Avian influenza and upland gamebirds: Protection through biosecurity

by

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Abstract

In a world that grows ever smaller with the speed of innovation and trade, the spread of disease, specifically zoonotic disease, becomes an ever-looming threat to the health of society. One such disease is avian influenza (AI). Once primarily confined to Asia, AI has migrated with wild waterfowl to North America. AI strains are subdivided into two categories: high pathogenic avian influenza and low pathogenic avian influenza; this classification is based on the severity of the disease in chickens. While avian to human and human to human spread of AI is rare, scientists and public health officials are identifying AI in humans. AI has been isolated primarily in people who have been exposed to poultry. Human case fatality rates vary from outbreak to outbreak.

The author describes her experience working with Dr. LewAnn Schneider with the USDA during the summer of 2018 and the variety of opportunities she participated in. She goes on to discuss her work in creating biosecurity plans for upland gamebird producers and some of the aspects of a good biosecurity plan. Some of the coursework the author completed as part of her degree are described and the advantages that each gave her.

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Chapter 1 - Avian Influenza and its Pandemic Potential

The influenza virus is a segmented genome RNA virus of the *Orthomyxoviridae* family. There are four genera of influenza virus: A, B, C, and D (Center for Disease Prevention and Control, 2017). Only type A influenza viruses have been isolated from birds (Alexander, D. 2007, Kaye & Pringle, 2005). Subtypes of avian influenza (AI) are differentiated by surface glycoproteins hemagglutinin (H) and neuraminidase (N) (Alexander, D. 2007). There are 18 different H and 10 different N subtypes, each serotype of AI containing one H and one N antigen (Center for Disease Prevention and Control, 2017). "High" or "low" pathogenic avian influenza terminology for a serotype is determined by the disease effect on chickens. Highly pathogenic avian influenza (HPAI) serotypes can have up to 100% mortality (Alexander, D. 2007). Low pathogenic avian influenza (LPAI) serotypes may result in mild or subclinical infections. Highly pathogenic avian influenza is only caused by some H5 and H7 subtype viruses (Alexander, D. 2007). However, not all H5 and H7 subtypes cause HPAI. Beyond the pathogenic disease state induced in chickens, the difference between HPAI and LPAI strains is the cleavage site and the amino acid at this site (Alexander, D. 2007); the hemagglutinin protein on the influenza virus must be cleaved for the virus to bind to the cell membrane and become infectious. Pathogenicity is partially determined by the presence of arginine and lysine at the cleavage site of the H protein. The cleavage site of the H molecule is necessary for infectivity of the virus, tissue tropism, and virulence of the virus (Kaye & Pringle, 2005). The cleavage site of HPAI allows for systemic infection of the host.

Influenza virus may infect all types of domestic or captive birds. Between birds, transmission is thought to be primarily fecal-oral, but studies show that transmission may be more complex than previously thought. AI can also be spread by indirect contact, i.e.

contaminated fomites, mechanical transmission, etc. (Alexander, D. 2007). Migratory waterfowl are known to be a maintenance host and responsible for the spread of AI (Role for migratory wild birds, 2016). This may occur via shared habitats, sources of drinking water or contaminated feces (Reperant et al., 2012). The frequency of the infections in poultry depend on the degree of contact with feral birds (Alexander, D. 2007). Feral waterfowl do not typically become severely ill from AI (Kaye & Pringle, 2005). LPAI can infect cells lining the gastrointestinal tract of waterfowl, causing mild to subclinical gastrointestinal symptoms. There are limited respiratory effects in waterfowl (Munster & Fouchier, 2009, Reperant et al., 2012). H5N1 was originally isolated in the Guandong province of China in 1995 and has spread to poultry and wild birds in Asia, Europe and Africa. As a result, millions of birds have been slaughtered or killed as a result of the virus (Alexander, D. 2007).

The full ecology of the virus is not completely understood, and public health scientists as well as veterinarians recognize this. They agree that the virus's ecological reach is complex in nature, and transmission of the virus depends on the species and geographical location (Munster & Fouchier, 2009). Significantly, human infection may occur as the result of inhalation of droplets, contact with fomites, or self-inoculation of the upper respiratory tract or conjunctiva (Reperant et al., 2012). The hemagglutination glycoprotein mediates attachment to glycans that are expressed on the surface of the host's cells, although they preferentially bind to glycans with sialic acids with an α2,3 linkage to galactose. In birds, these receptors are found throughout the body, with the highest concentration in the respiratory and gastrointestinal tract. The receptors that align with the H receptors on avian influenza viruses are found in the respiratory tract of some species of mammals, including humans, swine, horses, dogs, and ferrets (Reperant et al., 2012). The preferential receptors for AI in humans have been found on rarely on the epithelial

cells of the nasal mucosa and pharynx, focally on the tracheal, bronchial and bronchiolar epithelium, but primarily on alveolar epithelial cells (Reperant et al., 2012). However, there are a limited number of receptors on mammalian cells, which may explain the limited avian-to-human transmission. H7N9 causes low pathogenic avian influenza in chickens, but in humans it can cause severe respiratory disease. Based on a study by Qin et al. (2005), the data suggests many undiagnosed mild cases of H7N9 in humans, especially in children. The results of the study are highly suggestive of higher human susceptibility to H7N9; this highlights the public health significance of the phenomenon of virus adaptation between hosts. In a 2013 outbreak in China, 131 human cases of H7N9 occurred (Cowling, et al., 2013); in the same year, Indonesia had 195 confirmed human cases of H5N1, of which 163 were fatal (Setiawaty, et al., 2015). H5N1 is highly pathogenic in both poultry and humans. However, there have been relatively few human cases of H5N1 (Cowling, et al., 2013). While H5N1 causes severe disease in humans, it appears to be that there is a restricted population that is susceptible. Qin et al (2015) suggested a genetic component to H5N1 human susceptibility as there are relatively few human cases for the widespread circulation of H5N1. The rarity suggests significant biological barriers to human transmission and adaptation. Domesticated poultry are believed to be the intermediate host between feral birds and humans. Domesticated ducks have been shown to shed the virus in large numbers, but show no clinical signs (Kaye & Pringle, 2005). In a study by Cowling et al. (2013), two-thirds of H5N1 and H7N9 human patients reported contact with poultry. Most H7N9 cases reported contact with poultry in a live bird market. Patients with H5N1 were more likely to have been in contact with sick, dead or backyard poultry (Cowling, et al., 2013). Neither H5N1 nor H7N9 have achieved human-to-human transmission (Cowling, et al., 2013). However, molecular analysis of cases of avian influenza in Hong Kong showed direct transmission of AI from poultry

