

Oral and Fomite Transmission-Beef

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Practical Applications for Managing Biological Risks

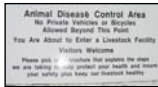
Oral and Fomite Transmission
Beef Producers

This presentation will review some key points of biological risk management, general prevention steps that can be applied to every farm to decrease the risk of disease introduction and spread, and specific steps to reduce the chance of oral transmission on farm.

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Biological Risk Management (BRM)

- Overall process of awareness education, evaluation, and management
- Designed to improve infection/disease control
 - Foreign and domestic diseases
- Provide tools to minimize risk



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Biological risk management is a term used to describe the overall process of evaluating a farm or an animal housing facility based on the risk of infectious disease entry and spread. BRM is designed to help livestock producers understand the need for risk management strategies not only for foreign animal disease threats but domestic diseases as well. Biological risk management is designed to help assess the potential of an infectious disease entering and spreading within a facility and provide the tools to minimize the risk. (Photo courtesy of: DB Weddle)

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Biological Risk Management (BRM)

- Disease risk cannot be totally eliminated
 - Animal, its environment
 - Decrease exposure
 - Infectious agent interactions
- Minimize threat to animals and humans
- No one-size-fits-all answer



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BRM recognizes that disease risk cannot be eliminated, but that the risk can be managed through effective control measures. As animal caretakers, it is our duty to be knowledgeable of the animal and its environment to minimize the risk of disease and keep the people working with them safe. It may seem hopeless to try to completely eliminate exposure to infectious diseases, especially diseases that are always present (endemic). For nearly all diseases there is a relationship between dose and severity. A threshold dose is required to establish infection, and low doses may cause subclinical or only mild infections. For endemic diseases, reducing the dose of infectious agent the animal is exposed to can positively affect the economic impact and help justify the cost of implementing BRM. Many different solutions exist and because all cattle facilities are different, there is not a one-size-fits-all answer. Photo depicts cattle in a pasture and the owner walking through them monitoring for illness (courtesy of USDA image #96cs0511, taken by Bill Tarpennig).

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Routes of Transmission

- Spread of disease agents
 - Animal ↔ animal
 - Animal ↔ human
- Different modes of transmission
 - Aerosol
 - Direct contact
 - Fomite
 - Oral
 - Vector-borne
 - Zoonotic



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The approach that was taken in the development of the biological risk management tools was to look at diseases based on their route of transmission to the animal, or human in the case of zoonotic diseases. Disease agents can be spread from animal to animal, or animal to human, through a variety of transmission modes. Many infectious agents can be transmitted by more than one route of infection. This presentation will focus on how to prevent direct contact transmission between animals and from animals to humans. This photo shows cow-calf pairs being herded to another pasture in Oregon (courtesy of USDA, image # 95cs0779, taken by Doug Wilson).

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Oral Transmission

- Consumption of contaminated feed, water
 - Feces, urine, saliva
 - Other contaminants (ruminant protein)
- Licking/chewing contaminated environment



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Pathogenic agents can also be transmitted to animals or humans **orally** through consumption of contaminated feed, water or licking/chewing on contaminated environmental objects. Feed and water contaminated with feces, urine or saliva are frequently the cause of oral transmission of disease agents. However, feed and water can be contaminated with other infectious agents as well such as ruminant protein in ruminant feed. This photo depicts Hereford calves eating silage at a wooden feed bunk, a potential source of bird, rodent, or dog contamination (photo source USDA).

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Selected Diseases Spread Orally

Foreign diseases <ul style="list-style-type: none"> • FMD • Melioidosis 	Present in U.S. <ul style="list-style-type: none"> • Anthrax • BVD • Cryptosporidiosis • <i>E. coli</i> • Johne's • Listeriosis • Rotavirus • <i>Salmonella</i>
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There are many diseases transmitted by the oral route, both diseases that are foreign animal diseases (FADs) and those that are present in the US (endemic). Some examples of the foreign animal diseases include foot and mouth disease (FMD) and melioidosis (pronounced: MEE-lee-oyd-OH-sis). Examples of the diseases that are already present in the US include anthrax, bovine viral diarrhea (BVD), cryptosporidiosis, *E. coli*, Johne's, listeriosis (circling disease), rotavirus, and *Salmonella*. The main point to drive home is that they are all transmitted by the same route and prevention practices aimed at one will protect against others. For a complete listing of all diseases transmitted by the aerosol route, please refer to the Bovine Routes of Transmission Handout- Oral.

