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An Assessment of the Risk Associated with the Movement of Egg-Type Day-Old Chicks Into, Within and Outside of a Control Area During a Highly Pathogenic Avian Influenza Outbreak

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Collaboration between the Egg Sector Working Group,
the University of Minnesota's Center for Animal Health
and Food Safety, and USDA:APHIS:VS:CEAH.



Safeguarding Animal Health



UNIVERSITY OF MINNESOTA

CENTER FOR ANIMAL HEALTH
AND FOOD SAFETY



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1. Abbreviations and Definitions

AHPA	Animal Health Protection Act
APHIS	Animal and Plant Health Inspection Service (USDA)
AI	Avian influenza
CEAH	Centers for Epidemiology and Animal Health
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
GMP	Good Manufacturing Practice
FSIS	Food Safety Inspection Service
HA	Hemagglutinin
HACCP	Hazard Analysis and Critical Control Point
HPAI	Highly pathogenic avian influenza
HPNAI	Highly pathogenic notifiable avian influenza
LPAI	Low pathogenic avian influenza
NA	Neuraminidase
NAHEMS	National Animal Health Emergency Management System
NPIP	National Poultry Improvement Plan
OIE	World Organization for Animal Health (formerly Office International des Epizooties)
P.I.	Probability Interval
PPE	Personnel protective equipment
RRT-PCR	Real-time Reverse Transcription Polymerase Chain Reaction
U.S.	United States of America
USDA	United States Department of Agriculture
VS	Veterinary Services (USDA: APHIS)
Breeder farm	

Farms with breeder flocks that produce hatching eggs. The hatching eggs from a breeder farm are transported to a hatchery.

Buffer surveillance zone

The zone immediately surrounding the infected zone. The buffer surveillance zone and the infected zone comprise the control area.

Chick handling materials

Handling materials used in the transport of day old chicks such as chick boxes and dollies.

Control area

A control area, consisting of an infected zone and a buffer surveillance zone, will be established to ensure the rapid and effective containment of the disease. Initially, the entire State, Commonwealth, Tribal Nation or territory may be declared a control area and subject to movement restrictions until appropriate surveillance and epidemiological evidence has been evaluated and the extent of the outbreak is known. All susceptible bird and other livestock movement will be stopped for a period long enough to determine the scope of the disease outbreak. The potential modes of transmission of HPAI will be considered when determining the minimum size and shape of a control area. Movement control through the use of permits should be maintained until the disease is eradicated.

Day Old Chicks

Day old chicks are newly hatched chicks that are moved from the hatchery within a couple of days after hatching. In some instances, it might take more than 72 hours for the “day old” chicks to be delivered because of delays in movement.

Egg

The shell egg of the domesticated chicken. Shell eggs of turkeys, ducks, geese, and guineas are outside the scope of this assessment.

Egg Movement Control (EMC) Response plan

The EMC Response Plan identifies specific surveillance, biosecurity, cleaning and disinfecting practices for moving different types of eggs, egg products and day-old chicks within, out of and into a HPAI Control Area. The EMC response plan is part of the USDA-APHIS_VS Draft Secure Egg Supply plan.

Egg handling materials

Handling materials used in the transport and storage of hatching eggs such as plastic flats, pallets, buggies, setter trays etc.

EID₅₀

50% embryo infectious dose, or dose at which 50% of inoculated embryos become infected.

Hatchery

A commercial establishment that produces day old chicks from hatching eggs. Commercial hatcheries receive hatching eggs from offsite breeder operations and produce day old chicks that are shipped to pullet raising operations.

Hatching egg

A fertilized egg produced by breeding birds. Chicks hatched from hatching eggs may be used for commercial egg production or to supply multiplier breeding flocks.

Infected zone

In an outbreak of HPAI, infected zone will encompass the perimeter of all presumptive or confirmed positive premises (“infected premises”) and include as many “contact premises” as the situation requires logistically or epidemiologically. Activities in an infected zone include:

- Preventing products from birds and other susceptible animals from leaving the zone unless a risk assessment determines that such movement can be permitted.
- Preventing movement of vehicles, equipment, and nonsusceptible animals out of the zone unless appropriate biosecurity procedures (as determined by a risk assessment) are followed.

Movement permit

A VS Form 1-27, a State-issued permit, or a letter—customized to the applicant’s situation—generated by the Permit Team and issued at the discretion of Incident Command to allow the movement of nest run eggs from a premises or a geographic area described in a quarantine order.

National Poultry Improvement Plan (NPIP)

Cooperative State-Industry-Federal program that establishes guidelines for evaluation of poultry products and poultry production relative to disease and eligibility for interstate/international trade

Nest run egg

Eggs that have been packed as they come from the production facilities without having been washed, sized, and/or candled for quality, with the exception that some checks, dirties or obvious undergrads may have been removed.

Pullet Farm

Pullet farm is a commercial establishment dedicated for chicks to about 16 to 18 weeks of age when they are moved onto layer facilities for egg production.

Restricted egg

Restricted egg means any check, dirty egg, incubator reject, inedible, leaker, or loss.

Shell egg

For this assessment, we define shell eggs as washed eggs.

2. Executive Summary

3. Introduction

4. Scope

4.1 Facilities Covered Under this Risk Assessment

This risk assessment is applicable to egg layer hatcheries that: are in the HPAI control area, receive hatching eggs from a breeder premises within the control area, or deliver day old chicks to a pullet farms in the control area that abide by the following protocols in the event of an HPAI outbreak.

- The National Poultry Improvement Plan (NPIP)
- The Egg Movement Control Plan and model cleaning and disinfection guidelines included in the UEP/UEA-USDA/APHIS/VS Secure Egg Supply Plan.

This risk assessment is also applicable to pullet farms which receive day old chicks from hatcheries in a HPAI control area that abide by the following protocols in the event of an HPAI outbreak.

- The National Poultry Improvement Plan (NPIP)
- The Egg Movement Control Plan and model cleaning and disinfection guidelines included in the UEP/UEA-USDA/APHIS/VS Secure Egg Supply Plan.

4.2 Types of Movements Addressed Under This Risk Assessment

This risk assessment addresses the following types of movements into, within, and outside of the control area during an HPAI outbreak:

- Movement of egg-type day-old chicks from a commercial layer hatchery to an offsite pullet farm
- Movement of cleaned and disinfected chick handling materials from the pullet farm to the premises of origin.

The risk assessment will consider distribution of day old chicks both domestically (within state and between states) and internationally outside the U.S. If trade is undertaken internationally, the risk assessment will take into account the international trade code as documented in the world organization for animal health (O.I.E.) Terrestrial Animal Health Code.

The assessment would evaluate the risk of moving day old chicks produced at premises receiving hatching eggs from an infected but undetected flock. The assessment would also evaluate the vertical transmission risk associated with day old chicks hatched from eggs produced by an infected but undetected flock.

If reusable material from pullet farm is returned to hatchery during an outbreak time, this risk assessment would only include day old chicks moved to pullet farm in the control area known to be free from NAI.

5. Significant Assumptions Used in the Risk Assessment

This assessment is proactive in nature and cannot address the specific circumstances surrounding an outbreak in detail. Therefore we are making some assumptions to establish context and applicability. These assumptions are:

- a) That a HPAI outbreak has been detected, APHIS is implementing the HPAI Response Plan, and some degree of planning has taken place at other levels. The APHIS HPAI Response Plan is intended to complement regional, State, and industry plans and APHIS recommends their continued development.
- b) Breeder operations may have HPAI infection in their flocks but it has not yet been detected. If there was absolute certainty that HPAI infection was absent there would be no risk. On the other hand, if HPAI infection has been detected, it is assumed that Incident Command would shut down the premises and movement of eggs and materials would not be allowed. This situation does not pose a risk associated with movement of hatching eggs.
- c) Pullet premises may have HPAI infection in their flocks but it has not yet been detected. If there was absolute certainty that HPAI infection is absent, there would be no risk. On the other hand, if HPAI infection has been detected, it is assumed that Incident Command would shut down the premises, supply of day-old chicks and movement of materials between the hatchery and pullet farm would not be allowed.
- d) Based on the results of a separate risk assessment for movement of hatching eggs during an HPAI outbreak, it is assumed that the risk of day old chicks at the hatchery being contaminated with HPAI virus is low.
- e) That all relevant preventive measures from the EMC response plan and associated model cleaning and disinfection guidelines are strictly followed. The assessment does not evaluate the risk that the preventive measures in the EMC response plan are incorrectly implemented either intentionally or unintentionally.

