COW-CALF INDUSTRY MANUAL

FAD PReP

Foreign Animal Disease Preparedness & Response Plan

National Animal Health Emergency Management System

USDA

APHIS

the Center for Food Security & Public Health
Iowa State University

United States Department of Agriculture • Animal and Plant Health Inspection Service • Veterinary Services

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Cow-Calf Industry Manual

The *Foreign Animal Disease Preparedness and Response Plan (FAD PReP)/National Animal Health Emergency Management System (NAHEMS) Guidelines* provide a framework for use in dealing with an animal health emergency in the United States.

This FAD PReP Industry Manual was produced by the Center for Food Security and Public Health, Iowa State University of Science and Technology, College of Veterinary Medicine, in collaboration with the U.S. Department of Agriculture Animal and Plant Health Inspection Service through a cooperative agreement.

This FAD PReP/NAHEMS Guidelines are under ongoing review. This document was last updated **January 2012**. Please send questions or comments to:

Center for Food Security and Public Health

2160 Veterinary Medicine
Iowa State University of Science and Technology
Ames, IA 50011
Telephone: 515-294-1492
Fax: 515-294-8259
Email: *cfsph@iastate.edu* -
subject line FAD PReP Beef Feedlot Industry Manual

National Center for Animal Health Emergency Management

US Department of Agriculture (USDA)
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
4700 River Road, Unit 41
Riverdale, Maryland 20732-1231
Telephone: (301) 734-8073 / (301) 851-3595
Fax: (301) 734-7817
E-mail: *FAD.PReP.Comments@aphis.usda.gov*

THE IMPERATIVE FOR FOREIGN ANIMAL DISEASE PREPAREDNESS AND RESPONSE

WHY FOREIGN ANIMAL DISEASES MATTER

Preparing for and responding to foreign animal diseases (FADs), like highly pathogenic avian influenza (HPAI) and foot-and-mouth disease (FMD), are critical measures to safeguard our nation's animal health, public health, and food supply.

There are significant potential consequences of an FAD outbreak in the United States. In addition to the economic impact, the social and psychological impact on both producers and consumers could be severe. The FMD outbreak in the United Kingdom had an estimated impact of between $12–18 billion. Studies have estimated a likely national welfare loss between $2.3–69 billion[1] for an FMD outbreak in California, depending on delay in diagnosing the disease[2].

CHALLENGES OF RESPONDING TO AN FAD EVENT

An FAD outbreak will be challenging for all stakeholders. For example, there will be disruptions to interstate commerce and international trade. Response activities are complex, and significant planning and preparation must be conducted before an outbreak. Outbreaks can become large and widespread. Large, geographically dispersed and diverse teams will need to be assembled rapidly and must react quickly. The response effort must have the capability to be rapidly scaled up, involving many times more resources, personnel, and countermeasures. As such, responding to an FAD—large or small—may be a very complex and difficult effort.

LESSONS LEARNED FROM PAST FAD OUTBREAKS

Past outbreaks both in the United States and in other countries offer important lessons that can be applied to preparedness and response efforts. To achieve successful outcomes in future FAD response, it is vital to identify, understand, and apply these lessons learned:

- Provide a unified State-Federal-Tribal-industry planning process that respects local knowledge.
- Ensure the unified command sets clearly defined and obtainable goals.
- Have a unified command that acts with speed and certainty to achieve united goals.
- Employ science-based and risk-management approaches that protect public health and animal health, stabilize animal agriculture, the food supply, and the economy.
- Ensure guidelines, strategies, and procedures are communicated and understood by responders and stakeholders.
- Acknowledge that high expectations for timely and successful outcomes require the:
  - Rapid scale-up of resources and trained personnel for veterinary activities and countermeasures, and
  - Capability to quickly address competing interests before or during an outbreak.
- Rapid detection and FAD tracing is essential for the efficient and timely control of FAD outbreaks.

1. Carpenter TE, O'Brien JM, Hagerman AD, & McCarl BA. 2011. "Epidemic and economic impacts of delayed detection of foot-and-mouth disease: a case study of a simulated outbreak in California." J Vet Diagn Invest. 23:26-33.
2. Estimates based on models may vary: Ekboir (1999) estimated a loss of between $8.5 and $13.5 billion for an FMD outbreak in California. Ekboir JM. 1999. "Potential Impact of Foot-and-Mouth Disease in California: the Role and Contribution of Animal Health Surveillance and Monitoring Services." Agricultural Issues Center. University of California, Davis.

FAD PREP MISSION AND GOALS

The significant threat and potential consequences of FADs and the challenges of and lessons learned of effective and rapid FAD response have led to the development of the Foreign Animal Disease Preparedness and Response Plan, also known as "FAD PReP." The mission of FAD PReP is to raise awareness, expectations, and develop capabilities surrounding FAD preparedness and response. The goal of FAD PReP is to integrate, synchronize, and deconflict preparedness and response capabilities as much as possible before an outbreak, by providing goals, guidelines, strategies, and procedures that are clear, comprehensive, easily readable, easily updated, and that comply with the National Incident Management System.

In the event of an FAD outbreak, the three key response goals are to: (*1) detect, control, and contain the FAD in animals as quickly as possible; (2) eradicate the FAD using strategies that seek to stabilize animal agriculture, the food supply, the economy, and protect public health; and (3) provide science- and risk-based approaches and systems to facilitate continuity of business for non-infected animals and non-contaminated animal products.* Achieving these three goals will allow individual livestock facilities, States, Tribes, regions, and industries to resume normal production as quickly as possible. They will also allow the United States to regain FAD-free status without the response effort causing more disruption and damage than the disease outbreak itself.

FAD PReP DOCUMENTS AND MATERIALS

FAD PReP is not just one, standalone FAD plan. Instead, it is a comprehensive US preparedness and response strategy for FAD threats. This strategy is provided and explained in a series of different types of integrated documents, as illustrated and described below.

FAD PReP Suite of Documents and Materials

Note: APHIS=Animal and Plant Health Inspection Service, NAHEMS = National Animal Health Emergency Management System, SOP = standard operating procedures.

Strategic Plans—Concept of Operations

- *APHIS Foreign Animal Disease Framework: Roles and Coordination:* This document provides an overall concept of operations for FAD preparedness and response for APHIS, explaining the framework of existing approaches, systems, and relationships.
- *APHIS Foreign Animal Disease Framework: Response Strategies:* This document provides significant detail on response strategies and activities that will be conducted in an FAD outbreak.
- *National Center for Animal Health Emergency Management (NCAHEM) Stakeholder Coordination and Collaboration Resource Guide:* This guide describes key stakeholders with whom NCAHEM collaborates.

- *NCAHEM Incident Coordination Group Plan:* This document explains how APHIS headquarters will organize in the event of an animal health emergency.

NAHEMS Guidelines

- These documents describe many of the critical preparedness and response activities, and can be considered as a competent veterinary authority for responders, planners, and policy-makers.

Industry Manuals

- These manuals describe the complexity of industry to emergency planners and responders and provide industry a window into emergency response.

Disease Response Plans

- Response plans are intended to provide disease-specific information about response strategies. These documents offer guidance to all stakeholders on capabilities and critical activities that would be required to respond to an FAD outbreak.

Critical Activity Standard Operating Procedures (SOPs)

- For planners and responders, these SOPs provide details for conducting 23 critical activities such as disposal, depopulation, cleaning and disinfection, and biosecurity that are essential to effective preparedness and response to an FAD outbreak. These SOPs provide operational details that are not discussed in depth in strategy documents or disease-specific response plans.

Continuity of Business (commodity specific plans developed by public-private-academic partnerships)

- *Secure Egg Supply (SES) Plan:* The SES Plan uses proactive risk assessments, surveillance, biosecurity, and other requirements to facilitate the market continuity and movement of eggs and egg products during an HPAI outbreak.
- *Secure Milk Supply (SMS) Plan:* Currently under development, the SMS Plan will help facilitate market continuity for milk and milk products during an FMD outbreak. This Plan also will employ proactive risk assessments.
- *Secure Pork Supply (SPS) Plan:* Currently under development, the SPS Plan will help facilitate market continuity for pork and pork products during an FMD, classical swine fever, swine vesicular disease, or African swine fever outbreak.
- *Secure Turkey Supply (STS) Plan:* Currently under development, the STS Plan will help facilitate market continuity for the turkey sector during an HPAI outbreak.

Outbreak Response Tools

- Case definitions, appraisal and compensation guidelines and formulas, and specific surveillance guidance are examples of important outbreak response tools.

State/Tribal Planning

- State and Tribal planning is essential for an effective FAD response. These plans are tailored to the particular requirements and environments of the State or Tribal area, taking into account animal populations, industry, and population needs.

Industry, Academic, and Extension Planning

- Industry, academia, and extension stakeholder planning is critical and essential: emergency management is not just a Federal or State activity.

APHIS Emergency Management

- APHIS directives and Veterinary Services (VS) Memorandums provide critical emergency management policy. APHIS Emergency Management documents provide guidance on topics ranging from emergency mobilization, to the steps in investigating a potential FAD, to protecting personnel from HPAI.

The information provided here is meant to be used as a preparedness resource rather than a comprehensive document. Several key APHIS documents complement this "FAD PReP Cow-Calf Industry Manual" and provide further details when necessary. This document references the following APHIS documents:

- APHIS Foreign Animal Disease Framework documents

- FAD PReP/NAHEMS Guidelines:
  - Biosecurity (2011)
  - Cleaning and Disinfection (2011)
  - Disposal (2012)
  - Health & Safety (2011)
  - Mass Depopulation and Euthanasia (2011)
  - Personal Protective Equipment (2011)
  - Vaccination for Contagious Diseases (2011)

- FAD PReP Standard Operating Procedures (SOP):
  - Biosecurity
  - Cleaning and Disinfection
  - Personal Protective Equipment
  - Continuity of Business

- FMD Response Plan: The Red Book, USDA-APHIS

- VS Memo 580.4 Procedures for Investigating a Foreign Animal Disease/Emerging Disease Incident (FAD/EDI) August 2010

These documents are available on the FAD PReP collaboration website: *https://fadprep.lmi.org*. For those with access to the APHIS intranet, they are available on the internal APHIS FAD PReP website: *http://inside.aphis.usda.gov/vs/em/fadprep.shtml*

Cow-Calf Industry Manual

Table of Contents

Table of Contents

Cow-Calf Industry Manual

Table of Contents

Cow-Calf Industry Manual

Purpose

This industry manual provides a broad overview of U.S. cow-calf operations and the procedures that may be established in the event of a cattle-susceptible, highly contagious foreign animal disease (FAD) outbreak. A highly contagious FAD outbreak will severely impact industries with susceptible livestock as well as allied industries and service providers. A quick, effective and well-coordinated response can minimize the harm to the cattle industry. Wide dissemination of this information is encouraged to establish open communication between regulators, cattle growers and other stakeholders with the goal of reducing the probability that cattle or their caretakers become infected with a highly contagious FAD or other zoonotic disease.

Intent

Local, state, and national level officials involved in developing policy in preparing for and responding to a highly contagious FAD outbreak should read this manual to increase awareness of normal business operations associated with the cow-calf industry and the inherent risk of disease transmission in order to effectively aid in disease containment or eradication. Veterinarians and animal health technicians who are members of the USDA-APHIS National Animal Health Emergency Response Corps (NAHERC) or their state or county veterinary response teams carrying out disease control efforts on cow-calf operations should familiarize themselves with the information presented in this manual. Cattle growers, other pertinent stakeholders, and any support personnel interacting with cow-calf operations need to be aware of the described procedures that may be implemented during a highly contagious FAD event and the biosecurity protocols they may be expected to adopt to reduce the risk of disease transmission.

Scope

This manual is divided into two parts plus additional sections for acronym descriptions, glossary and appendices.

- Part I provides an overview of U.S. beef cow-calf production, including herd management, animal husbandry, facility types, and animal movement.
- Part II describes the response to prevent or mitigate the spread of a highly contagious foreign animal disease, such as foot-and-mouth disease (FMD) or Rift Valley fever (RVF) including quarantine and movement control categories, and protocols for animal vaccination, treatment and care.
- An acronyms and glossary section defines and explains commonly used terms in the cow-calf industry and emergency response.
- Disease specific biosecurity measures are located in the appendices for the following: Foot-and-mouth disease (FMD) prevention practices, Rift Valley fever prevention practices, Heartwater prevention practices, bioterrorism and high consequence pathogens of cattle.

Learning Objectives

Upon reviewing this manual, readers should be able to:

1. Be aware of the basic animal husbandry requirements of cows, heifers, bulls and calves, as well as the cow-calf to finish concept;
2. Understand the differences between cow-calf operations associated with geographic locations or business model structure (e.g., primary source of income, secondary or supplemental source of income, hobby farm);
3. Illustrate containment categories and explain classifications of cow-calf premises during a response;
4. Implement prescribed biosecurity protocols and surveillance activities on cow-calf operations to prevent highly contagious FAD entry or spread;
5. Communicate with supervisory personnel and/or regulatory officials regarding cow-calf farm status (animal husbandry needs, biosecurity measures in place, test results, tracebacks/traceouts, product movement); and

6. Be able to differentiate normal cattle behavior and appearance from abnormal behavior or appearance associated with a diseased animal.