to humans, as the virus was unchanged between the poultry and human host. Fortunately, avian-to-human and human-to-human transmission is rare (Kaye & Pringle, 2005). However, HPAI H5N1 has spread on an unprecedented scale throughout Asia, the Middle East, Africa, and Europe, fueling concern for a human pandemic (Munster & Fouchier, 2009). The 1918, 1957, and 1968 influenza pandemics all had components of avian influenza viruses (Gary et al., 2007). The H1N1 outbreak of 1918 contained human and swine strains, but more closely resembled avian influenza (Reperant et al., 2012).

The large numbers of poultry may be a reservoir for the virus, potentially allowing mutations to occur that are needed to cross species barriers (Tian et al. 2015). Retrospective studies have shown positive AI titers in high-risk populations, such as poultry and swine workers (Gray et al. 2007). H5N1 and H7N9 have caused a large number of infections and have had a high mortality rate in humans (Qin et el., 2015). Li et al (2013) examined the epidemiology of H7N9 human infections; 82% of hospitalized patients with H7N9 confirmed by PCR reported contact with live animals (including poultry). Manabe et al. (2016) agree that direct or indirect contact with sick or dead poultry appears to be a route of transmission. In the study, contact with poultry was considered to be a risk factor in the 2003 H5N1 outbreak in Vietnam. They also found a timing overlap in the seasonality of human and poultry cases (Manabe et al., 2016). In a study by Tian et al. (2015) that examined the spatial and temporal patterns of HPAI H5N1 in China, the researchers found that cases of H5N1 in poultry preceded human outbreaks by 1-4 months.

Outbreaks of AI occurred in the U.S. in 1924, 1983, 2004, and 2014. The most recent outbreak occurred from December 2014 to June 2015, during which over 48 million birds were euthanized to control the spread of the disease (Ramos, MacLachlan, & Melton, 2017); the

estimated economy-wide loss is estimated to be $3.3 billion (Greene, 2015). Trade restrictions and a reduced supply caused consumers to pay higher prices for poultry products (Ramos, et al., 2017). During the 2014-2015 outbreak, public health officials monitored AI strains for an increased risk of human infection. Fortunately, no human infections were associated with this outbreak (Greene, 2015). The Center for Disease Control and Prevention (CDC) National Institute for Occupational Safety and Health and the Department of Labor's Occupational Safety and Health Administration issued recommendations for good hygiene, proper protective clothing, and health monitoring programs after contact with infected poultry (2015). Guidelines have been developed by the CDC for health care providers for monitoring, diagnosing, and treating human infections. A HPAI virus strain has been produced by the CDC for vaccine use in humans (Greene, 2015).

The author, preparing this chapter in the fall of 2018, and looking forward to Veteran's Day, endorses historians' reminder of the events of World War I and the so-called Spanish influenza pandemic in 1918. Of course, the fact that an estimated 50 million people died of influenza in the Spanish influenza outbreak should cause all public health and veterinary public health scientists to be vigilant when it comes to animal to human influenza transmission risk (Taubenberger & Morens, 2006). This field experience represents one such vigilant effort.

Chapter 2 - Field Experience

Preceptor

The author completed her field experience with Dr. LewAnn Schneider, a Veterinary Medical Officer with United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Veterinary Services. Dr. Schneider is based out of APHIS District 5 and reports to the Topeka, Kansas field office. Prior to working for the USDA, Dr. Schneider worked as a mixed-animal veterinarian in Kansas. Since joining the USDA, she has completed a variety of courses involving zoonotic diseases, including a foreign animal disease course at Plum Island, becoming a National Poultry Improvement Program (NPIP) Compartmentalization Auditor, and tuberculosis seminars.

Goals

As agreed upon in the field experience agreement, the student was to complete two main goals. She was to develop an in-depth understanding of APHIS's role in animal health and zoonotic/human disease prevention and learn the principles of biosecurity and how they can be applied to avian populations. Through the daily activities with her preceptor and the completion of biosecurity plan development for upland gamebird producers (see Chapter 3), the student achieved these goals.

Activities Performed

One of the first events the student participated in was training course *PER-333: Isolation and Quarantine Response Strategies in the Event of a Biological Disease Outbreak in Tribal Nations*. This was held in conjunction with the Kansas Division of Emergency Management and the Prairie Band Potawatomi Nation. Members of the community, local firefighters and law enforcement, and health care administrators attended the training course, which combined both

lecture and group exercises and illustrated the gaps that required improvement to protect public health.

A large portion of the field experience pertained to the regulatory work of the USDA and Kansas Department of Agriculture (KDA). Under the mentorship of Dr. Schneider, the student visited livestock sale barns, feedlots, and slaughter houses to learn about the work the USDA completes to protect public health and to ensure that the food that enters the supply chain is wholesome. Another part of the regulatory work the student participated in was disease surveillance, including AI testing birds, *Salmonella* testing at county fairs, obex collection for scrapie surveillance and comparative cervical testing on dairy cows. The student was able to work with several other AHPIS and KDA employees during her field experience.

The student spent some time at the USDA Topeka Field Office learning about the import and export requirements for animals and animal products. This portion of the experience stressed the important of the world market and what the USDA does to protect U.S. animal and human health.