6. Overview of Hatchery Operations

The primary sanitation effort in production of commercial layer hatching eggs is toward producing a nest-clean egg without disinfection or fumigation, but eggs may be disinfected/fumigated as soon as possible after collection at the breeder farm, and again upon arrival at the hatchery. The hatchery may collect eggs from many breeder farms and distributes day old chicks to many farms.

Flow in Hatchery involves Product, People, Air and Waste. Consequently, the hatchery lay-out is designed to control flow.

- **Product flow:** There is no crossing of eggs and chicks. Eggs arrive at the egg room, and then they are moved to the setter room and into setting incubators where they stay for 18 days at 37°C. The eggs are moved to the hatching room and transferred from setter trays to hatching trays and placed in the hatching incubator. Three days later after hatching, chicks are moved to chick room, processed, and loaded onto a truck for delivery. Hatching trays are moved to washing room.
- **People flow:** Generally there is limited movement of people from hatch area or chicken room back to the eggs area. There is little contact of personnel with eggs in the incubators. Visitors to the breeding facilities and hatcheries are usually discouraged.
- **Airflow:** positive pressure in the setting room relative to the egg room, hatch room and chick room. Air flow is from the incubation room with positive air pressure to hatching room, chick room, and finally to wash room.
- **Waste flow:** separate drains for egg room, setter room, hatch room, chick room and wash room.

6.1 Processing Day Old Chicks

Day-old chick processing and holding rooms are set at appropriate temperature and ventilation which is suitable for day-old chicks. Both processing and holding rooms are maintained at a temperature of 25-30°C and are well ventilated to be appropriate for day-old chicks.

On day 21 of incubation, hatcher dollies are removed from hatcher room and moved to chick processing room. In processing room, chicks are removed from hatcher trays with minimal stress and without causing injury to the chicks, leaving shells and unhatched eggs (hatch debris). Hatch debris is disposed in accordance with the industry's specific bio-security procedures. Chicks are then graded and cull chicks are identified and separated. Culled chicks (cockerels or sick, injured or weak) with associated debris may be macerated and vacuumed or eutanized using carbon dioxid and passed to the storage tank. Carcasses of culled chicks are removed and disposed

depending on the individual hatchery's practice through burial, landfill, incineration/combustion, rendering and/or composting.

Egg-type chicks selected for distribution will undergo sex separation by observation of feather color, feather growth or the vent. They will then be vaccinated for Marek's disease in accordance with veterinary guidelines, manufacturer's specifications, and hatchery procedures. Depending on customer request other vaccines may also be applied. All the vaccines are used in accordance to state and federal requirements and are USDA approved. Each time after use, vaccine administering equipment is cleaned, sterilized and kept properly. Vaccines used are recorded which include batch number, expiration date, dosage and vaccination date.

6.2 Processing and Holding Rooms Environment and Hygiene

After processing each batch, chick operations equipment and machinery are cleaned and sanitized in accordance with manufacturer's specifications. Processing- and holding- room temperature and humidity levels are set at the level suitable for day-old chicks. Doors for the rooms are closed all the time. Contact between egg room and hatching room personals are limited. After each processing, rooms are cleaned and disinfected and hatcheries at minimum will follow NPIP requirements as stated in 9 CFR_§ 147.23 Hatchery sanitation (Appendix 1).

6.3 Distribution of Day-Old Chicks

Depending on the distance where chicks are shipped, chick boxes can be reusable or disposable. Disposable chick boxes (cardboard) are mainly used for air shipments (international and domestic) while reusable chick boxes are usually used for truck shipments. Upon delivery reusable materials are returned immediately to the hatchery with the same chick truck and are cleaned and disinfected in the washing room at the hatchery. The clean and disinfected reusable materials are then stored in a clean room. Modern hatchery facilities have three docks – each dedicated for moving hatching eggs, day old chicks with associated materials and dirty materials (hatch debris, culled euthanized chicks etc.). In older facilities, however, only one dock might be available for moving in and out of eggs, chicks and associated materials. As normal activities, the truck driver enters chick holding room and loads the chicks into the truck. He also has a responsibility to unload chicks at the pullet farm and in most deliveries he remains on the tail gate of truck and does not enter the pullet barn. He then also reloads reusable materials in the truck and unloads boxes to the washing room in the hatchery.

Chicks need suitable temperature and humidity for their transport. An ideal temperature 24.5-25.0°C (76-77°F) and relative humidity of 63-70% may be maintained for the duration when chicks are hatched, processed and transported to their final destination.

It is common for larger pullet barns to receive chicks from more than one hatchery. On a multi age farm each barn may receive from a single hatchery or more than one hatchery.

If day old chicks are supposed to be transported to foreign countries internationally, rules and regulation accepted by the two countries will be followed. For this risk assessment, we will adopt the world organization for animal health, O.I.E. Terrestrial Animal Health Code 2009. Chapter 10.4 of this code particularly refer to Avian Influenza for the purposes of international trade which accounts not only with the occurrence of clinical signs caused by Notifiable Avian Influenza (NAI) or HPAI Virus, but also with the presence of infection with NAI virus in the absence of clinical signs. The O.I.E Terrestrial Animal Health Code considers status of NAI based on country, Zone, and compartment. Zoning and compartmentalization based on this code is subpopulations of distinct health status within country's territory for the purpose of disease control and/or international trade. While zoning applies to an animal subpopulation defined primarily on a geographical basis (using natural, artificial or legal boundaries), compartmentalization applies to an animal subpopulation defined primarily by management and husbandry practices related to biosecurity. In practice, spatial considerations and good management including biosecurity plans play important roles in the application of both concepts.

6.4 HPAI Outbreak Biosecurity Measures for Day Old Chick Processing, Holding, Transportation and Placement at the Farm

In the face of outbreak, increased biosecurity measures will be followed within the hatchery starting from processing until shipping. Based on egg movement control plan, the following biosecurity measures will be emplaced for truck and drivers: The cargo interior and exterior of the transport vehicle must be cleaned and disinfected, the driver will not be allowed outside the cab or else the cab interior must also be cleaned and disinfected, and the tires and wheel wells must also be cleaned and disinfected before leaving the premises within the "Control Area".

According to the model cleaning and disinfection procedures and based on provision given by NPIP, the chicks ready to ship must be placed in either new cardboard boxes, or plastic boxes that have been cleaned and disinfected at the hatchery. The chick truck must be cleaned and disinfected both outside and inside the cab and cargo area with products approved for that purpose and according to the manufacturer directions. (See http://www.epa.gov/pesticides/factsheets/avian_flu_products.htm). The truck must exit the control area with no stops inside the control area, and avoiding known infected premises by the most distance possible. The outside of the truck should be disinfected at an official station upon exiting the control area or as per ICS requirements. At the farm manager's discretion, the truck may be re-disinfected upon arrival at the brooder house (Full document of model cleaning and disinfection is found in Appendix 2). The truck should return directly to the hatchery by the same route through the control area, avoiding known infected premises by the most distance possible. The model cleaning and disinfection procedures also recommend that the truck driver should wear protective overall when outside the cab, and remove them immediately before reentering the cab. The truck drivers should not enter the brooder house.

Industry expert has also suggested that during outbreak time one delivery per day per vehicles and driver. There is a tendency to deliver day old chicks to facilities approved free of the disease

or outside the control area. The drivers after delivery of chicks should also take showers and change all clothes before re-entering hatcheries.

As practiced during normal time, associated materials (chick box papers) used for transporting day old chicks should be new and destroyed at the premises of destination. Reusable day old chicks handling materials (chick boxes and dollies) sent to farms in the control zone must be cleaned and disinfected before returning to the hatchery.

