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**Practical Applications for
Managing Biological Risks**

Aerosol Transmission
Dairy 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 aerosol 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 farm's economic impact and help justify the cost of implementing BRM. Many different solutions exist and because all dairy facilities are different, there is not a one-size-fits-all answer. Photo depicts two dairy employees working in a milking parlor (Photo courtesy of USDA - ARS).

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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 aerosol transmission between animals and from animals to humans. This photo shows several dairy cows grazing in a pasture (Photo courtesy of USDA – ARS).

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Aerosol Transmission

- Disease agents contained in droplets
 - Pass through air
- Most agents not stable in droplets
 - Close proximity required
 - Infected and susceptible animals



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Aerosol transmission occurs when disease agents contained in droplets are passed through the air from one animal to another, or animal to human. Most pathogenic agents do not survive for extended periods of time within the aerosol droplets, and as a result, close proximity of infected and susceptible animals is required for disease transmission. The photo depicts a tunnel ventilated dairy building; aerosol transmission is of concern if not properly ventilated (Photo courtesy of DB Weddle, ISU).

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Selected Diseases Spread by Aerosol

<p>Foreign diseases</p> <ul style="list-style-type: none"> • Contagious bovine pleuropneumonia • Foot and mouth disease • Malignant catarrhal fever 	<p>Present in U.S.</p> <ul style="list-style-type: none"> • Anthrax • BRSV • BVD • IBR • <i>M. hemolytica</i> • <i>Mycoplasma</i> • Q Fever • Tuberculosis
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There are many diseases transmitted by the aerosol route, both diseases that are foreign animal diseases (FADs) and those that are present in the US (endemic). Some examples of foreign animal diseases include contagious bovine pleuropneumonia (CBPP), foot and mouth disease (FMD), and malignant catarrhal fever (MCF). Examples of diseases that are already present in the US include anthrax, bovine respiratory syncytial virus (BRSV), bovine viral diarrhea (BVD), infectious bovine rhinotracheitis (IBR or red nose), *Mannheimia hemolytica* (was *Pasteurella*), *Mycoplasma pneumonia*, Q fever, and tuberculosis and others. 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-Aerosol.

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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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Every disease has to enter into an animal by some route, so looking at disease prevention through the routes of transmission makes sense. One advantage to this approach is that it will also help protect against new or unexpected infectious diseases. This classification system is effective and easy to understand without requiring knowledge about a wide range of diseases, like all those listed at the beginning of this presentation. 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 transmitted by various routes, it is easier to gain control over them. 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 wooden calf hutch (photo courtesy of DB Weddle, ISU).

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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 Bryan Buss, ISU.

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General Prevention Steps

- 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 essential for proper record keeping (vaccinations, treatments, pregnancy status) which is an integral part of managing animals and minimizing disease risk on farm. Keeping treatment records on a dairy 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. (photo courtesy of 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 veterinarian 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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By establishing and educating all employees on what to look for regarding sick animals and having a reporting system so that those in charge can make treatment decisions or the veterinarian can be contacted, serious diseases can be identified early on and minimize the risk of disease spread. 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 in a timely manner so predators, wild birds, etc do not spread disease. By having a

veterinarian necropsy animals that die of undetermined causes, a diagnosis may be obtained by sending samples into a diagnostic laboratory. Unusual diseases may not present in a manner you are used to, so involving a veterinarian may help identify a potentially infectious disease before it becomes widespread on your facility. Photo depicts an Ayrshire calf being necropsied and samples being collected for diagnostic testing (courtesy of UC Davis VMTRC).

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General Prevention Steps

- 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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Cows that are identified as ill should be removed from the rest of the herd immediately and placed in an isolation area where ventilation, feed/water, and other equipment are not shared and direct contact with other animals does not occur in order to minimize the risk of disease spread. Newly introduced animals, including show cattle/calves that have been away from the farm, may be carrying diseases that your home herd is not immune to, so quarantine them for a period of time. Time spent in isolation and quarantine varies depending on the risk so this should be determined together with your herd veterinarian. Before taking animals out of isolation or quarantine, it is a good risk management plan to test them for key diseases (determined together with your herd veterinarian) and make sure they are not carrying diseases that could be introduced into the home herd.

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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 deactivates vaccines and can render antibiotics ineffective, causing inadequate protection or treatment when used in your animals; make sure you read the label and store 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 on a dairy farm with a thermometer-purchased for less than \$3 at a large retail store (photo courtesy of DB Weddle, ISU).

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General Prevention Steps

- Ensure adequate ingestion of disease-free colostrum in first 6 hours of life
- Prevent contact with older animals, contaminated environments

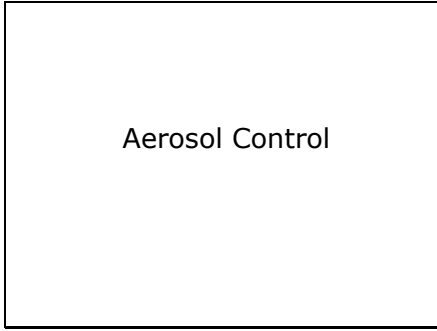


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Adequate ingestion of colostrum is the most important consideration for calf's resistance to disease and all calves should receive colostrum within 6 hours of birth. A calf's immune system depends on the antibodies in colostrum. After 6 hours of life, 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. The photo depicts colostrum in a freezer that is stored in palpation sleeves (with the fingers tied off), labeled with the cow ID number and dated. This allows for easy thawing and making sure the calf gets colostrum from one cow (photo courtesy of DB Weddle).