During the field experience, the student attended several meetings, including "Diagnostics of Endemic & Emerging Diseases: Beyond the Status Quo Workshop," hosted by the Center of Excellence for Emerging and Zoonotic Animal Diseases and the Kansas State Veterinary Diagnostic Lab, and the joint APHIS/KDA summer 2018 meeting. At the APHIS/KDA summer meeting, the student and Emily Farmer, a fellow MPH student, gave a presentation together introducing the biosecurity plans created for upland gamebird producers and the importance of veterinarians in helping producers create biosecurity plans. The last meeting attended by the student was at the Cobb-Vantress headquarters in Arkansas, where

several USDA APHIS veterinarians were going through orientation prior to a multi-week long compartmentalization auditing process.

A key aspect of the student's field experience was the development of a biosecurity plan template and custom plans for producers. This is explored in greater detail in Chapter 3.

Products Developed

As part of the student's field experience, she designed a biosecurity plan template for upland gamebird producers. She worked with eight producers to create each a custom biosecurity plan that was delivered in a binder with a digital copy of the plan and supplemental documents to help producers continue to modify their plan as they grow. A poster titled "Upland Gamebirds & Improving Your Biosecurity" was created and printed for use at producer meetings to introduce gamebird producers to the concepts and beginning steps of developing a bio-secure facility. This poster was made available at a gamebird producer meeting in August 2018.

Chapter 3 - Biosecurity Plans for Upland Gamebird Producers

Overview

Biosecurity is an important aspect of protecting a flock from diseases. Upland gamebirds producers who raise more than 25,000 birds were extended the offer to have a biosecurity plan designed for their facility. Eight facilities agreed to meet with the MPH student and a KDA or USDA veterinarian to design a biosecurity plan. Each facility provided a limited tour of their operation and discussed the protections they currently have in place. The goal was to work with each producer within their means to increase their biosecurity and to help them understand where risks can be reduced. Each producer received a customized biosecurity plan and auxiliary documents to help them continue to modify their plan as needed. On the condition of anonymity, many producers gave the author permission to use photos of specific practices for the purpose of this report and presentation.

Biosecurity Elements

The first step in establishing a biosecurity protocol was to designate a perimeter buffer area (PBA) and a line of separation (LOS). The LOS is a physical barrier, such as a wall or fence, that separates the captive birds from outside disease source. The PBA surrounds the LOS and includes the area that the producer reasonably controls access to. Producers identified places, property locations, and buildings where birds were kept. This information was illustrated on maps in the biosecurity plan with physical descriptions of what is raised in each building/pen. This required using satellite imaging to identify the area that is controlled by the producer in terms of access and property management. It is important that there is an established protocol for

who, what and how people, animals, and things can cross the PBA and LOS. Employees should be trained in these protocols at the time of hire, and then yearly.

Figure 1: Appropriate Signage – Areas of controlled access should be clearly labelled to discourage unauthorized visitors.

Employees can accidently bring in disease by coming into contact with other birds, whether is poultry at home or hunting. Prior to going to work, employees should be showered and wear clean clothing and footwear that has not been around other birds. Shoes should be disinfected prior to entering the PBA and if possible between crossing a new line of separation. The preference is to have a pair of shoes designated for working on the facility only.

Figure 2: Personal Protective equipment – Employees should have a designated pair of shoes that are worn only on the facility.

Pest control is another method of keeping disease out of the captive bird population. Producers need to take steps to protect their birds from rodents, insects, and wild birds that can carry disease into pens. Bait stations should be placed in pens and around feed stores. The flight pen walls should be buried 12-24" deep and the outer walls should be lined with tin panels.

Figure 3: Flight Pens – This is an example of a well-maintained flight pen LOS. Note the lack of vegetation along the outside of the pen.

Vegetation should be kept short to minimize hiding places for rodents and insects. A hot wire along the outer perimeter can reduce the incidence of larger predators in the flight pens.

Repairing flight netting and removal of bird nests can decrease the number of birds in the flight pens. Removal of unused feed from bins and lines as well as cleaning up spills can help reduce rodent and bird attractants.

Equipment, including trucks, skid loaders, crates, and buckets, is an important potential fomite. Producers need to consider what equipment leaves the PBA and what can return and under what conditions. Tires on vehicles need to be disinfected before entering the farm. Trailers that have left for deliveries need to be swept out and preferably washed out prior to returning to the farm. The ideal delivery crates are disposable (e.g., cardboard crates, etc.). Alternatives include plastic crates or sealed wooden crates. These crate types need to be washed and disinfected after use, especially after delivering to another farm. It is preferred that equipment is site specific and is not shared between locations or other producers.

Figure 4: Shipping Crates – The ideal crate is disposable, such as the cardboard crates in the image above.

Producers should be knowledgeable regarding the source of their feed, water, and replacement birds. Feed delivery trucks should follow farm protocol when crossing the PBA, such as disinfecting tires and wearing shoe covers. Ideally, gamebird producers are the only poultry producer on the route and do not share a truck route with any swine producers. Water should be sourced from a municipal source, rural water district, or a well. Do not use an open

water source and routinely disinfect water lines, especially between flocks. Replacement birds should come from a National Poultry Improvement Program certified farm and these records should be kept for 2 years.

Figure 5: Equipment Disinfecting – All equipment should be disinfected after use, including but not limited to crates, vehicles, and waterers.

Record keeping is an objective way to see where a biosecurity plan may have deficiencies. Shipping and receiving of birds, employee training, pest control, bait, and trap locations, manure spreading, visitors, and mortality records should be kept. Records can be kept digitally or on paper, but should be easily accessible and reviewed in cases of increased mortality or morbidity.

Challenges

There are many challenges for the upland gamebird producer in keeping a biosecurity tight. For many producers, raising gamebirds is a second or third source of income. While each producer wants only the best for their birds, there are limited resources, time, and money that can be put into biosecurity. Many of these operations are operated by a family. Finding the most economical practices to reduce risk is something that needs to be tailored to each producer.