PART I: UNITED STATES COW-CALF PRODUCTION

1. SCOPE OF THE COW-CALF INDUSTRY

1.1 Cow-Calf Numbers

The United States is the world's largest producer of beef and has the largest fed-cattle industry which is supplied primarily by U.S. cow-calf operations. Although the fed-cattle segment is an important component of beef production, this document focuses on the calf-producing aspects of the beef industry. More information on the feedlot industry can be found in the FAD PReP Feedlot Industry Manual (2011). The Economic Resource Service (ERS) of the USDA lists the sales of cattle and calves as the top agricultural commodity in 2010 with gross income from sales of cattle and calves totaling over $51.5 billion. Cattle and cattle products represent the single largest contributor to the overall U.S. farm economy, comprising 15% of agriculture's total economic output. In 2010, there were 40,000,000 cows that gave birth to 35,684,800 calves. Beef cows accounted for 30.9 million of the 40.0 million cows that calved. Those 30.9 million cows are found throughout the country on 742,000 cow-calf operations. These farms vary considerably in the size of their herds. In 2010, there were 588,000 cow-calf operations that maintained between one and forty-nine cows. In contrast to the smaller operations, there were fifty farms across the country that operated with over five thousand head of beef cows. Moderately-sized farms that maintain between 100 and 499 beef cows own the largest portion of the U.S. beef cow herd, as these 66,300 farms possess 38% of the U.S. beef cow inventory (Table 1). Within the U.S., the Southeast region has the highest number of individual cow-calf operations at 236,800. However, the Great Plains region has an average of 92.7 cattle per operation, the greatest average herd size of all the regions (Table 2).

Source:

- *Top 5 Agricultural Commodities, 2010. December 2011. USDA Economic Research Service. Accessed January 11, 2012*

Table 1. Number of Cow-Calf Operations and Percentage of Total U.S. Beef Cow Inventory by Cow-Calf Operation Size, 2010

Cow-Calf Operation's Beef Cow Inventory	Number of Operations	Percentage of Operations	Percentage of Total U.S. Beef Cow Inventory
1 - 49	588,000	79.2	28.0
50 - 99	82,000	11.0	17.4
100 - 499	66,300	9.0	38.0
500 - 999	4,280	0.6	8.8
1,000 - 1,999	1,090	0.1	4.5
2,000 - 4,999	280	0.04	2.1
5,000 or more	50	0.01	1.2
All Cow-Calf Operations	742,000	99.95*	100.0
* Not 100 due to rounding			

Source:

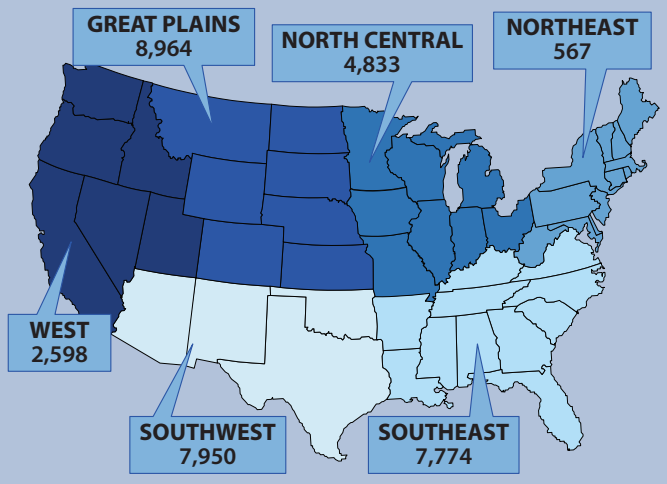
- *Farms, Land in Farms, and Livestock Operations: 2010 Summary. February 2011. USDA National Agricultural Statistics Service. Accessed June 24, 2011, at: http://www.nass.usda.gov/Publications/Todays_Reports/reports/fnlo0211.pdf*

Table 2. Beef Cow Distribution throughout the Contiguous United States, 2007			
Region	**Beef Cow Inventory, 2007 (Thousand Head)**	**Number of Cow-Calf Operations, 2007**	**Average Number of Beef Cows per Operation**
West (CA, ID, NV, OR, UT, WA)	2,598	46,800	55.5
Great Plains (CO, KS, MT, NE, ND, SD, WY)	8,964	96,700	92.7
North Central (IL, IN, IA, MI, MN, MO, OH, WI)	4,833	160,900	30.0
Southwest (AZ, NM, OK, TX)	7,950	189,200	42.0
Northeast (CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VT, WV)	567	38,600	14.7
Southeast (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA)	7,774	236,800	32.8
Total	32,686	769,000	42.5

Source:

- *Farms, Land in Farms, and Livestock Operations: 2007 Summary. February 2008. USDA National Agricultural Statistics Service.*
- *USDA National Agricultural Statistics Service Cattle report, January 28, 2011. Accessed June 24, 2011 at http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1017*
- *Beef 2007-2008. USDA-APHIS National Animal Health Monitoring System (NAHMS). May 2009. Accessed June 24, 2011 at http://www.aphis.usda.gov/animal_health/nahms/beefcowcalf/index.shtml*

Figure 1. Beef Cow Distribution Throughout the Contiguous United States (Thousand Head), 2007.



Adapted from Table 2

The U.S. cow inventory has experienced a significant decline in recent years. 2007 marked the beginning of a nation-wide liquidation of beef cattle due to persistent years-long drought in some of the most important cattle-producing regions, including the North Central and Great Plains regions. As the drought took its toll on available feedstuffs and water available to cattle, producers began to sell their herds; many have never returned to the cattle industry. In addition, increasing feed grain prices led to lower feeder cattle prices which stimulated additional cow sales. In 2008, a spike in production costs combined with sharply declining cattle prices in the last half of the year fueled continued liquidation. Then, in 2009, the U.S. and world economic crisis coupled with the negative impacts of the pandemic novel H1N1 influenza virus on all livestock and meat prices precipitated further decline in beef cow numbers. These and other factors are the reason for the differences in numbers between Table 2 (2007) and Table 1 (2010). Figure 1 shows a map of the U.S. divided into the discussed regions and shows the distribution of cattle throughout the U.S.

Source:

- *Petry, Tim. North Dakota State University, Extension Service, Livestock Market Advisor: Cattle Herd Decline Supports Prices. August 10, 2010. Accessed October 1, 2011*

For further discussion on the cow-calf industry as a whole, refer to section 2.1 Cow-Calf.

1.2 Animal Production

1.2.1 Location and Movement

U.S. cow-calf operations are distributed from the Pacific Ocean to the Atlantic Ocean and from North Dakota to the southern tip of Texas. This widespread distribution results in a diverse exposure to various climates and vegetation. These varying ecological factors significantly influence the size and management practices of cow-calf operations as well the types of cattle used and, ultimately, leads to regionalized trends in cow-calf management. For example, cow-calf operations in the central and western U.S. are more likely to calve in the spring with cattle grazing through the summer and calves being weaned in the fall. In contrast, cattle growers in the southeastern U.S. may choose to utilize the continuously warm climate and longer growing seasons to manage two calving seasons or possibly even calve year round. Nearly 90% of beef cows in the western and central part of the country reportedly calved within the first six months of 2008, according to the 2007-08 NAHMS Beef Survey. Only 66% of beef cows in the Southeastern states had calved during the same time frame. Regional differences also tend to affect the size of an operation, genetic makeup of cattle, the identification methods employed, the animal handling and vaccine protocols implemented, and a variety of other factors.

Source:

- *USDA. 2010. Beef 2007–08, Part V: Reference of Beef Cow-calf Management Practices in the United States, 2007–08 USDA–APHIS–VS, CEAH. Fort Collins, CO #532.0410*

Beef cow-calf production occurs to some degree in all 50 states (see Table 2 on page 3). The majority of beef cows are in the Southwest and Southeast, populated in more numerous, smaller herds. In the North Central, Great Plains, and Western regions however, there are vast areas of non-arable lands which are ideally suited for ruminants to convert forages into high quality protein and, as a result, herds tend to be larger. In the Southwest and Southeast, the grazing season tends to be year round. This may reduce costs associated with purchased feed or with growing and harvesting additional feedstuffs. This is in contrast to the North Central, Great Plains, and Western states where snow cover prevents grazing in the winter and feed must be supplemented in some form. While feeding in the winter is an extra expense in these regions, it is partially offset by the ability to maintain larger herds and sell larger calf crops each year. Dry hay, haylage, corn silage, and crop residues can be harvested to provide winter feed for cattle. Supplemental feeding can vary widely by region as well, depending on the grazing season, available nutrition, and weather.

Movement of animals and products onto and off of a cow-calf operation must occur in order to keep the business running. These movements increase the risk for the introduction and spread of contagious and infectious diseases. Movement of cattle onto an operation can occur for a variety of reasons. Young bulls may be brought onto farms to improve the genetics of future offspring and/or to replace mature bulls culled for infertility or illness. Along with bulls, replacement females may be added to herds to increase herd size, improve or diversify herd genetics, or to replace cows that are culled. Most operations replace culled cows by retaining their own heifers. Products moved onto an operation may include equipment, other vehicles, and feedstuffs. Any of these can act as a fomite and carry potential pathogens onto an operation and expose the resident animals. To prevent or minimize disease introduction onto a cow-calf operation, newly introduced animals should be tested for diseases of concern, vaccinated to match the resident herd, and quarantined without animal contact for a period of time determined with your herd veterinarian. Likewise, all equipment and vehicles should be properly cleaned and disinfected prior to entering the operation and feedstuffs should come from known and trusted sources so as to minimize the risk of disease introduction.

Cattle and products are moved off of cow-calf operations as part of their normal business activities. Cows and bulls are primarily culled from herds due to reproductive failure, physical condition, disease and/or advanced age. Cull cows and bulls are typically marketed through auction markets or directly to harvest facilities. Culling rates among U.S. beef herds are estimated at 15-20% annually. Equipment, vehicles, feedstuffs and other products may also be transported off of an operation for repair or maintenance, testing, or for a variety of other reasons. Equipment and vehicles should be cleaned and disinfected prior to leaving the operation.

1.2.1.1 Pasture Management

In contrast to dairy and feedlot operations where adult cattle are confined and intensively managed in dry lots or barns, cow-calf operations are typically managed primarily on pasture. During the grazing season when cattle are out on pasture, herd monitoring by caregivers can be highly variable ranging from daily to perhaps once yearly. Most often, cow-calf herds are monitored at least weekly while they are out on pasture. Beef cattle tend to be less accustomed to human interaction than dairy cattle, which are typically handled at least twice a day during their lactation. Less caregiver interaction of beef cattle can lead to handling difficulties; however most cattle become familiar and more comfortable with a routine. In the event of an FAD outbreak, many cattle will be out on pasture. Knowing how the herd is typically handled (people herding on foot, horseback, all-terrain vehicles, familiar farm truck, following a feed wagon) can help expedite safe animal movement. A basic knowledge of cattle handling principles is also essential. Cattle handling is discussed further in Sections 4.2 Cattle Behavior and 4.3 Methods for Safe Movement and Restraint of Beef Cattle.

Another management practice within the cow-calf industry that may increase the risk of disease exposure and spread is grazing on public lands. In contrast to private grazing, which typically involves privately owned land grazed by a single herd, public grazing may utilize publicly owned land. Public grazing may involve multiple producers who share range or pasture and commingle their cattle. It may also occur in the form of grazing associations who use co-operatively owned or leased range. In addition to an increased risk of exposure to bovines from outside the herd, the potential for disease exposure and transmission through contact from wildlife may be increased for public grazing.

Due to the largely unconfined open-air nature of cow-calf operations, animals such as deer, elk, horses, feral pigs, dogs, cats, goats, migratory waterfowl and chickens may all have contact with cow-calf herds. Non-domesticated ruminants with large roaming areas are of special concern as they may travel among and between cattle herds from numerous ranches. In addition to non-domesticated animals, cattle strays from other operations may also account for a portion of unintended contact with resident cow-calf herds.

Crossbred Cow

Registered or Seedstock Angus Cow

1.2.2 Classification of Cow-Calf Operations

Cow-calf operations differ in many aspects, including the size of the operation, the manner in which cattle are managed, and the type of breeding program that is used. However, one of the largest differences may be the cattle marketing method a particular operation utilizes. Beef cattle operations typically fall into one of two classifications: 1) commercial cattle, or 2) registered or seedstock cattle. As stated in the 2007-08 NAHMS Beef Survey, a majority of operations (76.3%) had commercial cattle in 2007. Commercial cattle herds include those that are focused on producing calves that will fit the needs of the feedlot industry and will be fed to produce beef. Many of these herds (65% in 2007) were composed of crossbred animals. Seedstock herds focus on the production of specific breed genetics designed to introduce genetic improvement when sold to a commercial herd.