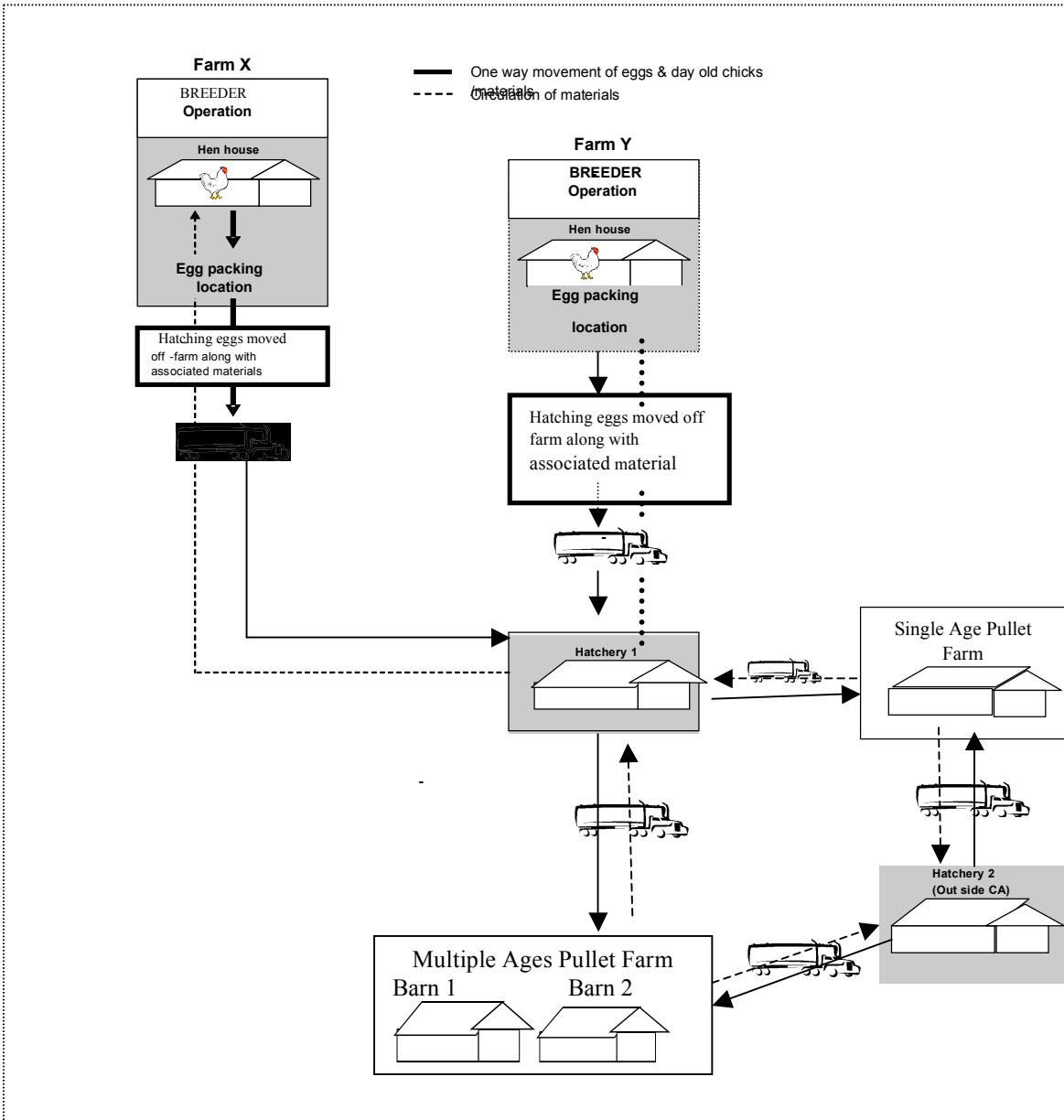
6.5 Pullet Farm Management

The term "pullet" refers to a young female chicken, usually prior to the onset of production. It can refer to egg-type or a meat-type chicken but we typically used this term in reference to an egg-type chicken. Pullet farms may operate as a single age facility or as a multiple age facility. A single age pullet farm houses chicks of a similar age group, whereas a multiple age pullet farm houses chicks of various ages. Prior to delivery of the chicks to either type of pullet farm, the brooding facility must be prepared and receiving barns cleaned and disinfected appropriately. Single age pullet farms use an all in and all out system for all barns on the premises. Multiple age pullet farms segregate different age chicks in different barns, thus each barn has a single age of chicks and an all in all out system is applied at the barn level. After moving out each batch of pullets, the industry follows a strict program of cleaning and disinfection as well as a good program of farm biosecurity. A large pullet farm can receive chicks from multiple hatcheries, and a single barn within the premises may receive chicks from multiple sources in some instances. During unloading and loading, employees from one barn can move and work in other barns. Pullet farms may also supply one or more different layer farms. In such cases, two way movements of materials are expected. During an HPAI outbreak, industries would follow model cleaning and disinfection protocols pertinent to cart and pullet truck (Appendix...).

6.5.1 Guidelines for Thirty Days Quarantine Period of Day Old Chicks during the face of HPAI

According to the Egg Movement Protocol, Day-Old Chicks from monitored flocks tested negative for AI virus by daily mortality sampling may be shipped by permit within or out of the Control Area. The protocol also requires day old chicks originated from hatcheries in control zone are needed to undergo in a “post-hatch” quarantine for 30 days.

Figure 1. Movement of eggs, day old chicks and material between breeder farms, hatchery and pullet farm



7. Risk of Day Old Chicks being Infected with HPAI Virus via Contaminated Chick Handling Materials at the Hatchery

7.1 Introduction

The risk that day old chicks at the hatchery become infected with HPAI virus from eggs or materials originating from an infected but undetected breeder premises via movements of equipment or personnel were addressed in a previous risk assessment for movement of hatching eggs. This chapter evaluates the risk of chick handling materials at the hatchery being cross contaminated with HPAI virus from an infected but undetected breeder farm and resulting in the infection of day old chicks.

In routine operations without an outbreak, used chick handling materials (chick boxes, dollies) returning from pullet farms are cleaned and disinfected in the hatchery and stored in a segregated area. In addition, most hatcheries design workflow patterns such that clean materials are not moved through potentially contaminated areas. In the event of an HPAI outbreak, the EMC response plan requires day old chicks to be placed in either new cardboard boxes, or in plastic boxes that have been cleaned before being returned to the hatchery. Furthermore, the Model Cleaning and Disinfection Guidelines require chick boxes to be cleaned and disinfected in the hatchery as well.

7.2 Evaluation of Risk

7.2.1 Likelihood of Cross-Contamination of Chick Handling Materials Prior to Cleaning and Disinfection.

A potential pathway for the contaminated of chick boxes or dollies at the hatchery is cross contamination from contaminated egg handling materials through hatchery floors or personnel. The contaminated egg handling materials may originate from an infected but undetected breeder premises supplying hatching eggs. We considered the following factors in evaluating the likelihood of this pathway.

- Hatcheries usually place disinfectant foam baths or foot baths at entry and exit doors of various hatchery rooms. Given the susceptibility of avian influenza virus to most disinfectants, the use of foam baths or foam baths reduces the likelihood that HPAI virus is transferred to hatchery floors from contaminated egg handling materials.
- In the event of an HPAI outbreak, the Model Cleaning and Disinfection guidelines recommend the C&D of loading docks, connecting passages and receiving storage areas after receiving each truckload of hatching eggs. This reduces the likelihood of chick handling materials from being contaminated if they are taken across the egg storage room. In general, most rooms of the hatchery are cleaned and disinfected on a daily basis.
- This pathway may occur when chick handling materials are taken across floor areas used for egg handling materials without C&D and within a short time. The likelihood of the preceding event is reduced depending on the specific workflow practices at a hatchery.

We conclude that the likelihood of chick handling materials being cross-contaminated through the hatchery floors before cleaning and disinfection is low to moderate when preventive measures in the model cleaning and disinfection guidelines and current industry practice discussed above are strictly followed.

7.2.2 Impact of Cleaning and Disinfection

According to the Model Cleaning and Disinfection guidelines in the event of an HPAI outbreak, chick handling materials are C&D for a second time within the hatchery and moved to a segregated storage area. Avian influenza viruses are susceptible to a wide range of disinfectants and detergents due to their lipid envelope. The degree of HPAI virus inactivation on materials with cleaning and disinfection according to the model cleaning and disinfection guidelines was evaluated in a previous risk assessment for the movement of nest run eggs {USDA: APHIS: VS: CEAH Unpublished #15140}. From this evaluation, there would be more than 4-log EID₅₀ (10,000) factor inactivation of HPAI virus on hard nonporous materials when such materials are washed with a detergent to ensure no visible organic matter, then disinfected according to the model cleaning and disinfection guidelines. Furthermore, most hatcheries perform routine (typically weekly) microbial testing to monitor and validate the C&D process. Given the estimated 4-log EID₅₀ factor inactivation due to detergent cleaning and disinfection, we conclude that the likelihood of viable HPAI virus being present on chick handling materials after cleaning and disinfection is *negligible*.