Chapter 4 - MPH Coursework

Core Competencies

Environmental Toxicology

This course explored the far-reaching effects of toxins into ecosystems. While this course more than prepared the student for use of the material in the field, there were no opportunities for this knowledge to be used.

Biostatistics

This course was more than adequate to prepare the student for understanding the statistics and data trends presented in research papers. Being conversant in biostatics was instrumental in the author's reading and understanding of epidemiology-oriented manuscripts.

Epidemiology

The student enrolled in this core course after her field experience was completed. While at the field experience, the student was exposed to basic epidemiology concepts. The information learned in this course as the student composed her masters report was beneficial in finding relevant, reputable, and reliable studies.

Health Services Administration

The student's field experience required working within and between organizations to meet the goals of each. The health services administration course provided the basic tools for interorganizational function.

Social and Behavioral Sciences

This course looked at the principles of health behavior change. The foundations learned during this course helped the student better encourage producers to make changes to their facilities.

Emphasis Competencies

Veterinary Virology

This course greatly benefited the author in her effort to design biosecurity plans for upland gamebird producers. Understanding the morphology and biology of the virus is important in reducing the risk of disease transmission.

Strategic Health Communication

An essential aspect in any public health campaign is communicating to the target audience. This course walked through the important aspects of how to reach an audience and create an effective message. The material learned in this course helped the student speak with the producers, some of whom were wary of government help. Dr. Schneider modelled effective communication techniques as she interacted with both producers and colleagues.

Food Protection and Defense

A key to protecting the well-being of society is to ensure a safe and secure food supply. This course discussed essential concepts in maintaining a secure food supply from intentional contamination and agriculture infrastructure. This was beneficial to the student during visits to livestock markets and slaughter house as it provided a foundation for understanding the work of USDA and KDA veterinarians.

Trade and Agricultural Health

This course illustrated the interconnectedness of world markets and the impact one may have on the other. A disease outbreak can cripple economies and have a far-reaching impact into the future of a country and its citizens. This course significantly helped during the literature review and understanding how an outbreak of avian influenza in the U.S. could cripple producers and harm consumers. The concept of compartmentalization was discussed in the course and the

familiarity with the term was of great benefit to the student when attending the Cobb-Vantress orientation meeting,

Toxicology

The material covered in this course was not specifically used during the field experience. However, the open-minded thinking that accompanies finding the source of a toxin was of great benefit when designing biosecurity plans and touring facilities.

Chapter 5 - Conclusions

It is not a matter of if there is another outbreak of avian influenza in the United States, but when the next outbreak will occur. The avian influenza virus poses a serious threat as a human pandemic. The best way to prevent this from happening is to work at the human-animal interface. Upland gamebird producers are an ideal intermediary in which steps can be taken to protect human health. The unique manner in which upland gamebirds are produced creates an interface with waterfowl, the most common source of avian influenza in the United States. By designing and implementing a solid biosecurity plan, we can protect both the gamebirds and those who care for them. Veterinarians and public health officials must work with producers to find the biosecurity plan that works for each farm, not only to benefit each producer, but the world population.

The student's field experience provided hands-on learning that could not be taught in the classroom. Dr. Schneider proved to be an excellent preceptor and mentor, exemplifying professionalism and a passion for continual education. Her guidance in working between the USDA and KDA allowed the student to see what strides could be made to protect human and animal health when agencies work together on a common goal. It was an eye-opening experience, and an introduction to the upland gamebird production that the student might not otherwise have ever seen. Of course, lessons gained during the field experience would not have been possible without the MPH coursework. While not every course directly applied to the field experience, the different ways of approaching and solving problems were instrumental in making the most of the field experience opportunities.

Again reaching back 100 years to the Spanish influenza outbreak of 1918, scientists, veterinarians, and public health officials are the necessary sentries to combat AI and other

zoonotic diseases. Veterinarians need to take steps to establish biosecurity protocols for producers and to carefully monitor the human-animal interface. It is only by working together across industries and regulating bodies that we can mitigate the risks posed by the next influenza outbreak.