Various cattle management protocols also exist, including conventiotnal, natural or organic methods. Most cattle are raised using conventional methods of production which may include using antibiotics to treat sick cattle, growth promoting technology such as implants, and application of pesticides to forage and cereal grain sources when necessary. Some cow-calf operators choose to manage their herds using natural standards or organic standards.

Source

- *USDA. 2009. Beef 2007-08, Part II: Reference of Beef Cow-calf Management Practices in the United States, 2007-08 USDA:APHIS:VS, CEAH. Fort Collins, CO #N512.0209 http://www.aphis.usda.gov/animal_health/nahms/beefcowcalf/downloads/beef0708/Beef0708_dr_PartII.pdf*

1.2.3 Workforce

The workforce on United States cow-calf operations is diverse. Consequently, ethnic and cultural differences may be potential barriers to effective communication and implementation of FAD prevention practices that are so critical to a successful animal health emergency response. For workers that do not speak English, language may also present a barrier to or hinder response efforts. Some workers may be skeptical and resist government intervention. As a regulatory official or someone tasked with visiting an operation, effective communication with all involved parties will be necessary to conduct the disease investigation or to carry out eradication efforts. Establishing relationships prior to an outbreak will help build trust but this may not always be possible. Awareness of the diversity of the workforce in a given community can facilitate this process. It should be a focus of preparedness efforts at the local level. Some workers may not be accustomed to communicating with response personnel, so identifying the primary facility manager is important. Working with that person to communicate tasks to the other employees will often facilitate acceptance and successful coordination of tasks. If language barriers are present, a translator can be very beneficial. Also, demonstrating concepts or tasks can be helpful. Not all personnel may be literate and having a variety of visual-based educational tools can be an effective way of explaining what is needed.

1.2.4 Business Continuity

In the event that a highly contagious FAD is diagnosed in the U.S., the use of quarantines and movement controls will be necessary to rapidly detect, control, and contain the disease. While quarantines and movement controls are highly effective at stopping the spread of the FAD, they also are likely to cause significant disruptions in typical business operations for the animal industries affected. Farms with susceptible animals that are not currently under investigation for the FAD need to move animals and supplies in order to remain in business. The economic viability and animal well-being on uninfected farms could be negatively affected if certain movements are restricted. Therefore, in order to mitigate these consequences, it is critical to implement science- and risk-based approaches and systems to facilitate continuity of business for non-infected premises.

Continuity of business is the management of non-infected premises, non-infected animals, and non-contaminated animal products in an FAD outbreak. This facilitates agriculture and food industries in maintaining business operations while mitigating the risk of disease spread. Continuity of business planning helps to mitigate losses, facilitate food security, and allow agriculture and food industries to continue operating within regulatory Control Areas.

Continuity of business planning helps to protect:

- Animal health, by preventing the transmission of an FAD from an infected to a naïve animal subpopulation;
- Food security, by ensuring movement of unaffected animals and animal products; and
- Public health, by mitigating zoonotic threats in animal populations and the food supply.

Many cow-calf operations are quite self-sufficient and do not require much daily movement of products onto or off of the premises. However, during an FAD response there may be situations when it would be critical to move animals or supplies onto or off of the premises. During a response effort, uninfected farms in a Control Area will still need to move raw or processed feed, water resources, supplies, pharmaceuticals, or equipment onto the farm and may also need to move weaned calves off of the operation to auction, to backgrounding, or to finishing facilities. Allowing business to continue during the control and eradication of an FAD is also essential for the economic viability of ancillary industries and associated rural communities.

Cow-calf operators and managers should develop preparedness plans now so that they can ensure that feed and any other necessities related to animal care and husbandry will continue to be delivered in an outbreak. Depending on location and season, feed supplies such as hay are often accumulated in the summer and stored for winter use, so large quantities of feed may already be available on the premises. It is important to consider different transport routes and to become familiar with the resources and methods necessary for cleaning and disinfecting large transport vehicles; in the event of an outbreak roads may be closed and cleaning and disinfection will be essential to minimize disease spread. Establishing preparedness plans with suppliers, cattle buyers, and state officials is essential to ensure animal welfare needs are met and movement returns as quickly as possible.

For more information please see the *FAD PReP/NAHEMS Guidelines: Continuity of Business (2011)*.

1.3 Disease Traceability

As defined by the World Organization for Animal Health (Office International des Epizooties or OIE), animal traceability means "the ability to follow an animal or group of animals during all stages of its life". During an animal disease emergency event, it may be necessary to locate the source of the animal(s) in question, the other premises on which the animal(s) resided, other animals that were exposed, and animals at risk of exposure. A uniform national system for identifying all U.S. beef cattle does not exist. However, multiple forms of cattle identification and farm/ranch based numbering systems are in use (described below) as part of health management plans, genetic improvements, marketability, and recording cattle inventory on many cow-calf operations.

A variety of cattle identification methods exist on U.S. cow-calf operations.Some, such as brands, are unique to the owner of the cattle. Brands are mostly used on cattle residing in states west of the Mississippi River. This is an official form of identification when the brand is registered with an official state brand inspection agency and accompanied by an official brand inspection certificate. These brands must be inspected by a brand inspector before the cattle can be shipped. Brands are registered to a particular location on the animal and may be found on the shoulder, rib, or hip. Brands can either be applied with extreme heat, termed hot iron branding, or extreme cold, termed freeze branding. In some cases, an animal may have multiple brands.

Freeze Brand

Plastic Dangle Ear Tag

Official Brucellosis & Bright Ear Tags

While not unique to the farm or the animal, animals that have received a brucellosis vaccine should have a tattoo in their right ear as well as an official individual ID. Some purebred cattle will have a unique registration number tattooed in their left or right ear. Many cow-calf operations identify animals using plastic dangle ear tags labeled with numbers that have some meaning to the cattle grower. Many owners will incorporate a standard year code, which is a predesignated letter corresponding to the year of birth, into the animal's identification number These ear tags can be custom printed with the name of the owner on the tag.

Radio frequency identification (RFID) tags (commonly referred to as electronic ID, or EID, in the cattle industry) are employed in a number of age and source verification systems and may be applied to a bovine at any stage of production from birth to arrival at the feedlot.

Individual animal identification methods are often used on cattle for various record keeping purposes (e.g., treatments, calving dates, etc.) and include ear tags, which may be an RFID tag, a plastic dangle tag, and/or a metal brucellosis vaccination tag in the right ear. Cattle growers in many states and licensed veterinarians can obtain brucellosis or bright (silver) tags from their State Animal Health Official. Plastic dangle tags may be marked with handwritten numbers or pre-printed through a commercial source or purchased from a breed association.

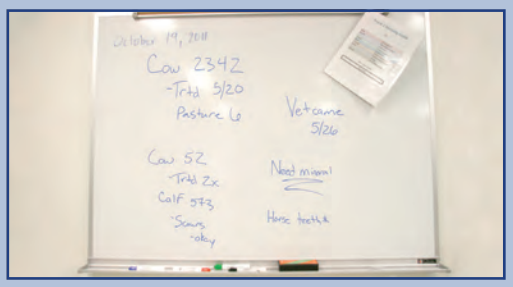
For more information about the USDA's cooperative approach with States and Tribal Nations about animal disease traceability, visit the USDA Animal Disease Traceability website: *https://www.aphis.usda.gov/traceability/*
Source:

- *OIE Terrestrial Animal Health Code 2010, Glossary, accessed May 3, 2011*
- *Bullock, D. et al. "Record Keeping" http://www.ca.uky.edu/agc/pubs/id/id108/11.pdf*

Record keeping systems also vary by operation, ranging from no written records to chalk/white boards to hand-written paper documents to computerized software programs. In the event of an FAD outbreak, beef cattle disease traceability

can play a key role in disease surveillance, control, eradication, and continuity of business. Cow-calf owners and managers are encouraged to retain records of animal origin and movement prior to arrival at their farm to expedite disease investigations.

National Cattlemen's Beef Association (NCBA) Red Book



White Board Record Keeping

2. BEEF CATTLE PRODUCTION STAGES

The beef cattle industry in the United States has three distinct sectors: cow-calf, backgrounder/stocker, and feedlot. The cow-calf phase is from birth to weaning, the backgrounder/stocker phase starts with the weaned calves and grows them to a specific size and weight range, and finally they enter the feedlot where they are 'finished'. The intermediate stage, referred to as backgrounders and/or stockers, is utilized to allow newly weaned calves to grow and prepare for the feedlot while utilizing lower cost, usually higher roughage, rations. The goal of the cattle industry is to produce beef for human consumption. An understanding of the interactions between these sectors is important when developing policies for highly contagious FADs and during a response to an animal health emergency. Some sectors rely on a supply of cattle from the previous phase; changes in demand or disruptions in supply can have serious impacts on individual operations and the entire beef cattle industry.

2.1 Cow-Calf

In the cow-calf stage, farmers/ranchers maintain herds of cows to produce calves. Cow-calf operations tend to be more "capital intense" than other production stages due to the need to own or rent enough land on which to pasture the cattle. Cows in the existing cow herd represent the accumulation of genetic selection and are typically a 7-10 year investment. Many operations have two or more generations of animals with descendants of the original animals in the herd. Loss of these animals can be more devastating than in other livestock operations because of the financial, genetic, and emotional investment that cow-calf operators have in their animals. The business model many cow-calf operations use incorporates both profit and quality of life and integrates them instead of viewing them as unique dimensions. This, coupled with the longevity of animals in the herd, often leads to emotional attachment and a human-animal bond between the caretaker and the cattle.

Each year the calf crop is evaluated at weaning. Once calves have been weaned from dams, there are various cattle-raising systems in which animals may be fed to a harvest weight. Some cattle growers feed out their own calves. Often, calves are marketed to feedlots for finishing. The heifer calves may be divided into two groups: one group is retained as replacement breeding stock for cows leaving the herd as culls, and the other group is marketed for feeding. Unless retained as breeding stock, the bull calves are marketed for feeding as well. These bull calves are generally castrated and then referred to as 'steers'.

Operations vary in their management of the cow and calf herd. Calves that are well-managed while on the cow-calf operation prior to transportation through marketing channels or directly to the feedlot tend to experience fewer health related challenges. This preparation is called preconditioning and involves weaning prior to leaving the operation as well as vaccinating, dehorning, implanting and castrating the bull calves. Calves are typically weaned at six to ten months of age, weighing 300-800 pounds. The weaning period can range from the day of movement off farm to a few weeks prior to movement off-farm. It is recommended that calves be weaned on the farm and retained for 30-45 days post weaning. These newly weaned calves may eat pasture grasses or ensiled forages with or without supplemental grain, depending on the region of the country, calf weight, time of year, and availability of pasture/forages prior to entering the feedlot. Calves are sometimes weaned and removed from the premises on the same day. These calves, frequently termed "high risk calves" because of their increased risk of disease, may go to auction barns, backgrounders, or feedyards.

Feedlots are discussed further in Section 2.3 Feedlots.

Source:

- *United States Department of Agriculture Economic Research Service, Cattle: Background. Accessed July 8, 2011.*
- *United States Department of Agriculture Economic Research Service, U.S. Beef and Cattle Industry: Background Statistics and Information. July 2010. Accessed July 8, 2011.*

2.2 Backgrounders/Stockers

Not all calves will immediately leave the farm or ranch of origin and proceed directly to a feedlot to be finished. Younger, lighter calves may go through a period of growth and development on a forage-based diet designed for light to modest gains at a lower cost. This type of operation may be referred to as a "backgrounding" or "stocker" operation. These operations play a central role in cattle production as they prepare calves to transition to the feedlot and grow the calves, without fattening, using lower cost feed ingredients compared to feedlot rations. Some cow-calf operations retain ownership of these calves and manage this stage of production and cattle development as part of their business plan.

During this phase of production, weaned calves are grown to feeder size, approximately 650-900 pounds. The length of time calves stay at a backgrounder or stocker enterprise (60 to 300 days) depends on the goals of the producer, the size of the calves when they arrive, and the availability of pasture as a feed source as determined by moisture conditions. For example, many calves are born in the spring in the U.S. and some stocker cattle operators will feed them at a lower rate of gain, keeping them longer and producing yearling cattle for feedlots year round.

The goal of backgrounding is to add value to the cattle by producing more uniform groups of calves that are acclimated to the conditions in a feedlot including feeding, watering, and effective preventive healthcare to reduce risk of infectionwith pathogens from other animals raised in similar conditions. Calves may also be conditioned to drink from a water trough if they have not previously had this experience. In most cases, calves also receive vaccinations at this stage. Facilities for routine processing and administration of treatments are variable between operations. Some may have very adequate facilities resembling what is found at larger feedlots (i.e., complete sorting pen, alleyway, and chute systems); others may not have a way to restrain animals other than with a gate in a pasture pen. At the backgrounder, calves may be put on pasture for a period of time and then moved into small dry lot pens and fed a supplemental diet to aid in growth and development and also to condition them to eating from a feedbunk. The ration is similar to feedlots in delivery but usually of a higher roughage and lower energy value. At a stocker operation, calves may be raised on forage the entire time, with supplemental feed in movable bunks rather than stationary concrete bunks at a post and rail on the edge of a pen.

