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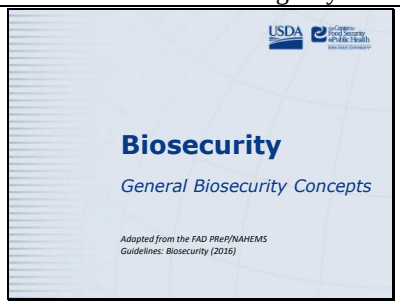

Biosecurity is a cornerstone of livestock production systems (including poultry production) to maintain food safety and security, protect the environment, and facilitate continuity of business by protecting animals and animal products. In addition to the daily protocols to protect the health of livestock populations, biosecurity is crucial in containing disease in a foreign animal disease (FAD) outbreak. Should the FAD also be zoonotic, biosecurity is necessary to protect public health. Understanding the risks of disease transmission and the necessary preventive procedures will be essential during the response. [This information was derived from the *Foreign Animal Disease Preparedness and Response (FAD PReP)/National Animal Health Emergency Management System (NAHEMS) Guidelines: Biosecurity (2016)*].

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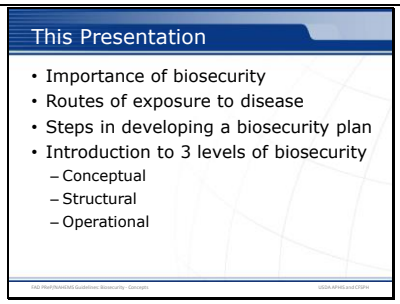

This presentation is intended to provide a general understanding of biosecurity concepts and biosecurity measures that can be implemented in routine production practices for domestic livestock and poultry, as well as in the face of a foreign animal disease (FAD) incident. This presentation addresses the following topics: the importance of biosecurity in livestock production management, the potential routes of exposure to disease, the three steps in developing a biosecurity plan, and an introduction to the three levels of biosecurity – conceptual, structural, and operational biosecurity. Additional PowerPoint presentations discussing these and other biosecurity topics are also available in this series.

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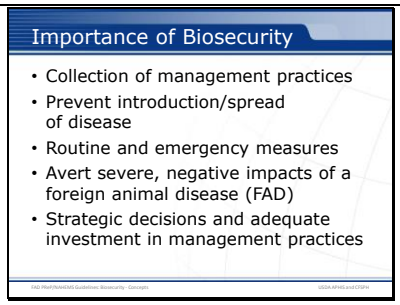

Biosecurity can be defined as a collection of measures or management practices intended to protect animals or humans against the introduction and spread of disease or harmful biological agents. Biosecurity is incorporated into the daily, routine management protocols to prevent the introduction of disease into naïve livestock populations. Biosecurity measures are crucial to prevent the spread of disease in an animal health emergency, such as an FAD. During an FAD outbreak, these measures help avert the profound, cascading, and long lasting negative impact on agriculture and the general economy of the United States. Biosecurity concepts involve strategic decisions, adequate investment, and management practices, as well as movements of livestock, equipment, and personnel. Training, supervision, and accountability of personnel are necessary.

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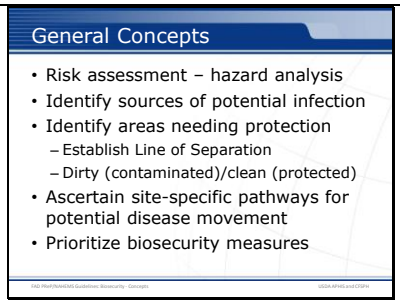

Before developing and implementing biosecurity measures, an individual site risk assessment or hazard analysis should be performed. The assessment and analysis will consider the health status and species of the livestock. The management and site arrangements of animals raised indoors versus animals raised outdoors will require individual consideration and will guide the selection of biosecurity protocols. It is necessary to identify sources/areas of potential contamination and areas that need to be protected from contamination. A Line of Separation is established - imagined or physical – separating dirty (potential sources of infection) from clean areas (non-infected). Specific pathways which potentially enable a disease to move onto, off of, or within a facility are ascertained, considering routes of disease exposure. Biosecurity measures are prioritized based on risk, probability of occurrence, ease/cost of implementation, and consequences (economic and non-economic).