7.2.3 Likelihood of Cross-Contamination of Chick Handling Materials After Cleaning and Disinfection

The risk pathway for contamination of chick boxes or dollies after C&D at the hatchery is similar to the pathway for cross contamination before C&D. Specifically, chick handling materials may become cross contaminated from unwashed egg handling materials through hatchery floors or personnel. The preventive factors discussed in section 7.3.3 such as foot baths, foam baths, and daily C&D of the hatchery are applicable for this event as well. The likelihood of chick handling materials being cross contaminated with HPAI virus after C&D at the hatchery is further low considering the following.

- Cleaned and disinfected chick boxes and dollies are stored in a separate clean room minimizing the potential for cross contamination. The chick box dollies are not used for any other movements in the hatchery.
- The hatchery workflow and sanitary practices are designed to prevent the microbial contamination of cleaned and disinfected materials. Several hatchery management guides emphasize the segregation of chick boxes to prevent microbial contamination (Cobb-Vantress). Given these work flow practices it is unlikely for cleaned and disinfection chick handling materials to be taken across floor areas used for egg handling materials without C&D.

We conclude that the likelihood of chick handling materials being cross-contaminated through the hatchery floors before cleaning and disinfection is low provided that the preventive measures discussed above are strictly followed.

7.3 Conclusion

We conclude that the risk of day-old chicks becoming infected with HPAI virus due to contamination of chick handling materials at the hatchery is low provided that the following preventive measures are strictly followed.

- Chick handling materials are cleaned and disinfected at the hatchery.
- Cleaned and disinfected chick handling materials are transferred to a designated clean area.
- Work flow practices to prevent cleaned and disinfected chick boxes from being moved through potentially contaminated areas are followed.

8. Likelihood that the Vehicle or Driver Transporting Day Old Chicks from the Hatchery is Contaminated with HPAI virus

8.1 Introduction

This section addresses the scenario where the hatchery is within a control area and there is undetected HPAI infection in a breeder flock supplying hatching eggs. Under this scenario, there is a possibility that the driver returning cleaned and disinfected chick boxes becomes contaminated at the hatchery before transporting the next batch of day old chicks.

During routine operations without an HPAI outbreak, the chick boxes are usually returned through a separate loading dock at the hatchery other than the dock used for loading day old chicks. Typically, the chick transport vehicle driver is limited to one pickup or delivery from the hatchery per day. This practice reduces the likelihood of microbial contamination in general for the driver transporting day old chicks. NPIP regulations for participating hatcheries 9CFR147 require the truck transporting day old chicks to be cleaned and disinfected after each use.

We evaluated the likelihood of the vehicle or the driver transporting day old chicks from a hatchery that receives hatching eggs from an HPAI infected but undetected breeder premises while considering the applicable current and future preventive measures.

8.2 Preventive Measures

8.2.1 Current Preventive Measures

The current preventive measures that we considered are from the NPIP program (9CFR145 and 9CFR147) and current industry practice. The relevant current preventive measures are summarized below:

- All vehicles used for transporting day old chicks should be cleaned and disinfected after use according to procedures described in 9CFR147.24
- Truck tires should be sprayed thoroughly with disinfectant before leaving the main road and entering the farm driveway
- Drivers should put on sturdy, disposable plastic boots or clean rubber boots before getting out of the truck cab.
- After unloading chick boxes, the driver should remove the dirty smock/coveralls and place into a plastic garbage bag before getting into the truck. Clean coveralls should be kept separate from dirty ones.
- Driver should reenter cab and remove boots before placing feet onto floorboards. Hairnets should be removed and left on the farm with boots.
- Drivers should sanitize hands with appropriate sanitizer

8.2.2 Future Preventive Measures

Future preventive measures in the event of an HPAI outbreak are those from the EMC response plan. The relevant measures are summarized below:

- The cargo interior and exterior of the transport vehicle must be cleaned and disinfected.
- The driver will not be allowed outside the cab or else the cab interior must also be cleaned and disinfected
- The tires and wheel wells must also be cleaned and disinfected before leaving the premises within the Control Area
- The truck driver should wear protective coveralls, boots, gloves and head cover when outside the cab, and remove them immediately before reentering the cab.

8.3 Risk Evaluation

We evaluate this risk in two parts:

- Likelihood that the driver transporting day old chicks to the pullet farm is contaminated with HPAI virus.
- Likelihood that the vehicle transporting day old chicks to the pullet farm is contaminated with HPAI virus.

8.3.1 Likelihood that the driver transporting day old chicks to the pullet farm is contaminated with HPAI virus

Most modern hatcheries use separate loading docks for shipping day old chicks and receiving used chick boxes. The driver may or may not unload the used chick boxes depending on the individual hatchery's practices. There is a possibility that the driver becomes contaminated through the hatchery floor areas if the driver unloads the chick boxes. The hatchery floor areas may in turn have been contaminated through movement of personnel or equipment from the egg room. Several important preventive measures exist to reduce contamination through this pathway.

- The driver is required to wear protective clothing such as gloves, disposable boot covers and coveralls if he gets out of the cab and removes them immediately before getting into the cab. A review of literature and expert opinion suggest that such protective clothing measures significantly reduce the likelihood of contamination although they may not be 100 percent effective in a small number of cases (L. Casanova, personal communication, July 27, 2010).
- Even if driver helps unload the cleaned and disinfected chick boxes, it is very unlikely for the driver to pick up a new batch of day old chicks for delivery until the next day.
- The chick processing and storage areas are have a very low likelihood of being contaminated with HPAI virus due to daily cleaning and disinfection, and limited movement of personnel and equipment from egg processing areas as described in the hatching eggs risk assessment.

The contamination of the vehicle driver through this pathway would involve at least three virus transfer steps (contaminated eggs/materials from breeder flock – personnel/equipment – driver gloves/boot covers). Given the lack of empirical data, precise quantitative evaluation of this pathway is challenging. However, data describing viral transfer efficiency between various contact surfaces (hands to food items or solid surfaces) show that roughly 6-27% (see Nest Run Eggs Risk Assessment) {USDA: APHIS: VS: CEAH Unpublished #15140} of the virus present on a donor surface is transferred to a recipient surface through each viral transfer step.

Given the significant reduction of viral titer with each successive transfer step between contact surfaces and the use of PPE measures, the overall amount of virus transferred through this pathway would be low. We conclude that the risk that the driver transporting day old chicks is contaminated while unloading chick boxes at the hatchery is low.

8.3.2 Likelihood that the Cab Interior of the Vehicle Transporting Day Old Chicks to the Pullet Farm is Contaminated

The Model Cleaning and Disinfection Guidelines recommend that the day old chick delivery truck driver uses PPE such as coveralls, disposable boot covers, gloves or equivalent to reduce the potential for the spread of HPAI virus.

Expert opinion indicated that PPE measures such as gloves are mostly effective in preventing viral transfer to hands. However, the PPE measures may not be 100 percent effective in all situations (L. Casanova, personal communication, July 27, 2010). Dee et al. found that 2 out of 10 samples taken from the steering wheel of a vehicle contacted by a driver with contaminated boot covers were positive for a test virus (see table in 13.3.2.2){Dee, Deen, et al. 2004 #15340}

The EMC response plan requires the cab interior to be cleaned and disinfected if the driver steps out of the cab. We expect the cleaning and disinfection of cab interior to effectively inactivate HPAI virus given its sensitivity to most disinfectants and detergents. Given the PPE measures for the driver, and the cleaning and disinfection of the cab interior as described in the EMC response plan, we conclude that the likelihood of the cab interior of the truck transporting day old chicks being contaminated is *negligible*.