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Fomite Transmission

- Contaminated inanimate object
- Carries pathogens to other animals
 - Balling guns, feed, water buckets
- Traffic
 - Vehicle, trailer, humans



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A component of oral disease transmission are fomites. A **fomite** is an inanimate object that can carry pathogenic agents from one susceptible animal to another. Examples of fomites include contaminated balling guns (top photo courtesy of DB Weddle, ISU), clothing, feed or water buckets (middle photo courtesy of DB Weddle, ISU), and shovels. These items must be managed as fomites but they will transmit disease when they have direct contact with a susceptible animal. **Traffic transmission** is a type of fomite transmission in which a vehicle, trailer, or human spreads organic material to another location, like the pickup and trailer pictured here (courtesy of Bryan Buss, ISU).

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Routes of Transmission

- Apply to all infectious agents
- Animal must be exposed to develop disease
- Understand different routes of transmission = Gain control
- Risk areas must be identified
 - Design protocols to minimize exposure

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The approach that was taken in the development of these biological risk management tools was to look at diseases based on their route of transmission to the animal, or human in the case of zoonotic diseases. An advantage of minimizing risk by examining routes of transmission is that it will also help protect against new or unanticipated infectious agents. While disease agents and the infections they produce vary, they all have one thing in common: the animal must be exposed to them to develop disease. Once it is understood that different diseases can be acquired orally and others are breathed in via aerosol transmission, it is easier to gain control over them. This classification system is effective and easy to understand without requiring knowledge about a wide range of diseases. From a management standpoint, it may be easier to identify risk areas, such as fomites, and then design protocols to minimize exposure.

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Disease Transmission

- Animals may not exhibit obvious clinical signs of disease
- Awareness of all routes of transmission is essential
 - Develop strategy to minimize disease risk for livestock operation



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It is important to remember that disease transmission can occur without animals exhibiting obvious clinical signs of disease. That is why awareness of the various routes of transmission becomes so essential when assessing and developing a strategy to minimize the risk of disease for a facility or operation. The photo shows a calf lying in a pasture (photo source USDA).

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General Prevention Steps

Overview

- Farm perimeter
- Animal identification
- Animal health
- Sick/dead animals
- Isolation/quarantine
- Supply handling
- Neonatal management

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There are many general prevention steps that every farm could implement that would help prevent against a variety of diseases that are transmitted in various ways. Things such as knowing what is in the area of your farm perimeter- farms, neighboring livestock, wildlife; individual animal identification, animal health protocols, recognizing and dealing with sick and dead animals, isolation/quarantine, supply handling, and neonatal management. This next section will provide some general prevention recommendations for those areas.

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General Prevention Steps

- Limit contact with animals
 - Neighbor's livestock
 - Wildlife, birds
 - Roaming cats, dogs
- Maintain fences
- Establish biosecurity protocols for delivery vehicles, personnel
- Lock gates



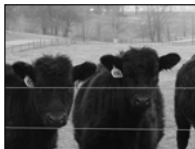
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Limit contact with animals that may present a disease risk by coordinating with your neighbors to avoid fence line contact between herds. Prevent cats and dogs from roaming between farms. By maintaining fences (repairing/replacing posts, tightening wires), you minimize the risk of animals escaping, or other animals entering, and mixing with other livestock or wildlife species, which increases their risk of disease exposure. You should establish biosecurity protocols for delivery vehicles and personnel to follow on your farm. Gates are installed as a barrier to human entry and should be locked to prevent animal contact and subsequent disease exposure. Photo courtesy of DB Weddle, ISU.