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Now that we have discussed some general prevention steps, let us look specifically at aerosol transmission and control measures you can apply on your dairy farm to minimize disease spread.

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Aerosol

- Basic prevention steps involve:
 - Increasing distance between sick and well animals
 - Maximizing ventilation
 - Provide fresh air to all animals
 - Decrease humidity and odor build up



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Aerosol transmission occurs when infected droplets are passed through the air from one animal (infected) to another animal (susceptible) as this graphic depicts. There are various prevention steps that can help ensure aerosol transmission does not occur. One essential step is to increase the distance between sick and susceptible animals. Another is to maximize ventilation so that fresh air is provided to all animals and humidity and odors do not build up. These basic steps will go a long way in preventing aerosol disease transmission. Graphic designed by Clint May, ISU.

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Isolation/Quarantine

- Distance is important
- Do not share air space between sick and healthy animals



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Isolation and quarantine were discussed under general prevention, so we will not cover that in detail here, other than to point out that for aerosol spread diseases, distance is extremely important. Air space should not be shared between sick and healthy animals as is depicted in this photo with the sick cow isolated by herself in an outdoor pen (courtesy of Geni Wren, Bovine Veterinarian Editor).

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Calving

- Calving pens should not be used to house sick animals
- Cows should calve separately from heifers to minimize disease exposure

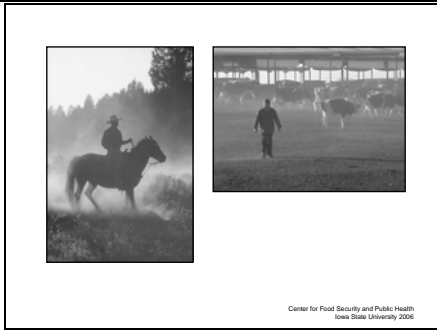


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The birthing process is a stressful time in an animal's life. Calving pens should be designated for this purpose and not used to house sick animals due to the risk of disease organisms being shed into the environment and exposing stressed animals at calving. Calving cows/heifers individually and following proper hygiene procedures between animals will also help minimize the risk of disease exposure. In this photo we have a perfectly clean, bedded calving pen with some lye which is a good environment for the animal placed there. The problem can be that if we house a sick animal in the next pen or the same air space, aerosol transmission can still occur; even with our excellent "clean" setup (photo courtesy of Colorado State University).

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Looking at this picture (left picture appears first) what do we see? A nice western setting, with a hard working cowboy. Reminiscent of the old west. (press next and the next picture and wording will appear). Now what do we see? DUST! Now looking back to our pretty picture on the left do we have the same perspective. Photos source: left – The Animal Photo Archive; right – Pat Gordon, DVM.

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Housing

- Control dust in dry lots
 - Damaged respiratory tract = disease
 - Use water in limited amounts



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Dust is an irritant to the throat, lungs and eyes and can predispose cattle to conjunctivitis and respiratory disease if their mucous membranes get damaged. There are products available to minimize dust in dry lots, as well as water mists that can be applied; however, excessive amounts of water can lead to mud which is not ideal for cattle either. Photo depicts a dry lot dairy in the SW U.S. where water is used as a coolant for cows in the heat but must not be used in excess due to mud (courtesy of DB Weddle, ISU).

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Housing

- Regulate indoor ventilation
 - Fans, curtain side walls, sprinklers
 - Requirements vary based on building
- Keep indoor humidity levels low
 - Pathogens build up in high humidity



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Adequate ventilation is essential to respiratory health and barns should be equipped to handle heat and humidity extremes (fans, curtain side walls, sprinklers) and prevent the buildup of stagnant air (ammonia, methane). Ventilation requirements vary based on building style but for every foot of fan diameter placed at a 30 degree angle, it will blow 10 feet. High humidity levels in a barn can decrease ventilation and air, carrying disease pathogens, can become stagnant making animals more susceptible to respiratory disease. Monitoring humidity in the barn is part of a good ventilation plan, allowing you to make fan and side curtain adjustments so that air does not become stagnant and pathogens build up that can cause respiratory disease. Photo depicts 3 foot diameter fans and sprinklers over the feedbunk with open curtain sidewalls in the background (courtesy of DB Weddle, ISU).

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Neonatal Housing

- Individual calf hutches ideal for decreased aerosol exposure



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Neonatal housing is important with regards to aerosol exposure. To minimize the risk, individual calf hutches are ideal to limit aerosol exposure with other calves, as the photo on the left depicts (courtesy of DB Weddle, ISU). The structure on the right could have excellent air flow, good quality air, and low humidity which is ideal for calves, but the risk of aerosol spread increases (photo courtesy of DB Weddle, ISU). Producers must decide what types of risks they are willing to accept- what can they manage.

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Summary

- Aerosol transmission occurs everyday on farms
 - IBR, BVD, BRSV, *Mycoplasma*
- Foreign animal diseases can also be spread via aerosol
 - CBPP, FMD
- Prevention steps as described here can help minimize your risk

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Aerosol transmission occurs on farms with everyday diseases like Infectious Bovine Rhinotracheitis (IBR) or 'red nose', Bovine Respiratory Syncytial Virus (BRSV), Bovine Viral Diarrhea (BVD), and *Mycoplasma bovis*. Should a foreign animal disease occur in the US, such as Contagious Bovine Pleuropneumonia (CBPP) or Foot and Mouth Disease (FMD), they too can be spread through aerosol 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 by managing disease exposure, the level of disease will decrease. 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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