8.3.3 Likelihood of the Trailer Interior of the Vehicle Transporting Day Old Chicks being Contaminated with HPAI virus

The EMC response plan contains provisions for cleaning and disinfection of vehicles during an outbreak. These plans are similar to ones developed to control the Exotic Newcastle Disease (END) outbreak in California and were found to be effective in that situation. The EMC response plan requires cleaning and disinfection of the cargo interior, exterior, tires and wheel wells of the transportation vehicles. The model cleaning and disinfection guidelines recommend that the trailer interior of the chick transport vehicle be cleaned and disinfected after unloading used chick boxes at the hatchery. The C&D of trailer interior after unloading chick boxes ensures that any contamination of the trailer interior while unloading chick boxes would be effectively inactivated. We conclude that the likelihood of the trailer interior of the vehicle transporting day old chicks being contaminated with HPAI virus is *negligible*.

8.3.4 Likelihood that the Exterior of the Vehicle Transporting Day Old Chicks from the Hatchery is Contaminated with HPAI Virus

The EMC response plan contains provisions for cleaning and disinfection of vehicles during an outbreak. These plans are similar to ones developed to control the Exotic Newcastle Disease (END) outbreak in California and were found to be effective in that situation. The Movement Control Plan requires cleaning and disinfection of the cargo interior, exterior, tires and wheel wells of the transportation vehicles. Similarly, other relevant guidelines such as the NAHEMS guidelines address the cleaning and disinfection of vehicles in detail. {U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services 2005 #280} These cleaning and disinfection procedures would effectively inactivate HPAI virus on the vehicle exterior given the sensitivity of HPAI virus to most detergents and disinfectants (see chapter 7).

The exterior of truck transporting day old chicks would be cleaned and disinfected according to the protocols mentioned above. We conclude that the risk of HPAI virus remaining on the exterior of a vehicle that has been cleaned and disinfected as specified in the EMC response plan is *negligible*.

8.4 Conclusion

The key preventive measures considered for the risk evaluation in this chapter are

- The C&D of chick delivery vehicle, protective clothing for chick delivery driver and other biosecurity measures from the NPIP program 9CFR147, the EMC response plan and the Model Cleaning and Disinfection guidelines.
- The driver does not pick up another shipment of day old chicks on the same day when he delivers used chick handling materials from a pullet farm.

We have the following results assuming that the above preventive measures are strictly implemented,

- The likelihood of the driver moving day old chicks being contaminated with HPAI virus is low.
- The likelihood of the trailer interior of the vehicle transporting day old chicks being contaminated with HPAI virus is *negligible*.
- The risk of HPAI virus remaining on the exterior of a vehicle that has been cleaned and disinfected as specified in the EMC response plan is *negligible*.

9. Risk of Day Old Chicks being Infected with HPAI Virus via Chick Handling Materials from a Single Age Pullet Farm

9.1 Introduction

In routine operations without an outbreak, reusable chick handling materials including chick boxes and dollies are returned from pullet farms, cleaned and disinfected in the hatchery, and stored in a segregated storage area prior to being used to transport day old chicks. In the event of an HPAI outbreak, the EMC response plan requires day old chicks to be placed in either new cardboard boxes, or in plastic boxes that have been cleaned before being returned to the hatchery. This chapter evaluates the risk that HPAI virus contaminated chick handling materials from a single age pullet farm in a HPAI control area are contaminated resulting in the infection of day old chicks at the hatchery.

The single age pullet farms use an all-in all-out system with C&D of the pullet house before introducing a different batch of chicks. Considering the C&D, there is no direct pathway for HPAI contamination of chick boxes, as the pullet house would not have any other poultry when the chicks are delivered. We briefly review the additional measures such as C&D of chick boxes and dollies before returning to the hatchery, and within the hatcher.

9.2 Evaluation of Risk

There is no direct pathway for HPAI contamination of chick handling materials at a single age pullet house which has been cleaned and disinfected after using for the previous batch of pullets. In the following, we evaluate the C&D of chick handling materials as specified in the model cleaning and disinfection guidelines. These guidelines require that chick handling materials are cleaned and disinfected before being returned to the hatchery. In addition the guidelines recommend following manufacturer label directions for the disinfectant with preoperational checks and monitoring of disinfectant concentration, temperature and contact time. In addition, use of an EPA registered disinfectant with label claims against avian influenza virus is recommended. The EPA maintains a list of registered disinfectants with label claims against avian influenza virus. The label claims have to be supported by efficacy data that demonstrate a 3-log reduction on applicable surfaces. Additionally, the data must be generated in GLP (Good Laboratory Practices¹) certified labs, utilizing agency-accepted protocols. Details concerning the nature of the various EPA registered virucides, registration requirements, efficacy testing and samples of virucide testing tables are included as appendices 4-6 of nest run eggs risk assessment. Most EPA registered disinfectants require a contact time of ten minutes for AI virucidal uses. Experimental studies show that several categories of disinfectants such as organic acids, alkalis, detergents and phenols can obtain a 3 log inactivation of HPAI virus on hard nonporous substances with a contact time of 10 minutes.^{33,34,37,38} Based on the nest run eggs risk assessment, using an EPA registered disinfectant according to manufacturer label directions for

¹ 40CFR160

AI virucidal uses would result in a 3-log reduction of avian influenza virus on hard nonporous surfaces such as plastic(chick boxes) or steel (dollies for stacking chick boxes).

9.3 Conclusion

We conclude that the Risk of Day Old Chicks being Infected with HPAI Virus via Chick Handling Materials from a Single Age Pullet Farm is negligible provided that chick handling materials are cleaned and disinfected as specified in the Model Cleaning and Disinfection - Guidelines.

10. Likelihood that the Vehicle or Driver moving from a Single Age Pullet farm to the Hatchery is Contaminated

10.1 Introduction

This section addresses the likelihood that the vehicle or the driver transporting used chick boxes from a pullet farm is contaminated at the pullet farm. Single age pullet farms follow an all in all out system where all pullet barns are cleaned and disinfected before introducing the next flock. Given the cleaning and disinfection of all pullet houses on the premises, it is unlikely that a single age pullet farm would be contaminated with viable HPAI virus when it receives the day old chicks. Risks specifically associated with a vehicle or driver moving from a multiple age pullet farm to a hatchery are addressed in a later chapter. Considering the C&D of the pullet house, there is no direct pathway for HPAI contamination of chick boxes, as the pullet house would not have any other poultry when the chicks are delivered. We evaluate the preventive measures from the NPIP program (9CFR145 and 9CFR147) and the EMC response plan in mitigating the risk of HPAI disease transmission in general.

10.2 Preventive Measures

10.2.1 Current Preventive Measures

The current preventive measures that we considered are those from the NPIP program (9CFR145 and 9CFR147). The relevant preventive measures for this risk event are summarized below:

- All vehicles used for transporting chicks should be cleaned and disinfected after use according to procedures described in 9CFR147.24
- Truck tires should be sprayed thoroughly with disinfectant before leaving the main road and entering the farm driveway
- Drivers should put on sturdy, disposable plastic boots or clean rubber boots before getting out of the truck cab. A clean smock or coveralls, gloves and hairnet should be put on before entering the poultry house
- After unloading chicks the driver should remove the dirty smock/coveralls and place into a plastic garbage bag before getting into the truck. Clean coveralls should be kept separate from dirty ones
- Driver should reenter cab and remove boots before placing feet onto floorboards. Hairnets should be removed and left on the farm with boots.
- Drivers should sanitize hands with appropriate sanitizer

10.2.2 Future Preventive Measures

Future preventive measures are those from the EMC response plan component of the USDA-APHIS-VS Secure Egg Supply plan and will be put in place in the event of an HPAI outbreak. The relevant preventive measures for this risk event are summarized below:

- The cargo interior and exterior of the transport vehicle must be cleaned and disinfected

- The driver will not be allowed outside the cab or else the cab interior must also be cleaned and disinfected
- The tires and wheel wells must also be cleaned and disinfected before leaving the premises within the Control Area
- A shower and a change of clothes at a cleaning station will be required of the driver before returning to the hatchery.
- The truck driver should wear protective coveralls, boots, gloves and head cover when outside the cab, and remove them immediately before reentering the cab.

10.3 Evaluation of Risk

We evaluated the likelihood of this pathway in two parts:

1. Likelihood of the driver moving from the pullet farm to the hatchery being contaminated.
2. Likelihood that the vehicle moving from the pullet farm to the hatchery is contaminated.

