

Response Planning for Wildlife Rehabilitation Centers: An Infectious Disease Management Policy— Highly Pathogenic Avian Influenza

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Abstract: Free-ranging and captive wildlife can serve as reservoirs for pathogenic diseases in humans, livestock, or poultry. In contrast to zoological institutions, there has been little to no infectious disease response planning by managed captive avian wildlife facilities such as wildlife or raptor rehabilitation centers. It is incumbent upon each managed captive wildlife facility to assure regulators that the facility and its operations do not pose a threat to public health or animal agriculture. This is accomplished by working with local regulators and stakeholders to develop infectious disease policies and management plans appropriate to each facility in order to protect staff, volunteers and the general public, animal agriculture, wild animals, and the environment. In 2014, highly pathogenic avian influenza virus (HPAIV) originating from Eurasia spread along wild bird migratory pathways into North America. This paper uses HPAIV as an example to assist facilities in developing an effective infectious disease management policy.

Keywords: All-hazards preparedness and response; risk assessment; infectious disease; highly-pathogenic avian influenza; wildlife rehabilitation center; raptor rehabilitation center

INTRODUCTION

Sometime during 2014, highly pathogenic avian influenza virus (HPAIV) originating from Eurasia spread along wild bird migratory pathways into North America. By the fall of 2015, almost 50 million

chickens and turkeys in 29 states were affected and depopulated at a cost of several billion dollars (Greene 2015). The United States Department of Agriculture (USDA), state departments of agriculture, and state veterinarians are responsible for safeguarding the health of animal agriculture. Zoological institutions, which are regulated by USDA, have been working with USDA and state veterinarians for many years to protect their collections from highly pathogenic avian influenza (HPAI) and other emerging and foreign animal diseases (ZAHP 2015a). Other facilities with managed captive avian collections, such as wildlife rehabilitation centers, are permitted by the US Fish and Wildlife Service (USFWS) and state departments of fish and game. This disconnect has resulted in little to no infectious disease response planning by managed captive avian wildlife facilities. In addition, the fragmentation amongst federal and state regulatory agencies has resulted in miscommunication, questions of jurisdiction, and inappropriate actions during the 2014–2015 HPAI outbreak (Willette, The Raptor Center, St Paul, MN, personal communication). Human health and animal agriculture will always take precedence over wildlife. Therefore, it is incumbent upon each managed captive wildlife facility to assure regulators that the facility and its operations do not pose a threat to public health or animal agriculture. This is accomplished by working with local regulators and stakeholders to develop infectious disease policies and management plans appropriate to each facility in order to protect staff, volunteers and the general public, animal agriculture, wild animals, and the environment.

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ALL-HAZARDS PREPAREDNESS AND RESPONSE

A hazard includes any incident or event, natural or man-made, which requires a response in order to protect life, health, and safety. All managed captive wildlife facilities are responsible not only for the health and safety of the animals in their care, but also the staff, volunteers, and visiting public. Managed captive wildlife centers should have a suite of emergency and disaster plans including a safety manual for the facility, a biosecurity protocol to prevent the spread of diseases between animals and from animals to people, an occupational health program for staff, volunteers and the public, and a veterinary preventive medicine program (Huckabee 2009; Willette 2014; ZAHP 2015; CFSPH 2015a; CFSPH 2015b; AVMA 2016; ZAHP 2016).

Infectious disease is considered a hazard. Wildlife can be a victim of an infectious disease, and/or wildlife can serve as a pathogen reservoir for diseases in humans, livestock, or poultry. Zoonotic diseases transmitted between humans and animals can result in illness or death in people. Diseases that can be transmitted from wild animals to agricultural animals can lead to illness, death, or depopulation of animals, resulting in significant economic loss and trade restrictions (Willette 2009; Willette 2013).

Risk assessment is a process used to identify potential hazards, the likelihood of occurrence, and the impacts or consequences of those hazards. With any new or emerging infectious disease, or one with significant human health or animal agriculture implications, a disease risk assessment relative to each institution should be performed. This assessment requires information about both the disease and the facility. A risk assessment is generally performed by a team of stakeholders and subject-matter-experts (Department of Homeland Security 2015). Key stakeholders for an infectious disease risk assessment of HPAIV in a wildlife rehabilitation center could include representatives of staff and volunteers, facility veterinarian and others knowledgeable about avian influenza and other infectious diseases in wildlife, other managed captive wildlife facilities in the area such as zoos, nature centers, and humane societies, local emergency management, and state regulatory authorities such as animal health/agriculture, public health, and fish and game. There are numerous web sites with information on conducting an infectious disease risk assessment, including some for managed captive wildlife facilities (ZAHN 2013; OIE/IUCN 2014).

