveyances from the transport company were already under quarantine, and thus no additional quarantines were placed as a result of the trace-out investigation of the transport company.

6. Farm visitors were traced during the critical period, using the visitor log book and information gathered during the interview process. Two family members visited IP#1 on December 27 to work in the barn. They used on-farm equipment and showered off the premises. Neither individual had contact with poultry, other than on this date. No movement of other farm visitors, service/repair people, or industry-related people took place during the identified critical period.

Another relative associated with both IP#1 and IP#1a owns a commercial turkey operation. It was determined that during his visits to the premises, he did not enter the barns and practised acceptable biosecurity regarding his conveyance movements. The potential for indirect spread of NAI via these relatives was considered negligible, and no further action was taken.

7. A tracing investigation was completed for all feed conveyances that supplied feed to IP#1 and IP#1a. Feed was sourced from only one company, a major supplier of feed to poultry operations in the Fraser Valley.

IP#1: Between the dates of December 22, 2008 and January 21, 2009, a total of 13 poultry premises were identified as being visited by a feed conveyance immediately after supplying feed to IP#1.

IP#1a: Between the dates of December 22, 2008 and January 21, 2009, a total of seven poultry premises were identified as being visited immediately after supplying feed to IP#1a. Of these premises, two were also linked to the feed conveyance movements associated with IP#1.

Routine biosecurity practices are in place for all feed delivery conveyances. These included the use of foot baths by drivers prior to entrance and upon exit from the conveyance cabs and automatic sprayers for tires and wheel wells, activated upon entering and prior to exiting a premises. Feed conveyance drivers do not enter barns, and all paperwork is placed in a mailbox at the feed bins. All conveyances are commercially washed once per week.

Based on a review and verification of the biosecurity practices in place with respect to feed conveyances and delivery personnel, it was determined that the potential for indirect spread of NAI was negligible. No further quarantines were issued as a result of the trace-out investigation into the feed conveyances.

8. Poults were delivered to IP#1 on January 7 and to IP#1a on January 21. The hatchery conveyance utilized for the delivery of poults to IP#1 visited two additional poultry premises on the same date after being on the infected premises. On the following day, two additional poultry premises were visited for poult placement by this conveyance. There were no deliveries on January 9 or 10. The hatchery conveyance visited IP#1a on January 21 and then one other poultry premises. The same conveyance visited two poultry premises on the following day; however, heightened biosecurity measures were implemented as a result of the announcement of NAI in the Fraser Valley on January 22. These enhanced biosecurity measures included wearing disposable coveralls and boot covers, which were left on-farm.

Following each delivery, the conveyance used to deliver day olds returned to the hatchery where the interior of the conveyance and crates were cleaned. The exterior of the conveyance was not cleaned between farm visits, only at the end of the day. During placement of poults, it was routine for the driver of the conveyance to enter the barns. However, biosecurity protocols were in place, which included disinfecting boots prior to entry and upon exit from the barns. The drivers also changed coveralls each time they returned to the hatchery.

A total of seven epidemiologically linked premises were identified as a result of the trace-out investigations of hatchery delivery conveyances. The potential for spread of NAI via this indirect movement was considered negligible, due to the biosecurity practices followed at the hatchery, as well as by hatchery delivery personnel. In addition, the section of the barn where poults were placed had been cleaned and disinfected prior to placement on both IP#1 and IP#1a. No further quarantines were issued as a result of the trace-out investigation of the hatchery.

9. A hatchery service technician visited IP#1a on December 23 to investigate increased mortality in 13 day-old poults. Disposable coveralls, boots, and gloves were worn. A diagnosis of dehydration was made. No additional poultry premises were visited in the 48-hour period after being on IP#1a. On January 21, prior to the declaration of infected place being issued for this premises, the hatchery service technician again visited IP#1 for a routine follow-up of poults placed on January 7. The technician visited three additional farms on the same date. However, no barn entry took place during these visits. The first farm visited was already under quarantine as a result of an epidemiological link to the catching crew, and the second two premises were considered negligible risk due to the biosecurity protocols in place and the fact that no barns were entered by the technician. No poultry premises were entered on the following two days. After considering the biosecurity protocol of the hatchery technician, this movement was considered negligible risk for the indirect spread of NAI, and thus no additional quarantines were issued.

10. A poultry health consulting company representative visited IP#1 on January 20 and procured the initial samples, resulting in the detection of NAI on this premises. This individual practised acceptable personal biosecurity, including using disposable boot covers and gloves. During this visit, the conveyance was parked away from the barns and on a paved surface. On January 21, the poultry consulting company again visited the farm to pick up additional samples for submission to the laboratory. The birds were double-bagged and taken directly to the lab. The conveyance was washed immediately after delivering samples to the laboratory, and the interior was disinfected using an aerosol-disinfecting agent. On this date, no other poultry operations were visited. The trace-out investigation determined that the potential for the poultry consulting company to have indirectly spread NAI via its movement was negligible.

In summary, the trace-out investigation revealed 10 routes by which NAI could have been spread indirectly from IP#1/IP#1a. It was determined that there were no direct contacts during the critical period. A total of 35 epidemiologically linked premises were identified. Of these premises, 12 were connected to both IP#1 and IP#1a or were identified as an indirect contact by one or more routes. A total of 11 trace-out premises were considered high risk, 1 was considered moderate risk, and 23 were considered negligible risk for further spread of NAI via these indirect movements.

The trace-out investigation associated with IP#1/IP#1a resulted in the placement of 10 additional quarantines. By January 31, a total of 36 quarantines were in place, with 26 premises located within the 3 km perimeter (including IP#1 and IP#1a) and 10 premises located outside the 3 km perimeter.

Trace-in Investigations for IP#1 and IP#1a

All movements onto IP#1 and IP#1a within the identified critical period of December 22 through January 15 were investigated and epidemiologically evaluated. As the clinical signs of respiratory disease observed in this flock may not have been attributable to infection with NAI, the date of January 15 was chosen as the posterior window for tracing activities in consideration of the finding that birds were seropositive to influenza A (H5) on January 22. The time period between exposure to NAI virus and the ability to detect antibodies via serology (AGID) was assumed to be a minimum of seven days. The assumption that guided our tracing activities was that birds were exposed to NAI virus on or before January 15.

The only direct movement of birds or bird products onto either IP#1 or IP#1a during the identified critical period was via the delivery of poults from a hatchery. All other trace-ins identified were via the indirect movement of people and conveyances. All poultry at potential source premises (trace-ins) were inspected for clinical signs of disease and placed under quarantine. The flocks present on these premises were subjected to serological and PCR testing to determine whether NAI virus was active, or whether there was evidence of previous exposure to NAI virus. The nature of the surveillance was dependent on the risk. Quarantines were maintained for a minimum of 21 days after the movement of birds, product, or material, and only after a statistically and epidemiologically valid sampling of the flock was completed and negative results for NAI were received.

The trace-in investigations included the following:

1. The catching crew was present on IP#1 on January 5 and 7 and on IP#1a on January 8. The movements of the catching crew for the three days prior to visiting both premises were investigated. Four poultry operations were identified as potential source premises. Each of these premises was already under investigation and quarantined as a result of the trace-out investigations of the catching crew.

2. Both IP#1 and IP#1a maintained a visitor log. Information contained in this log was cross-referenced with information attained during the on-site visit and completion of the ADPIQ. All visitors to the farm were accounted for in the trace-in investigation and epidemiologically evaluated.

Two extended family members visited the IP#1 on December 27 to complete farm work. Neither individual had any contact with poultry prior to visiting the farm. There were no other visitors identified during this period. The potential for NAI virus to have been introduced to either IP#1 or IP#1a via the movement of visitors onto the premises was negligible.

On December 30 and 31, 2008, the owner/operator of IP#1 entered the barn on IP#1a to check the turkeys. Prior to entering the barn on IP#1a on these dates, this individual had been in the barn on IP#1. It is unknown whether IP#1 was already infected with NAI on this date; however, the possibility exists that movement of this individual may have resulted in the spread of NAI virus between these co-located barns.

3. A transport company hauled birds from IP#1 on January 5 and 7 and IP#1a on January 8. The movement of these conveyances prior to visiting the farm on these dates was investigated. Two potential source farms were identified. Both these farms were already under quarantine as a result of its location (i.e. within the initial 3 km perimeter) or as a result of the trace-out investigations, and were subject to movement restrictions and surveillance for NAI.

4. The hatchery delivery conveyance visited IP#1 on January 7. Movement of this conveyance prior to visiting the farm on this date was investigated. One potential source premises was identified. This premises was already under quarantine as a result of the trace-out investigations and was subject to movement restrictions and surveillance for NAI. There were no deliveries to IP#1a during the critical period.