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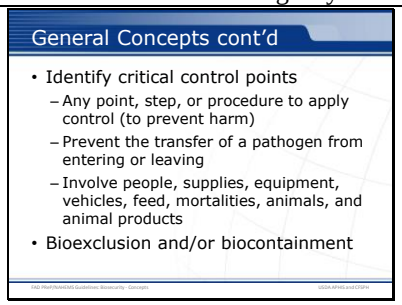

As part of this site-specific hazard analysis, critical control points should be identified in movement and work pathways. A critical control point is a point, step, or procedure where control can be applied to prevent the transfer of a disease agent (or in a more broad interpretation, to prevent harm). Points where the pathogen can be prevented from entering (or leaving) a premises, facility, or a barn unit (or perhaps all three) are identified as critical control points. Critical control points involve people, supplies and equipment, vehicles, feed, mortalities, and animals/animal products. The goal is to prevent the transfer of a disease agent across a specific control point, whether the intention is to keep disease out (bioexclusion), or keep disease in (biocontainment).

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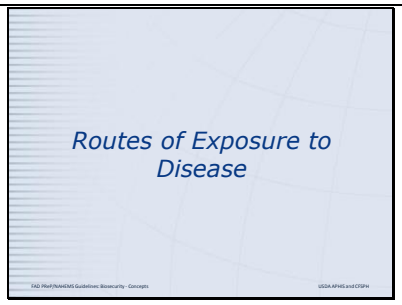

In order to develop a comprehensive, effective biosecurity plan, it is necessary to understand how each disease of concern is spread and how susceptible animals are exposed. Each disease has transmission pathways based on the nature of the pathogenic agent. Diseases may be spread between animals, and between animals and humans (zoonotic disease), in a variety of ways. A mitigating action which prevents the spread of one disease may not be effective against another. While direct contact may be the most obvious route of exposure and the easiest to prevent, exposure by indirect means may provide the highest risk. Indirect exposure may occur through the environment or surfaces contaminated with secretions or infective materials. It should be emphasized that disease agents can be carried by animals without signs of infection.

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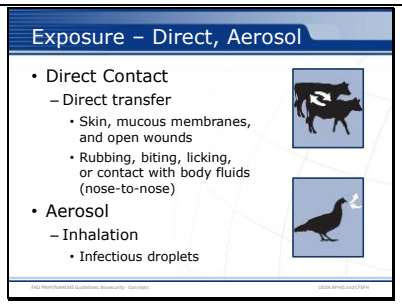
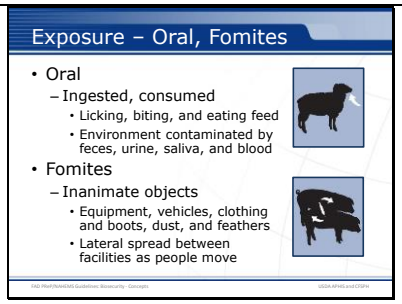


Direct exposure occurs when a susceptible animal physically contacts an infected animal. The disease agent is transferred to the skin, mucous membranes, or open wound of a susceptible animal through rubbing, biting, licking, or by contact with the blood, urine, milk, saliva, nasal secretions, or body lesions of an infected animal. Exposure may result from nose-to-nose contact. Exposure to some diseases occurs with the transfer of disease agents during breeding, or from dam to offspring during gestation, birth, and/or nursing.

Aerosol exposure occurs when infectious droplets containing pathogenic agents from an infected animal are inhaled by a susceptible animal, or make contact with the mucous membranes. Pathogenic agents in aerosol droplets that are spread through the air may be from respiratory secretions (sneeze or cough), urine, birthing fluids, or from feces of infected animals, as examples.