Backgrounder/stocker operators may have a relationship with a feedlot, or own a feedlot themselves and sell or transfer the calves when the calves are the appropriate age. If a relationship to a feedlot does not exist, the calves will be resold using auction markets, video sales, or a direct sale to a feedyard (private treaty).

This intermediate step in beef cattle production also presents a real challenge in animal disease tracking and traceability. Marketing small numbers of cattle from individual consigners through auction barns and assembling them into saleable lots of stockers and feeders involves extensive commingling and the associated loss of identity and traceability to the source. In addition, the stocker industry is concentrated in areas of the country away from where there are significant numbers of cows, so the calves must be moved to the stocker operations. This movement may increase the risk of disease exposure and spread.

2.3 Feedlots

After the cow-calf and/or backgrounder/stocker stages, calves, both heifers and steers, are sent to feedlots (sometimes referred to as feedyards). The majority of feedlots are located in the Great Plains (NE, KS, CO), North Central (IA), and Southwest (TX, OK) regions of the United States. Feedlots may vary from small "farmer-feeders" who feed small pens of cattle on their farming operations on a seasonal basis in order to utilize their own home-grown grain, to commercial feedyards with capacities of 100,000 or more head.

A majority (70%) of weaned calves are sent directly (i.e., by-pass backgrounding phase) from the farm or ranch to these feedlots. Ownership of these animals at this point in the production cycle can be variable. Some feeder cattle are sold on a live basis to another party through the auction market system. In other instances, ranchers may market their cattle directly to the feedlot or retain ownership throughout the finishing phase of the production cycle. Another source of cattle includes steers from the dairy industry, particularly Holsteins. These animals may be fed on dairies until they reach a certain size or raised at a calf ranch similar to backgrounders.

The purpose of a feedlot is to feed cattle to add muscle and fat to tissues, a process often referred to as finishing or fattening. Typically, these animals are fed a complete total mixed ration (TMR) that graduates over time from forage based to a primarily grain-based ration that is typically divided between two or more feedings each day. This phase of the production cycle ends when animals reach a weight of between 1,100-1,500 lbs., typically a timeframe of 150-180 days on feed.

2.4 Harvest Facilities or Packing Plants

Once cattle have reached their finishing weight (1,100 to 1,500 pounds), they are ready to be moved to a harvest facility, also referred to as a packing plant. Cattle that have reached this weight are called "fat cattle" or "fed/finished cattle." Feedlot operators typically put together a "show list" of cattle ready for harvest on a weekly basis. Buyers from one or more packing plants visit the operation, select animals from this list, and make an offer. Once agreed upon, transfer/sale documents are drawn up. In general, cattle contracts are agreed upon for the next week's delivery schedule. Some feedlots have long-term contracts with packing plants whereby a set number of cattle is purchased on a live-weight or carcass-weight basis and within a predetermined weight range. There are also delivery deadlines that must be met in order for the feedlot to fulfill its contractual obligation. This schedule must be adhered to or the feedlot is financially penalized because the plant loses productivity. Some cattle are marketed on a "grid" of carcass characteristics. In some cases, the packer is also the owner of the cattle.

For more information on harvest facilities and the feedlot industry as a whole, please refer to the *FAD PReP/ NAHEMS Beef Feedlot Industry Manual (2011)*.

3. LIFE STAGES & REPRODUCTION

3.1 Breeding Adults: Cows, Heifers, and Bulls

3.1.1 Cows and Heifers

Puberty in heifers is influenced by age, weight, genetics and breed (Table 3). If cattle growers want their heifers to calve as two year olds, the animals must reach puberty by 13-14 months of age.

The length of a cow's estrous cycle varies in length from 17-24 days, averaging around 21 days. After calving, some animals can be rebred as soon as 45 days later. However, the typical length of time between calving and the next opportunity for breeding is around 60 days. These estimates are largely dependent upon the nutritional intake and the body condition of the female at calving, and are negatively affected by problems during parturition (i.e., dystocia). A female beef animal is defined as a heifer until she gives birth, typically around two years of age, and is thereafter defined as a cow.

Table 3. Breed Comparisons: Heifer Age at Puberty

Breed	Days at Puberty
Angus	372 ± 12
Charolais	398 ± 7
Gelbvieh	341 ± 9
Hereford	390 ± 13
Limousin	398 ± 6
Red Poll	352 ± 8
Simmental	372 ± 6
Average	368 ± 3 [SE*]
* Standard Error	

Source: Heifer Development: Puberty. Steve Boyles, OSU Extension Team. TheCattleSite.com. Accessed June 24, 2011 at *http://www.thecattlesite.com/articles/901/heifer-development-puberty*

Yearling Heifer

Mature Cow

Sources:

- *Corah, L.H. and Hixon, D.L. Replacement Heifer Development. Beef Cattle Handbook. Extension Beef Cattle Resource Committee. Accessed May 4, 2011 at http://www.iowabeefcenter.org/Beef%20Cattle%20Handbook/Replacement_Heifer.pdf.*
- *Jaeger, J.R., Pirelli, G.J., and Weber, D.W. Beef Cow-Calf Management Guide. Oregon State University Extension Service. March 2003.*
- *Heifer and Young Female Management. University of Nebraska-Lincoln. Accessed May 4, 2011 at http://www.iowabeefcenter.org/IGLCI/HeiferMgtIGLCI810.pdf*

3.1.2 Bulls/Breeding Soundness

In addition to the cows, operators may own bulls or utilize artificial insemination (AI) to breed the cows. Bulls reach puberty around 9-11 months of age, depending on breed, weight, environment, and other factors (Table 4). Bulls of high genetic merit are used for natural mating and in semen collection facilities for use in AI. In most collection facilities, semen is collected from bulls 2 or 3 times a week to maximize the volume and sperm concentration obtained from each bull. Healthy, reproductively sound bulls are essential to the success of a cow-calf operation. Thousands of dollars are at risk if a breeding bull does not perform satisfactorily. Bulls that are not reproductively sound and do not impregnate their share of cows contribute to reproductive inefficiency, which can be just as costly as death loss. The vast majority (approximately 95%) of pregnancies in beef cows in the U.S. are a result |of natural mating. Each bull used in natural mating must be able to successfully mount a cow and deposit semen in the reproductive tract. In order to determine the reproductive ability of a bull, a veterinarian can perform a Breeding Soundness Examination before breeding season.

Table 4. Breed Comparisons: Bull Age at Puberty

Breed	Average Age (Days)
Angus	295
Charolais	287
Hereford	326
Red Poll	283

Source: Beef Bull Fertility Factsheet. Ontario Ministry of Agriculture, Food, and Rural Affairs. Accessed June 24, 2011at *http://www.omafra.gov.on.ca/english/livestock/beef/facts/06-015.htm#puberty*

Breeding Soundness Examinations have several components, including:

- A detailed medical history of the bull
- A general physical examination
- A detailed examination of the reproductive system, including a scrotal circumference measurement
- A semen evaluation
- Optional tests (serving capacity evaluation, pelvic measurement, testing for tritrichomoniasis, etc.)

Each bull's detailed medical history should include his identification number, age, breed, and weight. A list of vaccines and other products used should also be included, as well as the injection sites of those products, the dates of administration, and any previous health information. This ensures that bulls are healthy, disease free, and reasonably likely to be satisfactory breeders. The breeding soundness exam also provides an opportunity to collect diagnostic samples for additional testing. Diseases can be passed from bull to cow through natural mating and artificial insemination, so care must be taken to screen for potential disease risks.

Sources:

- *Spire, M.F. Breeding Soundness Evaluations. Beef Cattle Handbook. Extension Beef Cattle Resource Committee. Accessed August 2011 at: http://www.iowabeefcenter.org/Beef%20Cattle%20Handbook/Breeding-Evaluations.pdf*

- *Duren, E., Walker, Jack. Identifying the Functional Bull: Bull Soundness and Management. Cattle Producer's Library. Western Beef Resource Committee. 2nd edition; December 2010.*

Yearling Bull

Mature Bull

3.1.3 Bull Management

Providing proper nutrition for bulls is important. Without adequate nutrition, bulls will not express their full genetic potential. Meeting bulls' nutritional needs also allows them to reach puberty on time, which means the bulls can be used for breeding by 15 to 17 months of age. Under- or over-nourishment may cause testicular damage in young bulls and decreased sperm production in mature bulls. Specific ration design and ingredients will vary significantly from operation to operation, and between geographic regions based on cost, availability, and nutritional value of ingredients. Rations should be designed according to National Research Council (NRC) standards for nutrient requirements.

Age is a significant reason for culling bulls. After six years of age, semen quality decreases and mature bulls begin to lose their social dominance to younger, more aggressive bulls and thus have fewer breeding opportunities. Other reasons for culling include poor vision, lameness, lack of desirable conformation, low semen quality, inadequate serving capacity, number of daughters in the herd, and safety concerns because of poor disposition. To prevent slowing the genetic progress of the herd, bulls should also be culled if they produce low-performing offspring. When daughters are retained as replacements, bulls may be culled after several generations to avoid inbreeding.

Bulls kept for breeding on farm can be dangerous and unpredictable. Pens or pastures with bulls are not often marked. Heightened awareness of surroundings when working with breeding bulls is necessary for everyone's safety.

Source:

- *Sprott, L.R., Carpenter, B.B., and Thrift, T.A. Bull Management for Cow/Calf Producers. AgriLife Extention. Texas A&M University System. September 2005.*

Table 5. Average Duration of Bovine Reproductive Cycle Periods

Period	Duration (Days)
First Trimester	94
Second Trimester	94
Third Trimester	94
Postpartum Period (rebreeding)	variable
Approximate Total	365

3.1.4 Female Reproductive Cycle

In order for a beef cattle grower to be successful, the reproductive cycles of the females must be properly managed to maintain stable production. A cow's reproductive cycle is both constant and well-defined. In a broad sense, the cycle starts with fertilization of the egg and it ends with the weaning of a calf. Gestation is approximately 282 days (with variation due to breed and individuals), and the entire reproductive cycle repeats approximately every 12 months. The reproductive cycle can be divided into four definite periods and one variable period (Table 5).

The first trimester of gestation begins on the day of conception. While the duration of each period of the cycle remains relatively constant, the actual dates when these periods begin vary based on when each cow is actually impregnated.

Each of these events in the biological cycle is important to cow-calf producers. If a cow is to conceive and calve every calendar year, it must occur within the constraints of the biological cycle. Thus, management practices and strategies must complement the periods within the biological cycle, and also determine the chronological cycle by selecting the calving season and thus the breeding date.

Source:

- *Hixon, D.L., Sanson, D.W. The Biological Cycle of the Beef Cow. Cow-Calf Management Guide: Reproduction Section. Western Beef Resource Committee. Second Edition, December 2010.*

3.1.5 Natural Mating

Although the dairy industry uses artificial insemination almost exclusively, natural mating is still very common in the beef cow-calf industry. From a safety standpoint, it is important to be aware of how many cows, and therefore how many bulls, are in a pasture during the breeding season. Table 6 shows the serving capacity of bulls of a certain age. Factors that should be considered when determining bull count needs include bull age and terrain.

Source:

- *Beef Bull Fertility Factsheet. Ontario Ministry of Agriculture, Food and Rural Affairs. January 2006. Accessed June 29, 2011 at http://www.omafra.gov.on.ca/english/livestock/beef/facts/06-015.htm#puberty*

Table 6. Maximum Number of Cows Per Bull

Bull Age	Number of Cows
Yearling	15 - 20
2 Year Old	20 - 30
3+ Years Old	30 - 40

Beef Bull Fertility Factsheet. Ontario Ministry of Agriculture, Food, and Rural Affairs. Accessed June 29, 2011at *http://www.omafra.gov.on.ca/english/livestock/beef/facts/06-015.htm#puberty*

Approximately 60 days after calving, cow-calf pairs are moved to breeding pastures so that the females can be exposed to bulls to be bred back and begin the next gestation.

3.1.6 Artificial Insemination and Embryo Transfer

Artificial insemination (AI) is a practice also used on cow-calf operations across the country, especially in purebred herds. The highest-quality bulls are often housed all together in bull studs, where semen is collected from each bull two or three times each week, with two or three ejaculations per collection. A bull's semen is typically frozen to be shipped out to the cow-calf operations. One major advantage of using AI is the rapid genetic progress that goes along with only using top-performing bulls to sire calves. AI will also decrease the potential for many sexually transmitted diseases. Semen is most commonly collected using artificial vaginas or electroejaculation and tested for a variety of diseases.

Embryo transfer (ET) is another means of rapid genetic progress in beef herds. It is mostly utilized by purebred breeders, as well as some club calf breeders for use in show animals. While AI focuses on the use of superior sires in breeding, ET is based on the principle of getting as many progeny from superior cows as possible.