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General Prevention

- Identify individual animals
- Important for:
 - Communicating health status
 - Treatment needs
 - Location on farm
 - Record keeping



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If more than one person works on an operation, individual animal identification is imperative for proper communication of health status, treatment needs, antibiotic withdrawal/residue prevention status, and location on farm. Individual animal identification is imperative to proper record keeping (vaccinations, treatments, pregnancy status) which is an integral part of managing animals and minimizing disease risk on farm. Keeping treatment records is an integral part of minimizing disease risk on farm because protocols can be tracked over time with your veterinarian and used to determine whether things are working in various disease situations. If these black Angus heifers did not have identification tags in their ears, it would be hard to communicate health status to someone else because they all look alike (photo source: DB Weddle, ISU).

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General Prevention Steps

- Keep health records on every animal
- Review vaccination and treatment programs
 - Annually, bi-annually
 - Protocol versus actual
- Investigate unusual signs, unresponsive cases
 - Neurologic, downers, sudden death



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To monitor health status, it is imperative to keep health records on every animal. There are many computer programs out there that can simplify this for producers as the photo depicts (courtesy of Dale Moore, UC Davis VMTRC). It is important to work with your clients to review treatment and vaccination records so alterations can be made to the animal health protocols on farm; this will also help ensure what you think is happening is actually happening. Producers should work with their veterinarian to investigate those animals that present with unusual symptoms or are unresponsive to treatment, especially neurologic cases, downers and those that die suddenly.

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General Prevention Steps

- Train farm personnel to report sick animals
 - Inspect animals daily
 - Clean equipment, boots, clothing
- Euthanize terminally ill animals promptly and appropriately
 - Removed or rendered
- Perform necropsy on animals that died from unknown causes



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Educate all employees on how to recognize sick animals and have a reporting system so that treatment decisions can be made or the veterinarian can be contacted. It is important to clean any equipment, boots, clothing that is used between groups of animals with differing health status. Animals that are not going to recover can serve as a reservoir for many disease organisms and should be euthanized humanely and in a timely manner. Dead animals can also serve as a reservoir for many disease organisms and should be promptly removed from the operation. Dead animals need to be rendered, composted or buried so predators, wild birds, etc do not spread disease. Unusual diseases may not present in a manner you are used to, so have a veterinarian necropsy those odd cases to help identify a potentially infectious disease before it becomes widespread on your facility. Photo depicts a steer being necropsied by veterinary students at a feed yard (courtesy of Dan Thomson, KSU).

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General Prevention

- Isolate ill animals immediately
 - No shared ventilation, direct contact with other animals
- Quarantine newly introduced animals
 - New purchases, returning animals
- Time determined with veterinarian
- Test for key diseases before placing with rest of herd

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Cattle that are identified as ill should be removed from the rest of the herd immediately and placed in an isolation area where ventilation and direct contact are not shared with other animals in order to minimize the risk of disease spread. Before taking animals out of isolation, it is a good biological management plan to test them for key diseases (determined together with your herd veterinarian) and make sure they are not harboring diseases that could be introduced into the home herd. Newly introduced animals may be carrying diseases that your home herd is not immune to, so quarantining them for a period of time (determined together with your herd veterinarian) in an area that does not share ventilation, feed/water, and other equipment with the rest of the herd is essential to minimize disease introduction to your operation. Show cattle/calves that have been away from the farm and potentially exposed to disease causing organisms that they, or their herd mates, are not immune to should be treated like a newly introduced animal.

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General Prevention Steps




- Store non-refrigerated vaccines and antibiotics out of sunlight as it can deactivate them
- Monitor refrigeration temperature monthly
 - Ideal temp 36-46°F
- Restrict access to medication to only properly trained personnel



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Sunlight can deactivate vaccines resulting in inadequate protection; it can also reduce effective treatment by rendering antibiotics ineffective. When using these in your animals, make sure you read the label and store them properly. Vaccines and medicines that need to be refrigerated are susceptible to changes in temperature and may not be effective if they get too warm (greater than 46 degrees Fahrenheit) or too cold/frozen (less than 36 degrees Fahrenheit); monitoring your refrigerator at least monthly can help ensure the products are adequately stored. Work with your veterinarian to teach proper handling procedures to all people who routinely deal with vaccines and medicine and restrict access to only trained personnel. The photo depicts a refrigerator with a thermometer- purchased for less than \$3 at a large retail store (photo courtesy of DB Weddle, ISU).