[These two illustrations depict disease exposure through direct contact and aerosol routes. Illustration by: Dani Ausen, Iowa State University]

Slide 8

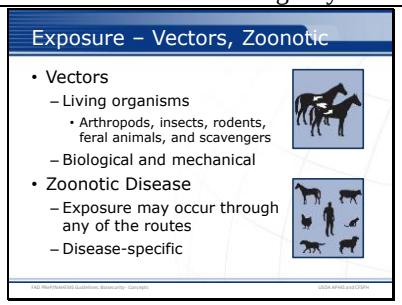


Oral exposure may occur when the disease agent is ingested by a susceptible animal licking or biting an infected animal. Feces, urine, saliva, and other secretions containing disease agents can contaminate feed, water, or objects in the environment that animals lick or chew, such as feed bunks, equipment, fencing, water troughs, salt and mineral blocks, etc.

Fomites are inanimate objects capable of transferring disease agents from an infected animal to a susceptible one. Shovels and other tools, bowls or buckets, medical equipment such as needles, vehicles and trailers, and animal cargo areas contaminated with infectious disease agents can leave pathogens behind in the environment. The potential movement of disease agents by fomites such as a plume of dust particles, on wind-blown feathers, and by feed and feed containers has been investigated. Historically in disease outbreaks, lateral spread through the movements of people with contaminated outerwear, equipment and vehicles has been high risk.

[These two illustrations depict disease exposure through oral and fomite routes. Illustration by: Dani Ausen, Iowa State University]

Slide 9



Vectors are a route of exposure to some diseases. Vectors can be described as any living organism, including, but not limited to, arthropods, insects, rodents, feral animals, and scavengers that can carry disease causing agents from an infected animal to a susceptible animal. Two types of vectors are recognized, biological and mechanical.

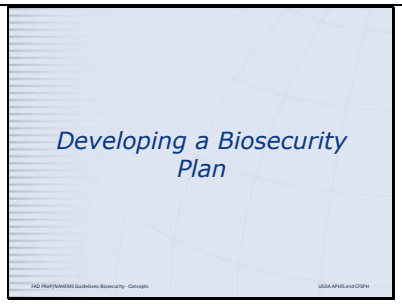
A **biological vector** transfers a disease agent from an infected animal to a susceptible animal after the disease agent has undergone some part of its life cycle within the vector. The vector may acquire the agent from an infected animal through a blood meal. The agent replicates or develops within 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.

A **mechanical vector** transfers a disease agent to a susceptible animal via external body parts of the vector, such as on the fur or feet. Many species of flies serve as mechanical vectors.

Zoonotic diseases are transmissible between animals and humans. Exposure may occur through any of the five methods described above, depending on the disease. The biosecurity assessment should consider the risk of zoonotic disease to personnel and the public if the disease agent is not contained.

[These two illustrations depict disease exposure through vectors and zoonotic disease exposure through any of the previously described routes. Illustration by: Dani Ausen, Iowa State University]

Slide 10



The process of developing a biosecurity plan focused on bioexclusion and/or biocontainment involves similar concepts and considerations. An assessment of the existing situation needs to be conducted, evaluating the disease agent(s) and the routes of transmission, the physical facility, and options for mitigation. To develop a biosecurity plan, consider a three step process.

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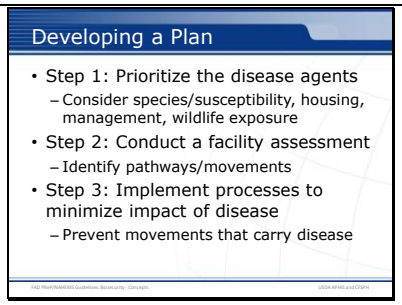

Step 1: Identify and prioritize the disease agents of greatest concern. For example, disease agents will be based on species, susceptibility, age, and production stage of the animals. The risk of exposure may depend on management, type of housing, and potential contact with wild or feral animals.

Step 2: Conduct an assessment of the facility. Identify how disease agents may be transferred from one location to another - allowing exposure of susceptible animals to contaminants from outside the facility, or allowing the pathogen to escape containment or quarantine. In this step, the critical control points are recognized, so that mitigation measures can be implemented.

Step 3: Implement processes and procedures that eliminate, prevent, or minimize the potential impact of animal disease by preventing movement of entities that may carry disease, or that inadvertently transport the disease agent. Strategic actions need to mitigate the risk of movements of personnel, service crews, visitors, wild and feral animals, and pets/domesticated animals, as well as any vehicles, and the drivers of those vehicles. Implement steps at critical control points for the movement of equipment, manure, and animal carcasses, in addition to deliveries that may transport pathogens, either in the product being delivered (feed, bedding), or on the delivery vehicle that may be contaminated from contact with other animals or premises.