Due to the movement of animals in the form of recipient cows as well as animal products associated with artificial insemination and embryo transfer, the risk of disease exposure exists. Biosecurity practices are essential in controlling the spread of diseases when implementing these reproductive technologies.

Source:

- *Rouge, M. Semen Collection from Bulls. 2 September 2002. Colorado State University. Accessed June 28, 2011 at: http://www.vivo.colostate.edu/hbooks/pathphys/reprod/semeneval/bull.html*
- *Grimes, J.F. Utilization of Embryo Transfer in Beef Cattle. Fact Sheet: Agriculture and Natural Resources. 2008. The Ohio State University. Accessed June 29, 2011 at http://ohioline.osu.edu/anr-fact/pdf/ANR_17_08.pdf*

3.2 Gestation

3.2.1 Pregnancy Testing

Pregnancy testing is a useful tool for operations to confirm pregnancy, estimate due dates, and identify non-pregnant, or open, cows and heifers. Open females will likely be culled because of the ongoing cost of feeding and housing them with no calf to offset those costs.

There are two common times during the year when pregnancy testing is performed: once as early as possible after the breeding season ends (as early as 35 days by rectal ultrasound exam), and once when calves are weaned (approximately 150-200 days by rectal exam). Fall pregnancy testing (in a spring calving herd) and subsequent culling of open cows ensures that only pregnant cows are fed during the winter.

There are several advantages to strategic pregnancy testing. These include:

- Early warning of problem breeders (infertile males or chronically open females)
- Possibility of rebreeding or selling open females
- Grouping pregnant and open females separately
  - This enables cattle to be fed, housed, and managed according to pregnancy status
- Effective use of facilities year-round and especially during calving time
- Ability to guarantee pregnancy in for-sale cows and heifers

Sources:

- *Stenquist, N.J., Sasser, R.G. Pregnancy Testing. Cattle Producer's Library: Reproduction Section. Western Beef Resource Committee. Second edition, December 2010.*

3.3 Calving

3.3.1 Spring vs. Fall Calving

The calving season is a critical time for cow-calf operations because the production of live calves is essential to profitability. "Tradition" was the most frequently cited factor reported in NAHMS data for determining timing of calving season. It is likely that years of experience have revealed a calving season that is optimally suited to local conditions. Thus, though calving usually takes place during either the spring or the fall, variation will often exist between regions based on weather and forage availability. In addition, calving seasons may also vary based on types of operations and business models. A purebred seedstock enterprise may choose to calve at a different time than a commercial or secondary income based operation; though all three could be in the same geographic region. There are several factors to consider when deciding whether spring calving or fall calving is best suited to an operation. Economically, the timing of a calving season can have an impact on the subsequent value of weaned calves. Transitioning from an early spring calving season to a late one can decrease the pounds of live calf for sale or pounds produced per exposed cow by up to 100 pounds due to the comparatively younger age of later-born calves. In contrast, fall calving may fit into the operation's management schedule better by more effectively utilizing grazing in warmer climates and decreasing nutrient requirements and feed costs during the winter. This may provide a method for taking advantage of spring markets, which typically offer higher weaned calf prices compared to the fall market. However, weaning weight alone is not a good indicator of profitability. Moving the calving season to a later date is done to decrease weather stress on the newborn calves, decrease calf morbidity and mortality, and decrease feed costs for the calving females.

Sources:

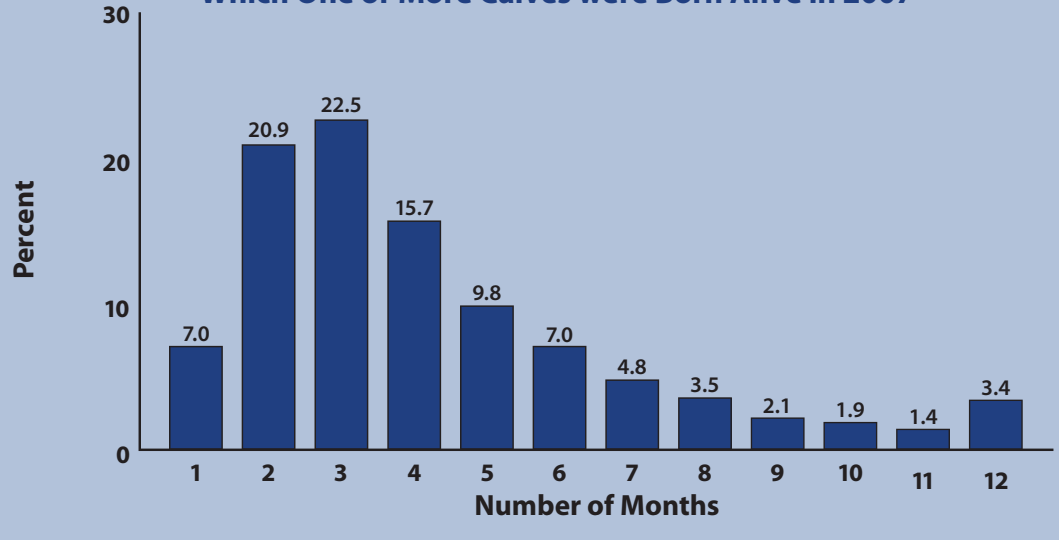
- *Stokka, G.L. Spring vs. Late Spring vs. Fall Calving: a Veterinarian's Perspective. Beef Tips. Kansas State University Department of Animal Science. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. February 1998.*
- *USDA-APHIS Veterinary Services Centers for Epidemiology and Animal Health. Calving Management Practices on U.S. Beef Cow-calf Operations. February 2009.*

3.3.2 Calving Management

The goal for a cow-calf enterprise is to produce healthy, live calves that are well-suited to the needs of the fed-cattle market while creating replacement females appropriate for the ranch environment. Thus, all management factors on a cow-calf operation must be optimized to contribute to this goal as well as to the larger goal of the cattle industry—the production of safe and wholesome beef. These management factors include a defined calving season, a clean and dry calving area, appropriate frequency of calving observation, facilities to enable calving assistance, appropriate timing of assistance, when needed, and a system which favors maternal bonding and minimizes the exposure of calves to pathogens.

A narrow, defined calving season enables operations to pinpoint management assistance at specific times. Establishing a defined breeding season is useful for maintaining a manageable calving season and efficient management of cattle through breeding and weaning. Based on data from 2007, about half of U.S. cow-calf operations had calves born over three months or less (Figure 2). Approximately 16% of operations had calves born over four months of the year, and 3.4% of operations had calves born every month of the year. Lack of a defined calving season becomes more common as the herd size decreases because time commitment increases with operation size. Consolidating the calving season focuses labor requirements and lessens competition with other seasonal activities such as planting and harvesting forages and grains.

Figure 2. Percentage of Operations by Number of Months in Which One or More Calves were Born Alive in 2007



Source:

- *USDA-APHIS-VS Centers for Epidemiology and Animal Health. Calving Management Practices on U.S. Beef Cow-calf Operations. February 2009.*

Despite the wide availability of information regarding selection to increase calving ease Expected progeny differences (EPDs), sire selection, pelvic measurements, etc., according to the 2007-08 NAHMS Beef Survey about 17% of heifers and 3% of cows will still require calving assistance. However, many veterinarians advocate for early intervention during the parturition process. Thus, the calving assistance statistic may reflect an increase in education as well as concern for the welfare of dam and calf. Most calves are born with little or no assistance provided, and the majority of the provided assistance was described as an "easy pull." Dystocia, or difficult calving, is the primary cause of neonatal death; over half of these losses are preventable through timely, correct intervention. While most veterinarians recommend that cows and heifers receive assistance after laboring for two hours, the 2007-08 NAHMS Beef Survey showed that almost half of all operations allowed cows to labor three or more hours, and almost 40% of operations allowed heifers to labor an average of three hours or more before providing assistance.

During calving, producers should observe cows and heifers on a regular basis to identify prolonged or difficult births. Almost 90% of operations observed cows during calving, and over 90% regularly observed heifers. Prolonged labor can lead to less thrifty calves with weaker immune systems and higher susceptibility to hypothermia. Delayed intervention in cases of prolonged labor will result in higher rates of stillbirths, calf losses, failure of passive transfer of immunity (dam to calf via colostrum), and hypothermia.

Source:

- *USDA:APHIS:VS, CEAH. 2009. Beef 2007-08, Part II: Reference of Beef Cow-calf Management. Practices in the United States, 2007-08. Fort Collins, CO. #N512.0209*

It is crucial for calves to ingest high-quality colostrum as soon as possible after calving – ideally within thirty minutes, and definitely within two hours of calving. This is the foundation of the calves' immune system and provides resistance to disease. Ideally, the umbilicus of newborn calves should also be dipped in an antiseptic solution such as strong iodine especially in heavily used calving grounds. It should be noted, however, on many beef operations calves are born

on open range and are not handled until branding or the first vaccination at several months of age, so dipping of the umbilicus and observation of colostrum ingestion is not always possible. Producers should be alert and aware of the signs of a sick calf, such as lowered head and ears, rapid breathing, diarrhea (scours), abnormal posture and/or unusual position in relation to the rest of the herd (isolation). Cows and calves should always be provided with shelter or a windbreak in the event of severe weather as cold and/or wet calves will succumb to illness more readily.

Sufficient nutrition and a healthy environment are vital to the health and well-being of newborn calves. Cow-calf pairs should be housed separate from pregnant cows, allowing producers to more easily observe calves and decreasing the pathogen load in the environment. In many operations, during a calving season, pregnant cows are moved every week or two during the calving season. This separates them from those that have already calved in order to give new calves the cleanest possible pasture.

Sources:

- *Dargatz D.A., Dewell G.A., Mortimer R.G. Calving and Calving Management of Beef Cows and Heifers on Cow-Calf Operations in the United States. Journal of Theriogenology (61) 997-1007. 2004.*
- *Calving Management Practices on U.S. Beef Cow-calf Operations. APHIS Info Sheet. Veterinary Services: Centers for Epidemiology and Animal Health. February 2009.*
- *Calving Season – Calves. Cow-Calf Management Guide. Western Beef Resource Committee. Second edition. January 2002.*

3.3.3 Calf Management

There are several management practices that should be done soon after birth to ensure calf health and growth. The major causes of calf losses at birth and during the first few weeks of life include disease and poor growth performance. The young calf has a naive immune system and efforts should be made to minimize disease exposure. Ensuring adequate nutrition is also essential to meet the needs of the growing calf.

Each calf should ideally be weighed at birth and at weaning, and their body weights should be recorded. For convenience, scales can be placed near the calving area and calibrated for accuracy. Keeping careful records of calves' weights will provide a direct measure of the success of an operation's feeding program, breeding program, and overall management strategy. Also, unthrifty calves that require special attention, either due to poor nutrition or disease, can be identified. Observation should take place at least once a day to evaluate vigor, behavior, response to environment, and relationship with their dams.

Good recordkeeping is crucial to monitoring herd health and overall operation profitability. Registered herds may have more extensive record keeping systems than commercial herds because of registration requirements and marketing expectations. A complete recordkeeping system should, at a minimum, include birth date, gender, and ear tag/ID numbers for each and every animal, particularly the calves. As soon as possible following birth, each calf should be individually identified. Every producer has their own unique system for color coding and numbering ear tags; many breed organizations have numbering standards as well. Individual records at least partially provide the basis for short- and long-term health, breeding, and feeding management decisions for the herd.

If bull calves are not going to be used for future breeding, castration should occur as early as possible. Many producers will castrate their calves around the time of birth as the calves are given their identification number. Younger calves generally recover much quicker, and older calves are more difficult to restrain and may bleed more. One common method of castration in young calves is by applying rubber bands with an elastrator or Callicrate bander, a method commonly called banding. This causes necrosis of the tissue below the band; the scrotum and testicles then slough off in 1-3 weeks. Other methods of castration include the Burdizzo (a clamp that cuts off the testes' blood supply), and surgical or "open" castration. If the cow-calf operation is located in a state where branding is done, calves are often castrated at the time of branding.

Dehorning is another management practice that is best done when the calves are as young as possible and only have small horn buttons. Older calves are likely to undergo greater stress, weight loss, infections, or death in very rare cases. There are both chemical methods and physical methods of dehorning, including tube dehorning, hot iron dehorning, and Barnes dehorners. Saws, obstetrical wire, and keystone dehorners are methods commonly used in older cattle.

3.3.3.1 Graft Calves

Rarely, scenarios occur where a producer must 'graft' a new calf to a cow in order to maintain the dam's production within the herd. Grafting means to facilitate a bond between a cow and a young calf that was not born to her.

Reasons for grafting may include:

- A cow losing her own calf
- A calf has been orphaned or rejected
- A calf that is part of a set of multiples (i.e., twins, etc.) that was born to a mother that cannot or will not handle multiple calves.