10.3.1 Likelihood that the Driver Moving from the Pullet Farm to the Hatchery is Contaminated

Single stage pullet farms practice an all in all out system where all poultry are moved from the premises, and all barns are cleaned and disinfected prior to arrival of the new flock. It is assumed that the driver arrives at the pullet farm to deliver day old chicks and retrieve reusable chick boxes in the same trip. Given this system, it is unlikely that an infected but undetected flock would be moved from the pullet farm and remain undetected through the time period in which barns would be prepared for new flocks. This reduces the risk of the driver becoming contaminated at the pullet farm to a negligible level. Additionally, driver PPE and biosecurity protocols further reduce the likelihood of contamination from the pullet farm entering the hatchery.

10.3.2 Likelihood that the vehicle moving from the pullet farm to the hatchery is contaminated.

Given the all-in all-out system where all poultry are moved from the premises prior to arrival of new flocks, and all barns are cleaned and disinfected prior to arrival of the new flock, it is unlikely that the interior or exterior of the vehicle moving chick boxes from the pullet farm to the hatchery is contaminated while at the pullet farm. Also considering the cleaning and disinfection of the vehicle before entering the hatchery premises we conclude that the likelihood that the vehicle moving from the pullet farm to the hatchery is contaminated is *negligible*.

10.4 Conclusion

The likelihood that the vehicle or driver moving from a single age pullet farm to the hatchery is contaminated is negligible provided that the vehicle C&D and the driver biosecurity measures from the NPIP program and the Model Cleaning and Disinfection guidelines are strictly followed.

11. Likelihood of HPAI virus being Transferred to the Hatchery via Vehicle or Driver Moving Chick Handling Materials from a Multiple Age Pullet Farm

11.1 Introduction

This section addresses the likelihood of HPAI virus being transferred to the hatchery via vehicle or driver transporting used chick handling materials from a multiple age pullet farm. Multiple age pullet farms segregate barns by age and follow a barn level all in all out system where the receiving pullet barns are cleaned and disinfected before introducing the next flock. For multi-age pullet farms in the control area, there is a possibility that the vehicle or driver delivering day old chicks becomes contaminated with HPAI virus from an adjacent infected but undetected pullet flock.

The NPIP program 9CFR145 and 9CFR147 has truck C&D as well as driver biosecurity (protective clothing) measures associated with the movement of day old chicks. The Model Cleaning and Disinfection guidelines have additional C&D and biosecurity measures in the Event of an HPAI outbreak. We consider applicable preventive measures from the NPIP program and the EMC response plan in our evaluation.

11.2 Preventive Measures

11.2.1 Current Preventive Measures

The current preventive measures that we considered are those from the NPIP program (9CFR145 and 9CFR147), and are similar to those listed in section 6.2.1 for single stage pullet farms.

- All vehicles used for transporting chicks should be cleaned and disinfected after use according to procedures described in 9CFR147.24
- Truck tires should be sprayed thoroughly with disinfectant before leaving the main road and entering the farm driveway
- Drivers should put on sturdy, disposable plastic boots or clean rubber boots before getting out of the truck cab. A clean smock or coveralls, gloves and hairnet should be put on before entering the poultry house.
- After unloading chicks the driver should remove the dirty smock/coveralls and place into a plastic garbage bag before getting into the truck. Clean coveralls should be kept separate from dirty ones.
- Driver should reenter cab and remove boots before placing feet onto floorboards. Hairnets should be removed and left on the farm with boots.
- Drivers should sanitize hands with appropriate sanitizer.

11.2.2 Future Preventive Measures

Future preventive measures are those from the EMC response plan component of the USDA-APHIS-VS Secure Egg Supply plan and will be put in place in the event of an HPAI outbreak. The relevant preventive measures for this risk event are similar to those listed in section 6.2.2 for single stage pullet farms.

- The cargo interior and exterior of the transport vehicle must be cleaned and disinfected
- The driver will not be allowed outside the cab or else the cab interior must also be cleaned and disinfected
- The tires and wheel wells must also be cleaned and disinfected before leaving the premises within the Control Area
- A shower and a change of clothes at a cleaning station will be required of the driver before returning to the hatchery.
- The truck driver should wear protective coveralls, boots, gloves and head cover when outside the cab, and remove them immediately before reentering the cab.

11.3 Evaluation of Risk

We evaluated the likelihood of this pathway in two parts:

- Likelihood of the driver moving from the pullet farm to the hatchery being contaminated.
- Likelihood that the vehicle moving from the pullet farm to the hatchery is contaminated.

11.3.1 Likelihood that the Driver Moving from the Pullet Farm to the Hatchery is Contaminated

This section evaluates the likelihood that the driver delivering reusable materials (chick boxes) to the hatchery from a multiple stage pullet farm is contaminated with HPAI virus. The potential pathways of contamination of the driver and the applicable risk mitigation measures are shown in figure XX.

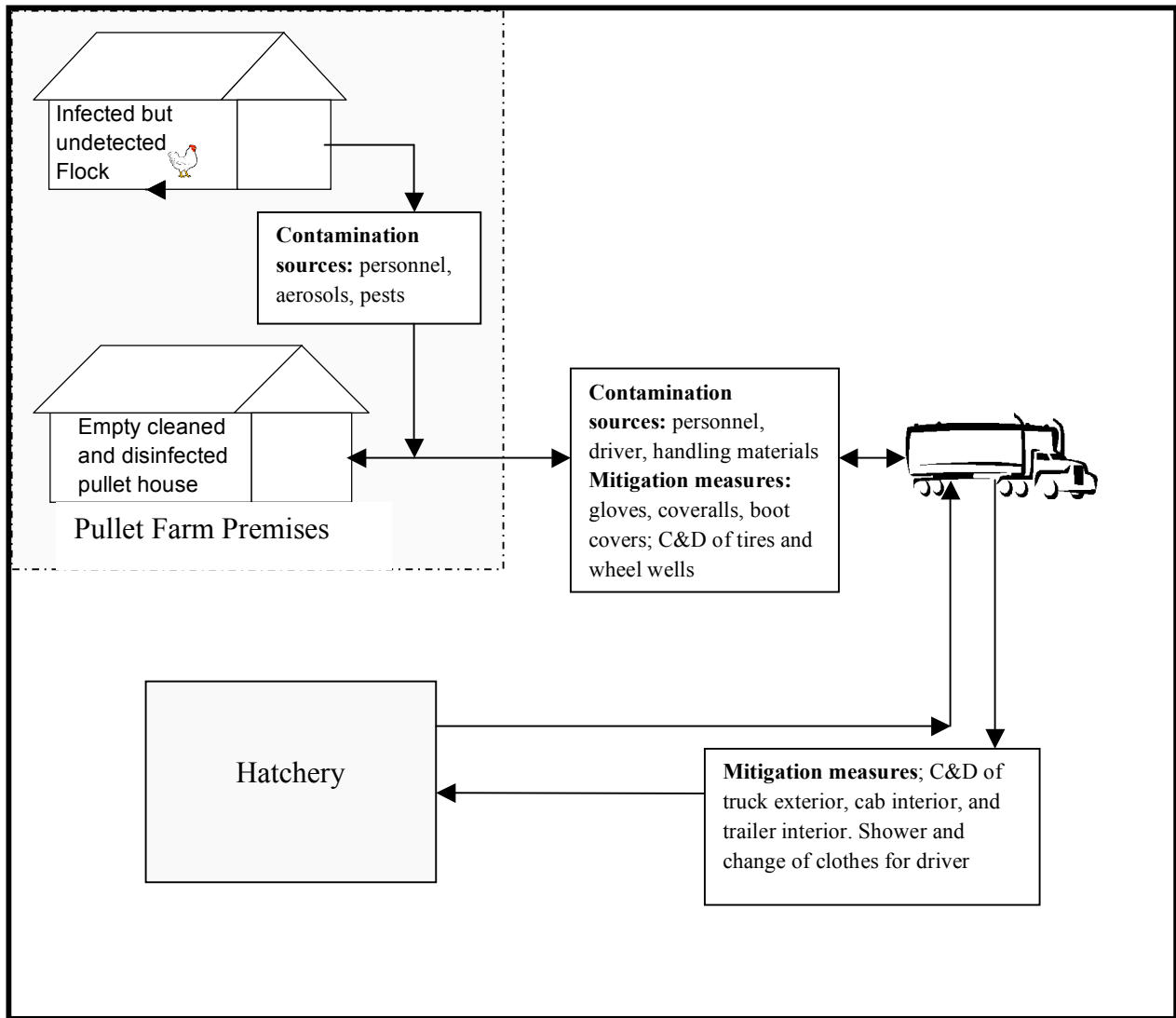


Figure XX

11.3.1.1 *Likelihood of the Driver leaving an infected but undetected pullet farm is contaminated with HPAI virus.*

As shown in figure XX, personnel movements from infected but undetected premises may result in the transfer of HPAI virus via shoes or hands to the floors and other environmental surfaces of the empty cleaned and disinfected pullet barn for receiving day old chicks. Similarly, surrounding ground areas of the cleaned and disinfected pullet house may potentially become contaminated through movements of personnel or equipment. Another potential pathway for contamination of pullet house and surrounding areas is via aerosols originating from the infected but undetected flock.