5. The hatchery technician visited IP#1a on December 23 to investigate increased mortality in the poults. There were no prior visits on this date by the technician. The biosecurity practices of the technician were reviewed and the potential for the movements of this individual to have been an indirect source of NAI to IP#1a were deemed negligible.

6. A tracing investigation was completed for all feed conveyances that supplied feed to IP#1 and IP#1a. Feed was sourced from only one company. This company is a major

supplier of feed to poultry operations in the Fraser Valley. Biosecurity protocols in place for all feed delivery conveyances include foot baths prior to entrance and upon exit from the conveyance cabs, as well as automatic sprayers for tires and wheel wells that are activated upon entering and prior to exiting a premises. Feed conveyance drivers do not enter barns, and all paperwork is placed in a mailbox at the feed bins. All conveyances are commercially washed once per week.

IP#1: Between the dates of December 22, 2008 and January 20, 2009, 13 poultry premises were identified as being visited by a feed conveyance immediately prior to supplying feed to IP#1.

IP#1a: Between the dates of December 22, 2008 and January 20, 2009, seven poultry premises were identified as being visited immediately prior to supplying feed to IP#1a.

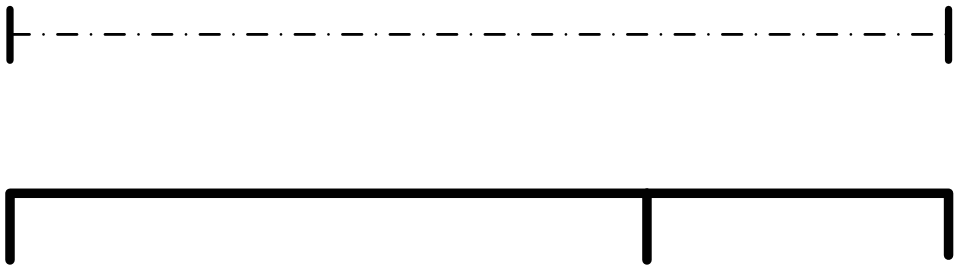
Based on a review and verification of the biosecurity protocol in place with respect to the feed conveyances and the delivery personnel, it was determined that the potential for the movements of the feed conveyance or personnel associated with this company to be a source of NAI was negligible. No further quarantines were issued as a result of the trace-in investigation into the feed conveyances.

In summary, the trace-in investigation revealed six routes by which NAI could have been introduced to IP#1 and IP#1a. A total of seven potential source premises were identified. All were already under quarantine as a result of the trace-out investigations and subjected to a detailed epidemiological investigation and active surveillance for NAI. No evidence of NAI was found on any of the potential source premises identified during the trace-in investigations completed for IP#1 or IP#1a.

### 4.2 Epidemiological Tracing Associated with IP#2

A review of flock records for IP#2 did not reveal any increased morbidity/mortality or decrease in production parameters. The diagnosis of NAI by RT-PCR was made from samples procured on February 5. The critical period for tracing associated with IP#2 was based on the 21 day period prior to the finding of the RT-PCR positive result on the premises. This premises was already under quarantine as a result of its location (i.e. within the 3 km perimeter established around IP#1/IP#1a) and had been under movement controls since January 31.

**Figure 4: Epidemiological Tracing Information for IP#2**



Trace-out Investigation for IP#2

Epidemiological trace-outs were identified for the following:

1. The operator of IP#2 owns or is associated with multiple other poultry premises. The potential for the further spread of NAI via the movement of this individual or associated fomites during the critical period was investigated. Although this individual owned or was associated with 10 separate poultry premises, only 3 were epidemiologically linked to IP#2. This linkage was established via the movement of the owner among farms. All other premises associated with this individual were not visited during the identified critical period, and there was no evidence of shared equipment or personnel.

The movement of the owner was considered high risk for indirect spread of NAI based on a review of his activities on each farm. One of these premises was already under quarantine as a result of the 3 km perimeter associated with IP#1. The other two premises were quarantined, based on the potential for NAI to have been spread via these indirect movements. These two premises were located outside both 3 km perimeters.

2. Eggs were moved daily from IP#2 to a hatchery operated by the same owner.
The hatchery conveyance and associated egg baskets were evaluated to determine their potential for spreading NAI from IP#2. Hatchery biosecurity protocols were reviewed and verified with respect to cleaning and decontamination of all equipment and conveyances. The hatchery used color-coded baskets, which were returned to the source farm each day

after being washed. There was no potential for cross-farm use of the baskets. The potential for indirect spread of NAI via the movement of the hatchery conveyance/personnel/egg baskets was considered negligible.

3. This premises was under quarantine as a result of its geographical proximity to IP#1 and IP#1a, and thus subject to surveillance for NAI. During the critical period, surveillance was completed by CFIA staff. On January 24 and 26, the CFIA conducted dead bird surveillance. This consisted of roadside pickup of birds in biosecure bins. On February 5, five CFIA staff were on-site to conduct additional investigative surveillance testing, which included in-barn collection of blood and swabs from a representative number of birds.

The potential for movement of CFIA staff to result in the indirect spread of NAI (prior to IP#2 being declared an infected premises) was evaluated. Movements were traced for the 48-hour period after being on this premises. The same staff visited two poultry premises on February 6 and two poultry premises on February 7. All four premises were already under quarantine as a result of the outbreak response associated with IP#1/IP#1a and subject to regular surveillance testing for NAI.

The CFIA staff practised acceptable biosecurity during their visits, and this was verified by a record review. Other than the surveillance sampling completed on quarantined premises as part of the outbreak response, there was no other contact with poultry, involving CFIA staff. The potential for indirect spread of NAI via the movement of CFIA staff was considered negligible. Results of surveillance testing on the premises epidemiologically linked to IP#2 via the movements of the CFIA staff did not reveal any evidence of NAI spread as a consequence of these movements.

4. Farm visitors were traced during the critical period using information that was gathered during the interview process. There was one employee who worked full time on IP#2, and was involved with egg collection and delivery of eggs to the hatchery, in addition to daily chores. The potential for this individual to have spread NAI via his movements was investigated. He had no association with other poultry premises and practised acceptable biosecurity on-site. There were no visits by veterinarians, feed representatives, maintenance staff, or others during the critical period identified for tracing. The potential for farm visitors or staff to have resulted in the indirect spread of NAI was deemed to be negligible. No further quarantines were issued as a result of the trace-out investigation of farm visitors.

5. The operator of IP#2 owns his own feed conveyances, as well as his own feed mill. The feed for IP#2, however, was purchased from a local feed mill but delivered using his own feed conveyances. Feed was delivered to IP#2 on January 24, 26, and February 4. As this premises was placed under quarantine on January 31, the movement on February 3 was authorized under licence issued by the CFIA.

The potential for NAI spread from IP#2 as a result of the movement of the feed conveyances was investigated. The premises visited immediately after being on IP#2 for each date was determined. The delivery on the January 24 was the only delivery on this date. After the delivery on the 26th, the conveyance visited another premises owned by this individual. This premises was already under quarantine as a result of the tracing investigation into the movements of the owner. No other poultry premises were visited by the feed conveyance after being on the infected premises on February 3.

All feed conveyances have automatic wheel sprayers that are used upon entry to a premises. Based on a thorough review of the biosecurity protocol of both the feed conveyances and the associated personnel, it was determined that the potential for NAI to have been spread via this movement was negligible. No further quarantines were issued as a result of the trace-out investigation of the feed delivery conveyances.

6. A private veterinary practitioner on contract with the CFIA to complete surveillance sampling visited IP#2 on January 31. This premises was quarantined on this date as a result of being within the 3 km perimeter designated around IP#1/IP#1a, and therefore subject to surveillance testing. The movement of this veterinarian was traced for 48 hours after being on IP#2. During this period he visited two additional premises for surveillance sampling. Both these premises were already under quarantine as a result of an identified epidemiological association with IP#1 and IP#1a.

The biosecurity and biocontainment protocol used by the veterinarian during his visit to IP#2, and his movements onto the two other premises in the 48 hours after being on IP#2 were reviewed and verified in accordance with existing protocol. Active surveillance on these two premises did not reveal any evidence of NAI.

In summary, the trace-out investigation revealed six routes by which NAI could have been spread via indirect movement during the critical period. No direct contacts (movement of birds during the critical period) were identified. A total of 3 high risk epidemiologically linked premises were identified. There was no other indirect movement associated with catching crews, shavings delivery, manure/litter, or transport

conveyances identified during the critical period. The trace-out investigation associated with IP#2 resulted in the placement of two additional quarantines.