A graft calf can originate from a number of sources including orphaned calves or twin calves from the same operation, or calves obtained from feedlots or dairies that are sold at a very young age. Of course, the introduction of calves from outside sources provides an opportunity for the introduction of disease to the operation. Caution and proper biosecurity measures, such as quarantining the cow and new calf, should be considered to minimize the risk of disease transmission.

Sources:

- *Hopkins, F.M., Neel, J.B., and Kirkpatrick, F.D. Dehorning Calves. Agriculture Extension Service. University of Tennessee. Accessed July 7, 2011, at https://utextension.tennessee.edu/publications/documents/pb1684.pdf.*
- *Jensen, S., Parsons C., England J. Castration of Bulls. Cattle Producer's Library: Management Section. Western Beef Resource Committee. Second edition. January 2002.*
- *Olson, D.P., E.P. Duren, K.A. Bramwell, S.R. Henson, R.R. Panting, T.W. Ritter, and D.W. Sharp. Management of Neonatal Beef Calves. Cattle Producer's Library: Management Section. Western Beef Resource Committee. Second edition. January 2002.*
- *Thomas, H. Grafting Calves. Western Cowman. January 2011. Accessed December 17, 2011 at: http://www.western cowman.com/january2011/grafting_calves.html*
- *Williams, S., Gunn D. Grafting Calves. Cattle Producer's Library: Management Section. Western Beef Resource Committee.*

3.3.4 Weaned Calves

The main goal of a weaning program is to separate cows and calves as stress-free, simply and efficiently as possible. Time of weaning will vary, but should be when the cow's milk production decreases and the calf's weight gain becomes more dependent on forage intake. Calves must also be old enough to be able to utilize other feed resources. The traditional weaning age is approximately five to seven months. Early weaning is at any age before five months.

One method of weaning is to separate the cow-calf pairs by placing each across the fence from each other for a couple of weeks. Strong, secure fences are essential to keeping cows and calves separated and avoiding prolonged weaning. Fence-line weaning, as described above, has been shown to reduce the stress of weaning for both cows and calves. Visual contact between cows and calves is maintained while calves remain in familiar surroundings and are aware of feed and water sources. Another low-stress weaning method is to place plastic flaps (blabs) in the nose of the calves that prevent nursing before separating the calves from the cows.

Successful weaning programs encourage calves to eat supplemental feed, such as grain, protein supplement, or hay, very soon after being separated from their dams. The supplemental feed available will vary based on the time of year and resources on the operation. Creep feeding, providing supplemental feed to calves prior to weaning, may help reduce some of the stress of weaning by teaching calves to eat on their own sooner and become "bunk broke." Dehorning, castration, and other stressful management practices should be done soon after birth or well before weaning to avoid additional stress at weaning time. Preconditioning is a term that is often used to describe nutrition and management practices done to calves prior to weaning to help reduce the overall stress of weaning such as vaccination, deworming, dehorning, castration, and creep feeding.

Sources:

- *Pirelli, G., and Zollinger, W.A. Weaning Management for Calves. Cattle Producer's Library. Western Beef Resource Committee. Second edition, December 2010.*

3.4 Post-Calving Cow

The most important aspect of managing post-calving cows is body condition. Cows that are thin and remain thin after calving will have delayed estrus and lower conception rates than those that are fed a diet that maintains their body condition. The nutritional needs of the cow should be assessed when the calves are weaned, while she is in mid-gestation. This is the time when her nutritional requirements are at their lowest and the feeding program is easiest to manage.

The nutritional demands of lactation in post-calving cows present a challenge to maintaining body condition. Nursing cows must receive enough nutrients to support their own needs, as well as to produce enough milk to feed their calf or calves. If the lactating cow diet is deficient, the available nutrients will be used in milk production and she will lose body condition. In addition, younger cows (2-3 years old) are still growing and need to be fed to further develop as well as lactate. As a rule of thumb, post lactation cows nutritional requirement is one-third as much as when she is lactating.

Source:

- *Boyles, S. Beef Cow Nutrition. Ohio State University. Accessed June 29, 2011*

4. CATTLE APPEARANCE AND BEHAVIOR

4.1 Cattle Appearance

There are two major subspecies of cattle in the U.S., each with many different breeds and types of cattle. Some breeds of *Bos indicus* descent have a fatty skin-covered hump over their shoulders, naturally droopy ears, and a large dewlap. These breeds also have less hair than many of the *Bos taurus* breeds of cattle. *Bos indicus* cattle usually handle high temperatures much better than the *Bos taurus* breeds. However, *Bos taurus* is more comfortable in colder weather climates. Within the two subspecies, there can also be large variations in body frame, size, and shape. The Oklahoma State University Breeds of Livestock webpage (*http://www.ansi.okstate.edu/breeds/cattle/*) has a complete listing, with pictures, of all the cattle breeds with.

Bos indicus

Bos taurus

4.2 Cattle Behavior

Cattle behavior is best understood and explained in the context of cattle as a prey species. Their senses are developed to rapidly detect changes in their environment. Cattle seem to have poor detailed vision but they have a wide range of vision and are very good at detecting changes in light and movement. They also have excellent hearing. In most situations, prey animals will flee situations they find frightening. Cattle will tend to flee if an alarming presence is detected within their flight zone – an area in which a threat is determined to be too close for comfort (Figure 3). Flight zone size depends on each animal's temperament and previous experiences. Some flight zones are small enough to allow close contact with the animal and some are extremely large.

It is also important to realize that as prey animals, cattle may hide signs of disease or pain until it becomes overwhelming. In the wild, diseased or injured animals are targeted by predators and prey species have adapted to hide these signs. This behavior can complicate early disease detection in animals, especially if they are easily excited.

4.3 Methods for Safe Movement and Restraint of Beef Cattle

Handling and restraint of cattle requires substantial training and experience to be carried out effectively. Dangerous situations can arise, especially if cattle are excitable. On cow-calf operations in particular, handlers must keep in mind that some mother cows have extremely strong protective instincts of their calves. When handling cow-calf pairs, be aware of where the calves are in relation to their dams and avoid getting in between them if possible. These situations require experienced personnel and good facilities for a satisfactory outcome.

Cattle behaviors can be utilized to handle them safely and effectively. When moving cattle, it is best to utilize their flight zone. By entering the flight zone behind the shoulder, cattle can be encouraged to move forward; alternatively, entering the flight zone in front of the shoulder will initiate backward movement. The shoulder is referred to as the point of bal-

ance. It is best to work at a 45 to 60 degree angle behind the animal's shoulder (Figure 3). When moving the cattle, avoid coming at the animal straight on. Instead work back and forth near their point of balance parallel to the direction in which you would like them to move. Cattle have a panoramic field of vision, which means they can see everything around them except what is directly behind their hindquarters, known as the blind spot (Figure 3). They cannot be driven from directly behind, and they may startle if approached within their blindspot. Cattle's natural reaction when approached from behind is to turn around so they can visualize the possible threat, which is counterproductive to attempts to move them. A demonstration video of proper cattle handling can be found at: *http://www.youtube.com/watch?v=rLpIOW0bt4M*.

Low-stress stockmanship and handling are practices that employ the principles of flight zone and point of balance as well as the cattle's natural herd instincts. There are many well-known cattle handling experts whose principles and systems can be found within a variety of resources. Humans can gain cattle's trust by slowly entering their flight zones and then backing out at the first sign of a reaction.

In review, several pointers to keep in mind when handling cattle are:

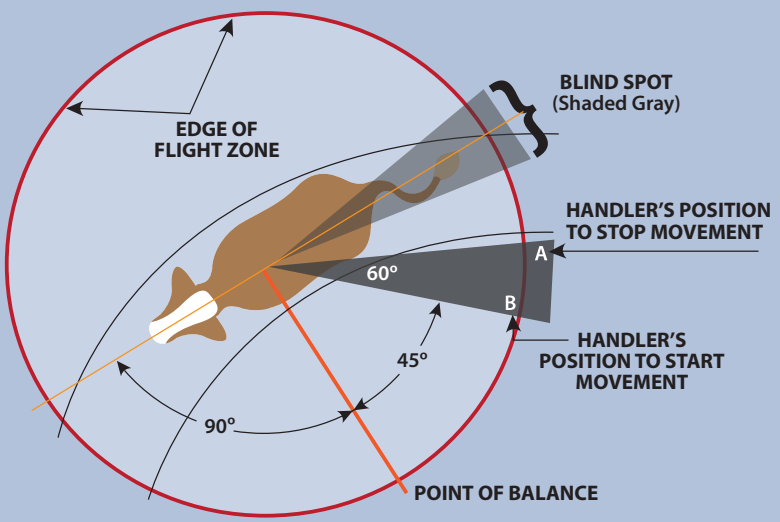
- The only way to work cattle quickly is with patience.
- Work from the front of the group to draw cattle to you.
- Apply pressure (i.e., move towards the cattle) when cattle have somewhere to go.
- Pressure from the side, not from directly behind.
- Cattle must be comfortable to go by you and walk straight ahead.
- When working cattle, move in straight lines.
- Moving against the flow of cattle slows them down or stops their movement.
- Moving with the flow of cattle initiates or accelerates their movement.
- Cattle work best when they are calm.

Following these guidelines will create a safe, stress-free working environment for both humans and animals. Overall, cattle movement done in this manner will be completed in a shorter time span than that done in the traditional "whoop and holler" approach.

Sources:

- *Grandin, T., Lanier, J., and Deesing, M., Low Stress Methods for Moving and Herding Cattle on Pastures, Paddocks, and Large Feedlot Pens (April 2008 Update on Loose Bunching). Colorado State University. Accessed July 21, 2011 at http://www.grandin.com/B.Williams.html*
- *Gill, R., Pate C., Machem R. Cattle Handling Pointers. AgriLife Extension. Texas A&M System. Accessed July 21, 2011 at http://animalscience.tamu.edu/images/pdf/beef/cattle-handling-pointers.pdf*

Figure 3. A Cow's Flight Zone, Point of Balance, and Blind Spot



Source: American Veterinary Medical Association, Emergency Response and Preparedness, April 2009, page 207

Cattle handling is most successful if all personnel involved remain calm. Cattle tend to react to loud noises and sudden movements by balking, fleeing, or fighting the pressure that is being applied. By remaining calm, cattle tend to respond well to the movement techniques described in the preceding paragraphs. Electric cattle prods should only be used as a last resort, and should never be applied to areas in front of the point of balance or the rectal area. Improper handling is very stressful for cattle and can have production and health consequences.

When cattle are being handled in a confined area such as a crowding pen or sorting alley, handle them in smaller groups. For example, bring eight or ten cattle into a crowding pen instead of twenty. Overloading the crowding pen is a common handling mistake; the animals must be able to move and turn around in the pen. Likewise, cattle need room to move along the alley. A stick or whip with plastic streamers or a garbage bag tied on the end is useful for turning cattle in the crowd pen. Shake the streamers on the right side of the head to turn left and vice versa. Use the animal's natural following behavior to assist with filling chutes. Wait until the single file alley leading to the squeeze is almost empty before refilling. Avoid the overuse of crowd gates; if the cattle are moving, do not use the crowd gate.

An animal left alone in the crowding pen after the other animals have entered the single-file chute may attempt to jump the fence to rejoin its herdmates. A lone animal may become agitated and charge the handler. A large portion of serious handler injuries occur when an animal, separated from its herdmates, refuses to enter the single-file chute. If a lone animal refuses to move, the handler should release it from the crowding pen and bring it back with another group of cattle. Proper facilities will help avoid this situation.

Cattle work done in extreme weather conditions warrants extra precautions. During hot conditions, cattle handling should occur during the coolest parts of the day. Working cattle in cold weather can also have consequences. If the cattle get alarmed and excited, their body temperature will rise. When the animal calms down, body temperature can drop to hypothermic levels.

Sources:

- *Hubert, D.J., et al., Cattle Handling Safety in Working Facilities. Oklahoma Cooperative Extension Service. Accessed June 15, 2009 at: http://www.nasdonline.org/docs/d001801-d001900/d001810/d001810.pdf.*
- *Grandin, T. Recommended Basic Livestock Handling. Accessed July 8, 2010 at: http://www.grandin.com/behaviour/principles/principles.html*
- *BQA: The cattle industry's guide for the care and handling of cattle. Accessed October 10, 2011 at http://www.bqa.org/uDocs/Guidelines%20for%20the%20Care%20and%20Handling%20of%20Cattle.pdf.*

Handling facilities vary widely from operation to operation, from a "Bud-Box" (used with low-stress cattle handling techniques) or a complete tub and chute system to nothing but pastures and lariats. Non-hydraulic squeeze chutes are among the most common methods of cattle restraint. A properly operated chute will capture an animal by narrowing an opening around an animal's neck. The head is too large for the animal to back out of the head catch, and the body is too wide for the animal to move forward. In addition to the head catch, some chutes have mechanisms to squeeze the animal. This promotes a sense of well-being in the restrained animal and prevents dangerous movement in the chute. Some chutes have additional features that allow the animal to be tipped onto their side to work on their feet or that will further restrain the head and neck for procedures like ear-tagging or blood collection. Chutes and alleyways should be adjusted to accommodate the size of animals being processed. If the head catch is set too wide, animals will slip their heads out of it and pose a safety hazard for both the animals and the workers. If the head catch is set too narrow, it can squeeze the animal's neck tight enough to asphyxiate the animal.

