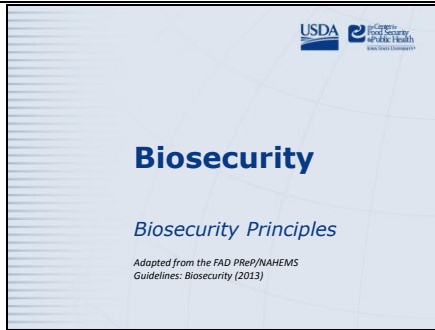


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Biosecurity is a series of management practices designed to prevent the introduction or spread of disease agents on an animal production facility. During an animal health emergency, biosecurity measures are necessary to:

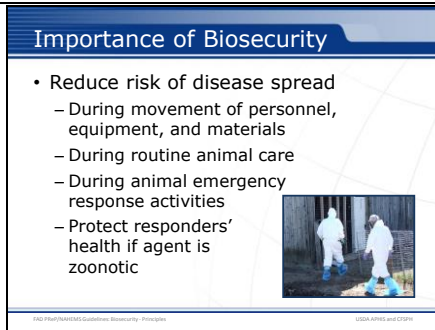
- Help keep disease agents out of livestock and poultry populations where the agents are not already present; and
- Prevent the spread of disease agents from infected groups in the population to uninfected groups within the same population.

Aside from animal health emergencies, many of the concepts presented here are also applicable to routine farm visits.

This presentation will outline basic biosecurity principles and the importance of biosecurity during an animal health emergency response.

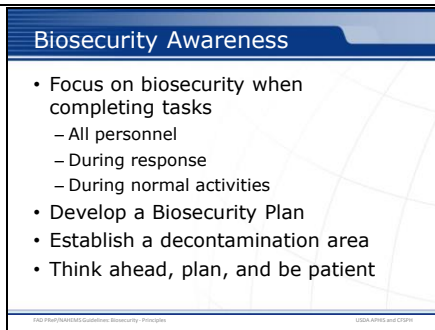
Information for this presentation was adapted from the USDA APHIS Foreign Animal Disease Preparedness and Response (FAD PReP)/National Animal Health Emergency Management System (NAHEMS) Guidelines: Biosecurity (2013).

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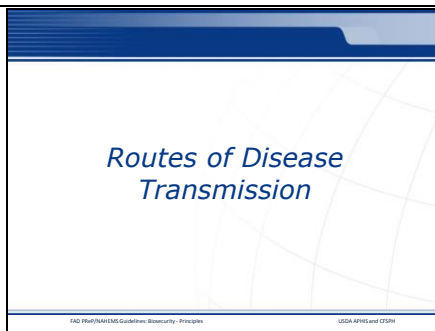
When properly implemented and enforced, biosecurity measures help reduce the risk of spreading pathogenic agents during the movement of personnel, equipment (including vehicles), and materials around and between livestock facilities. These biosecurity measures are especially necessary for activities associated with an animal health emergency response (e.g., surveillance, vaccination, appraisal, depopulation, and disposal). In the case of an outbreak involving a zoonotic agent, biosecurity measures can help protect the health of responders and the general public. Remember “backyard” facilities are “livestock” facilities with the potential for disease spread. *[This photo shows responders in PPE entering an animal facility. Photo source: Jane Galyon, Iowa State University]*

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Everyone needs to focus on biosecurity. Biosecurity measures can only be effective if all personnel strictly adhere to the protocols. Factors such as fatigue, stress, distraction, and lack of forethought can cause even the most conscientious individual to lose focus on the crucial importance of biosecurity measures. Develop a Biosecurity Plan that describes the mitigation measures to prevent the potential spread of the disease agent. Before entering a facility, establish Work Zones, or at least a “Clean-Dirty” line, and set up a decontamination area. Properly handle all clothing and supplies to avoid spreading contamination from the “dirty” to the “clean” side. Personnel must exercise the utmost thought, patience, persistence, and care in creating and carrying out a biosecurity plan — both under normal circumstances and during an outbreak. A little advance thought, planning, and extra effort in following biosecurity procedures can go a long way toward preventing pathogen transmission, protecting the well-being of livestock and poultry, and safeguarding American agriculture.