The HPAI virus from the pullet house environmental surfaces and surrounding areas contaminated through these pathways may subsequently contaminate the driver's protective clothing. Quantitative Data on the likelihood or degree of HPAI virus contamination through these pathways is not available to date. We briefly review qualitative factors that impact the likelihood of contamination of the drivers protective through these pathways.

- The active surveillance of pullet flocks would reduce the likelihood of a significant portion of the flock becoming infectious before HPAI infection is detected. Logically, a lower proportion of infectious pullets would also reduce the likelihood of the spread of contamination to other barns via movements of people or equipment.
- Relatively lesser amount of work would need to be performed in a cleaned and disinfected henhouse for receiving the chicks. Consequently, the frequency of movements of personnel between the empty barn for receiving day old chicks and other barns would be limited.
- The chain of events for contamination of the driver's protective clothing through such pathways involves more than three viral transfer steps (e.g, pullet house- farm personnel-common floor areas-driver bootcover). Virus transfer studies have shown that only a portion of virus present on the donor surface is transferred to the recipient surface through direct contact. Hence, there reduction in viral titer with each successive transfer step. (see Nest Run Eggs Risk Assessment) {USDA: APHIS: VS: CEAH Unpublished #15140}
- In a natural outbreak study that there was a 2-order of magnitude reduction in HPAI viral titer from the inside of an infected barn (with high proportion of infectious birds) to the outside of the barn {Schofield, Ho, et al. 2005 #14390}{Schofield et al. 2005}. Brugh et al. (1986) found that while five of six samples taken outside of an HPAI infected poultry barn were positive at 3-6m, only 1 of 12 samples were positive at 45-85 meters downwind{Brugh & Johnson 1986 #14400}. In general, several aerosol studies have shown 80-90 percent reduction in bioaerosol concentration at a distance of 25-50 meters from the generating building {Hartung, Seedorf, et al. #15350}{Gibbs, Green, et al. 2006 #15360}

In summary, the qualitative review showed that there are several factors which reduce the likelihood of contamination of driver's protective clothing through these pathways. However, considering the uncertainties associated with these pathways, we rate the likelihood of the contamination of the driver's protective clothing as low to moderate.

11.3.1.2 Likelihood that the driver is contaminated with HPAI virus when entering the Hatchery

We first consider the likelihood that the driver's skin or personal clothing is contaminated through removal of PPE. Studies on the transmission of porcine reproductive and respiratory syndrome (PRRS) and foot and mouth disease (FMD) found that removal of boots, coveralls, nitrile gloves and hand washing were completely effective in interrupting transmission from infected to uninfected swine {Otake, Dee, et al. 2002 #15300} {Amass, Mason, et al. 2004 #15330}. However, a few studies indicated that the PPE measures may not be effective in some instances. {Amass, Halbur, et al. 2003 #15320} {Dee, Deen, et al. 2004 #15340}. The table below summarizes results from several studies evaluating the effectiveness of PPE.

Study Design	Materials/Procedures Tested	Results	Source
PRRS transfer from infected swine to uninfected swine through personnel	Changing clothes (boots, coveralls), handwashing, showering	no infection of un-inoculated swine	Otake et al. 2001 {Otake, Dee, et al. 2002 #15300}
FMD transfer from infected swine to uninfected swine through personnel	Changing clothes (disposable coveralls, nitrile gloves, rubber boots), handwashing, showering	no infection of un-inoculated swine	Amass et al. 2004 {Amass, Mason, et al. 2004 #15330}
E. Coli transfer from infected swine to uninfected swine through personnel	Changing clothes (disposable boots, coveralls), handwashing, showering	92% sentinel pigs infected despite removal of boots, coveralls, and handwashing No infection of un-inoculated swine after showering and change of clothes	Amass et al. 2003 {Amass, Halbur, et al. 2003 #15320}
Porcine reproductive and respiratory (PRRS) syndrome carrier :	Disposable boots	-Hands & steering wheel: 2/10 positive -Significant difference between groups using and not using disposable boots	Dee et al. 2003 {Dee, Deen, et al. 2004 #15340}

nonpathogenic virus transfer to underlying clothing and hands	Removal of PPE (gloves, gowns, goggles, respirator)	Mean titer to right hand: 2.4 (90% of individuals) Mean titer to left hand: 1.8 (70% of individuals)	Casanova et al. 2008 {Casanova, Alfano-Sobsey, et al. 2008 #15310}
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Based on the above studies, the likelihood that personal clothing or skin of the driver is contaminated after removing PPE is low. Studies implementing protocols that included a shower and change of clothes found these measures to be 100 percent effective in preventing virus transmission to animals via personnel (Otake *et al* 2001, Amass et al. 2003) {Amass, Mason, et al. 2004 #15330} {Amass, Halbur, et al. 2003 #15320} {Otake, Dee, et al. 2002 #15300}. Given the PPE measures, the shower and change of clothes for the driver as required by the Model Cleaning and Disinfection Guidelines before the driver returns to the hatchery, we conclude that the likelihood of the driver being contaminated with HPAI virus at when entering the hatchery is *negligible*.

11.3.2 Likelihood that the vehicle moving from the pullet farm to the hatchery is contaminated.

In this section we evaluate the likelihood that the interior or exterior of the vehicle moving chick boxes from the pullet farm to the hatchery is contaminated. The possibility of contamination resulting from personnel contact or driver with the cargo interior is considered. Preventive measures such as cleaning and disinfection of pullet houses, driver PPE and cleaning and disinfection of the truck interior and exterior are also considered.

11.3.2.1 The likelihood and degree of HPAI virus contamination of the vehicle interior while at the pullet farm.

Potential means by which the vehicle interior may become contaminated is through contact with contaminated shoes of personnel, or contaminated chick boxes. Possible ways for personnel shoes or chick boxes to become contaminated is through contact with floor areas that were contaminated due to personnel traffic from an infected but undetected pullet barn.

The day old chicks are typically delivered to the pullet farms in the morning {Bell & Weaver 2002 #14730}. Therefore it is unlikely for farm personnel who have worked in other pullet houses on the same day beforehand to assist in unloading chicks or loading chick boxes into the truck. Typically, the immediate surrounding areas outside of the pullet house are also cleaned and disinfected along with the pullet house before placing a new batch of day old chicks. This practice reduces the likelihood that personnel shoes are cross contaminated from the floor/ground of the areas surrounding the pullet house. The trailer interior could also become contaminated through direct contact with contaminated chick boxes. We conclude that the likelihood of the trailer interior of the vehicle leaving an infected but undetected premises being contaminated

with HPAI virus is low to moderate provided that applicable preventive measures from NPIP regulations 9CFR147 and the EMC response plan are strictly followed.

The use of protective footwear for the driver according to the procedures specified in the model cleaning and disinfection guidelines and NPIP regulations would reduce the likelihood of contamination of the cab interior. In addition to the above PPE measures, the EMC response plan requires the cab interior to be cleaned and disinfected if the driver steps outside. We conclude that the likelihood of the cab interior of the vehicle leaving an infected but undetected premises being contaminated with HPAI virus is low provided that applicable preventive measures from NPIP regulations 9CFR147 and the EMC response plan are strictly followed.