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S l i d e 1 7	<h3>General Prevention Steps</h3> <ul style="list-style-type: none">• Ensure adequate ingestion of disease-free colostrum in first 6 hours of life• Prevent contact with older calves, contaminated environments  <p><small>Center for Food Security and Public Health Iowa State University 2006</small></p>	<p>Adequate ingestion of colostrum is the most important consideration for calf's resistance to disease and all calves should receive colostrum within 6 hours of birth. A calf's immune system depends on the antibodies in colostrum. After 6 hours of life, the calf's ability to absorb antibodies from colostrum diminishes. Once a calf is born, subsequent milk production in the cow will dilute colostrum and therefore require the calf to consume more for maximum antibody absorption and immune function. Another good practice is to prevent contact of the neonate with older animals and also contaminated environments. This will decrease the pathogen load to the newborn and give the colostrum the ability to provide protection. (Photo courtesy of USDA, image # 95cs0931, taken by Fred S. White).</p>
S l i d e 1 8	<h3>Oral and Fomite Control</h3>	<p>Now that we have discussed some general prevention steps, let us look specifically at oral and fomite transmission and control measures you can apply on your beef operation to minimize disease spread.</p>
S l i d e 1 9	<h3>Oral, Fomite</h3> <ul style="list-style-type: none">• Basic prevention steps involve:<ul style="list-style-type: none">- Isolating sick animals- Keeping feed and water clean- Managing manure- Keeping equipment clean<ul style="list-style-type: none">• Feeding, treatment, delivery trucks <p><small>Center for Food Security and Public Health Iowa State University 2006</small></p>	<p>There are various prevention steps that can help ensure oral and fomite transmission are minimized, and this presentation will discuss these. One essential step in prevention is to isolate all sick animals immediately so that they do not contact other susceptible animals. Keeping feed and water clean by minimizing fecal and urine contamination is extremely important. Another is to manage animal manure so that it does not contaminate young stock areas or contaminate grazing areas. Finally, keep your equipment clean- feeding, treatment equipment and delivery trucks especially. These basic steps will go a long way in preventing oral and fomite disease transmission.</p>
S l i d e 2 0	<h3>Isolation</h3> <ul style="list-style-type: none">• Diarrheal diseases spread organisms• Separation is essential to minimize spread• Separate feeding and watering equipment  <p><small>Center for Food Security and Public Health Iowa State University 2006</small></p>	<p>Isolation and quarantine were discussed under general prevention, so we will not cover that in detail here. For diarrheal diseases (<i>Salmonella</i>, crypto, rotavirus), animals shed thousands, even millions of organisms into the environment and should be separated from susceptible animals. Separate equipment for feeding and watering are important to minimize disease spread. The animal in this photo should be isolated so as not to expose the other calves; photo courtesy of Pioneer Hybrid International.</p>
S l i d e 2 1	<h3>Feed</h3> <ul style="list-style-type: none">• Do not step into feedbunks with contaminated boots<ul style="list-style-type: none">- Install "man-passes"• Protect feed from fecal and urine contamination• Examine feed for contaminants, quality<ul style="list-style-type: none">- Manure, mold, carcasses• Monitor feed tags, deliveries  <p><small>Center for Food Security and Public Health Iowa State University 2006</small></p>	<p>Feed and water can become contaminated with feces and urine if not properly handled both before and after feeding. Do not allow people to step into feedbunks with manure on their boots – install man-passes at the end of feedbunks allow entry/exit. Feed should be offered in troughs or mangers, but protected in such a way so feces and urine cannot contaminate it, as pictured here (courtesy of Bryan Buss, ISU). Feed stuffs should be examined routinely for contaminants such as manure, mold, or foreign material (carcasses during ensiling), and overall quality. Ruminant protein is a contaminate and should not be fed to cattle- monitor feed tags and delivery of commodities to help prevent this as a source of disease on your farm.</p>