Trace-in Investigations for IP#2

All movements onto IP#2 within the time period of January 16 through February 5, the first confirmation of NAI virus on the premises, were investigated and epidemiologically evaluated. Serological testing to date on this premises had been negative for antibodies to H5. It was determined that the only direct movement of birds or bird products onto IP#2 was the placement of pullets which occurred prior to the start date of the critical period identified for tracing. All trace-ins identified during the critical period were via the indirect movement of people and conveyances.

All poultry at potential source premises (trace-ins) were inspected for clinical signs of disease and placed under quarantine. The flocks present on these premises were subjected to serological and PCR testing to determine whether NAI virus was present in the flock or whether there was evidence NAI virus was present in the flock at some point in time. The nature of the surveillance was dependant on the perceived risk. Quarantines were maintained for a minimum of 21 days after the movement of birds, product, or material occurred and only after a statistically and epidemiologically valid sampling of the flock was completed and negative results received.

The trace-in investigation on IP#2 included the following:

1. The owner of IP#2 owns multiple other poultry premises. The potential for the introduction of NAI via the movement of this individual or associated fomites during the critical period was investigated. Three epidemiologically linked premises were identified and categorized as high risk. One of these premises was already under quarantine as a result of the 3 km perimeter associated with IP#1. The two other premises were quarantined, based on the potential for NAI to have been introduced to IP#2 via these indirect movements.

2. During the critical period, there were three deliveries of feed to IP#2. These occurred on January 24, 26, and February 4. The movement of the feed conveyances prior to being on the IP was investigated. As this premises was placed under quarantine on January 31, the movement on February 4 was authorized under licence, issued by the CFIA.

The potential for movement of feed conveyances to have resulted in the spread of NAI onto IP#2 was investigated. On each date that feed was delivered, the conveyances came directly from the feed mill, and no other poultry premises were visited prior to the conveyances coming onto IP #2.

3. Farm visitors were traced during the critical period, using information gathered during the interview process. There was one full-time employee who worked on IP#2, and was involved with egg collection and delivery of eggs to the hatchery, in addition to daily chores. The potential for this individual to have introduced NAI via his movements was investigated. He had no association with other poultry premises and practised acceptable biosecurity on-site. There were no visits by veterinarians, feed representatives, maintenance staff, or others during the critical period identified for tracing. The potential for farm visitors or staff to have been a source of NAI to IP#2 was deemed to be negligible.

4. The hatchery conveyance and associated egg baskets were evaluated to determine their potential as a source for NAI on IP#2. Hatchery biosecurity protocols were reviewed and verified with respect to cleaning and decontamination of all equipment and conveyances. The potential for NAI to have been brought on-farm due to the movement of egg baskets or the hatchery conveyance was determined to be negligible.

5. A private veterinary practitioner on contract with the CFIA to complete surveillance sampling visited IP#2 on January 31. This premises was quarantined on this date due to its location (i.e. within the 3 km perimeter designated around IP#1/IP#1a), and thus subject to surveillance testing. The movement of this veterinarian was traced for the 48 hours prior to being on IP#2. During this period, he visited two additional premises for surveillance sampling. Both these premises were already under quarantine as a result of an epidemiological link associated with IP#1 and IP#1a. The biosecurity and bio-containment protocol used by the veterinarian during his visit to IP#2, along with his movements into/off of the two other premises in the 48 hours prior to being on IP#2, was reviewed and verified in accordance with existing protocol. Active surveillance for NAI on the two premises visited by this veterinarian prior to being on the IP did not reveal any evidence of NAI.

6. As this premises was under quarantine as a result of its geographical proximity to IP#1 and IP#1a, it was subject to surveillance for NAI. During the critical period surveillance was completed by CFIA staff. On January 24 and 26, the CFIA conducted dead bird surveillance. This consisted of roadside pickup of birds in biosecure bins. On February 5,

CFIA staff were on-site for additional investigative surveillance testing. This testing was completed by five CFIA staff and included in-barn blood and swab collection from a representative number of birds.

The potential for movement of CFIA staff to be the source of NAI for this premises was investigated. The CFIA staff practised acceptable biosecurity during their visits, which was verified by a record review. Other than the surveillance sampling completed on quarantined premises as part of the outbreak response, no other contact with poultry occurred with respect to CFIA staff. None of the CFIA staff involved in surveillance sampling on IP#2 had been on either IP#1 or IP#1a. The potential for the movement of CFIA staff to have been the source of NAI to IP#2 was negligible.

By February 26, 52 quarantines had been issued as part of the outbreak response. Within the first 3 km perimeter (including IP#1 & IP#1a), 26 premises were located, and 10 additional premises were located within the second 3 km perimeter. Twelve quarantines outside both perimeters were added as a result of the movement-tracing investigations associated with IP#1/IP#1a (10) and IP#2 (2). Four (4) quarantines were issued as a result of CFIA-licensed movements of leghorn pullets from quarantined premises located within 3 km of an infected premises. During the course of the outbreak investigation, we did not identify any epidemiologically linked non-commercial poultry premises.

## 5. Movement Restrictions

This outbreak did not require declaration of a control area pursuant to section 80 of the *Health of Animals Regulations*. Domestic movements of live birds were managed via quarantines and licenses for commercial flocks, as well as non-regulated commercial flocks of epidemiological significance.

All movement of poultry, poultry products, and things exposed to poultry or poultry products from infected premises and associated quarantined premises was restricted and enforced by the CFIA. For any premises under quarantine (within or outside of the 3 km perimeter), a licence issued by the CFIA was required to permit movement of poultry, poultry product and by-products, or anything used with respect to poultry (farm equipment, transport conveyances, feed, sawdust, etc.). In accordance with the NAIHSP, a pre-movement testing and licence issuance system was implemented for birds moving to slaughter, hatching eggs moving to hatcheries, as well as for eggs moving to grading stations. Licences were only issued after receiving official negative surveillance results. There were a total of 479 licences issued for movement during the outbreak response.

For premises under quarantine intending to restock barns with poultry, producers were required to follow cleaning and disinfection guidelines developed by the CFIA, based on protocols previously established in conjunction with the BC poultry industry and the BC provincial government. In addition, the re-stocking of poultry in a barn on a quarantined premises was dependent on a CFIA inspection to verify cleaning and disinfecting requirements and only after receiving negative surveillance results on other barns within the premises, as well as from barns on neighbouring properties.

The quarantines, which were placed on all premises located within the 3 km perimeter as a result of geographical proximity to the infected farms, were eligible for removal 21 days after biological heat treatment of the compost piles was complete. This 21 day period began on February 12 for IP#1/IP#1a and February 25 for IP#2. Removal of quarantines released all movement restrictions on birds and bird products, with the exception of the infected premises. Quarantines outside the 3 km perimeters and associated movement restrictions were lifted in accordance with a 21 day period from the last contact and pending receipt of negative surveillance sample results.

The infected premises remained subject to movement restrictions, pending the completion of approved cleaning and disinfection and a 21 day fallow period. Cleaning and disinfection was completed on February 21 for IP#1/IP#1a and on March 11 for

IP#2. Movement restrictions were released on March 17 on IP#1/IP#1a and April 1 on IP#2.

**Note:** Movement restrictions on IP#1/IP#1a were eligible for removal on March 14, based on a 21 day fallow period after cleaning and disinfection. However, since these operations were also affected by their location (i.e. within the 3 km perimeter surrounding IP#2), their movement restrictions were not removed until March 17.

Raw poultry product from flocks and processors in BC produced between 21 days prior to the outbreak until 90 days following approval of the cleaning and disinfection on the last infected premises was subject to segregation and identification procedures that included marking product with a triangle BC mark. Restrictions on movement of live poultry were limited to those imposed by quarantines of premises involved. Movement of poultry products and table eggs from outside BC through the province was not restricted. There were no restrictions on movement of poultry products or eggs purchased from grocery stores.

Certification of international export shipments were overseen on a case-by-case basis to ensure that all requirements of the importing jurisdictions were met. This included direct oversight by CFIA inspectional staff of the assembly process for each export. The restrictions imposed by international trading partners varied from the individual premises placed under quarantine, to specific geographic regions, to provincial or country-wide restrictions.