Special consideration needs to be given to horned cattle. Typically, the head catch must be opened wider in order to get the animal's horns through; however, this creates the risk of missing the catch of the animal. Experienced horned animals can move through obstacles (such as a chute) very quickly by moving their head rhythmically as they go. Some operations, where they breed cattle to have very large and long horns, will have special chutes for handling that allow cattle to move through with less stress and without damaging the horns.

In operations without chutes, cattle can be captured and restrained using ropes in a variety of ways. Some specific

tools include rope halters and nose tongs. These tools can be used to restrain an animal's head for a short period of time. These methods require substantial skill and much practice to be utilized effectively.

Chemical restraint involves the use of tranquilizers or general anesthetic agents and is primarily limited to surgical procedures conducted by a licensed veterinarian. Occasionally, chemical methods are utilized in unique situations such as to capture very wild cattle or to restrain cattle where there are no handling facilities. In this case, the tranquilizer is typically delivered via a specially adapted dart gun. There are various protocols available depending on the depth and length of sedation that is required for a given procedure. Chemical restraint can be used effectively in combination with physical restraint in many cases. As with use of any drugs, there is a risk of side effects with chemical restraint including, but not limited to, hyperthermia and bloat. Chemical restraint also poses a risk to human health and safety if improperly handled and therefore should only be done by or under the direct supervision of a licensed veterinarian. In addition, food safety is paramount and use of chemical restraint in food producing animals requires the observance of all withdrawal times prior to slaughter.

4.3.1 Handling Bulls

Bulls account for only about two percent of the United States cattle population, but they are responsible for over half of livestock related fatalities. They are considered the most dangerous of all livestock. Because of their weight, strength, and inconsistent, unpredictable temperament, bulls require extra caution and consideration. If feasible, one person alone should never handle a bull; at least two people should be available for safe handling. Some facilities are set up to handle bulls without ever getting in the pens with them. Housing and confinement areas should be very secure, and ideally allow producers to feed and access the animals without coming in direct contact with the bulls. While the disposition of bulls varies within breeds and between bulls, no bull should be trusted.

Sources:

- *Hallman, E. and Demmin D. Animal Handling Safety. Cornell Agricultural Health and Safety Program. National Ag Safety Database.*
- *Shooter, M.M. Bull Behavior and Handling Safety. Nov. 9, 2009. North Carolina State University Extension.*
- *Cattle Safety. "Farm Safety – Protect Yourself from Livestock Injuries" series. December 2004. Nova Scotia Department of Agriculture. Accessed March 31, 2011 at http://www.gov.ns.ca/agri/farmsafety/livestock/cattle1.pdf*

4.3.2 Working Horses and All-Terrain Vehicles

Working horses are critical to the workforce of many cow-calf operations. These horses are ridden by operation workers who need to ride across land to examine, move, and/or sort cattle. The horses are generally housed permanently at the cow-calf operation. Working cow horses are generally well maintained and are routinely vaccinated according to recommended standards and local disease challenges.

Working Horse

All-Terrain Vehicle (ATV)

In the event of a disease outbreak affecting cattle and horses (e.g., vesicular stomatitis, surra), these horses and their tack should be quarantined to the cow-calf operation. In the case of vector-borne diseases, like vesicular stomatitis and surra, direct contact is not a main route of transmission so interactions with cattle in the pastures could still occur unless regulatory officials advise otherwise. For other diseases spread via fomite (e.g., foot-and-mouth disease), a horse's tack (e.g., bridle, saddle, blanket) or their hooves could become contaminated with manure or saliva from infected cattle and may carry disease pathogens between pastures and to other areas of the operation.

On some cow-calf operations, especially smaller ones, all-terrain vehicles (ATVs) are used instead of horses to move and work cattle. ATVs should be considered as potential fomites and treated like any other vehicle. They should be cleaned and disinfected prior to leaving the operation, upon entering the operation, and between different susceptible populations within the operation in a disease outbreak.

5. ANIMAL HUSBANDRY

5.1 Facilities

Unlike feedlots where cattle are maintained in confinement, cow-calf herds typically utilize grass pastures or crop residue that provide cattle the ability to roam and graze freely. Depending on location, available facilities, and producer preference, the cows may be brought into dirt or bedded lots or even barns for calving. Facilities for routine processing and administration of treatments are extremely variable between operations. Some may have very adequate facilities resembling what is found at larger feedlots (i.e., complete holding pen, alleyway and chute systems); others may not have a way to restrain animals other than with a rope in a pasture.

Lot

Pasture

Crop Residue (Corn Stalks)

5.2 Culling Cows and Bulls

Cows may be culled from herds due to disease, temperament, physical condition, reproductive failure, and/or age. Older cows may be culled to make room for incoming replacement heifers and to maintain profitability with a quality calf crop. In 2007, a NAHMS study revealed 33% of cows were culled due to reproductive status (i.e., open or aborted) and just over 32% were sold because of bad teeth or age.

Bulls may be culled due to poor libido, breeding soundness examination failure, lameness or other injury, temperament, and/or age. A bull may also be culled to alter genetics in the herd or to reduce inbreeding if his daughters are retained as replacement heifers. Cull cows and bulls are generally marketed through auctions or direct sales for slaughter. Bulls that are culled but are still reproductively sound may be sold to other producers for use in their herds. Typical culling rates for beef herds in the United States are estimated at 15-20% annually.

Source:

- *USDA:APHIS:VS, CEAH. 2010. Beef 2007–08, Part IV: Reference of Beef Cow-calf Management Practices in the United States. Fort Collins, CO #523.0210*

5.3 Diets and Feeding

Supplemental Salt and Mineral in Pasture

Cow-calf herds are usually kept on pasture as much as possible. In the Southern Plains and Southeastern states, forage is typically available year round. In the Northern Plains and parts of the West, forage availability only lasts a few months (late spring to early fall depending on weather). Supplemental feed (hay) must be provided when grass is dormant and the ground is snow covered. Some operations will "bank" standing forage by not grazing itduring the summer and then grazing it in the winter, along with supplemental feedstuffs. Protein supplementation is critical during the winter months, especially late in gestation and early lactation. Cows can also be fed various forms of silage depending on the location of the herd. Cattle raised in farming areas may graze on corn or soybean stalks after harvest. Supplementation with grain, protein supplements, minerals and/or salt may also be warranted to provide balanced nutrition for the cows during gestation and lactation.

5.3.1 Water Access

Beef cattle can require anywhere from 6-19 gallons of drinking water per day depending on things such as reproductive status, nutritional intake, and ambient temperature. Cattle on the farm need to have continuous year-around access to fresh water. This can be provided through natural water sources (e.g., streams, dams, ponds, etc.) or water tanks filled from another source (an underground well, water hauled in from an outside source, etc.) Water sources, especially tanks, should be checked frequently for availability and quality of water. Water tanks should be cleaned on a regular basis to remove organic matter buildup.

Pasture Dam

Windmill and Watertank

Source:

- *Lardy, G., and Stoltenow C. "Livestock and Water." North Dakota State University. AS-954, July 1999. http://www.ag.ndsu.edu/pubs/ansci/livestoc/as954w.htm*

5.4 Routine Vaccinations and Parasite Control

Use of vaccinations in a cow-calf herd is an important component of animal health. The 2007-08 NAHMS Beef Survey revealed that 68.9% of operations vaccinated cattle and/or calves. Smaller operations were shown to be least likely to vaccinate animals. Vaccine protocols will vary depending on the prevalence of disease in the region and the specific herd. Vaccinating cows protects not only the cow, but may also contribute to passively acquired immunity to the calf after it nurses colostrum. Other considerations in a vaccine protocol selection are the efficacy of the vaccine against the disease and the economic loss associated with a particular disease.

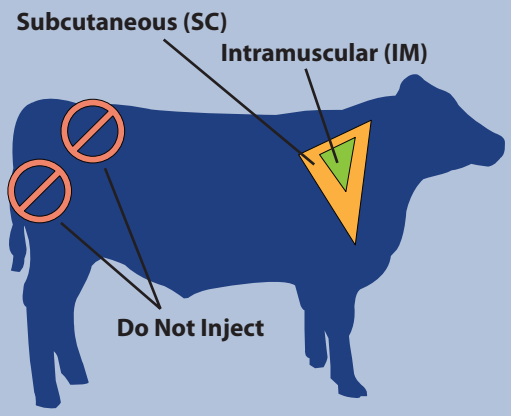
Most animals in cow-calf herds receive vaccinations for common respiratory, enteric, and reproductive pathogens as well as clostridial diseases. Respiratory pathogens may include bovine herpes virus 1 or infectious bovine rhinotracheitis (IBR), parainfluenza 3 virus (PI3), bovine viral diarrhea virus types 1 and 2 (BVDV or BVD), and bovine respiratory syncytial virus (BRSV). Common reproductive pathogens in vaccines include *Campylobacter fetus* subspecies *venerealis* and multiple *Leptospira* spp. In some states, females intended for breeding may be vaccinated against *Brucella abortus* between 4 and 10 months of age. Common names for clostridial diseases are blackleg, malignant edema, black disease, enterotoxemia, and redwater. They are all common diseases in various areas of the country. Cows may be vaccinated in late gestation against enteric pathogens, including *Escherichia coli*, *Salmonella* spp., rotavirus and coronavirus to protect their calves against scours (diarrhea).

Veterinarian Vaccinating Cattle in the Field

Cattle Vaccine Syringes in a Cooler

When administering any type of injection to cattle it is important to give the injection in the neck region (Figure 4). This should be followed whether the injection is subcutaneous or intramuscular. The most valuable cuts of meat are located in the hip and thigh region. Giving injections in the neck reduces any damage to surrounding tissue and minimizes loss of tenderness or presence of injection site blemishes in the meat after harvest. Always follow the product labels of injectable products and when possible, give the injection subcutaneously instead of intramuscularly. Have a plan and a set protocol to be used in case of adverse reactions. It should be considered to have epinephrine available in case of anaphylactic reactions to the injections. This will aid in administering the treatment when time is of critical importance. Anaphylactic reactions usually occur within 10 to 20 minutes of administering the vaccine; however a reaction may not occur for up to two hours. It is best to treat cattle as soon as the symptoms occur. Epinephrine should be administered subcutaneously at a dosage of 1cc per 100 pounds when using the 1:1,000 dilution of epinephrine. A second dose can be given fifteen to twenty minutes after the initial dose if the animal has not recovered sufficiently.

Figure 4. Cattle Injection Sites



Source:

- *Berrier, R.J. Anaphylaxis in Cattle. [Online] Colorado Serum Company, January 2003. Accessed July 31, 2009 at http://www.colorado-serum.com/vets/vol_3/vol3_1.htm.*
- *USDA. 2010. Beef 2007–08, Part IV: Reference of Beef Cow-calf Management Practices in the United States, 2007–08. USDA:APHIS:VS, CEAH. Fort Collins, CO #523.0210 http://www.aphis.usda.gov/animal_health/nahms/beefcowcalf/downloads/beef0708/Beef0708_dr_PartIV.pdf*

Internal and external parasite control is very important on cow-calf operations for several reasons. Parasites can serve as both biological and mechanical vectors for bovine and zoonotic diseases. External parasites (flies, mosquitoes) can lead to increased stress and may lead to cessation of normal activities such as eating and resting. Internal parasites compete for nutrition and decrease the growth rate, requiring more feed to grow, maintain, and finish an animal.

Oral, topical, and injectable anthelmenthics are used routinely to control these parasites. Some parasiticides work against external and internal parasites. Since parasite types and burdens differ depending on geography, parasite control programs should be determined by geographic origin of particular groups of cattle. Since cattle are destined for human consumption, only products labeled for use in food-producing animals should be used. Appropriate withdrawal times, which will be listed on the drug label, must be followed.

Feed additives containing insect growth regulators (IGRs) may help reduce the numbers of adult flies by disrupting larval development in manure. Wasps that target fly larvae in fecal material may also reduce the fly burden. Manure management and avoiding spilled feed are other components to adequate pest control.

Fly tags in the ears, sprays, dust bags or rubs can also be used to help lessen the fly load on cattle.