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Water

- Clean/flush out waterers at least weekly
- Install rails around waterers to prevent cattle from stepping or defecating in them
 - 2 foot clearance for head space
- Control access to natural water sources
 - Ponds, streams
 - Fencing to prevent animal entry and contamination


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Clean waterers by flushing them out completely to remove the sediment at the bottom of the trough at least once a week (more often if needed). This will help avoid buildup that allows disease organisms, like *Salmonella*, to grow. Install rails around waterers with 2 feet of clearance to allow their heads to pass through but prevent cattle from stepping or defecating into the trough. If a natural water source, such as a pond or stream, is the main drinking water for the herd, control access so that cattle can drink from it but not enter and potentially contaminate it. This can be done with strategic fencing and a concrete or gravel rock pad leading into the water source.

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Feed and Water

- Rodent/Pest Control
 - Rodents can carry disease, contaminate feed
 - Feces or urine
 - Rodent control programs
 - Deterrents, baits or poison, traps
 - Clean up spilled feed




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As stated earlier, the greatest threat for exposure to orally transmitted disease is ingestion of disease causing agents in the environment or in feed and water contaminated by other animals. Rodents can carry diseases that affect cattle and can readily contaminate feed with their feces and urine. Every operation should have a rodent control program. Control measures that should be considered include the use of deterrents, baits/poisons and traps as pictured- closed box top photo, open box bottom photo. These boxes would benefit by having a bit of water added to them to attract the rodents to the bait. In addition, attempts should be made to secure all feed storage areas, clean up spilled feed, and avoid having excess feed available to any animals (e.g. wildlife, birds, vermin, dogs, cats, horses, cattle, sheep). For specific information about rodent control, refer to the Bird and Rodent Control Measures handout. Photos courtesy of DB Weddle, ISU.

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Feed and Water

- Bird Control
 - Birds are disease carriers
 - Often difficult to control
 - Discourage nesting and roosting
 - Contact local extension office for recommendations
 - Limit access to feed




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Birds are also disease carriers, *Salmonella* for instance, and while it is nearly impossible to eliminate them from animal housing areas, steps should be taken to discourage their nesting and roosting. There are legal regulations in many areas, so check with your local extension office for recommendations. The risk of feed contamination by birds may be as important as that by rodents so it is important to limit their access and clean up spilled feed so it is not an attractant. Top photo depicts a farm yard with hundreds of birds roosting on the roof and fence (courtesy of <http://ianrpubs.unl.edu/wildlife/graphics/ncr451p1.GIF>) and the bottom photo is a common scene on many farms where the birds are eating right out of the feedbunk with cattle (courtesy of <http://whyfiles.org/193prion/images/feedlot.jpg>).

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Manure Management

- Scrape areas around feed bunks frequently to minimize build up
 - Move to clean ground
- Scrape concrete aprons around feed and water troughs frequently



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Because oral transmission of disease is generally dependent on contamination by infected animals, manure management is very important. For cattle being fed on pasture or in dry lots, scrape areas around troughs/feeders frequently to minimize feces build up and move them, if possible, to clean ground. If feeding and/or watering sources are on concrete pads, scrape these regularly to remove debris as it builds up. Photos courtesy of Bryan Buss, ISU.

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Manure Management

- Storage
 - Compost
 - Kills many disease organisms
 - Lagoons
 - Build to prevent spills, overflows
 - Spread on crop, pasture ground
 - Prohibit animal access
 - Sunlight cannot kill all disease organisms




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Manure storage must be done in such a way to limit exposure to animals. Composting will kill many disease organisms, if done properly, while preserving the nutrient value of the manure. Lagoon storage, as pictured here, allows for long term storage but it should be built to prevent spills or overflows that could contaminate water sources or crop ground, and thus exposing animals or humans. If manure is spread on crop or pasture ground, prohibit animals from grazing the field for a sufficient length of time (this will vary with weather conditions, age of animals grazing, and diseases of concern). While sunlight has killing action on organisms, penetrating thick manure does not always occur and the disease risk, especially for Johne's, will be present for months. Photo courtesy of Paul Hester, ISU.