# 6. Surveillance

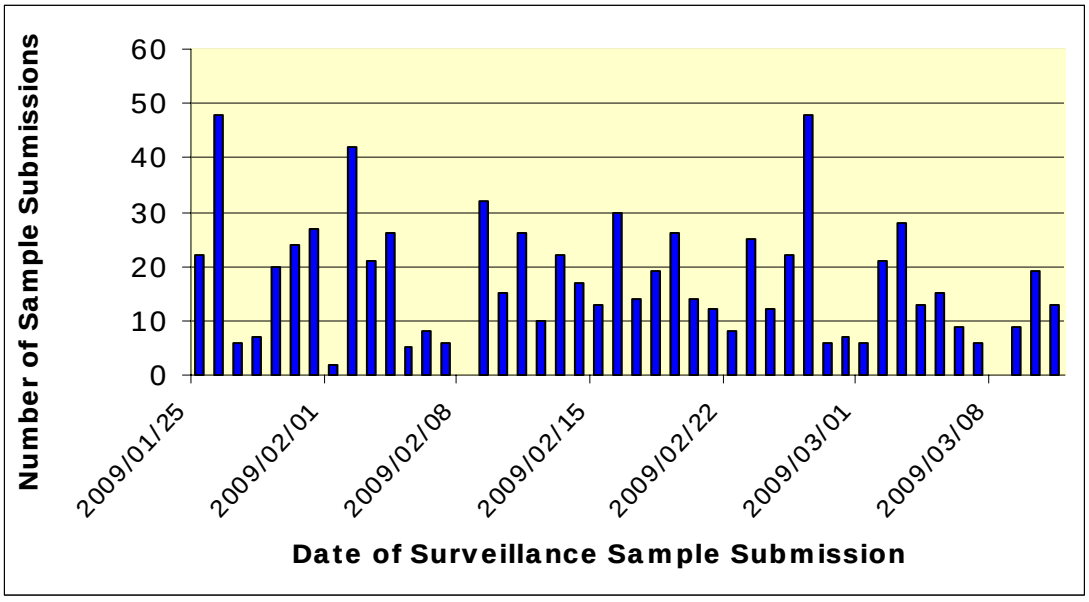
## 6.1 Surveillance on Movement-Restricted Premises

Surveillance testing during the outbreak was directed at premises in close proximity to infected premises and premises that had an established epidemiological link through movement of people, things, equipment, or birds. The surveillance protocol, as outlined in the NAIHSP, was developed to rapidly detect further spread of NAI. Every precaution was taken to ensure that NAI was not inadvertently spread by surveillance staff.

During the outbreak period of January 21 through March 11 (date of CFIA approval of cleaning and disinfection on the last infected premises), a total of 752 surveillance sample submissions were made to BCMAL. This surveillance was composed of swab samples from 22,711 birds on 45 premises which were tested for NAI by RT-PCR. Surveillance completed after March 11 will be summarized as part of the Canadian Notifiable Avian Influenza Surveillance System (CanNAISS) report on post-outbreak surveillance in BC (POS BC 2009), which will be generated by the Epidemiology and Surveillance Section of the Terrestrial Animal Health Division of the CFIA.

Figure 5 shows the temporal distribution of surveillance samples by outbreak period, and Figure 6 illustrates the distribution of surveillance sample submissions by reason for submission.

**Figure 5: Temporal Distribution of Surveillance Samples by Date of Submission**



### 6.1.1 Surveillance within the 3 km perimeters

Once identified, all farms with poultry in the two 3 km perimeters surrounding the infected premises were subjected to full surveillance for NAI and a detailed epidemiological investigation. Surveillance on farms quarantined as a result of geographical proximity to an infected premises resulted in 77.6 percent (588 surveillance sample submissions) of the total surveillance samples. This included the sampling of 16,543 birds on 30 premises (including IP#2) and includes all forms of surveillance conducted on farms within these perimeters during the outbreak period. Four premises quarantined within the 3 km perimeter did not contain birds during the outbreak period and therefore were not subject to surveillance.

An evaluation of the biosecurity and bio-containment measures in place to prevent disease introduction or transmission was completed for each premises. In addition, a weekly flock health questionnaire was submitted by the owner for review by the Surveillance and Diagnostic Unit.

Full surveillance involved the submission of oropharyngeal and cloacal swabs from 60 birds per barn (to give 95 percent confidence in detecting influenza A if the prevalence in the barn were 5 percent or greater) for RT-PCR testing at the BCMAL laboratory. The swabs were pooled in groups of five in phosphate-buffered saline (PBS) for transport to BCMAL. Blood samples were collected from 20 birds in each barn (to give 95 percent confidence in detecting influenza A antibody if the prevalence in the barn were 15 percent or greater) for submission to the NCFAD.

### 6.1.2 Surveillance on contact premises outside the 3 km perimeters

An additional 15 premises identified as having an established epidemiological link through movement of people, things, equipment, or birds located outside the 3 km perimeters were subjected to full surveillance for NAI. An evaluation of the biosecurity and bio-containment measures in place to prevent disease introduction or transmission was completed for each premises. In addition, a weekly flock health questionnaire was submitted by the owner for review by the Surveillance and Diagnostic Unit.

Full surveillance involved the submission of oropharyngeal and cloacal swabs from 60 birds per barn for RT-PCR testing at the BCMAL laboratory. The swabs were pooled in groups of five in phosphate-buffered saline (PBS) for transport to BCMAL. Blood samples were collected from 20 birds in each barn for submission to NCFAD. Surveillance on contact premises, provided as a result of pre-movement testing, provided 22.4 percent

(170 surveillance sample submissions) of the total surveillance samples and includes all forms of surveillance conducted during the surveillance period. This included the sampling of 6348 birds from 15 premises.

**Note:** There were 16 premises quarantined outside the 3 km perimeters associated with IP#1/IP#1a and IP#2. One of these quarantines was issued to maintain control of manure/litter moved off IP#1/IP#1a, and therefore no surveillance was completed on this premises.

Quarantines were maintained for a minimum of 21 days after contact with the infected premises was identified and only released pending negative results from the final round of surveillance testing.

## 6.2 Types of Surveillance Conducted During the Outbreak

### 6.2.1 Dead bird surveillance

Routine testing of mortalities from quarantined flocks is an efficient and bio-secure method of detecting viral infection with NAI at an early stage. This surveillance is not statistically valid sampling, but is useful to monitor the health of the flock. Mortalities are sampled at the “roadside” which reduces the potential for virus spread because the premises are not entered by the surveillance team. All sample collections are carried out by surveillance teams, using appropriate bio-containment techniques.

Each producer was provided with covered plastic containers and instructed to place recent mortalities in the container for sample collection weekly on a specified day. The surveillance team collected oropharyngeal and cloacal swabs in pools of five for submission to BCMAL. The birds were disposed of by the producer on-farm. Dead bird surveillance resulted in 40.8 percent (307 submissions) of the total surveillance samples and included those farms both within and outside the 3 km perimeters. This included the sampling of 1071 birds (4.7 percent total birds tested) from 37 premises.

Producers were required to immediately report any illness compatible with NAI, including unexpected high mortality. A foreign animal disease (FAD) diagnostician would immediately investigate these reports.

### 6.2.2 Pre-movement surveillance

Samples were collected for RT-PCR testing two to four days prior to scheduled movement of birds to slaughter from all quarantined premises. Pre-movement testing is described in the NAIHSP and includes oropharyngeal and cloacal swabs from 60 birds, pooled in groups of five, from each barn from which birds are to be shipped. Other barns on the premises not shipping birds to slaughter were sampled with oropharyngeal and cloacal swabs from 20 birds. A licence for movement was issued upon receipt of official negative laboratory results.

Surveillance as a result of pre-movement testing provided 35.8 percent (269 surveillance sample submissions) of the total surveillance samples. This included the sampling of 11,260 birds (49.6 percent total birds tested) from 21 premises.

### 6.2.3 Surveillance prior to quarantine release

For both premises within 3 km of an infected premises and premises that had an established epidemiological link to an infected premises, a final round of surveillance testing was carried out prior to release of the quarantine. Surveillance testing to qualify a flock for release from quarantine was completed within 48 hours of the release of the premises from quarantine. Surveillance involved the submission of oropharyngeal and cloacal swabs for RT-PCR testing at the BCMAL laboratory. A minimum of 60 birds per barn were sampled from all barns on the premises. Upon receipt of negative test results for RT-PCR testing completed at BCMAL, the quarantine was released. Therefore, all premises under movement restriction had a minimum of two rounds of surveillance testing completed prior to release from quarantine. Surveillance on farms prior to quarantine release provided 4.9 percent (37 surveillance sample submissions) of the total surveillance samples. This included the sampling of 2220 birds (9.8 percent total birds tested) from 12 premises.

