

S  
l  
i  
d  
e  
  
1

**Practical Applications for  
Managing Biological Risks**

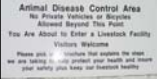
Aerosol Transmission  
Beef Producers

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 aerosol transmission on farm.

S  
l  
i  
d  
e  
  
2

**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




Center for Food Security and Public Health  
Iowa State University 2006

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)

S  
l  
i  
d  
e  
  
3

**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




Center for Food Security and Public Health  
Iowa State University 2006

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 Tarpenting).

S  
l  
i  
d  
e  
  
4

**Routes of Transmission**

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




Center for Food Security and Public Health  
Iowa State University 2006

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).

S  
1  
i  
d  
e  
5

### Aerosol Transmission

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



Center for Food Security and Public Health  
Iowa State University 2006

**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 shows a situation where cattle are always in close proximity to one another- a feedlot (photo source USDA).

S  
1  
i  
d  
e  
6

### Selected Diseases Spread by Aerosol

<p>Foreign diseases</p> <ul style="list-style-type: none"> <li>• Contagious bovine pleuropneumonia</li> <li>• Foot and mouth disease</li> <li>• Malignant catarrhal fever</li> </ul>	<p>Present in U.S.</p> <ul style="list-style-type: none"> <li>• Anthrax</li> <li>• BRSV</li> <li>• BVD</li> <li>• IBR</li> <li>• <i>M. hemolytica</i></li> <li>• <i>Mycoplasma</i></li> <li>• Q Fever</li> <li>• Tuberculosis</li> </ul>
--	--

Center for Food Security and Public Health  
Iowa State University 2006

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 the 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.

S  
1  
i  
d  
e  
7

### 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


Center for Food Security and Public Health  
Iowa State University 2006

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.

S  
1  
i  
d  
e  
8

### 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



Center for Food Security and Public Health  
Iowa State University 2006

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).


## Aerosol-Beef

S l i d e 9	<h3>General Prevention Steps</h3> <p>Overview</p> <ul style="list-style-type: none"><li>• Farm perimeter</li><li>• Animal identification</li><li>• Animal health</li><li>• Sick/dead animals</li><li>• Isolation/quarantine</li><li>• Supply handling</li><li>• Neonatal management</li></ul> <p><small>Center for Food Security and Public Health Iowa State University 2006</small></p>	<p>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.</p>
S l i d e 1 0	<h3>General Prevention Steps</h3> <ul style="list-style-type: none"><li>• Limit contact with animals<ul style="list-style-type: none"><li>- Neighbor's livestock</li><li>- Wildlife, birds</li><li>- Roaming cats, dogs</li></ul></li><li>• Maintain fences</li><li>• Establish biosecurity protocols for delivery vehicles, personnel</li><li>• Lock gates</li></ul>  <p><small>Center for Food Security and Public Health Iowa State University 2006</small></p>	<p>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.</p>
S l i d e 1 1	<h3>General Prevention</h3> <ul style="list-style-type: none"><li>• Identify individual animals</li><li>• Important for:<ul style="list-style-type: none"><li>- Communicating health status</li><li>- Treatment needs</li><li>- Location on farm</li><li>- Record keeping</li></ul></li></ul>  <p><small>Center for Food Security and Public Health Iowa State University 2006</small></p>	<p>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).</p>
S l i d e 1 2	<h3>General Prevention Steps</h3> <ul style="list-style-type: none"><li>• Keep health records on every animal</li><li>• Review vaccination and treatment programs<ul style="list-style-type: none"><li>- Annually, bi-annually</li><li>- Protocol versus actual</li></ul></li><li>• Investigate unusual signs, unresponsive cases<ul style="list-style-type: none"><li>- Neurologic, downers, sudden death</li></ul></li></ul>  <p><small>Center for Food Security and Public Health Iowa State University 2006</small></p>	<p>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.</p>

S  
1  
i  
d  
e  
  
1  
3

**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



Center for Food Security and Public Health  
Iowa State University 2006

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).

S  
1  
i  
d  
e  
  
1  
4

**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


Center for Food Security and Public Health  
Iowa State University 2006

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 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.

S  
1  
i  
d  
e  
  
1  
5

**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




Center for Food Security and Public Health  
Iowa State University 2006

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 with a thermometer- purchased for less than \$3 at a large retail store (photo courtesy of DB Weddle, ISU).

S  
1  
i  
d  
e  
  
1  
6

**General Prevention Steps**

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

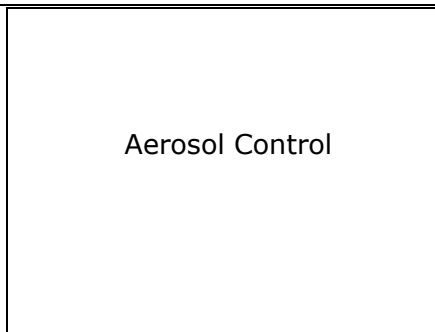


Center for Food Security and Public Health  
Iowa State University 2006

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)

## Aerosol-Beef

S  
l  
i  
d  
e  
  
1  
7

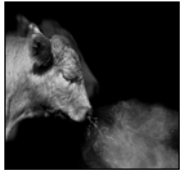


Now that we have discussed some general prevention steps, let us look specifically at aerosol transmission and control measures you can apply on your cattle farm to minimize disease spread.

S  
l  
i  
d  
e  
  
1  
8

### 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




Center for Food Security and Public Health  
Iowa State University 2006

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.

S  
l  
i  
d  
e  
  
1  
9

### Isolation/Quarantine

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




Center for Food Security and Public Health  
Iowa State University 2006

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. This steer has a respiratory infection and should be pulled from this pen and isolated so as not to expose other cattle in the area (photo courtesy of Geni Wren, Bovine Veterinarian Editor).

S  
l  
i  
d  
e  
  
2  
0

### Calving

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




Center for Food Security and Public Health  
Iowa State University 2006

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).

S  
l  
i  
d  
e  
  
2  
1

### Housing

- Control dust in dry lots
  - Damaged respiratory tract = disease
  - Use water in limited amounts
- Keep indoor humidity levels low
  - Pathogens build up in high humidity



Center for Food Security and Public Health  
Iowa State University 2006

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. 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 a dusty pen where cattle are housed (courtesy of Department of Education and Training - Gov. of

S  
1  
i  
d  
e  
  
2  
2

**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

Center for Food Security and Public Health  
Iowa State University 2006

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.

S  
1  
i  
d  
e  
  
2  
3

**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!

Center for Food Security and Public Health  
Iowa State University 2006

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!

S  
1  
i  
d  
e  
  
2  
4

**Questions?**

**[www.cfsph.iastate.edu/BRM](http://www.cfsph.iastate.edu/BRM)**  
brm@iastate.edu  
515-294-7189


CFSPH  
Iowa State University,  
College of Veterinary Medicine  
Ames, IA 50011

Center for Food Security and Public Health  
Iowa State University 2006

S  
1  
i  
d  
e  
  
2  
5

**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.*




Center for Food Security and Public Health  
Iowa State University 2006

S  
l  
i  
d  
e  
  
2  
6

### Acknowledgments

**Authors:** Bryan Buss, DVM, MPH  
Danelle Bickett-Weddle, DVM, MPH

**Reviewer:** James Roth, DVM, PhD