Risk management is the development and implementation of procedures or processes to eliminate or mitigate the risk, and/or help the facility deal with

the impact of, and recovery from, the hazard. If the infectious disease risk assessment indicates that the likelihood and/or the consequences of the disease hazard are unacceptable, part of the risk management could include writing an individual disease management policy. This infectious disease management policy is dictated by the nature of the disease as well as the managed captive wildlife facility, hence the need for the disease management policy to be customized to each facility and for each disease. For subsequent infectious disease management policies, much of the material can be duplicated or adapted for diseases of a similar nature. A significant amount of the material will be carried over from a facility's biosecurity, human health and protection, and veterinary preventive medicine protocols. If a facility does not have pre-existing emergency and disaster plans, completing an individual infectious disease policy and management plan is a good first step. It can be used as starting material for many of the other plans. An individual infectious disease management policy for a new or emerging disease will need to be updated frequently as new information becomes available.

The Incident Command System (ICS) is a management system utilized by local, state, and federal emergency management teams during a response to an emergency or disaster of any size or nature. Appropriate staff and volunteers should be familiar with its structure and method of operation before the need for it arises. Free, online courses are available from the Federal Emergency Management Agency (FEMA), including ICS 100: Introduction to the Incident Command System (FEMA 2016). The Center for Food Security and Public Health Emergency Response also offers a free, online course: Introduction to Animal Emergency Management (CFSPH 2016).

INFECTIOUS DISEASE MANAGEMENT POLICY

Infectious Disease Profile. A disease profile will form the backbone of the infectious disease policy and management plan, and is also needed to perform the risk analyses. Design a template (see Appendix 1—Infectious Disease Profile: Highly Pathogenic Avian Influenza Virus) and write out an informational sheet with references. Include information on species affected, routes of transmission, clinical signs, diagnosis, treatment, zoonotic potential, preventive medicine, and other pertinent information. This can be challenging for a new or emerging disease, and the information may need to be updated frequently. In conjunction with the facility's staff or contract

veterinarian, an excellent first contact would be the state veterinarian or state board of animal health or agriculture. Take this opportunity to develop a list of stakeholders and subject-matter experts.

Facility Profile.

Similarly, a descriptive analysis of the facility will be incorporated into the infectious disease management policy, used for the risk analyses, and may be included in emergency preparedness and response plans as required by regulatory authorities.

For the animal programs describe the:

- current program in terms of number and species of animals
- floor plan of the physical facilities
- how different groups of animals are housed and move through the program and the facility
- veterinary preventive medicine program for each species or taxonomic group
- ability to quarantine incoming animals or isolate ill individuals
- ability to identify animals affected by the disease in question and capability to confirm the diagnosis
- ability to manage suspect or confirmed cases to prevent nosocomial and/or zoonotic spread of the disease

For the staff and volunteer programs describe the:

- safety manual and occupational health program
- protocols for general hygiene, food safety, handling of biowaste, and availability and use of personal protection equipment
- work flow of staff and volunteers through the facility
- documentation and policies regarding exposure of staff and volunteers to other domestic animals, wildlife, and/or facilities
- required testing and vaccination in order to work or volunteer in the facility
- training programs offered and completed by staff and volunteers

It is important to note if there are education/outreach program animals at the facility, if members of the general public visit the facility, or if animals go off-site to other locations. It is also important to note other facilities near the managed captive wildlife site. The potential impact of HPAIV in a managed captive avian wildlife facility is significantly greater if the facility is located near a poultry operation or other similar enterprise.

Risk Assessment. There are a myriad of consequences from an infectious disease outbreak in a wildlife rehabilitation center that should be addressed in the risk analyses that are not covered in this article. These issues include economic impacts of the cost of treatment and/or the loss of revenue, public perception of 'disease' in the facility, and psychological effects on staff, volunteers, and the public from the loss or depopulation of animals.