The quarantines, which were placed on all premises located within the 3 km perimeter as a result of geographical proximity to the infected farms, were eligible for removal 21 days after biological heat treatment of the compost piles was completed. This 21 day period began on February 12 for IP#1/IP#1a and February 25 for IP#2. Quarantines outside the 3 km perimeters and associated movement restrictions were lifted in accordance with a 21 day period from the last contact and pending receipt of negative surveillance sample results. As a result, the majority of surveillance associated with pre-quarantine release was conducted after March 11 (the date of approval of C&D on the last infected premises) and is accounted for in post-outbreak surveillance.

### 6.2.4 Full surveillance

Full surveillance involved the submission of oropharyngeal and cloacal swabs from 60 birds per barn and was completed on all movement-restricted premises on at least one occasion during the quarantine period for that premises. Full surveillance accounted for 16.4 percent (123 surveillance sample submissions) of the total surveillance samples. This included the sampling of 7340 birds (32.3 percent total birds tested) from 41 premises during the outbreak period.

### 6.2.5 Additional surveillance completed during the outbreak

In addition to the above, surveillance was also undertaken for the purpose of investigative testing in response to suspicious laboratory results (1.2 percent of total sample submissions) and as part of validation of test results between NCFAD and the BCMAL laboratory (0.9 percent).

**Figure 6: Distribution of Surveillance Sample Submissions by Reason for Submission**

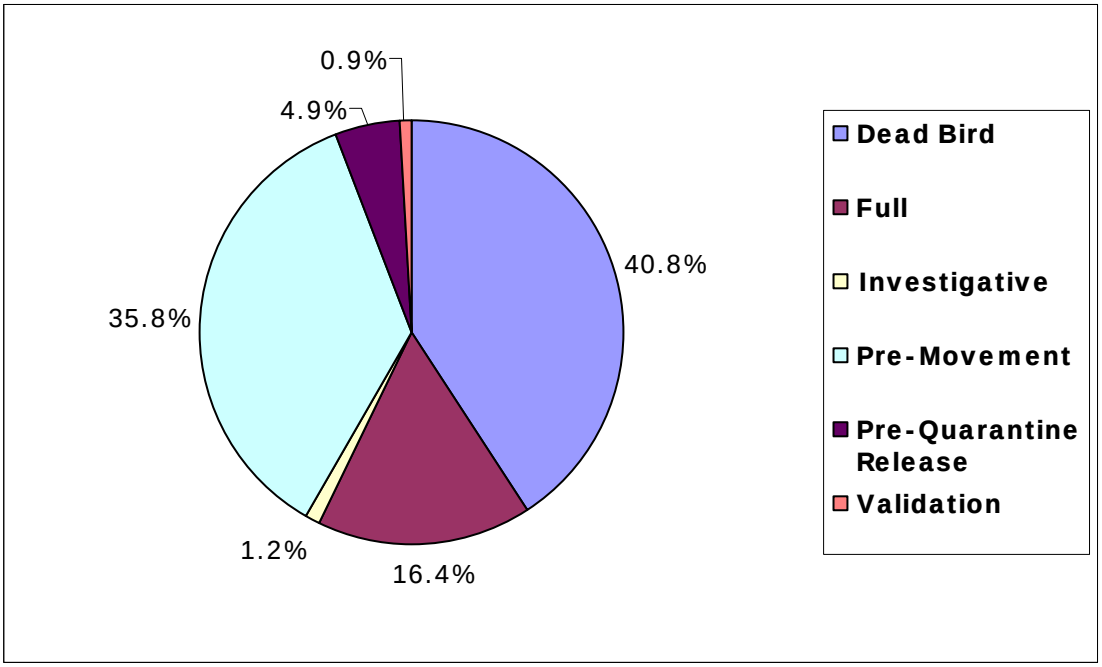


**Table 1: Summary of Outbreak Surveillance (January 24 – March 11, 2009)**

| Type of Surveillance | Number of Surveillance Sample Submissions | Total Sample Submissions (%) | Number of Birds Tested | Total Birds Tested (%) |
|---|---|---|---|---|
| **Dead Bird** | 307 | 40.8 | 1,071 | 4.7 |
| **Full** | 123 | 16.4 | 7,340 | 32.3 |
| **Investigative** | 9 | 1.2 | 440 | 1.9 |
| **Pre-Movement** | 269 | 35.8 | 11,260 | 49.6 |
| **Pre-Quarantine Release** | 37 | 4.9 | 2,220 | 9.8 |
| **Validation** | 7 | 0.9 | 380 | 1.7 |
| **Totals** | **752** | **100** | **22,711** | **100** |

### 6.3 Post-Outbreak Surveillance

The CanNAISS was developed by the CFIA in collaboration with provincial and territorial governments and poultry industry representatives in 2008. It is a comprehensive approach to NAI surveillance in commercial poultry flocks.

CanNAISS is one of a number of domestic and international initiatives that has been implemented by governments, industries, and Canadian poultry producers to prevent, detect, and eliminate the presence of NAI in Canada's domestic poultry flocks. CanNAISS has been designed to meet the current OIE NAI guidelines.

Further information on CanNAISS is available here: Canadian Notifiable Avian Influenza Surveillance System (CanNAISS) for commercial poultry in Canada.

The CanNAISS framework was applied to conduct POS BC 2009. The design of this surveillance is science-based and driven by amendments to the OIE guidelines (Article 10.4.3) with consideration for the re-establishment of trade. The aim of post-outbreak

surveillance was, during the three month surveillance period, to bring the confidence of detecting at least one positive farm (given the design parameters) in BC to the same level as the rest of Canada.

Cleaning and disinfection were completed on the last infected premises (IP#2) on March 11, and thus surveillance started on this date. And June 11, 2009, marked the 3-month period of surveillance required to claim that BC's negative status for NAI had been regained. All farms sampled to release movement restrictions on or after March 11 and approximately 200 other poultry premises in BC were to be included in this surveillance.

A combination of random, targeted, and convenience sampling was applied, and CanNAISS protocols and logistics were adapted for implementation during the post-outbreak period. Both private veterinarians and CFIA staff were involved with blood sample collection, and all diagnostic testing was performed at NCFAD. As per the CanNAISS protocol, all samples were tested by c-ELISA with a full HI panel for confirmatory testing. A CanNAISS report on POS BC 2009 will be generated by the Epidemiology and Surveillance Section of the Terrestrial Animal Health Division of the CFIA.

## 7. Destruction

The CFIA requires the employment of humane methods of flock destruction, as recommended by the OIE and the Canadian Veterinary Medical Association. Birds were destroyed on infected premises by $CO_2$ inhalation. Representatives of organizations responsible for animal welfare were invited to observe the destruction activities. In addition, a BCMAL veterinarian was in attendance during the depopulation activity at IP#1.

A destruction order was issued for approximately 60,000 birds on IP#1/IP#1a on January 25. Destruction of birds on IP#1 was completed on January 26 and IP#1a on January 27. A destruction order for approximately 12,000 birds on IP#2 was issued on February 10. Destruction of birds on IP#2 was completed on February 12.

## 8. Disposal Activities

Composting is the preferred method of disposal by the CFIA. In-barn biologic heat treatment (BHT) of carcasses, feed, and litter inactivate virus in the compost material, so it can be safely removed from the barn(s) without risk of spreading virus to surrounding poultry operations.

On IP#1 and IP#1a, bird (turkey) carcasses, feed, litter, stored manure and bedding (wood shavings) were disposed using in-barn composting, according to the CFIA risk assessment (024) "Hazard Identification on Release Criteria For Poultry Compost Piles Containing HPAI H5N1 Positive Poultry Carcasses, Crushed Eggs, Litter and Feed," and the BCMAL Protocol #2, "On-Farm, In-Barn Biological Heat Treatment of Materials Potentially Infected with Avian Influenza."

Litter and birds were gathered from all barn sections into one area of the barn on both IPs. Materials from feed bins, manure storage buildings, and shaving storage sections were combined with the litter/birds into composting windrows under the guidance of a composting consultant and a CFIA disposal technical specialist. Stage 1 composting was initiated for IP#1 on January 27 and for IP#1a on January 30, and windrow construction was completed on February 2 for IP#1 and February 4 for IP#1a.

The temperature of the compost piles was monitored daily according to a risk assessment prepared by the Animal Health Risk Assessment Unit of CFIA (#024: Hazard Identification on Release Criteria For Poultry Compost Piles Containing HPAI H5N1-Positive Poultry Carcasses, Crushed Eggs, Litter and Feed, June 2007). The results were analyzed by the disposal technical specialist to ensure that the time-temperature combination obtained release criteria. These criteria specify that the temperature in each layer of compost must be greater than or equal to 37 degrees Celsius for six consecutive days.