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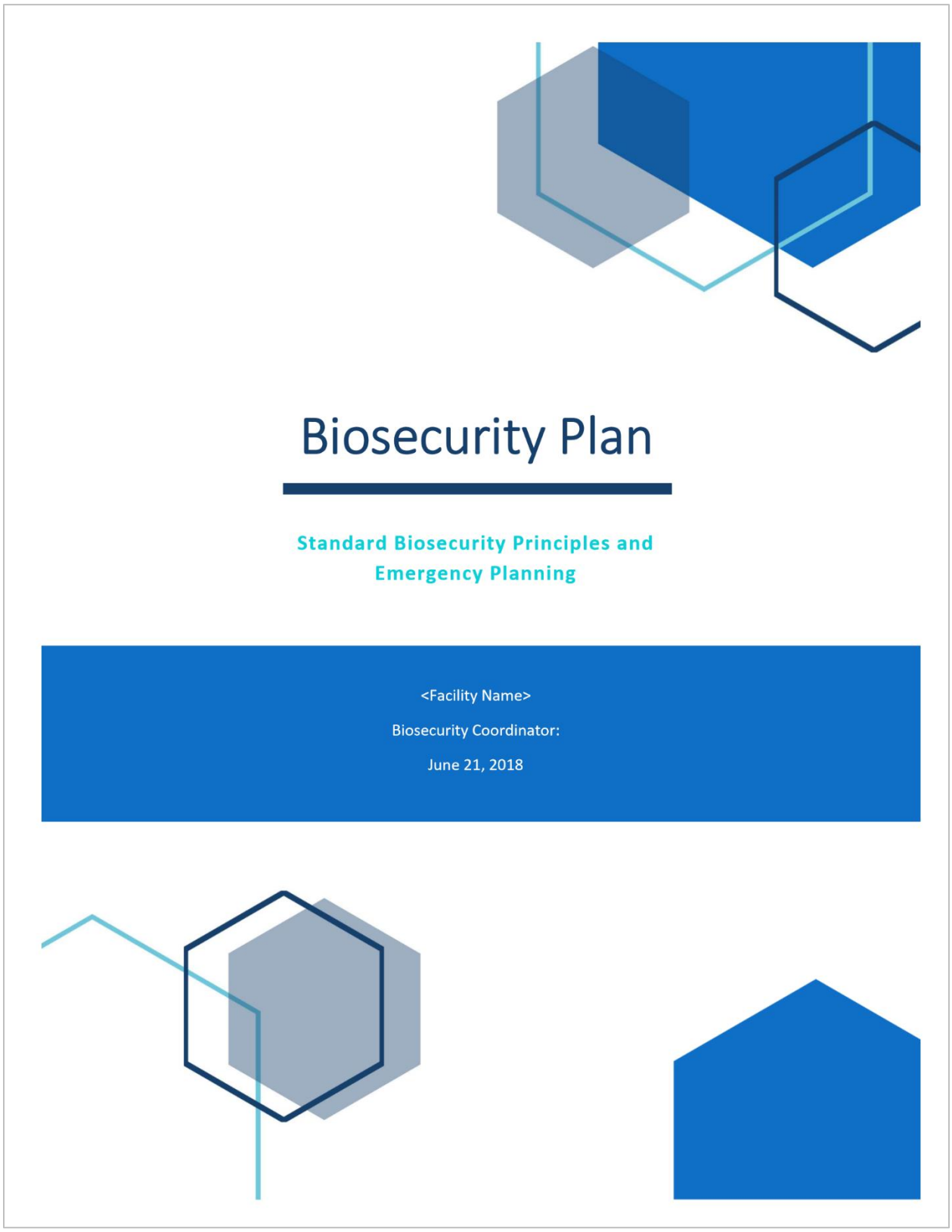
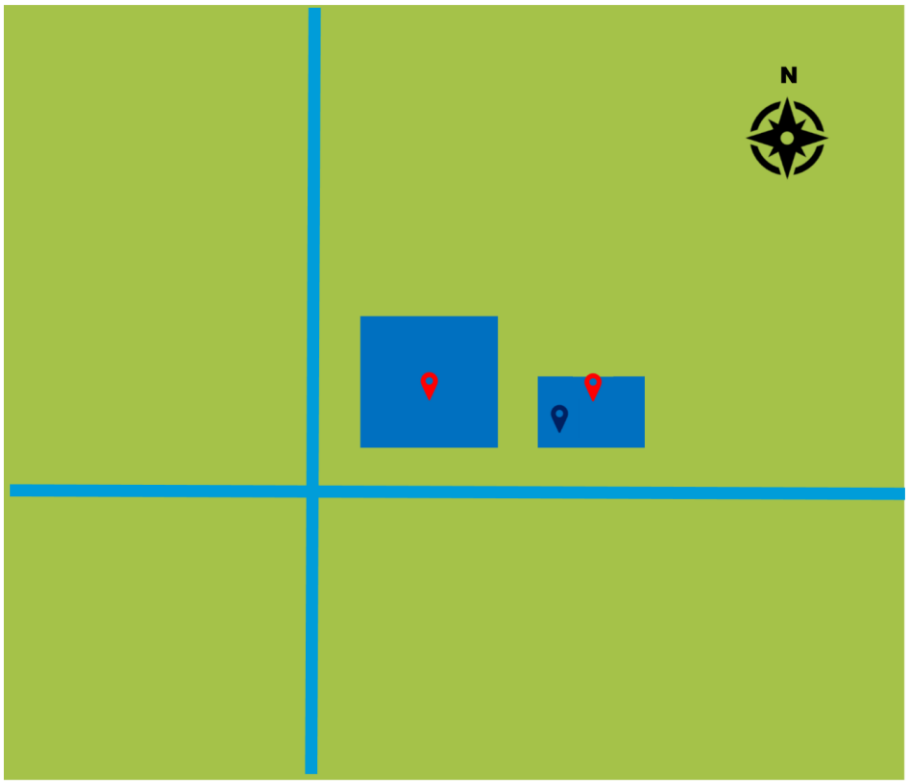
Appendix A - Biosecurity Plan Template



Contents



Key:

Main Office

Bird Locations

Biosecurity Plan

I. General Information

a. Operator Name: < >
b. Farm Name: < >
c. Main Office Physical Address: < >
d. Mailing address: < >
e. Phone number: < >
f. Biosecurity Coordinator's Name: < >
    i. Responsibilities
        1. The Biosecurity Coordinator is responsible for training and documentation of site-specific training for all production personnel and suppliers. Training is to be done at time of hire for all employees and at least one time during the calendar year. Documentation is kept in the primary biosecurity plan binder (Appendix B).
        2. The biosecurity plan will be reviewed internally at least annually and revised if needed. Records of these reviews are kept in the primary biosecurity binder (Appendix C).

II. General Biosecurity Protocol

g. Employees
    i. Fresh laundered clothing is to be worn to work daily.
    ii. Change into work gear at assigned location. This location is <>. When leaving the farm, all work gear is left at the same location.
    iii. Do not visit younger birds or the hatchery after visiting older birds, unless shoes and clothes are adequately cleaned and disinfected.
    iv. Employees who have poultry or pet birds at home are required to shower prior to coming to work and wear different clothing and footwear.
    v. Employees who hunt ducks or geese are required to shower prior to coming to work and wear clothing and footwear that has not been worn hunting.
    vi. Employees must step into the footbath to disinfect shoes, if one is available, each time they exit or enter a building or flight pen. Footbath contains <trade/chemical name and concentration>.
    vii. Personal protective equipment
        1. All personnel entering the hatchery are required to wear shoes that are not worn off-site or into the flight pens. Shoes to be worn in the hatchery can be stored on the premises at <location>.
        2. Boots for wearing into the flight pens can also be stored <location>. However, these boots cannot be worn into the hatchery.
        3. Disposable masks and gloves are available for all farm workers at their request.
h. Visitors

i. All visitors are required to sign in at the main office and disinfect shoes. The main office can be found at < >. The visitor entrance is < >.
ii. Visitors are required to have been away from poultry for a minimum of 48 hours.
iii. Visitors must have showered and equipped with clean clothing and shoes that have not been previously exposed to poultry.
iv. Visitors are not permitted to enter buildings and or pen areas.
v. All visitors are accompanied by management personnel. Any farm tours are completed in farm vehicles only. Visitor vehicles are to be left at the main office.
vi. Biosecurity and disease prevention signs are placed in multiple highly visible locations at each operating facility.