To determine the risk of infectious disease in a managed captive wildlife facility, use the disease profile, in this case HPAIV, and consider the current known routes of transmission: direct from an infected animal; indirect from fomites or vectors; and indirect from feeding infected poultry or waterfowl to another carnivorous bird or mammal (CFSPH 2015). Therefore, methods of introduction of HPAIV into a wildlife rehabilitation center could include admission of a sick bird or mammal, admission of a host/carrier bird or mammal, virus on the shoes or clothing of a staff member or volunteer who is involved with domestic or wild animals or animal agriculture at another facility, virus on the shoes or clothing of a staff member or volunteer after interacting with wild birds such as bird watching or feeding waterfowl at a pond, feeding an infected bird to another carnivorous bird or mammal at the facility, and exposure to virus in outdoor housing from wild birds, rodents, insects, or other vectors.

Once an infectious disease is introduced into a managed captive wildlife facility, consider the routes of transmission and consequences to humans, animals, and the environment. The foremost concern must always be zoonotic spread. The lineages associated with the 2014 introduction of HPAIV into North America did not appear to be zoonotic; however, other lineages have been zoonotic, although rarely. The majority of human cases of HPAI have been contracted while working closely with infected poultry or waterfowl. These cases have resulted in conjunctivitis, respiratory disease, and/or death (CFSPH 2015).

Another major concern is nosocomial spread of the disease to other species which may or may not be susceptible to disease or host state. Type A avian influenza viruses (generally low pathogenic avian influenza viruses, or LPAIV) have been isolated from over 100 avian species worldwide. Many species of waterfowl and shorebirds serve as reservoir hosts with mild to no apparent clinical signs but can spread the disease to other susceptible individuals (CFSPH 2015). The lineages associated with the 2014 introduction of HPAIV into North America were not associated with transmission to mammals. In other lineages,

transmission of HPAIV from birds to mammals involved the feeding of birds infected with HPAIV to carnivores or avivores (CFSPH 2015). An additional consequence of the introduction of HPAIV is the spread of the virus *from wildlife rehabilitation centers to other facilities*. This can occur by staff and volunteers serving as mechanical vectors and transporting the virus to facilities with domestic avian species such as poultry operations, veterinary clinics, pet stores, or private homes. Subsequent spread of the virus to free-ranging birds and wildlife from birds that have been rehabilitated and released is unlikely to affect the overall prevalence in the environment; none-the-less consideration should be given to where rehabilitated birds are released.

Risk Management. If the infectious disease risk assessment indicates that the likelihood and/or the consequences of the disease hazard are unacceptable, stakeholders should consider risk management plans (see Appendix 2—General Infectious Disease Policy and Management Plan). Begin by determining what procedures or processes need to be in place to eliminate or mitigate the risk of infectious disease introduction and spread, and/or help the facility deal with the impact of, and recovery from, the infectious disease. Given the *specific* facility, animal programs, and staff and volunteer programs, consider how to prevent or manage the introduction and consequences of HPAIV.

All facilities will have some management plans in common: a safety manual for the facility that includes a biosecurity protocol; an occupational health program for staff, volunteers and the public; and a veterinary

preventive medicine program. The infectious disease (e.g., HPAIV) management plan will be unique to each facility based on species admitted, ability to quarantine incoming animals, including individuals of known reservoir avian species, ability to suspect and confirm HPAIV, and ability to isolate and treat suspect and confirmed cases of HPAIV to prevent nosocomial and/or zoonotic spread of the virus.

At one end of the spectrum, a HPAIV management plan for a facility that does not admit birds may only include the common management plans, information regarding the possible transmission of HPAIV from wildlife to humans and non-avian species, and a food-source management plan. At the other end of the spectrum, a facility that admits all avian and mammalian species and has the capability to identify and confirm a diagnosis of HPAIV may have a much more extensive management plan. How will an animal that is strongly suspected or confirmed positive for HPAIV be handled? Will the patient be isolated and treated, or will the patient be euthanized? Will other in-contact animals be isolated and treated, or euthanized? Will the facility stop admitting all animals or certain species? Will the facility close? Regardless of the original infectious disease management plan, as any disease outbreak develops, the management plan will need to be revisited with stakeholders and amended as new information becomes available.

Supplemental risk analyses will need to be conducted if there are education/outreach program animals at the facility, members of the general public visit the facility, or animals go off site to other locations. The biosecurity and/or separation of physical

		Impact				
		Very Low	Low	Medium	High	Very High
Likelihood	Very High					
	High					
	Medium					
	Low					
	Very Low					

Figure 1. Sample Risk Matrix.

facilities, supplies and equipment, personnel, etc., between the rehabilitation and education/outreach collections will be of paramount importance.