Once the BHT was completed (IP#1 on February 10 & IP#1a on February 11), the piles were moved outside the barns into one large static aerated windrow. This secondary composting was completed on-farm under the guidance of a composting consultant and according to provincial regulations. The compost pile was covered with Compostex™, according to provincial regulations, to aid in the shedding of rainwater and regularly monitored by a composting consultant. When secondary composting is complete, the material can be spread as agricultural waste according to provincial regulations.

On IP #2, bird carcasses, feed, and litter were disposed using in-barn composting, according to the CFIA and BCMAL protocols described for IP#1/IP#1a. The feed system was emptied, and material from the second floor of the barn (carcasses, litter, and manure) was moved to the lower level of the barn via trap doors in the floor. All material was combined with fresh shavings under the guidance of a CFIA disposal technical specialist into a compost windrow for BHT and was completed on February 15.

The compost piles were monitored daily by the CFIA for temperature according to Appendix 2 of the risk assessment (024), and the results were analyzed to ensure that the time-temperature combination obtained release criteria as outlined for IP#1/IP#1a. When the BHT was complete on February 25, the pile was released and moved outside the barn for secondary composting on-farm. A static aerated windrow was built on a geo-membrane and covered with Compostex™, in accordance with provincial regulations, to aid in the shedding of rainwater. The windrow was regularly monitored by a composting consultant. When secondary composting is complete, the material can be spread as agricultural waste according to provincial regulations. Secondary composting was complete on IP#1/IP#1a on April 11 and on IP#2 on April 27.

## 9. Cleaning and Disinfection of Facilities and Equipment

Protocols for cleaning and disinfection (C&D) of NAI infected premises have been developed by the CFIA. C&D activities are the physical and financial responsibility of poultry producers, but these activities must meet standards set by, and approved by, the CFIA. Adherence to existing protocol is enforced and documented through a series of inspections by CFIA personnel. All areas and equipment potentially contaminated with NAI virus are included in the C&D protocol. All things, including CFIA equipment and conveyances, were cleaned and disinfected according to strict biosecurity protocols before they were removed from infected premises. All persons leaving an infected premises were required to follow established biosecurity and bio-containment procedures.

C&D of the physical structures on the infected premises was initiated after the compost piles were moved outside for the secondary composting process. The cleaning and disinfection of IP#1 and IP#1a was complete and approved by the CFIA on February 21. Cleaning and disinfection of IP#2 was complete and approved by the CFIA on March 11.

In accordance with the current guidelines of the OIE *Terrestrial Animal Health Code* (2008), a country is eligible to have its negative status for NAI reinstated three months following the completion of C&D of the last infected premises, provided that acceptable post-outbreak surveillance is completed and that no additional NAI cases are identified.

# 10. Working Hypothesis on Source and Transmission of NAI

AI virus can be transmitted directly from bird to bird through secretions and feces, and indirectly through human movement, contaminated feed, fomites, water, or equipment. There are two possible ways in which the virus could have been introduced on these premises:

1. the direct or indirect movement of virus from a source poultry premises; or

2. exposure to virus in the natural environment. The natural environment includes spread by wild birds either via direct contact or indirectly by the contamination of feed, water, etc.

## 10.1 Infected Premises #1 & #1a

The first infected premises (IP#1) was a turkey meat-production operation comprising 28,453 birds housed in a four-staged open-sided barn. A review of flock records associated with IP#1 revealed increased mortality in all populated barn stages the week prior to the diagnosis of NAI. Clinical signs of respiratory disease were observed and included coughing, snicking, lethargy, and dyspnea. Results of testing for avian respiratory disease pathogens and post-mortem examinations completed on turkeys submitted to BCMAL from IP#1 support that the respiratory clinical signs observed were attributable to concurrent disease, rather than infection with LPNAI.

The initial samples submitted to BCMAL by a poultry consultant were taken from birds located in stage 4, which were 86 days of age. Two other stages of the barn contained the following birds: stage 1 housed 9453 turkeys that were 16 days old, and stage three housed approximately 10,000 turkeys that were 50 days old. Stage 2 was empty.

Samples from stage 4 were identified as being seropositive for antibodies to Influenza A on AGID, and the presence of H5 virus was confirmed using RT-PCR. Additional investigative sampling was completed by the CFIA on January 22. This testing confirmed the presence of H5 virus on this premises by both RT-PCR and conventional PCR.

The initial epidemiological investigation of IP#1 resulted in the quarantine of a co-located premises. A review of flock records associated with this epidemiologically and

geographically linked premises did not reveal a similar increase in mortality above expected, and all production parameters were within normal limits at the date of quarantine issuance.

This second premises also consisted of turkey-meat-type birds, housed in a four-staged open-sided barn. Both premises shared a paved driveway. There were approximately 10,000 turkeys in stage 4 that were 79 days old; stage 3 was empty; approximately 10,000 turkeys in stage 2 that were 44 days old; and about 10,000 turkeys in stage 1 that were 2 days old. Routine biosecurity was in place for all human traffic entering the barn, including the use of coveralls and boot dips.

This premises was also sampled on January 22 to determine its infection status for NAI. Clinical signs of respiratory disease were not reported for birds in any of the barn stages on this date. Results from sampling on this date were positive for NAI (H5) on both serology and RT-PCR, confirming this premises as IP#1a.

By the date of destruction there were clinical signs of respiratory disease in birds housed in both stages 3 and 4 of IP#1. Increased morbidity and mortality were noted in stage 4, and increased morbidity was noted in stage 3. No increase in morbidity or mortality was identified in birds housed in stage 1. On IP#1a, there were clinical signs of respiratory disease in birds housed in both stages 2 and 4. High morbidity and low mortality was noted for both stages. No increase in morbidity or mortality was identified for birds in stage 1. The clinical signs observed were more severe on IP#1 than those on IP#1a and included coughing, snicking, lethargy, and dyspnea.

Results from samples taken from IP#1 just prior to depopulation were positive for NAI (H5) on serology (HI), and RT-PCR for birds housed in stage 4. A H5N2 virus was isolated with a low pathogenicity HA cleavage site and an IVPI of 0 confirming the LPNAI designation. All samples submitted from birds housed in stage 3 were negative for NAI. Birds from stage 1 were not sampled. Results from all samples tested on this premises support that only one of the four barn stages was infected with NAI.

Results from samples taken from IP#1a just prior to depopulation were positive for NAI (H5) on serology (HI) and RT-PCR for birds housed in stage 4. Birds in stage 2 were negative on serology, but RT-PCR positive results were confirmed. NAI virus was isolated and identified as H5N2 with a low pathogenicity HA cleavage site and an IVPI of 0, confirming the LPNAI designation. Results from all samples tested on IP#1a support that two of the four barns were infected with NAI. Based on the negative serological results

for stage 2, it appears that NAI was only recently introduced into this population of birds. These results support the hypothesis that stage 4 was infected first on IP#1a.

Rapid molecular diagnostic tests and virus isolation are used to indicate active infection in a flock. Isolation and identification of AI virus from tracheal or cloacal swabs, feces, or internal organs is the gold standard method of diagnosis. The NCFAD confirmed the presence of influenza A type H5N2 virus from IP#1 on January 24, 2009. Results of gene sequencing indicated a low pathogenicity cleavage site (NVPQRETR/GLFGAIA). This sequence is 99 percent related to another H5 virus (H5N2), isolated from California in 2007. The closest match in Genbank is A/American green-winged teal/ California/HKWF609/2007(H5N2), accession number: CY033444. The virus characterized was not the high pathogenicity H5N1 strain circulating in Asia.

In this particular outbreak, no trace-in premises were confirmed as the source of NAI to either IP#1 or IP#1a. All premises identified during the trace-in investigations were subjected to statistically and epidemiologically valid surveillance for NAI, with negative results reported for each. Based on this negative surveillance, the source of virus for IP#1 and IP#1a does not appear to be an epidemiologically linked poultry premises.

Feed and water contamination as potential sources of NAI were also investigated. This included a review of the feed and water sources for both premises. The feed mill was inspected and its processes and written procedures were reviewed. Any opportunities for contamination which may have existed during ingredient receiving were excluded as possible sources of NAI virus. Procedures for the load-out area restricted the access of birds and there did not appear to be a contamination risk. Both IP#1 and IP#1a had a dedicated well, and water to the barns was treated with chlorine. There was no history of a mechanical malfunction of the chlorination equipment. Any potential for well contamination that could occur should have been addressed by the chlorine treatment. Feed and water contamination did not appear to be a likely source of NAI onto either IP#1 or IP#1a. Feed and water testing were not pursued.