i. Animal Control
    i. Employees should avoid contact with wild birds, waterfowl, and other wild or feral animals.
    ii. Hunting dogs and pets are to be kept away from captive bird areas.
    iii. Wild birds should be discouraged from flocking around and entering pens. Flight pen netting is repaired as needed.
    iv. Rodents and insects are to be controlled both inside and outside buildings and pens.
        1. Reduce pest friendly environments
            a. Remove unwanted debris in and around the outside of poultry buildings. This includes trash, equipment, lumber, containers, and non-essential litter.
            b. Grass and weeds is to be mowed, removed, and/or chemically treated with herbicides along the line of separation and outside buildings.
        2. Feed management
            a. Spilled feed is to be cleaned up and removed as soon as identified.
            b. Unused feed is removed from buildings, tanks, and feed equipment not in use.
        3. Rodent control
            a. Bait traps are placed in various locations through the premises, including but not limited to the hatchery, inside flight pens, and around buildings. Live traps are located around the property to remove larger pests.
            b. Any open rodent holes outside the buildings are covered and baited if they become active.
            c. Monitor bait stations routinely and refill rodenticide as necessary.

d. The bottom edge of the fencing of each flight pen is buried < > inches below the surface to help keep out rodents and other pests.
e. Record bait station and live trap maintenance in log in Appendix E.

4. Insects
   a. The incubator room and each incubator are fogged < > to control insects.
   b. Egg washing room is intermittently fogged to control insects.
   c. Brooder barns are fogged/sprayed <how often>.

v. Dispose of dead birds in a timely manner.
   1. Dead birds from brooder barns are gathered (how/how often).
   2. All dead birds are (how disposed of)
   3. Ashes are spread in fields or disposed of in the dumpster. The dumpster is located at the < >.

j. Line of Separation & Perimeter Buffer Area
   i. Line of separation (LOS): The walls of the brooder barns serve as the line of separation. The perimeter fencing of each flight pen serves as the line of separation for each pen. On maps, this is defined as a red line.
      1. General biosecurity protocol must be followed by all employees and visitors prior to crossing the line of separation.
   ii. Perimeter Buffer Area (PBA) for each location is defined by the nearest road, unkept brush, or building not associated with <facility name>. On maps, this is defined as a yellow line.
      1. There are no specific procedures from crossing into the PBA due to significant geographical isolation.
   iii. Building/Location #1 – <building name>
      1. <address>
      2. Description of procedure to cross LOS.
      3. <map of building with LOS and PBA>
   iv. Building/Location #2 – <building name>
      1. <address>
      2. Description of procedure to cross LOS.
      3. <map of building with LOS and PBA>
   v. Building/Location #3 – <building name>
      1. <address>
      2. Description of procedure to cross LOS.
      3. <map of building with LOS and PBA>

k. Equipment
   i. Shipping containers
      1. Here describe the crates, including the material, and how they are cleaned. What age of birds are put in crates/boxes and where do they

go? How are they cleaned and stored after returning? Is there any routine maintenance of these crates? Do birds from other farms ever go in the crates? If so, are any additional measures taken?

2. Examples:
    a. Plastic crates used for shipping day old chicks are power washed with hot water and allowed to dry, in the sun if possible.
    b. Cardboard shipping crates are sprayed with disinfectant upon return to the farm.
    c. When delivering to farms with a suspect disease on farm, cardboard boxes are used and not picked up.
    d. Movement and shipping of adult birds occurs in painted wooden crates. These crates belong to the owner and are not left on another farm.

ii. Vehicles
1. Are vehicles and equipment shared between farms/locations? If so, are any measures taken to disinfect or clean the vehicles prior to returning to the farm?
2. Farm vehicles are to be used only for driving in between brooder barn and flight pen locations.
3. Delivery vehicles should not be used for on-farm tasks.
4. When delivering to suspect farms, the delivery vehicle needs to be washed prior to returning to <facility>.
5. Trailers are swept out after shipments and periodically washed down and disinfected.

l. Waste, Manure and Litter Management
i. Flight pens are plowed under and disked at the end of the season. Flight pens sit empty at the end of the production season, with the exception of the breeding stock flight pens.
ii. Used litter from brooder barns is <spread on nearby fields as fertilizer/composted/distributed to neighbors as compost or fertilizer, etc.>.
1. A log of waste litter distribution is kept in the log in Appendix E.
iii. Hatchery waste, including eggs that have failed inspection and egg shells, is collected in the hatchery in garbage bags and then placed in the dumpster at <dumpster location>. The dumpster is emptied <how frequently> by a waste collection company.

m. Replacement Poultry
i. Sourcing
1. <where do eggs/chicks/adults come from, are the source farms NPIP certified>
    a. Shipping and receiving records are kept for at least two years <location of records>.

ii. Delivery/Restocking

1. <method by which eggs are brought into farm, new birds are added to barns>

n. Water Supplies
   i. <Source of water for each location: well, rural water district (treated), municipal water source, open water source>
      1. If an open water source is used, is any testing done or additional disinfecting after using open water to rinse or flush equipment?
   ii. In between flocks, brooder barn water lines are <disinfected with <>/flushed/cleaned>.

o. Feed and Replacement Litter
   i. Feed is delivered by <>.
      1. Feed company policy/farm policy requires <washing of trucks and donning PPE> prior to opening feed bins.
      2. Feed is delivered to containers outside of the LOS of each brooder barn and set of flight pens.
   ii. Fresh litter is stored in a building in originally plastic packaging.