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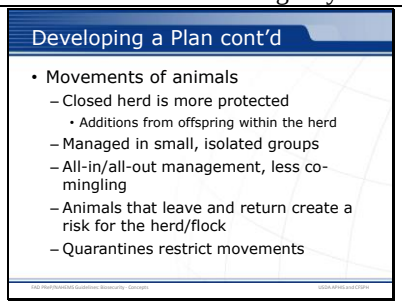

Importantly, consider the movements of the animals themselves. A closed herd with herd additions coming from offspring within the herd, managed in small groups and isolated from others, will be more protected than a large group allowed to co-mingle. All-in/all-out management with less co-mingling between groups minimizes exposure to disease. Animals that leave the premise and are allowed to return pose a risk to the animals at home. Exposure to disease elsewhere creates an epidemiological exposure for the herd/flock at home when these animals return. A quarantine imposed on a herd/flock prevents movements of those quarantined animals.

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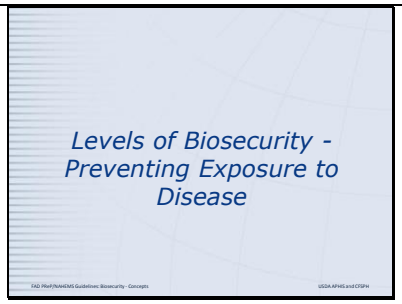
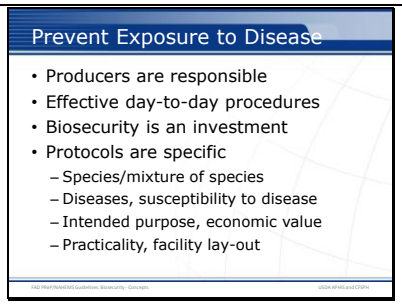


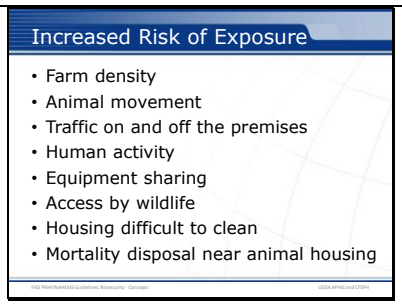
The scope of implementation will vary and depends on the individual livestock facility, the risk/benefit, and practicality of the measure. The types of biosecurity measures can be divided into three levels – conceptual, structural and operational. A biosecurity measure is only effective if it is practiced correctly and consistently. To emphasize, correctly and consistently are key concepts.

Slide 14



Owners and producers are responsible for protecting their animals from disease. Ideally, day-to-day procedures should be stringent enough that in the face of a disease outbreak, no enhancements would be necessary. Practically, this may not be feasible. If biosecurity is considered an investment in the protection of livestock health, the cost of this investment is weighed by each producer against the cost of the consequences. Consequences may not only be economic but, in some cases, may include significant loss of genetics. Biosecurity protocols will be based on the species and/or mixture of species to be protected, types of diseases and the susceptibility of the animals to those diseases, the intended purpose and economic value of the animals, practicality, and facility lay-out.

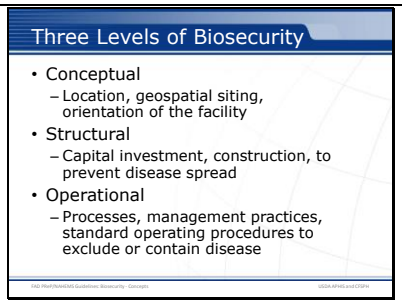
Slide 15



The increased risk of disease is associated with:

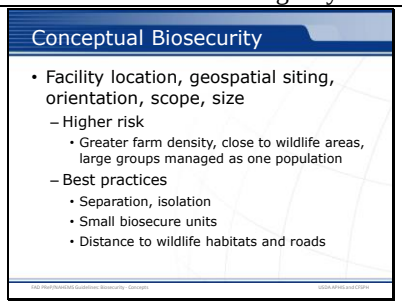
- Farm density – other production facilities within a few miles;
- Animal movement – especially if animals leave, then return to the premises;
- Traffic on and off the premises – vehicles (feed, milk, garbage, rendering) and drivers;
- Human activity – employees, service personnel, visitors;
- Equipment sharing – between facilities, or between animal groups within the facility;
- Access by wildlife – such as insects, birds, rodents, feral animals;
- Animal housing construction that is difficult to clean and disinfect; and
- Mortalities disposed near animal housing.