11.3.2.2 *The likelihood of HPAI virus contamination of the vehicle interior after Cleaning and Disinfection.*

The NPIP program (9CFR147) requires vehicles delivering day old chicks to be cleaned and disinfected before being used to transport the next batch of day old chicks. The EMC response plan contains provisions for cleaning and disinfection of vehicle and cab interior during an HPAI outbreak. The EMC plan requires the cleaning and disinfection of the vehicle trailer interior after the chick boxes have been removed. These procedures would effectively inactivate HPAI virus on the trailer and cab interior given the sensitivity of HPAI virus to most detergents and disinfectants. We conclude that the risk of HPAI virus remaining in the interior of chick transport vehicle that has been cleaned and disinfected as specified in the EMC response plan is *negligible*.

11.3.2.3 *The likelihood of HPAI virus contamination of the vehicle exterior after Cleaning and Disinfection.*

The EMC response plan contains provisions for cleaning and disinfection of vehicles during an outbreak. These plans are similar to ones developed to control the 2002 Exotic Newcastle Disease (END) outbreak in California and were found to be effective in that situation. The Movement Control Plan requires cleaning and disinfection of the cargo interior, exterior, tires and wheel wells of the transportation vehicles. Similarly, other relevant guidelines such as the NAHEMS guidelines address the cleaning and disinfection of vehicles in detail. {U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services 2005 #280} These cleaning and disinfection procedures would effectively inactivate HPAI virus on the vehicle exterior given the sensitivity of HPAI virus to most detergents and disinfectants (see chapter 7).

The exterior of trucks delivering hatching eggs would be cleaned and disinfected prior to arrival according to the protocols mentioned above. We conclude that the risk of HPAI virus remaining on the exterior of a vehicle that has been cleaned and disinfected as specified in the EMC response plan is *negligible*.

11.4 Conclusion

The likelihood that the vehicle or driver returning to the hatchery moving from a multiple-age pullet farm being contaminated with HPAI virus is negligible provided that the risk mitigation measures listed below are strictly followed.

- The cargo interior and exterior of the transport vehicle must be cleaned and disinfected
- The driver will not be allowed outside the cab or else the cab interior must also be cleaned and disinfected
- The tires and wheel wells must also be cleaned and disinfected before leaving the premises within the Control Area
- The truck driver should wear protective coveralls, boots, gloves and head cover when outside the cab, and remove them immediately before reentering the cab.
- A shower and a change of clothes at a cleaning station will be required of the driver before returning to the hatchery.

12. Risk of Day Old Chicks being Infected with HPAI Virus via Chick Handling Materials from a Multiple Age Pullet Farm

12.1 Introduction

In a multiple- age pullet farm, there is a possibility that chick handling materials used for transporting day old chicks become contaminated with HPAI virus associated with an infected but undetected pullet flock. The potential pathways for this event involve indirect contamination through a chain of events associated with movement of personnel or equipment from a barn housing an infected but undetected path. For example, floor areas of the empty pullet house prepared for receiving day old chicks may become contaminated via movement of personnel and in turn contaminate chick handling materials.

Specific mitigation measures to prevent the spread of poultry diseases through chick handling materials have been implemented in current industry practice as described in the NPIP program. In routine operations, reusable chick handling materials including chick boxes and dollies are returned from pullet farms, cleaned and disinfected in the hatchery, and stored in a segregated storage area prior to being used to transport day old chicks. In the event of an HPAI outbreak, the EMC response plan requires day old chicks to be placed in either new cardboard boxes, or in plastic boxes that have been cleaned before being returned to the hatchery. This chapter evaluates the risk of day old chicks becoming contaminated via HPAI virus associated with used chick handling materials returning from an infected but undetected multiple age pullet farm while considering the applicable risk mitigation measures from the EMC response plan.

12.2 Preventive Measures

12.2.1 Current Preventive Measures

- The chick boxes are lined with new paper that is disposed at the destination pullet house.
- The C&D of pullet house before placing a new batch of day old chicks.
- Receiving day old chicks at the pullet house in the morning hours.
- Cleaning and disinfection of reusable chick boxes at the hatchery.

12.2.2 Future Preventive Measures

- C&D of reusable chick handling materials moved from a pullet farm according to the Model Cleaning and Disinfection Guidelines before being returned to the hatchery.
- C&D of trailer interior of the vehicle moving chick handling materials from pullet house to the hatchery after unloading the chick boxes at a cleaning station.

12.3 Evaluation of Risk

We evaluated the risk in two parts:

- Likelihood of handling materials used in the delivery of day old chicks becoming contaminated at an infected but undetected multiple-age pullet flock.
- Risk of day-old chicks at the hatchery becoming infected with HPAI virus an infected but undetected multiple-age pullet flock via contaminated chick handling materials.

12.3.1 Likelihood of handling materials used in the delivery of day old chicks becoming contaminated at an infected but undetected multiple-age pullet flock

We evaluated the likelihood of the cleaned and disinfected pullet barn for receiving day old chicks and its surrounding ground areas becoming contaminated through the movement of personnel or equipment or aerosols in Section 11.3.1. Based upon qualitative review of various factors and considering the associated uncertainties, we rated the likelihood of the driver's protective clothing (boots, coveralls etc) becoming infected with HPAI virus through cross-contamination from pullet house environmental surfaces as low to moderate. The pathways for the contamination of chick boxes from pullet barn for receiving day old chicks and its surrounding ground areas are similar to the pathways for the contamination of driver's protective clothing from Section 11.3.1. We rate the likelihood of the contamination of the chick boxes at a multiple-age pullet farm as low to moderate given the uncertainties associated with this event.

12.3.2 Risk of day-old chicks at the hatchery becoming infected with HPAI virus an infected but undetected multiple-age pullet flock via contaminated chick handling materials

In the following, we evaluate the C&D of chick handling materials as specified in the Model Cleaning and Disinfection guidelines. These guidelines require that chick handling materials are cleaned and disinfected before being returned to the hatchery. In addition, the guidelines recommend following manufacturer label directions for the disinfectant with preoperational checks and monitoring of disinfectant concentration, temperature and contact time. In addition, use of an EPA registered disinfectant with label claims against avian influenza virus is recommended. The EPA maintains a list of registered disinfectants with label claims against avian influenza virus. The label claims have to be supported by efficacy data that demonstrate a 3-log reduction on applicable surfaces. Additionally, the data must be generated in GLP (Good Laboratory Practices²) certified labs, utilizing agency-accepted protocols. Details concerning the nature of the various EPA registered virucides, registration requirements, efficacy testing and samples of virucide testing tables are included as appendices 4-6 of nest run eggs risk assessment. Most EPA registered disinfectants require a contact time of ten minutes for AI virucidal uses. Experimental studies show that several categories of disinfectants such as organic acids, alkalis, detergents and phenols can obtain a 3 log inactivation of HPAI virus on hard nonporous substances with a contact time of 10 minutes.^{33,34,37,38} Also note that the organic load

² 40CFR160

on the chick boxes when they are cleaned and disinfected would be reduced due to the use of a paper lining which is disposed at the pullet farm. In general, the effectiveness of detergents and disinfectants is greater when the organic load is reduced. Based on the nest run eggs risk assessment, cleaning with a detergent and applying an EPA registered disinfectant according to manufacturer label directions for AI virucidal uses would result in a 4-log reduction of avian influenza virus on hard nonporous surfaces such as plastic(chick boxes) or steel (dollies for stacking chick boxes).

Industry expert's mentioned that during an HPAI outbreak, the routine C&D of chick handling materials at the Hatchery will continued to be performed despite that additional C&D of the chick handling materials at a cleaning station before returning from the pullet farm as required in the EMC Response Plan. This second C&D of chick handling materials would further reduce the likelihood of residual HPAI virus on chick handling materials before they are used for the next batch of chicks.

We conclude that risk of day-old chicks at the hatchery becoming infected with HPAI virus an infected but undetected multiple-age pullet flock via contaminated chick handling materials is *low* provided that the chick handling materials are cleaned and disinfected as specified in the Model Cleaning and Disinfection Guidelines.

12.3 Conclusion

We conclude that the risk of day old chicks being infected with HPAI virus via chick handling materials from a multiple age pullet farm is low provided that chick handling materials are cleaned and disinfected as specified in the Model Cleaning and Disinfection Guidelines.