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Pathogenic agents can be transmitted from animal to animal, or between animals and humans through a variety of routes. Understanding the routes of transmission is essential to developing and implementing a Biosecurity Plan. The most common routes of transmission are aerosol, oral, direct contact, fomites, vector and zoonotic.

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Aerosol Transmission

- Inhalation of droplets containing pathogens
 - Animals in close proximity
 - Typically respiratory, some diarrheal diseases
- Examples:
 - FMD
 - END
 - Influenza
 - Q Fever




FAD PReP/NAHEMS/CSFIS/USDA APHIS and OIE/2013

Aerosol transmission occurs when droplets containing pathogenic agents from an infected animal are inhaled by a susceptible animal. Most pathogenic agents transmitted via aerosols do not survive for extended periods of time in droplets, so infected and susceptible animals must be in close proximity for disease transmission to occur. Typically, respiratory diseases and some diarrheal diseases can be spread via aerosol transmission. Examples of diseases spread by aerosol transmission include exotic Newcastle disease (END), foot-and-mouth disease (FMD), influenza, and Q fever. *[This illustration depicts aerosol disease transmission (arrows). Illustration by: Andrew Kingsbury, Iowa State University]*

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Oral Transmission

- Ingestion of pathogenic agents via feces, urine, saliva, other secretions
 - Contaminated feed, water or other items in animal's environment.
- Examples:
 - END
 - FMD
 - Hendra
 - Nipah
 - Q Fever




FAD PReP/NAHEMS/CSFIS/USDA APHIS and OIE/2013

Oral transmission occurs when a susceptible animal consumes pathogenic agents. Feces, urine, saliva and other secretions may contain pathogenic agents which can contaminate feed, water, or other items in the environment that animals lick or chew. This includes items such as feed bunks, equipment, fencing, water troughs, salt and mineral blocks. Examples of diseases spread by oral transmission include exotic Newcastle disease (END), foot-and-mouth disease (FMD), Hendra, Nipah, or Q fever. *[This illustration depicts oral disease transmission (arrow). Illustration by: Andrew Kingsbury, Iowa State University]*

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Direct Contact

- Physical contact between susceptible and infected animal/environment.
 - Via skin, mucus membranes, wound
 - Rubbing, biting, licking
 - Fomites
- Examples: African Swine Fever, FMD, Q Fever, Contagious Equine Metritis




FAD PReP/NAHEMS/CSFIS/USDA APHIS and OIE/2013

Direct contact transmission occurs when a susceptible animal physically contacts an infected animal or a pathogenic agent in the environment. The susceptible animal is exposed when the pathogenic agent comes in direct contact with its skin, mucus membranes or an open wound. Transmission can occur through rubbing, biting, licking, contact with the blood or saliva of an infected animal, or contact with fomites. Diseases spread during breeding or from dam to offspring during gestation are also considered to be transmitted by direct contact. Direct contact transmission can occur between animals of different species and through contact with humans. Examples of diseases spread by direct contact include African swine fever (ASF), foot-and-mouth disease (FMD), Q fever, or contagious equine metritis (CEM). *[This illustration depicts disease transmission via direct contact (arrows). Illustration by: Andrew Kingsbury, Iowa State University]*

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Fomite Transmission

- Pathogen transfer by inanimate objects
 - Direct contact or oral transmission
 - Boots, clothing, tools, vehicles, syringes, and other equipment
- Examples: ASF, CSF, FMD, Influenza




FAD PReP/NAHEMS/CSFIS/USDA APHIS and OIE/2013

Fomites are inanimate objects capable of transferring disease agents through either direct contact or oral transmission. Fomites can include: boots, clothing, vehicles, shovels, tools, bowls or buckets, tack, brushes, clippers, needles, and other medical equipment. Vehicles and trailers with contaminated tires, wheel wells, and undercarriages can serve as fomites. Humans with contaminated clothing, shoes, or boots are also considered fomites with the potential for moving disease agents within the facility or from one facility to another. Examples of diseases spread by fomites include African swine fever, classical swine fever (CSF), foot-and-mouth disease, or influenza. *[This illustration depicts disease transmission via fomite such as a needle and syringe shared between cattle (arrows and syringe). Illustration by: Andrew Kingsbury, Iowa State University]*

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Vector Transmission

- Arthropods transfer pathogens from infected animal to healthy animal
 - Mechanical and biological vectors
 - Fleas, ticks, mosquitoes
 - Examples: Bluetongue, EIA, West Nile Virus