Slide 16



In general, there are three levels of biosecurity:
Conceptual biosecurity relates to the location, geospatial siting, and orientation of the facility. It also includes the scope and size of animal production units and complexes.
Structural biosecurity refers to the capital investment that enhances the ability to prevent disease spread. It includes the physical design, construction, and maintenance of a facility which help prevent the transfer or aid in the containment of disease.
Operational biosecurity refers to those processes and protocols, management practices, or standard operating procedures implemented to exclude or contain disease. Operational biosecurity pertains to procedures conducted on the premises, as well as the management of people, animals, supplies, equipment, vehicles, and other items related to disease control.

Slide 17



As described previously, conceptual biosecurity relates to the location, geospatial siting and orientation of the facility. It also includes the scope and size of animal production units and complexes. The greater the farm density, or the closer facilities are in proximity, and/or the closer facilities are to areas that attract wildlife, the higher the risk of disease introduction. As the number of animals managed as one population increases, the number of animals at risk and the consequences from one introduction of disease also increases.

Best practices include:

- Separation/isolation with enhanced distance to neighboring livestock/livestock facilities;
- Conceptual designs to manage smaller groups of animals as biosecure units;
- Enhanced distance to wildlife areas (ponds, grassy habitats, crops that may serve as wildlife feed); and
- Isolation from roads to avoid heavy volume of traffic nearby.

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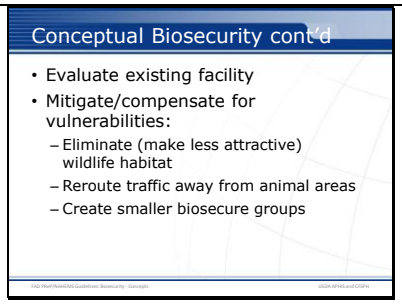

A producer's evaluation of the facility can identify existing weaknesses or deficiencies that may elevate the risk of exposure, render the facility more vulnerable, and enhance the magnitude of consequences. These may need to be mitigated with structural and/or operational biosecurity measures. For example, it may be possible to eliminate wildlife habitat or alter the areas surrounding a facility to be less attractive to wildlife. It may be impossible to close or reroute traffic on public roads, but it may be possible to reroute traffic within the facility to avoid animal areas. Operational measures may involve to dividing a large herd into smaller isolated biosecure groups.

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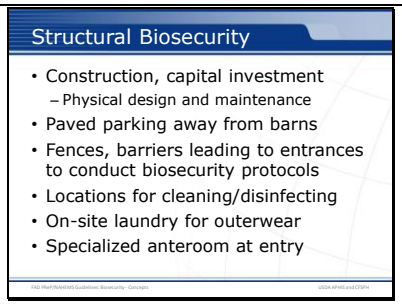
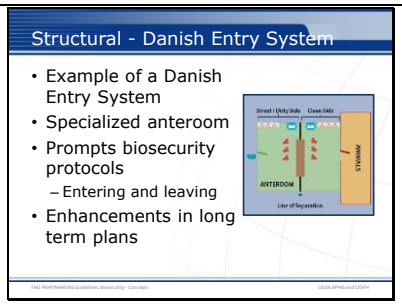


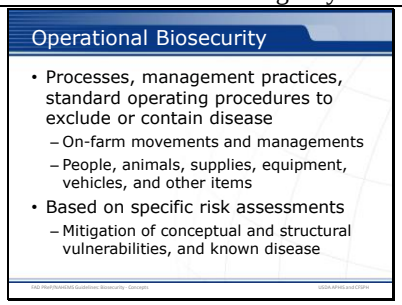
Again, structural biosecurity refers to the construction, physical design, and maintenance of a facility that enhances the ability to prevent disease introduction and spread. This may include a paved parking area away from animal housing, and fences, barriers, or gates that direct personnel and visitors to the appropriate entrance where biosecurity protocols are implemented. Locations that facilitate the cleaning and disinfection of all equipment and vehicles entering/exiting the premises, and on-site laundry so that personnel outerwear is maintained on-site, and specialized anterooms for entry into an animal building that prompts biosecurity protocols are examples of structural biosecurity measures.