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Manure Management

- Pastures
 - Drag to disperse manure
 - Monitor forage availability to prevent overgrazing




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Another consideration is the risk that manure presents on pastures. Breaking up manure on pastures by dragging with a tractor exposes the disease agents to sun and wind, which will kill them more quickly (not as done by hand in Nepal as seen in this picture). It is important to monitor forage availability to prevent overgrazing, which can result in cattle grazing closer to the ground and nearer to fecal pats. Cattle will typically avoid grazing close to fecal pats, but will graze closer when feed is limited and this increases the risk of ingestion of potential disease causing agents in the manure. (Photo source: Nepal School Project at http://www.nepal-school-projects.org/village_life_in_pictures.htm)

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Equipment - Farm

- Use separate loader buckets for feeding, scraping manure
 - Some operations: it's cost prohibitive
- Same equipment:
 - Wash
 - Scrub **completely** to remove manure
 - Rinse and dry in sunlight




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Using different loader buckets for mixing feed and scraping manure is perhaps the best way to minimize the risk of transmitting diseases orally to the herd. If separate buckets are cost prohibitive, then the loader bucket, tires and anything else that has manure on it must be washed with warm water, scrubbed to remove organic matter, rinsed and allowed to completely dry in the sun to avoid fomite spread to animals. (Photo source University of Iowa, College of Public Health).

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Equipment - Treatment

- Ill animals shed disease organisms
- Often need supportive treatment
 - Electrolytes, fluids, medication
- Equipment must be cleaned after each animal
 - Wash, disinfect, rinse, dry
 - If used for antibiotics, do NOT disinfect




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Animals that are ill often need supportive treatment with electrolytes, fluids, or medication. Equipment used to treat these animals can become contaminated with disease causing organisms. After use on an animal, this equipment should be washed in warm water, and if it is not used for antibiotics, disinfected and hung up to dry in an area where it will not be contaminated. (Disinfectants can have residual effect and deactivate antibiotics). Photo depicts an esophageal feeder often used to tube a calf with electrolytes- this should be cleaned after each use (courtesy of DB Weddle, ISU).

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Vehicles

- Designate a vehicle parking area
 - Away from primary animal traffic
- Minimize vehicle traffic on farm
 - Load/unload, rendering at perimeter
 - Do not allow feed truck drivers to cross animal paths



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By having a designated parking area away from animal traffic areas with posted signs, visitors and employees have no reason to drive personal vehicles onto the farm and introduce disease agents on their tires, wheel wells. Any vehicle coming into an operation could introduce disease agents that can be transmitted orally. Minimize vehicular traffic on farm by loading/unloading animals and keeping rendering piles only at the perimeter of the operation. It is also good management to prevent feed truck drivers from driving in areas where animals will cross the tire path or come into contact with the truck. (Photo courtesy of DB Weddle, ISU).

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Summary

- Oral transmission occurs everyday on farms
 - Crypto, Johne’s, leptospirosis
- Foreign animal diseases can also be spread via oral route
 - FMD, melioidosis
- Prevention steps as described here can help minimize your risk

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Oral disease transmission does occur on farms with everyday diseases like cryptosporidiosis (crypto), Johne’s disease (*Mycobacterium avium* ssp *paratuberculosis*), and leptospirosis. Some foreign animal diseases, such as Foot and Mouth Disease (FMD), can be spread through oral transmission. Taking some of the basic prevention steps as described in this presentation can help you decrease your risk of disease introduction and spread on your farm.

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Key Learning Objectives

- Biological risk management is important
- All diseases are transmitted by a few common routes
- Disease risk can be managed
- Awareness education is essential
- You play a critical role!

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Throughout this presentation, we have stressed that biological risk management is important. All diseases are transmitted by a few common routes and managing disease exposure will help decrease the level of disease. While disease risk cannot be completely eliminated, it can be managed. Awareness education is critical for assessment and response and each of YOU play a critical role!

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Questions?

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Acknowledgments

Development of this presentation was funded by a grant from the USDA Risk Management Agency to the Center for Food Security and Public Health at Iowa State University.

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