Surveillance for Infectious Disease.

Surveillance for an infectious disease may be part of an infectious disease management policy. Surveillance for an infectious disease may be voluntary or may be required by a regulatory authority, generally state and/or federal wildlife and/or agriculture agencies. Protocols may include routine testing on admission, contingent upon specific clinical signs, and/or prior to release. There are a variety of points to consider before testing for HPAIV or any other disease. For example, why test individual animals? Is there a particular research question? Will a confirmed diagnosis in an individual patient help guide treatment decisions or allow for isolation to prevent the spread of disease to other animals or humans? Do HPAIV-positive animals need to be euthanized? Will a positive test result in testing of other in-contact, in-room, or in-facility animals? Can only test-negative animals be released?

There are also test, procedure, and data considerations. How accurate is the test? Does it result in false positives or false negatives? Can the test distinguish between exposure, disease, and/or vaccination? Are the test results available in a timely enough fashion to be useful for preventive or treatment purposes? What does the test require in terms of cost, samples, training, equipment and supplies, storage, and shipping? Finally, how are the results communicated? Who owns the data, where is the data kept, and how will the data be used?

Diagnostic tests for HPAIV include fecal/cloacal/oropharyngeal swabs, blood sampling, and/or submitting birds or other animals for necropsy (USDA 2015). Be sure to contact the regulatory authority and laboratory prior to submitting any samples or carcasses for testing. If testing is mandated, materials

and instructions should be provided by the regulatory authority, and all costs, including shipping, should be reimbursed.

Record Keeping—An infectious disease management policy includes what information will be collected and how it will be documented. This information will be used for decision making during an outbreak, as well as for any subsequent epidemiological investigations. Signalment data, location found, date admitted, and specific clinical signs will be particularly important. Once admitted, key data will include when and where the animal(s) were housed within the facility, and what other animals were in the facility during that time. Finally, the disposition, date of disposition, and release location (if applicable) should be recorded.

The Clinical Wildlife Health Initiative (CWHI 2015) promotes the use of standardized terminology by institutional data management programs. The availability of a comprehensive, integrated database will allow for long-term species monitoring, qualitative disease and toxin monitoring, identification of areas for targeted surveillance, and guide the development and implementation of effective strategies in public health and public policy. On an institutional level, standardized medical records can improve animal welfare and advance wildlife rehabilitation science.

SUMMARY

There is a plethora of resources available for the development of emergency and disaster preparedness and response protocols, including infectious disease policies. The challenge is to garner the appropriate information and stakeholders, and dedicate the time and intentionality required to prepare these documents. While templates and shared resources are helpful, each facility has unique needs and available resources. Each facility should develop its own robust and realistic plans to prepare for, respond to, and recover from an emergency or disaster of any kind, including infectious disease outbreaks.

APPENDIX 1—INFECTIOUS DISEASE PROFILE: HIGHLY PATHOGENIC AVIAN INFLUENZA VIRUS (HPAIV)

General Information. Highly pathogenic avian influenza is a Type A avian influenza virus. Avian influenza viruses are distributed worldwide and occur naturally in some species of waterfowl and shorebirds. These viruses can infect domestic poultry, other bird and animal species, and, rarely, humans. Avian influenza viruses are named for the combination of two proteins on the surface of the virus, hemagglutinin (H) and neuraminidase (N), for example, H5N1. They are also classified as either high pathogenicity (HPAI) or low pathogenicity (LPAI) virus based on the viruses' ability to cause disease and mortality *in poultry*, not people. Avian influenza viruses that are classified as H5 or H7 are of particular importance because LPAI H5 or LPAI H7 virus can mutate into a highly pathogenic virus (CDC 2015; CFSPH 2015).

Introduction of HPAI (H5Nx) Virus into North America. HPAI H5 virus originating from Eurasia spread along wild bird migratory pathways in the Eastern hemisphere and into the Pacific Flyway of North America sometime during 2014. After mixing with North American origin low pathogenicity avian influenza A viruses, multiple new (novel) viral combinations with genes from Eurasia (EA) and North American (AM) lineages emerged including HPAI H5N1, HPAI H5N2 and HPAI H5N8. Note that HPAI (AM) H5N1 is *not* the same H5N1 virus as in Eurasia (CDC 2015; CFSPH 2015). It is expected that these viruses will continue to circulate within the environment.