Slide 20



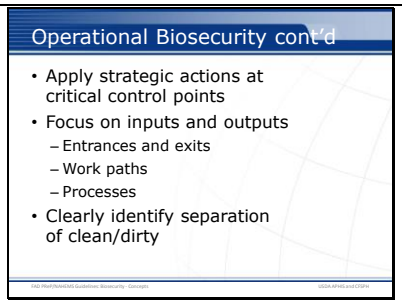
This illustration depicts an example of a Danish Entry System, a specialized anteroom for entry into an animal building that serves to house the visible Line of Separation. With this type of anteroom, personnel enter from the left and are prompted to perform the appropriate biosecurity protocols prior to entering the animal building on the right. A bench is used as the physical Line of Separation; street clothes remain on the left, handwashing is performed, the bench/Line is crossed, and site-specific biosecurity attire is donned on the right before proceeding into the animal area. Similar procedures are followed when exiting. Producers should include enhancing structural biosecurity in their long term capital investment plans. More details about the Danish Entry System, and more examples of structural biosecurity are discussed in the *FAD PReP/NAHEMS Guidelines: Biosecurity*. *[This example of a Danish Entry System is adapted from http://www.inspection.gc.ca/animals/terrestrial-animals/biosecurity/standards-and-principles/general-producer-guide/eng/1398640321596/1398640379048?chap=9. Illustration by Sydney Heppner, Iowa State University]*

Slide 21



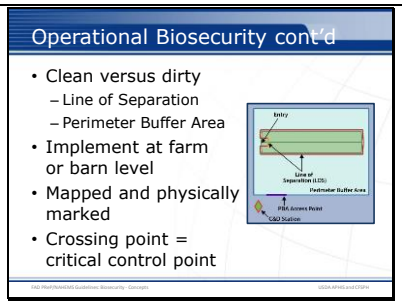
Operational biosecurity refers to those processes and protocols, management practices, or standard operating procedures implemented to exclude or contain disease during movements. Operational biosecurity pertains to procedures conducted on the premises, as well as the management of people, animals, supplies, equipment, vehicles, and other items related to disease control. Procedures should be chosen based on risk assessment of the individual situation, which may involve mitigating vulnerabilities in the conceptual or structural biosecurity of the premises, as well as known disease in the area. A specific combination of measures should be chosen based on the circumstances of the site and of the operation.

Slide 22



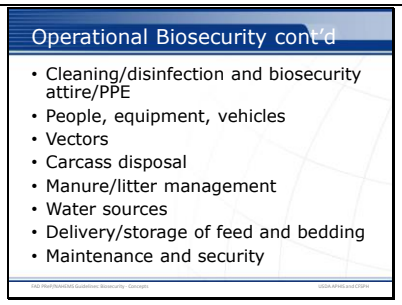
Evaluation to determine the most effective operational biosecurity procedures is based on critical control points, focusing on inputs and outputs. Strategic controls are applied to prevent the transfer of a disease agent. Control points may be entrances to/exits from the clean area of the premises (movements of inputs/outputs), work pathways, or related processes where biosecurity protocols, such as cleaning and disinfection, movement controls, and employment restrictions help to mitigate disease exposure. One (or more) clearly identified levels of separation between the area considered clean (non-infected, protected) and the area considered dirty (potential source of infection) are differentiated. And as a reminder, for biosecurity purposes, the area where the non-infected animals are located is considered clean. The source of potential disease contamination is considered dirty.