Both IP#1 and IP#1a were open-sided barns that allowed the continual presence of wild birds, particularly starlings, within the barns. Although appropriate biosecurity practices were in place for the entry of personnel who worked within the barns, as well as farm visitors, the lack of a closed barn and the opportunity for entry of wild birds resulted in the significant potential for exposure to NAI viruses in the wild bird population.

It has been well established that wild birds, especially waterfowl, act as reservoirs of avian influenza virus and may be the initial source of infection to domestic birds, through direct contact or indirectly via the contamination of feed and/or water. LPNAI viruses have been isolated from at least 105 wild bird species globally, including starlings. The Fraser Valley is located in the Pacific flyway for wild migratory birds.

Since 2005, The Canadian Cooperative Wildlife Health Centre has coordinated national inter-agency surveillance for avian influenza in wild birds across Canada. Wild birds that are found dead (mortalities), and targeted species that are collected live, are tested by Matrix-PCR for avian influenza. This surveillance was stimulated, in the first instance, by a major outbreak of influenza in the Canadian poultry industry in 2004, and subsequently by the spread of the Asian H5N1 high pathogenicity strain. Objectives of this surveillance are to identify strains of influenza viruses present in Canada's wild bird reservoir, to acquire information needed to assess the biosecurity of Canada's poultry industry, and to monitor viral genes of concern to human and animal health.

In BC, sampling of live wild ducks for avian influenza surveillance began in 2005, when 640 ducks were sampled in the BC Interior. For 2006 only, the survey effort was expanded to include live ducks in the Fraser Valley region of the province, in addition to those sampled in the BC interior. Samples from the BC interior were also collected in the fall of 2007 and 2008, but to date, the 2008 samples have not been tested. All viruses detected have been of low pathogenicity and of North American lineage.

Inclusion of avian influenza data from wild birds found dead and submitted to a diagnostic laboratory for cause-of-death analysis began in late 2005. In BC, approximately one-half of these submissions are received from the Vancouver and Fraser Valley regions. Most of the other submissions are collected from Vancouver Island and the neighbouring gulf islands; the remainder are from various locations in the BC interior.

**Table 2: Summary of Live Bird Surveillance Results for British Columbia**

(2005–2008)

| Year | Region | No. Sampled | No. Matrix PCR + | No. H5 PCR + | No. H7 PCR + |
|---|---|---|---|---|---|
| 2005 | Interior | 640 | 353 | 161 | 0 |
| 2006* | Interior | 797 | 237 | 28 | 0 |
| | South Coast | 627 | 33 | 0 | 0 |
| 2007 | Interior | 444 | 84 | 0 | 2 |
| 2008 | Interior | 200 | - | - | - |

*The samples collected on the south coast were collected in December, whereas those samples from the Interior were collected in late summer and early fall.

**Table 3: Summary of Dead Bird Surveillance Results for British Columbia**

(2006–2008)

| Year | No. sampled | No. Matrix PCR+ | No. H5 PCR+ | No. H7 PCR+ |
|---|---|---|---|---|
| 2006 | 639 | 2 | 0 | 0 |
| 2007 | 598 | 7 | 0 | 1 |
| 2008 | 386 | 1 | 1 | 0 |

Surveillance for avian influenza in wild birds collected in BC has resulted in the isolation of several viruses of various H types. This includes two H5N2 viruses (2006: live mallard from the Merrit region and 2008: dead trumpeter swan of unknown location).

Introduction of influenza virus onto IP#1 and IP#1a could have resulted from direct commingling with infected wild birds or indirectly via contaminated feed and/or drinking water inside the barns. Although all external feed storage bins were secured on these premises, the nature of the barn construction allowed a continual presence of wild birds inside the barns. It was not uncommon to observe hundreds of wild starlings *(Sturnus vulgaris)* within the barn at any given time. In addition, it has been speculated that cooler than average temperatures during the winter of 2008–2009 may have resulted in increased numbers of starlings entering the barns for feed and water.

There are limited global reports of avian influenza virus being isolated from starlings in their natural environment, although experimental studies would suggest that this species may be capable of viral shedding. However, it is also possible that by co-mingling with avian influenza-infected waterfowl starlings could serve as a mechanical vector for the spread of NAI virus to domestic poultry.

Based on the epidemiological investigation and surveillance testing of all possible sources of NAI onto IP#1/IP#1a, the direct or indirect movement of virus from a source poultry premises was ruled out. In consideration of the barn construction and history of continual exposure to wild birds, the most probable source of NAI for both IP#1 and IP#1a is exposure to virus in the natural environment.

On December 30 and 31, 2008, the owner/operator of IP#1 entered the barn on IP#1a to check the turkeys. Prior to entering the barn on IP#1a on these dates, this individual had been in the barn on IP#1. It is unknown whether IP#1 was already infected with NAI on this date; however, it is possible that movement of this individual may have resulted in the NAI spread between these co-located barns. Results of diagnostic testing completed for both IP#1 and IP#1a, including serology and virus isolation/genotyping, support the hypothesis that IP#1 was the index premises.

### 10.2 Infected Premises #2

Infected premises #2 was a specialty bird breeding operation with approximately 12,000 chickens housed in a two-storey completely enclosed barn. A review of flock records associated with this premises did not reveal any increase in morbidity/mortality or decrease in production parameters prior to the laboratory confirmation of LPNAI.

The flock was composed of birds approximately 24 weeks of age, which had been in the barn for the past 8 to 10 weeks. Prior to placement of these birds, the barn had been empty since October 9 (lower) and September 12 (upper). The barn was not cleaned out from the previous cycle, and manure/litter was being composted in the barn. Routine biosecurity was in place for all human traffic into the barn, including the use of coveralls and boot dips.

As this premises was under quarantine as a result of its geographical proximity to IP#1/IP#1a, it had been subject to surveillance for NAI since January 31. Sampling completed on this date was negative for NAI on both serology and RT-PCR testing. Additional samples of on-farm mortalities were tested on February 4, with negative

results for NAI. On February 5, additional investigative surveillance was completed on this premises as a result of laboratory evidence of an active flock infection with an H3 virus from samples taken on January 31. Results of testing on February 5 identified a single confirmed RT-PCR positive result for NAI (H5) in the upper barn and additional suspicious results in both the lower and upper barns. Testing for antibodies to avian influenza was negative for H5 but positive for H3.

Enhanced investigative surveillance to further characterize the presence of LPNAI (H5) on this premises was conducted on February 10. Positive serology for H5 was identified in the upper barn in a limited number of samples. The finding of positive serological results indicates previous exposure to avian influenza virus (H5) on this premises. Based on results of testing from February 5 and February 10, this premises met the criteria for a presumptive case of NAI. It was suspected of being infected with NAI and subsequently declared an infected place (IP#2).

Rapid molecular diagnostic tests and virus isolation are used to indicate active infection in a flock. Isolation and identification of AI virus from tracheal or cloacal swabs, feces, or internal organs is the gold standard method of diagnosis and required to confirm a case of NAI. Results of sampling completed just prior to depopulation of birds on this premises identified positive matrix RT-PCR results for influenza A. Positive RT-PCR results for H5 were not identified in samples procured on this date. It has not been possible to further characterize the virus by H5 RT-PCR or by conventional RT-PCR. Because NAI virus was not isolated from this premises and the clinical findings did not support an active infection with NAI, it was not possible to classify IP#2 as a confirmed case.

No trace-in premises to IP#2 were confirmed as the source of NAI. All premises identified during the trace-in investigations were subjected to epidemiologically valid surveillance for NAI, with negative results reported for each. Based on this negative surveillance, the source of virus for IP#2 does not appear to be an epidemiologically linked poultry premises.

Feed and water contamination as potential sources of NAI were also investigated. This included a review of the feed and water sources for both premises. The feed mill was inspected, and their processes and written procedures were reviewed. Any opportunities for contamination, which may have existed during ingredient receiving were dismissed. Procedures for the load-out area restricted the access of birds, and there did not appear to be a contamination risk. The source of water for IP#2 was the municipal water supply. This indicates that there would not be the potential for contamination that could occur

with surface water or water drawn from a shallow well. Feed and/or water contamination did not appear to be a likely source of NAI onto IP#2. Testing on feed and water sources were not pursued.

Based on the epidemiological investigation and negative results from surveillance testing, the direct or indirect movement of virus from a source poultry premises was ruled out. Infected premises #2 was a closed two-storey barn. Although appropriate biosecurity practices were in place for the entry of personnel working within the barns, as well as farm visitors, it is possible that indirect exposure to the virus in its natural environment could occur as a result of a break in biosecurity. The source of NAI onto this premises was not determined.