All EA/AM H5Nx viruses analyzed to date are highly similar and are highly pathogenic in poultry. Wild birds are presumed to be the original pathway for the virus' introduction into the Pacific and Midwest flyways. However, despite increased surveillance, virus was detected in very few wild birds (USDA 2015a; USDA 2015d) during the 2014–2015 outbreak. Movement of the virus into and between poultry operations may have resulted from breaks in biosecurity, wind, and tillage practices (USDA 2015a). Based on whole genome sequencing, the risk to human health remained low and molecular markers associated with antiviral resistance or increased virulence and transmission in mammals were not detected with these lineages (USDA 2015a).

Species Affected. It should be assumed that all avian species can be infected with HPAIV. Transmission of HPAIV to mammals has *not* been noted with these EA/AM H5Nx lineages (USDA, 2015a); however, some lineages of Type A avian influenza have been known to infect pigs, horses, dogs, cats, ferrets, captive wild carnivores, marine mammals, bats, and, rarely, humans (CDC 2015; CFSPH 2015).

Avian influenza should be considered as a differential for any individual bird or groups of birds presenting in a manner inconsistent with normal patterns of admission. During the 2014–2015 HPAI H5Nx outbreak, the US Geological Service National Wildlife Health Center (USGS NWHC) recommended special attention to: mortality involving gallinaceous birds (wild turkeys, quail, sage grouse); waterfowl (ducks, geese, swans); other water birds (loons, grebes, coots, shorebirds); wading birds (egrets, herons, cranes); and raptors or avian scavengers (ravens, crows, gulls) (USGS NWHC 2015).

Routes of Transmission. Current known routes of transmission for HPAIV include: fecal/oral; respiratory/aerosol; fomite/vector; and food sources—primarily infected poultry or waterfowl. HPAIV can spread rapidly among avian populations, especially in cool, wet environments (CDC 2015; CFSPH 2015).

Clinical Signs. Clinical signs depend upon the species of bird and individual characteristics (age, concurrent morbidities, etc.), and pathogenicity and virulence of the viral strain. Unfortunately, little is known about the specifics of avian influenza virus in the majority of the world's 10,000 bird species. Most avian influenza viruses are adapted to waterfowl (especially ducks in the genus *Anas*) and shorebirds, and may not cause disease in these species. However, these 'carrier' birds may be infectious and may spread the virus to another species. Clinical signs in free-ranging avian species are non-specific and can involve the respiratory, enteric, reproductive, and/or the neurological systems (CDC 2015; CFSPH 2015).

EA/AM HPAI H5Nx Case Observations (December 2014 to November 2015). With the exception of the black-capped chickadee discussed below, all cases of HPAI H5Nx in non-domestic bird species in the U.S. involved waterfowl or raptors (USDA 2015d). Clinical signs in affected Canada geese (*Branta canadensis*) included swimming in circles, twisted necks, and tremors prior to euthanasia or death (USGS NWHC 2015).

HPAI was detected in numerous raptor species. Necropsy of these raptors identified HPAIV infection as causing or contributing to their deaths (USGS NWHC 2015). Raptors generally become infected through the consumption of HPAIV-infected prey. Several captive raptors (birds used for falconry and at a wildlife rehabilitation center) that were fed infected waterfowl became ill and died. Clinical signs associated with the falconry birds included: bright green mutes; lethargy; 'almond-eyed' appearance (dehydration); regurgitation followed by anorexia and 'shut down' of the

gastrointestinal tract; ataxia and seizures; and, acute death. The time between clinical signs and death was 48 hours in three birds; a fourth bird was euthanized when it became lethargic and refused food (Redig, The Raptor Center, St. Paul, MN, personal communication). The infection rate for raptors consuming HPAIV-infected prey and the mortality rate for HPAIV infected raptors is not known (USGS NWHC 2015).

In June 2015, a juvenile black-capped chickadee (*Poecile atricapillus*) was admitted to a wildlife rehabilitation center. It was one of a number during a two-week span that had similar clinical signs including torticollis, nystagmus, and physically 'log-rolling.' Several were submitted for necropsy and two were positive for HPAI EA H5. The remaining chickadees did not appear to be infected with HPAIV; a few did have *Baylisascaris larval migrans* and/or encephalitis (Schott, Wildlife Rehabilitation Center of Minnesota, Roseville, MN, personal communication).