Slide 23



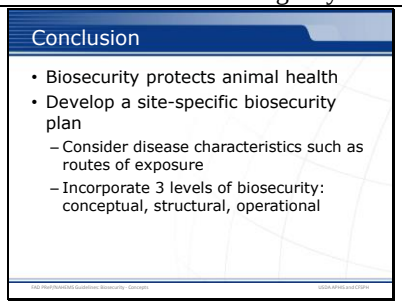
A Line of Separation distinguishing clean from dirty is established. On some operations, a Perimeter Buffer Area places additional separation between the non-contaminated and contaminated space, to reduce pathogen load in the buffer environment. Separation may be implemented at the farm or barn level, and should be visually identified on a map and physically marked for all present at the facility. A point where movements cross the Line of Separation is a critical control point and serves as a controlled access point. The image on the right is a simplified example for animals raised indoors. It illustrates a Line of Separation (red) defined by the walls of the barn, with a Perimeter Buffer Area (light green) around the animal building. Biosecurity protocols would be enforced at the entry (orange) for crossing the controlled access point at the Line of Separation, and prior to that, there may be sanitation protocols for entry into the Perimeter Buffer Area. A C&D Station is positioned at the PBA Access Point (purple). *[This image is an example of a Perimeter Buffer Area and a Line of Separation protecting one housing unit. Illustration by: Sydney Heppner, Iowa State University]*

Slide 24



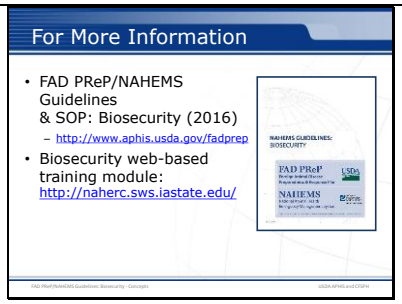
Operational measures in most biosecurity plans include cleaning and disinfection, as well as the use of biosecurity attire or personal protective equipment to reduce the chance of fomites transferring a disease pathogen. In addition to the movement of people, equipment, and vehicles, operational measures also involve mitigating disease spread by vectors, the disposal of carcasses, the management of manure/litter, the source of water supplies, and by the delivery and storage of supplies such as feed and bedding. Operational measures can dictate how the facility is routinely cleaned and disinfected to reduce environmental contamination, and how areas are secured to prevent unauthorized access. For more details and examples of operational measures, refer to the *FAD PReP/NAHEMS Guidelines: Biosecurity*, and see the PowerPoint presentation in this series titled "Operational Biosecurity Measures."

Slide 25



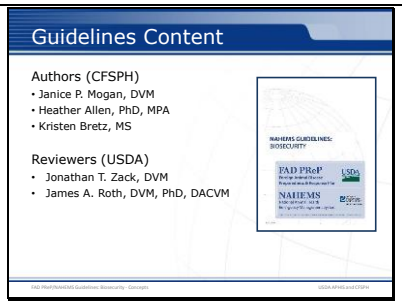
In conclusion, be aware that biosecurity is crucial to the protection of animal health–for bioexclusion or biocontainment–to prevent healthy animals from exposure to disease. Biosecurity plans need to be specific for the individual site. Consider the characteristics of the diseases that pose a risk, such as the route of possible exposure, and incorporate the three levels of biosecurity into the plan – conceptual, structural, and operational.

Slide 26



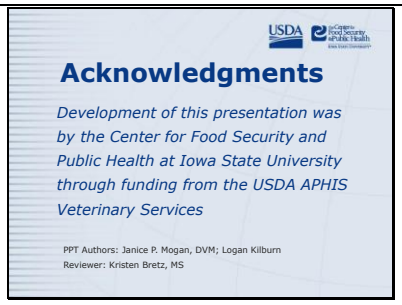
More details can be obtained from the sources listed on the slide, available on the USDA website (*http://www.aphis.usda.gov/fadprep*) and the National Animal Health Emergency Response Corps (NAHERC) Training Site (*http://naherc.sws.iastate.edu/).*

Slide 27



The print version of the Guidelines document is an excellent source for more detailed information. This slide acknowledges the authors and reviewers of the Guidelines document. It can be accessed at *http://www.aphis.usda.gov/fadprep*.

Slide 28



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