FAD PReP/NAHEMS/USDAAPHIS Biosecurity Principles USDA APHIS and CSIS

Vectors are insects or arachnids capable of transmitting pathogens from an infected animal to a healthy animal. Vectors can transmit disease agents either mechanically or biologically. In mechanical transmission, the vector transports the disease agent from one animal to another, with the disease agent remaining unchanged. Many species of flies serve as mechanical vectors, simply carrying the agent from one location to the next. Biological transmission occurs when the vector acquires the agent from an infected animal, usually through a bloodmeal, and the agent replicates or develops within the vector. The disease agent is subsequently introduced to a susceptible host, usually through a bite. Fleas, ticks, and mosquitoes are common biological disease vectors. Examples of diseases spread by vectors include bluetongue, equine infectious anemia (EIA), or West Nile virus. *[This illustration depicts disease transmission by a vector, such as ticks (arrows and tick). Illustration by: Andrew Kingsbury, Iowa State University]*

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Zoonotic Transmission

- Pathogens spread between animals and humans
- Any route
- Occupational and public health concerns
- Examples: Brucellosis, END, Influenza, Q Fever, Hendra, Nipah, Tuberculosis



FAD PReP/NAHEMS/USDAAPHIS Biosecurity Principles USDA APHIS and CSIS

Zoonotic diseases are transmitted between animals and humans. Human exposure to zoonotic diseases may occur through any of the five routes of transmission discussed previously - aerosol, oral, direct contact, fomites, and vector transmission. Because of occupational and public health concerns, the zoonotic risk of a particular pathogenic agent should be considered in a biosecurity risk assessment. Examples of zoonotic diseases include brucellosis, exotic Newcastle disease (END), influenza, Q fever, Hendra, Nipah, or tuberculosis. *[This illustration depicts that various animal species can transmit diseases to humans. Illustration by: Andrew Kingsbury, Iowa State University]*

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Clothing and PPE for Biosecurity

FAD PReP/NAHEMS/USDAAPHIS Biosecurity Principles USDA APHIS and CSIS

Responders need a thorough understanding of the clothing and personal protective equipment (PPE) required under the Biosecurity Plan to prevent disease transmission while visiting a premises. This section will briefly describe some of the clothing and PPE used to maintain biosecurity on premises. Always follow the specific biosecurity protocols developed for the response.

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Importance

- Pathogenic agents can be transferred via contaminated clothing
- Ask about biosecurity practices before entering animal areas
- Follow premises biosecurity protocols
 - Shower-in; shower out


FAD PReP/NAHEMS/USDAAPHIS Biosecurity Principles USDA APHIS and CSIS

Pathogenic agents can be transferred to uninfected animals via clothing. Responders must pay careful attention to their clothing including boots and outerwear, when entering and leaving premises. Before entering animal areas, ask about biosecurity procedures and make sure you understand them and comply with them. Some types of facilities (swine and poultry) may have shower-in shower-out procedures and require visitors to use clothing provided on-site.

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Outerwear

- Clean outerwear:
 - Disposable or reusable coveralls, lab coat, smock, etc.
 - Remove when leaving premises
- Wear gloves, wash hands after removing




Follow the specific biosecurity protocols developed for the site and incident. At a minimum, all responders should wear clean outerwear over street clothes when entering animal areas. Outerwear can be either disposable or reusable. Wear disposable or clean coveralls, laboratory coats, smocks, or other suitable outerwear when coming in contact with animals, their secretions, or manure. If visiting multiple facilities, be sure to have an adequate supply of clean or disposable coveralls, so a fresh pair can be used at each site. Remove outerwear when leaving a premises. Follow all cleaning and disinfection and/or disposal protocols for contaminated outerwear. Dirty items should be placed into a double plastic bag which is sealed and kept in the vehicle's "dirty" area. Wear disposable gloves, such as latex or nitrile. Hands should be washed after removing gloves. *[This is a photograph of various types of disposable outerwear and PPE. Photo source: Center for Food Security and Public Health, Iowa State University]*

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Outerwear

- Footwear:
 - Rubber boots, disposable plastic boots or other easily cleanable footwear
- Boots:
 - Remove all organic matter
 - Thoroughly disinfect with water and approved disinfectant