The neurological signs associated with HPAI infections are not well characterized. During the HPAI H5Nx outbreak, the USGS NWHC recommended special attention to waterfowl, raptors, and avian scavengers with clinical signs consistent with neurological impairment, which may include: swimming or walking in circles, moving the head in a jerky motion, and holding the neck and head in an unusual position (more drastic than simple drooping) (USGS NWHC 2015).

Diagnosis. Samples for avian influenza testing can come from live or dead birds (oral/cloacal swabs or tissues) or the environment that the birds inhabit. Testing occurs in stages, beginning with a rapid screening test. If initial tests determine that avian influenza is present, those samples are sent to USDA's National Veterinary Services Laboratory for confirmation, subtyping, and pathogenicity determination (USDA 2015).

Treatment. Treatment is supportive care. Anti-virals, such as Tamiflu® (Genentech, San Francisco, CA), should **not** be administered to wildlife. The use of anti-virals in wildlife has the potential to create a resistant form of avian influenza in the environment which could have serious implications for human health (Singer 2007).

Zoonotic Potential. The risk to human health from the 2014–2015 EA/AM H5Nx lineages was low. However, some lineages of HPAIV have been transmitted to humans, resulting in conjunctivitis, respiratory disease, and/or death (CDC 2015; CFSPH 2015).

Disinfection. A ten percent bleach dilution or quaternary ammonium is effective at eliminating influenza Type A viruses (CFSPH 2015).

Vaccination. Vaccine development and vaccination remains a controversial topic due to issues with effectiveness, administration, and trade implications. The use of a vaccine would require approval from USDA and the state veterinarian. If and when a vaccine is developed and made available, the quantity and scope of use would likely be limited. It is possible that managed captive avian collections in zoos or endangered species breeding facilities would be granted permission to use a vaccine. It is highly unlikely that wild birds would be approved for vaccination (USDA 2015b; ZAHN 2013).

Euthanasia.

There are no special euthanasia concerns for euthanizing wild birds outside of standard biosecurity cautions. Carcasses can be disposed of via composting, onsite burial, incineration, rendering, and landfilling (USDA 2015c). Facilities should work with state and federal departments of agriculture for disposal of wild birds found to be positive for HPAIV.

Reportable. HPAI viruses are reportable to state, federal, and international animal health authorities per World Organization for Animal Health (OIE) standards, and any suspect or confirmed cases of avian influenza should be reported to the state veterinarian or board/department of animal health and/or agriculture. Because LPAI H5 and H7 viruses can potentially mutate into HPAI viruses, these viruses are reportable as well (OIE 2016).

Management of Food Sources and HPAIV. Avian and mammalian carnivores can contract HPAIV if they are fed a bird (poultry, waterfowl, shorebirds, etc.) carrying the virus, with or without clinical signs. This includes raptors, felids, and other mammals (CDC 2015; CFSPH 2015). In the face of an outbreak of HPAI, consider the elimination of the feeding of poultry and egg products, or only utilize those operations that routinely test for avian influenza through the National Poultry Improvement Plan (NPIP 2015). Never feed deceased wildlife patients to other animals in the facility. Because preparing poultry or other birds for feeding can also be a source of infection for humans, be sure staff and volunteers follow all food handling protocols and utilize appropriate personal protection equipment (CDC 2015; CFSPH 2015).

APPENDIX 2—GENERAL INFECTIOUS DISEASE POLICY AND MANAGEMENT PLAN

1. Background Information
 - a. Disease
 - i. Case definition
 - b. Facility
 - i. Programs
 - (1) animal
 - (2) outreach/education
 - (3) public
 - ii. Floor plan
 - iii. Proximate facilities
2. Risk Assessment
 - a. Likelihood
 - i. Entry into facility
 - b. Consequences
 - i. Transmission
 - (1) humans
 - (2) animals
 - (3) environment
 - c. Impact
3. Risk Management
 - a. Preventive medicine program
 - i. Quarantine
 - ii. Husbandry/housing
 - iii. Diet
 - iv. Biosecurity
 - (1) occupational health and safety program
 - (2) disinfection protocols
4. Surveillance and Monitoring
 - a. Passive monitoring protocol
 - b. Active surveillance protocol
 - c. Consequences of a positive test
 - i. For animals
 - ii. For people
 - iii. For facility
5. Case Management Protocol
 - a. Isolation
 - b. Treatment
 - i. Vaccination
 - c. Euthanasia
 - i. Necropsy
 - ii. Disposal
 - d. Resolution
6. Record Keeping
7. Communication and Reporting
8. References

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