# 11. Response Infrastructure

## 11.1 The Role of the CFIA

The CFIA is the lead agency whenever a reportable animal disease, such as notifiable avian influenza, is detected. Supportive roles are assumed by other federal, provincial and municipal agencies, veterinary associations, and producer organizations.

### 11.1.1 The CFIA's foreign animal disease plans

The CFIA has developed contingency strategies and operational plans to deal with potential incursions of foreign animal and reportable diseases. The FADES Plan is the framework of federal-provincial cooperative agreements that specify the roles and responsibilities of federal and provincial government stakeholders during an animal disease emergency. The *Notifiable Avian Influenza Hazard Specific Plan* (NAIHSP) forms part of the overall plan to deal specifically with an incursion of NAI; it supplies background information on the disease itself, as well as outlines the principles of control and eradication, disinfection of infected premises, and surveillance. The emergency response organization and the detailed procedures to implement these contingency plans are set out in the CFIA Emergency Book and the CFIA *Animal Health Functional Plan*.

### 11.1.2 Emergency operations centres established

When a high-risk specimen is submitted due to evidence of a disease that is federally reportable (e.g. NAI), the area and national emergency response teams are alerted. Once the diagnosis is confirmed, a sequence of events is activated that put in place the control and eradication procedures described in the NAIHSP, the CFIA Animal Health Functional Plan, and the CFIA Emergency Book. At the discretion of the Regional Operations Director, a local emergency operations centre (EOC) is established to coordinate the field investigation and disease control activities. In addition, a national EOC is established at Headquarters in Ottawa to support the field activities associated with disease control and eradication policy, legal issues, communications, consultations with producer groups, international relations, and inter-provincial liaison activities.

### 11.1.3 British Columbia Regional Emergency Operations Centre

The BC-REOC was activated in Abbotsford on January 22, 2009, at the CFIA Regional Office. The Province of British Columbia's emergency response operations were co-located to support the federal government response, as outlined by the FADES plan, and a Joint Emergency Operations Centre (JEOC) was activated on January 23. A unified command utilizing the principles and precepts of the Incident Command System facilitated close working relations among federal, provincial, and municipal agencies involved with human health, animal health, the environment, logistics support, and information technology services.

The provincial Animal Health Centre, an accredited full-service veterinary diagnostic laboratory, was utilized to support the diagnostic laboratory capacity of the CFIA. The BCMAL provided support in veterinary epidemiology and surveillance, industry connections, GIS and mapping, and consultation on disposal methods and requirements.

### 11.1.4 National Emergency Operations Centre

On January 22, 2009, the National Emergency Operations Centre (NEOC) was activated in Ottawa. The situation was declared to be an emergency by the CFIA President, Ms. Carol Swan, on January 24. A National Emergency Response Team was established with the Associate Vice-President of Operations as National Incident Commander.

## 12. Communications

Daily inter-agency briefings were held at the JEOC that included CFIA staff, section heads and representatives from provincial and municipal governments, public health agencies, and industry. Communications with foreign governments were handled through the NEOC.

Communication with the media was managed through official CFIA spokespersons, which were designated at the beginning of the response to handle all contacts with the media. Media became aware of the quarantine and reported activity on the index farm on January 23, 2009. In conjunction with BCMAL, a technical briefing was held on January 24, upon confirmation of the official test results.

In support of the spokespersons, a team of Area and Headquarters communications officers worked together to prepare news releases, media lines, web updates, and to coordinate media interviews. This group worked closely with provincial communications staff. The CFIA website was updated regularly with new and significant information as it became available.

## 13. The Role of Poultry Producer Organizations

Since previous avian influenza events in BC, industry and the BCMAL have worked collaboratively to improve premises identification. The project has entailed the creation and maintenance of a secure central database that contains accurate premises and sub-premises (barn or production floor) identification and contact information for all poultry premises in the BC-regulated marketing system.

The regulated poultry industry in BC provided industry data to support GIS mapping and the development of outbreak and post-outbreak surveillance protocols. In addition, industry representatives facilitated producer understanding of the disease response with respect to the outbreak, as well as the surveillance required in the post-outbreak surveillance period.

# 14. The Role of Human Health Agencies

Avian influenza is considered a zoonosis and some strains can present a human health risk, and thus contacts were initiated with local, provincial, and federal public health authorities.

## 14.1 Health Canada Workplace Health & Public Safety Programme and the Public Health Agency of Canada

Workplace Health and Public Safety Programme (WHPSP), Health Canada, provided advice and support to the CFIA on occupational health issues relating to avian influenza. On-site services provided by the Health Canada Occupational Health Nurses (OHN) and Occupational Health Medical Officers (OHMO) at the CFIA Emergency Operations Centre in Abbotsford, BC included:

1) provision of seasonal influenza vaccinations (if not yet received) and antiviral prophylaxis to CFIA employees who were assigned to work in avian influenza contaminated areas, as recommended by the Public Health Agency of Canada (PHAC). Tetanus/diphtheria vaccinations were also provided to individuals if required.

2) provision of on-call and/or on-site advice from an OHN and/or OHMO with respect to communicable disease issues related to avian influenza.

3) initial and ongoing education to CFIA employees with respect to:
i) the importance of the proper use of personal protective equipment (PPE) and frequent hand-washing;
ii) the need to self-monitor for (and report) side effects of the antivirals or vaccinations for appropriate follow-up; and
iii) the need to report any flu-like symptoms for appropriate follow-up and treatment by local public health authorities.

During the course of the outbreak, the Health Canada team worked in close consultation and cooperation with CFIA management, CFIA Safety and Health Advisors, the Abbotsford Public Health Unit, and the BC Centre for Disease Control (BCCDC). The Health Canada team also worked closely with PHAC for ongoing advice on preventive measures (antivirals and PPE), based on the risk of exposure during the various phases of the avian influenza response.

## 14.2 British Columbia Centre for Disease Control

BCCDC provided ongoing consultation and support to the local health authority responding to the outbreak on issues relevant to human health, as outlined in the roles and responsibilities sections of both the *Human Health Issues and Guidelines Related to Avian Influenza in British Columbia* and the FADES Plan.

BCCDC had prepared human health guidelines related to avian influenza in BC, based largely on experience during the 2004 AI outbreak. These guidelines, along with sample letters and information sheets for workers and farmers concerning risks and protective measures, were shared with the local health authority for further adaptation.

BCCDC Laboratory Services conducted testing of human specimens collected from workers and farmers over the course of the outbreak investigation. Likewise, BCCDC Pharmacy Services participated by providing antiviral kits (oseltamivir) to the local health authority, information on antivirals to the workers, and support related to adverse drug reactions to public health nurses. In conjunction with the BC Provincial Health Officer, BCCDC also participated in regular teleconferences, facilitating critical information exchange among key stakeholders.

### 14.3 Fraser Health Authority

Fraser Health Authority (FHA) staff partnered with local, provincial, and federal agencies to assist in providing a coordinated response in the follow up of NAI exposed farm workers. This included the provision of influenza seasonal vaccine and oseltamivir prophylaxis to employees on infected premises, as well as to contract workers. A total 44 individuals were provided with influenza vaccine, and 52 were provided with oseltamivir prophylaxis. In addition, testing of exposed symptomatic workers was undertaken, with no individuals being confirmed with H5N2.

FHA staff also worked to inform and educate farm workers about self protection, including the use of appropriate PPE, self-monitoring, and reporting of symptoms to appropriate officials. Communication with BCCDC, Work Safe BC, Ministry of Healthy Living & Sport, Health Canada, and other partners was initiated on a regular basis via the facilitation of regular teleconferences.

## 15. Occupational Health and Safety

A CFIA occupational health and safety (OSH) advisor was on-site during the response activities. The role of this individual was to monitor the following: compliance with federal occupational health and safety legislation, safe work practices and hygiene procedures, the use, effectiveness, performance, and replenishment of PPE, as well as monitor and assist with bio-containment and provide advice in a timely manner.

The CFIA provided employees with biosecurity training sessions respective to their tasks. A buddy surveillance system was implemented to minimize the risk of accidents or biocontainment breaches. A five (5) person biocontainment team was established at each infected premises to assist destruction and disposal teams in the use, maintenance, and preparation of PPE. Biocontainment team members assisted employees who entered the infected premises with the donning and doffing of their PPE, monitored compliance with protocols, and provided first aid.

## Appendix A: Map of 3 km movement-restricted perimeters placed around IP#1/IP#1a and IP#2