Wear rubber boots, other footwear that can be cleaned and disinfected, or disposable plastic boots. Remove all dirt and organic matter (mud, manure, straw, etc.) from boots and thoroughly disinfect them before entering and before leaving an animal facility. Use a bucket of water with an appropriate broad-spectrum disinfectant and a brush to disinfect your boots. *[This photo depicts responders disinfecting boots using scrub brushes and an approved disinfectant. Photo source: Gordon Harman, USDA APHIS]*

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Disposable Outerwear

- Dispose of on-site, if possible
 - Coveralls, gloves, boot covers (and disposable equipment)
 - If not disposed on-site, place in garbage bag, seal, double bag, and dispose of later




If possible, dispose of used disposable coveralls, gloves, and boot covers at the facility. Otherwise, place the items in a plastic garbage bag, seal it, and double bag it for disposal later in a designated container at a designated location. *[This photo illustrates disposal of contaminated outerwear into a plastic bag. Photo source: Andrew Kingsbury, Iowa State University.]*

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Reusable Outerwear

- May be reused after cleaning and disinfection
 - Washable coveralls
 - Rubber boots
- May need to leave at premises
- May have protocol for transporting contaminated items




Reusable outerwear may be used after proper cleaning and disinfection. If reusable outerwear is used, make sure you are familiar with all procedures for cleaning and decontamination. Examples of reusable outerwear include: washable coveralls and rubber boots. In some cases, reusable outerwear may need to be left at the premises for cleaning and disinfection. In other situations, guidance will be provided for the proper storage and transportation of contaminated outerwear removed from the site. *[This photo shows reusable outerwear and boots. Photo source: Tom Chavrolietti, Ohio Aquaculture Association]*

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PPE

- Personal Protective Equipment (PPE) purposes:
 - Protect responder from hazards
 - Prevent spread of hazards animals and locations
- PPE briefing:
 - To don, doff, clean, and disinfect PPE
 - Avoid cross-contamination



Personal Protective Equipment (PPE) refers to special clothing and equipment that places a special barrier between an individual and a hazard. In an animal health emergency, PPE serves two purposes: 1) protection of the responder against potential hazards that could result in occupational illness or injury, and 2) when appropriately used, prevention of the spread of hazards (pathogens) between animals and locations. The level of PPE protection needed will vary with the situation and the pathogenic agent(s) involved. Responders will be briefed on PPE requirements upon arrival at the Incident Command Post. Before going out to the field, thoroughly understand the protocols for donning (putting on), doffing (taking off) and cleaning and disinfecting PPE you may be required to use. Avoid cross-contamination, inadvertently spreading a pathogen to a clean area, by proper doffing and disposal. *[These responders are putting on Tyvek® suits, boots and gloves prior to having contact with animals. Photo source: Jane Galyon, Iowa State University]*

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Biosecurity and other Fomites

All personnel should take extreme caution to avoid spreading disease agents on their clothing. However, attention needs to be paid to other ways of transferring pathogens from contaminated areas to clean areas. This section will briefly describe some common fomites, and biosecurity principles and protocols to prevent disease transmission. As a reminder, fomites are inanimate objects capable of transferring disease agents.

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Vehicles

- Park vehicles away from animal areas and runoff.
- Avoid driving in manure or wastewater
- Clean vehicles between visits to production facilities
- Follow cleaning and disinfection protocols

Vehicles – passenger vehicles or animal conveyances - are often the method of disease spread from one location to another. Biosecurity protocols must be followed for all vehicles, including those used to transport response personnel between premises or within a worksite. Follow protocols developed for the response for cleaning and disinfection of vehicles and follow these general guidelines:

- Park vehicles away from animal areas and runoff;
- Avoid driving through manure or wastewater;
- Clean vehicles between visits to animal production facilities; and
- Follow the cleaning and disinfection protocols developed for the specific incident.