p. Elevated Morbidity or Mortality
   i. In the case of elevated morbidity or mortality, notify the Biosecurity Coordinator immediately.
   ii. In the event of illness in a pen, employees will be assigned to that pen only to limit the spread of disease.
   iii. Outside Resources:
      1. Dr. Paul Grosdidier, KS NPIP Contact (785) 633-3638
      2. Dr. LewAnn Schneider, APHIS VS (785) 207-2127
      3. Dr. Kara Butterfield, APHIS VS (620) 290-0636

q. Auditing and Further Plan Review
   i. Review the biosecurity plan annually and in the event of increased mortality and morbidity as well as local disease outbreaks.
   ii. Employees will be trained annually by reviewing the biosecurity plan. New hires will also receive the same training at time of hire.
      1. Records of training will be kept for a minimum of 3 years in Appendix E.
   iii. Records for kept of auditing purposes include: training, monitoring records, any corrective actions taken, and any changes and records of plan review.

III. Emergency Biosecurity Protocol

a. In the event of a serious disease problem ***on the farm***:
   i. Contact the Biosecurity Coordinator immediately.
   ii. All vehicles, equipment, and clothing are quarantined to the farm. Nothing can leave one property location to go to another until given permission by proper regulatory authorities.
   iii. No clients or visitors allowed on premises.

iv. State veterinarian's office/USDA APHIS is immediately contacted for further instructions.

v. In the event of a natural disaster or mass mortality, a section of property will be identified for a mass burial site.

b. Upon suspicion of a serious disease problem ***in the state of Kansas***, including but not limited to highly pathogenic avian influenza (HPAI), the following biosecurity measures will be put in place:

vi. Personal Protective Equipment

1. Shoes worn into the hatchery must not be worn outside of the hatchery and need to be sprayed off with water and disinfected prior to entry.
    a. If exiting the hatchery at any point, shoes need to be sprayed again with water and disinfectant.
2. Wear disposable gloves when handling birds, including collection of dead birds. Change gloves between barns and flight pens.

vii. Line of Separation

3. Footbaths will be placed at all entrances to the hatchery, brooder barns, and flight pens. Anytime personnel enter or exit a building or pen, these tubs need to be stepped in.
4. Employee footwear for entering flight pens can be stored <location>.

viii. Wash vehicles that have gone to other poultry farms as soon as possible after delivery. Spray tires with disinfectant prior to return to farm.

Appendix A: Cleaning Procedures

I. The following three steps are to be followed (where applicable for the time of year). These steps are broken down further below.
   a. Dry clean the building. Remove all litter from the previous flock. Allow pens to sit idle exposed to sunlight and warm temperature if possible.
   b. Wash down the building and apply disinfectant.
   c. Wash and disinfect all equipment within the building or pen.

II. Building Cleanout and Disinfection
   a. Preclean
      i. Remove all feed from feeders, feedlines, and from the feed tank.
      ii. Remove all dead birds from the building and properly dispose of according to biosecurity protocol.
      iii. Cover all exposed electrical devices and sensors.
      iv. Flush, clean, and disinfect water lines using < type of cleaner >
   b. Clean
      i. Push out litter and sweep the floor. Brush free debris from the floor, walls, and ceiling.
      ii. Load litter on the truck/trailer, properly cover litter, and transport off site according to protocol.
      iii. Wash down all surfaces with high pressure water including the ceiling, walls, feeders, water lines, curtains, feed tanks, floor, brooder stoves, inlets, fans, shutter, and fan boxes.
      iv. Remove all excess debris and water caused by the wash out.
      v. Clean and wash down area where litter was pushed out, then the entry way(s) and service rooms.
      vi. Soak all surfaces with soap or disinfectant with high pressure washer.
      vii. Rinse all equipment with fresh water.
   c. Disinfection
      i. Using the approved disinfectant, spray all building surfaces and equipment using an orchard sprayer. Apply product per label instructions.
      ii. Close up the building for 24 hours.
      iii. It is important to ventilate building prior to entry.

Appendix B: Training Documentation

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

I, __________________, have received biosecurity training for <Facility Name> on this date,
___/____/____, by ______________________. Signature: _________________________

Appendix C: Biosecurity Plan Changes and Review

Record all changes and dates of review of the biosecurity plan here.

Date	Review/Changes Made	Signature

Appendix D: Emergency Contact List

State Veterinarian	Dr. Justin Smith, Animal Health Commissioner Dr. Paul Grosdidier, KS NPIP Contact Dr. Gerald Gibson	(785) 564-6601 (785) 633-3638 (785) 215-9217
USDA APHIS Veterinarian	Dr. LewAnn Schneider Dr. Kara Butterfield	(785) 207-2127 (620) 290-0636
Employees		
Feed Delivery Person		
Clientele		
Utility Companies		
Insurance Contact		
Other Important Contacts		

Appendix E: Logs

Pest Control Log			
Bait Station	Date	Comments	Initials
Traps	Date	Comments	Initials

Rodent Bait and Live Trap Maps

Sketch map to show number and location of bait stations and live traps.

Mortality Records

Date Removed	Quantity	Location	Initials

Manure Spreading Log

Date Spread	Location Spread	Initials

Visitor Log

Date	Name	Reason for Visit	Time In	Time Out

REPORT OF SALES OF HATCHING EGGS, CHICKS AND POULTS

REPORT NUMBER
OK 123-23

DATE OF SHIPMENT
06/12/2018

NAME, PHYSICAL ADDRESS AND PHONE NUMBER OF PURCHASER
K-State Wildcat Gamebirds 1234 Wildcat Ln Manhattan KS 66502 Phone:785-564-6602

DESTINATION OF EGGS CHICKS, AND/OR POULTS ADDRESS
K-Stae Wildcate Gamebirds 1234 Wildcat Ln Manhattan KS 66502 Phone:785-564-6602

NAME, PHYSICAL ADDRESS AND PHONE NUMBER OF SHIPPER
Oklahoma Cowboy's Gamebirds 645 S Mustang Rd Newcastle OK 73064 Phone:405-256-1234

Quantity	Variety, Strains or Trade Name	Product					Sex			Type (Intended Use)									Classification - U.S.	
										Commercial Production Stock			Multiplier Breeding Stock			Primary Breeding Stock				
		Chicken Eggs	Turkey Eggs	Chicks	Poults	Other	Straight-run	Females	Males	Eggs	Meat	Other	Eggs	Meat	Other	Eggs	Meat	Other	U.S. H5/H7 Avian Influenza Clean	US Pullorum-Typhoid Clean
3	Chuckar					X		X								X			X	X
1	buff ameraucana				X				X							X			X	X

Remarks

State Inspector Signature:

This is to certify that the above name producer or shipper is participating in the National Poultry Improvement Plan — State Inspector Signature — 06/11/2018

This is to certify that the description and classification of the products listed above are properly indicated — *State Inspector Signature* — 06/16/2018

Appendix C - Biosecurity Principles Audit Form

NPIP Program Standards

Biosecurity Principles Audit Form

1. Biosecurity responsibility

	Y or N	COMMENTS
Is there a Biosecurity Coordinator? If so, please provide their name.		
Is there a site-specific biosecurity plan?		
Is the Biosecurity Coordinator knowledgeable in the principles of biosecurity?		
Does the Biosecurity Coordinator review the biosecurity program at least once during each calendar year and make revisions as necessary?		
Does the biosecurity plan indicate there will be a review by the Biosecurity Coordinator in periods of heightened risk of disease transmission?		

2. Training

	Y or N	COMMENTS
Does the biosecurity program include training materials that cover both farm site-specific procedures as well as or company and/or complex-wide site-specific procedures as applicable?		
Do all poultry owners and caretakers that regularly enter the perimeter buffer area (PBA) complete this training?		
Has the training been completed at least once per calendar year and documented?		
Are new poultry caretakers trained at hire?		
Are training records retained as stated in Title 9-CFR §145.12(b) and 146.11(e)?		

3. Line of Separation (LOS)

	Y or N	COMMENTS
Does the site-specific biosecurity plan describe or illustrate the boundaries of the LOS? If not, please explain.		
Does the site-specific biosecurity plan clearly outline procedures to be followed when caretakers, visitors, or suppliers cross the LOS?		

4. Perimeter Buffer Area (PBA)

	Y or N	COMMENTS
Does the site-specific biosecurity plan describe or illustrate the boundaries of the PBA?		
Does the site-specific biosecurity plan clearly outline the procedures to be followed by caretakers, visitors, or suppliers when entering and leaving the PBA?		

NPIP Program Standards

Biosecurity Principles Audit Form

5. Personnel

	Y or N	COMMENTS
Does the biosecurity program and/or site-specific biosecurity plan include provisions specifically addressing procedures and biosecurity personal protective equipment (PPE) for site dedicated personnel?		
Does the biosecurity program and/or site-specific biosecurity plan address the procedures and biosecurity PPE for non-farm personnel?		
Does the biosecurity program and/or site-specific biosecurity plan specify procedures which all personnel having had recent contact with other poultry or avian species should follow before re-entering the PBA?		

6. Wild Birds, Rodents and Insects

	Y or N	COMMENTS
Are there control measures in the biosecurity program and/or site-specific biosecurity plan to prevent contact with and protect poultry from wild birds, their feces and their feathers as appropriate to the production system?		
Does the biosecurity program and/or site-specific biosecurity plan contain control programs for rodents, insects, and other animals?		
Are these programs documented?		

7. Equipment and Vehicles

	Y or N	COMMENTS
Does the biosecurity program and/or site-specific biosecurity plan include provisions for procedures for cleaning, disinfection, or restriction of sharing of equipment where applicable?		
Are vehicle access and traffic patterns defined?		

8. Mortality Disposal

	Y or N	COMMENTS
Is there a mortality disposal plan?		
Does the mortality disposal plan reference the frequency of removal, storage of mortality, and pest control around mortality storage and disposal areas?		

Does the mortality disposal plan address procedures for handling mortality disposal in a way that minimizes the potential for cross-contamination from other facilities or between premises?		

9. Manure and Litter Management

	Y or N	COMMENTS
Is the manure and spent litter handled in a manner that limits the spread of infectious disease?		

10. Replacement Poultry

	Y or N	COMMENTS
Is replacement poultry sourced from flocks which are in compliance with NPIP provisions and program standards?		
Is replacement poultry transported in equipment and vehicles that are regularly cleaned, disinfected and inspected?		
Are biosecurity protocols in place for equipment and personnel involved in the transport of replacement poultry?		

11. Water Supply

	Y or N	COMMENTS
Is drinking water or water used for evaporative cooling sourced from a contained supply such as a well or municipal system?		
If water comes from a surface water source, is water treatment used to reduce the level of disease agents?		
If surfaces have been cleaned or flushed with surface water, is subsequent disinfection employed to prevent disease transmission?		
If water treatment is not possible, is a risk analysis performed to determine actions needed to mitigate risks?		

12. Feed and Replacement Litter

	Y or N	COMMENTS
Is feed, feed ingredients and litter stored and maintained in a manner that limits exposure to and contamination by wild birds, rodents, insects, and other animals?		
Does the biosecurity plan address feed spills within the PBA (outside of the LOS)?		

NPIP Program Standards

Biosecurity Principles Audit Form

13. Reporting of Elevated Morbidity and Mortality

	Y or N	COMMENTS
Does the biosecurity program address elevated morbidity and/or mortality above expected levels?		
Is there a plan to report and take appropriate action should you suspect and need to rule out reportable disease agents?		

☐ Satisfactory ☐ Unsatisfactory ☐ Opportunity for Improvement ☐ N/A

Additional Comments: _____

X _____

Official State Agency - Date

X _____

OSA Designee/Reviewer - Date

X _____

Company Name and Representative
NPIP Approval Number- Date