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Vehicles

- Designate “clean” and “dirty” areas in vehicle
 - Properly contain any contaminated clothing, equipment or supplies
 - Follow protocols for later disposal or decontamination



Designate “clean” and “dirty” storage areas in the vehicle and keep clean and dirty clothing, equipment and supplies separate. If contaminated materials cannot be decontaminated or disposed on-site, keep any contaminated supplies separated from clean supplies. Strictly follow the protocols for disposal or decontamination (cleaning and disinfection) as soon as possible. *[This photo shows a plastic bin in a separate area of the vehicle, used for storing dirty clothing. Photo source: Danelle Bickett-Weddle, Iowa State University]*

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C&D- Cleaning/Disinfection

- Two-step process:
 - Cleaning
 - Disinfection
- Items to clean and disinfect include:
 - Vehicles
 - Tools and equipment
 - Reusable clothing, reusable PPE
 - Hands

Cleaning and disinfection are physical or chemical processes to kill or remove microorganisms and are vital for disease eradication efforts. This is generally a two-step process involving cleaning to remove gross contamination, followed by the use of a disinfectant to kill remaining microorganisms. Protocols will be established for the incident. Be sure to follow all protocols. This includes properly using the disinfectant selected for this disease agent. Items which may need to be cleaned and disinfected include: vehicles, tools and equipment, reusable clothing and reusable PPE, and hands.

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C&D Vehicles

- Clean between visits to production facilities, include tires and floor mats
- Use commercial car washes with wheel-well washing
 - May need a tire spray



Clean response vehicles between visits to animal production facilities. It is best to clean the vehicle upon leaving one premises and if possible, prior to entering the next. Cleaning should include the tires and interior cab floor mats. Cover vehicle carpets with plastic floor mats. Commercial car washes with wheel well washing provide adequate exterior cleaning. In some situations, tire sprays may be needed. *[This photo shows a pickup truck undergoing cleaning procedures when exiting a premises. Photo source: Carla Huston, Mississippi State University]*

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C&D Equipment and Hands

- Equipment:
 - Select easily cleanable equipment
 - Use disposable equipment when possible
 - Clean and disinfect before leaving premises, if at all possible
- Hands:
 - Wash with antibacterial soap
 - Wash hands even if gloves are worn

For field use, select equipment that is easily disinfected (e.g., plastic vs. wooden clipboards). Keep all equipment used in the field clean. If at all possible, use disposable equipment or disinfect all equipment prior to leaving the premises. Even if equipment did not appear to come into contact with animals or their secretions, disease agents may “hitch a ride” on equipment through environmental contamination. Clean and disinfect all equipment, or keep it properly contained in a bag for later cleaning/disposal, before taking it off the premises. And as a reminder, thoroughly wash hands with antibacterial soap when entering and leaving premises. Wearing disposable gloves is not a substitute for hand washing. Hands should be washed even if gloves are worn.

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Prevent Contamination

- Avoid walking through contaminated areas
- Avoid direct contact with contaminated items
- Protect injured skin
- Stay upwind of airborne contaminants
- Do not carry personal items into contaminated areas

The next two slides cover principles to prevent contamination. Preventing contamination minimizes worker exposure to hazards and prevents cross contamination of areas and of test samples. General measures to preventing contamination include:
 Avoid walking through known contaminated areas;
 Avoid direct contact with contaminated items, surfaces and vehicles;
 Protect injured skin from contaminants;
 Stay upwind of airborne contaminants; and
 Do not carry personal items (e.g., cigarettes, gum, food, drink, etc.) into contaminated areas.

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Prevent Contamination

- For equipment:
 - Limit time vehicles and equipment are in contaminated area
- When taking samples:
 - Set contaminated samples and tools in clean bag before placing on clean surface
 - Bag sample containers before removing from site

Similar precautions should be taken to minimize contamination of equipment and samples removed from the site. For equipment, limit the exposure and contact time heavy equipment and vehicles have with contaminated areas. When obtaining samples from a contaminated site, set contaminated samples and tools inside clean plastic bags before placing them on non-contaminated equipment and/or vehicles for transportation to decontamination stations. Decontaminate the bag containing the samples, and if possible double bag them, before removing them from the site and carrying them to a clean area.

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For More Information

- FAD PReP/NAHEMS Guidelines & SOP: Biosecurity (2013)
 - http://www.aphis.usda.gov/animal_health/emergency_management/
- Biosecurity web-based training module
 - <http://naherc.sws.iastate.edu/>

More details can be obtained from the sources listed on the slide, available on the USDA website (http://www.aphis.usda.gov/animal_health/emergency_management/) and the NAHERC Training Site (<http://naherc.sws.iastate.edu/>).

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Guidelines Content

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