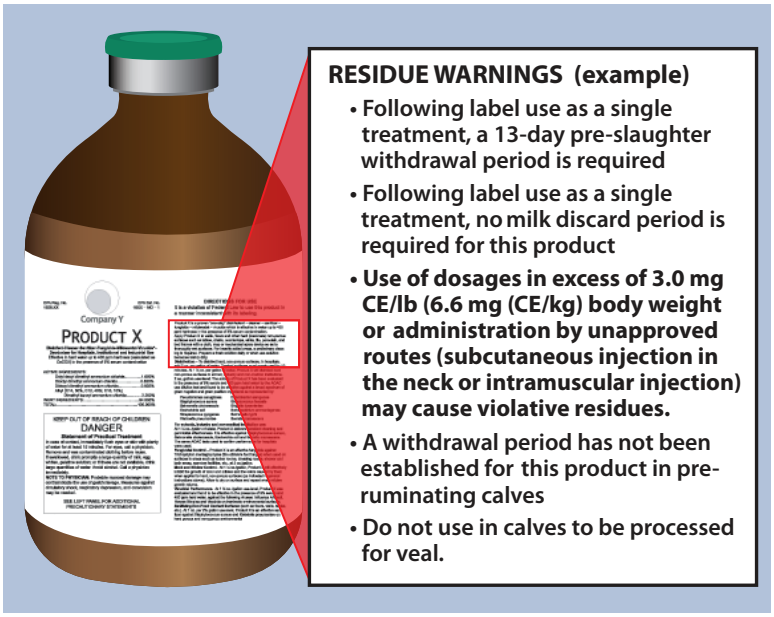
5.5 Sick Animal Care and Treatment with Drug Withdrawal Information

Withdrawal time consideration is very important when medicating, vaccinating, or supplementing cattle on cow-calf operations. Withdrawal time is the time that it takes for residues from substances introduced into the animals system to fall below acceptable set levels so that the animal products are safe for human consumption. Withdrawal times have been published for many common

pharmaceuticals and biologicals in beef cattle production and must be taken into account when emergency harvest is considered as a control measure in a highly contagious FAD outbreak.

To meet withdrawal times, it is important to keep precise records on every animal that is given any drug, implant, vaccine, or feed additive. These records, for each animal or group of animals, should include the substance, quantity, and duration along with reason for administration. Required withdrawal times should also be noted on the records. Drugs and vaccines should be used according to label directions. According to the U.S. Food and Drug Administration, as of April 1, 2011, the following drugs, families of drugs, and substances are prohibited for extralabel animal and human drug uses in food-producing animals:

1. Chloramphenicol
2. Clenbuterol
3. Diethylstilbestrol (DES)
4. Dimetridazole
5. Ipronidazole
6. Other nitroimdazoles
7. Furazolidone
8. Nitrofurazone
9. Sulfonamide drugs in lactating dairy cattle (except approved use of sulfadimethoxine, sulfabromomethazine, and sulfathoxypyridazine)
10. Fluoroquinolones
11. Glycopepetides
12. Phenylbutazone in female dairy cattle 20 months of age or older.



Source:

- *Code of Federal Regulations Title 21. Accessed on December 16, 2011 at http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=530.41*

It is very important to read a drug's label before administering its contents. The label offers the most current information about indications for use, contraindications, route(s) of administration, and withdrawal times. Information is dynamic and could change based on the product.

Vaccines are regulated by USDA-APHIS Center for Veterinary Biologics and those made with oil adjuvants have a 60-day meat withdrawal period; all others have a 21-day withdrawal. Emergency vaccines used in the event of a highly contagious FAD outbreak will have specified withdrawal times printed on the label.

5.6 Management of Mortalities

Once a dead cow, calf or bull is identified in a pen or pasture, the carcass should be removed and placed in a designated area. The disposal of livestock mortalities (carcasses) is regulated by the state in which the cow-calf operation is located. Four primary methods of disposal are typically considered: burial, rendering, open air burning, and composting. Environmental and legal regulations should be considered and there may be limitations, restrictions, or regulations governing each of these options. When planning disposal of large numbers of carcasses, cooperation and communication with applicable State departments (such as Environmental Protection Agency and Natural Resources and Conservation Service), industry stakeholders, surrounding property owners, and other appropriate groups should occur. Listed below are potential options:

1. On-site carcass burial is a common disposal procedure on some operations, particularly smaller facilities. Eventually, buried materials are degraded and broken down into minerals and organic material. Timeliness of burying and prompt covering of the carcasses is critical to maintaining a biosecure and aesthetically acceptable burial site. Most states regulate separation distances of the burial site from wells, surface water and the property line, and limit the number of animals that can be buried in an area. Some states have maps that show where animals can be buried safely and lawfully. In some cases, off-site burial is the disposal option of

choice; some types of commercial or industrial landfills may provide a reasonable option for carcass disposal. Landfills being considered for carcass disposal are required to meet specific design and operating standards. Depending on environmental risks and available land, burial may be the method of choice for the disposal of large numbers of cattle during a disease outbreak.

2. Rendering is an off-site process that uses heat to convert carcasses and associated disposal materials into protein-based solids (carcass meal), water, and melted fat/tallow. Rendering of carcasses is a common disposal method among some operations located in an area where the service is available. Rendering is nearly always carried out by a business independent from the farm and often includes a "pickup" service at a designated location; preferably at the edge of the farm away from main traffic areas. This can be an expensive option which may be offset by the benefit of having a third party take the responsibility for managing the mortalities in an environmentally sound manner. Policies for animal pickup vary among different rendering companies and some will not accept carcasses that have been necropsied or have had the brain removed. Rendering collection trucks moving between different types of animal related enterprises can present a biosecurity risk if not considered ahead of time in an operation's biosecurity plan. Rendering services are not available in all areas. In situations involving mass depopulation, rendering services can be quickly overwhelmed

3. On-site open air burning of carcasses on cow-calf operations could work well for a small number of animals but is often regulated. Open air burning and other thermal methods use high-temperature combustion to destroy animal carcasses and associated animal materials. Using this method, carcasses can be burned in open fields or on combustible heaps called pyres. To enable and promote thermal production, materials such as hay, straw, dry timbers, or other kindling is added to the carcasses. In addition, diesel or other fuels are typically used in open-air burning. Many states allow for incineration of carcasses on-farm but specifically prohibit burning them in the open. It may be possible to obtain a waiver in a declared animal carcass disposal emergency. The process of open air burning takes several hours to complete and the odor from burning and pollution caused by smoke can be a public concern. Public perception of open-air burning is overwhelmingly negative and, if selected as a disposal method, this aversion must be addressed during planning. State regulations should always be checked before a decision is made to use open-air burning as a disposal method.

4. The use of composting as an on-site disposal method can provide a nutrient rich product that can be applied to land to increase productivity. Composting on farm may be an inexpensive option in some climates/localities. However, it requires a large space when incorporated into a sizable operation. Composting protocols and the required equipment will vary among states and animal populations. This method requires prolonged management, maintenance, and monitoring. Care must be taken to identify a site that will have all-season access by personnel. When composting is conducted at a proper site with appropriate cover, the risk of environmental contamination is low. Producers using this method must have a plan in place for utilizing the finished compost. Well-described techniques are available at *http://www.abe.iastate.edu/cattlecomposting/* and *http://tammi.tamu.edu/largecarcassE-422.pdf*. During an animal health emergency involving large numbers of carcasses, off-site composting may be used as a disposal option.

6. DESIGNATION OF ZONES, AREAS, AND PREMISES

A critical component for FAD response is the designation of zones, areas, and premises. Epidemiological investigation and tracing will be used to classify premises. It is the responsibility of the Incident Management Team to designate zones and premises in an FAD outbreak. These zones, areas, and premises designations will be used in quarantine and movement control efforts.

Table 7 summarizes the premises designations that would be employed in an FAD outbreak response. Table 8 summarizes the zone and area designations that would be used in an FAD outbreak response.

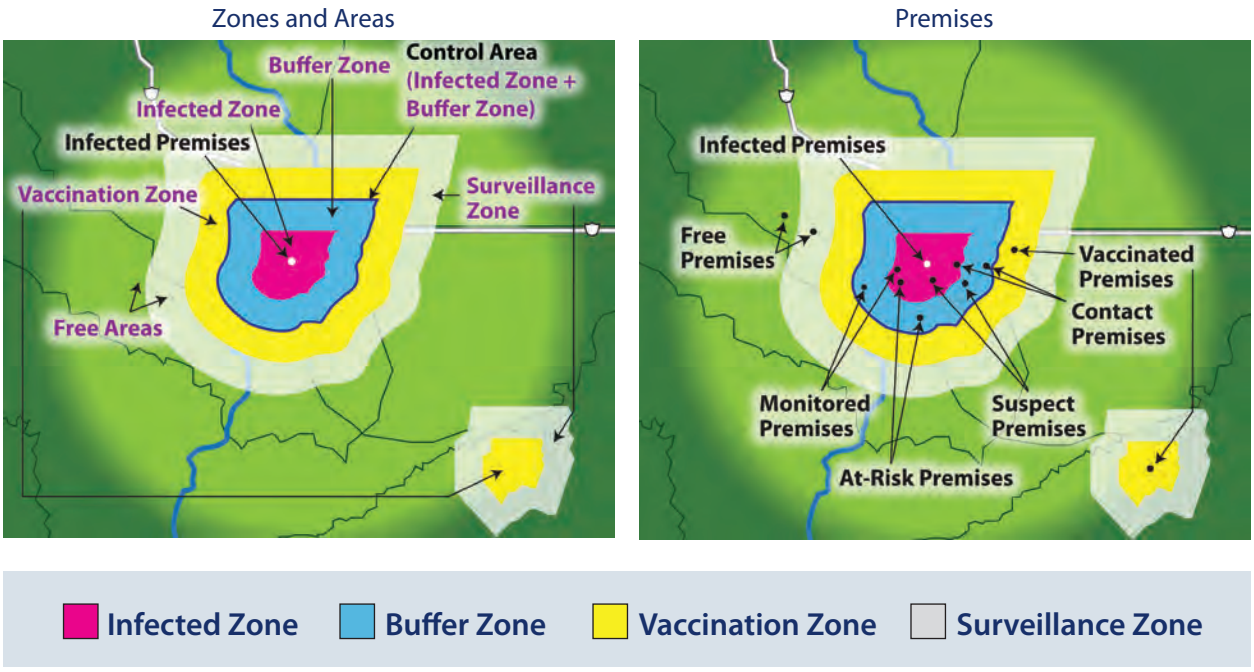
Table 7. Summary of Premises Designations

Premises Category	*Definitions*	*Zone*
Infected Premises (IP)	Premises where a presumptive positive case or confirmed positive case exists based on laboratory results, compatible clinical signs, case definition, and international standards.	Infected Zone
Contact Premises (CP)	Premises with susceptible animals that may have been exposed to the FAD agent, either directly or indirectly, including but not limited to exposure to animals, animal products, fomites, or people from Infected Premises.	Infected Zone, Buffer Zone
Suspect Premises (SP)	Premises under investigation due to the presence of susceptible animals reported to have clinical signs compatible with the FAD. This is intended to be a short-term premises designation.	Infected Zone, Buffer Zone, Surveillance Zone, Vaccination Zone
At-Risk Premises (ARP)	Premises with susceptible animals, but none have clinical signs compatible with the FAD. Premises objectively demonstrates that it is not an Infected Premises, Contact Premises, or Suspect Premises. At-Risk Premises seek to move susceptible animals or products within the Control Area by permit. Only At-Risk Premises are eligible to become Monitored Premises.	Infected Zone, Buffer Zone
Monitored Premises (MP)	Premises objectively demonstrates that it is not an Infected Premises, Contact Premises, or Suspect Premises. Only At-Risk Premises are eligible to become Monitored Premises. Monitored Premises meet a set of defined criteria in seeking to move susceptible animals or products out of the Control Area by permit.	Infected Zone, Buffer Zone
Free Premises (FP)	Premises outside of a Control Area and not a Contact or Suspect Premises.	Surveillance Zone, Free Area
Vaccinated Premises (VP)	Premises where emergency vaccination has been performed. This may be a secondary premises designation.	Containment Vaccination Zone, Protection Vaccination Zone

Table 8. Summary of Zone and Area Designations	
Zone	***Definition***
Infected Zone (IZ)	Zone that immediately surrounds an Infected Premises.
Buffer Zone (BZ)	Zone that immediately surrounds an Infected Zone or a Contact Premises.
Control Area (CA)	Consists of an Infected Zone and a Buffer Zone.
Surveillance Zone (SZ)	Zone outside and along the border of a Control Area.
Free Area (FA)	Area not included in any Control Area.
Vaccination Zone (VZ)	Emergency Vaccination Zone classified as either a Containment Vaccination Zone (typically inside a Control Area) or Protection Vaccination Zone (typically outside a Control Area). This may be a secondary zone designation.

Figure 5 illustrates all the zones and premises. Note: Figures are not to scale. The Vaccination Zone can be either a Protection Vaccination Zone or Containment Vaccination Zone

Figure 5. Example Zones and Premises



For details on the zones, areas, and premises, please see the *APHIS Foreign Animal Disease Framework: Response Strategies*. For additional information integrating the zones, areas, and premises designations with specific FAD response strategies, please see the disease specific response plans, such as the *FMD Response Plan: The Red Book*.

These documents are available on the following sites:

- FAD PReP collaboration website at: *https://fadprep.lmi.org*.
- APHIS FAD PReP website (for APHIS employees) at: *http://inside.aphis.usda.gov/vs/em/fadprep.shtml*.

7. DISEASE-SPECIFIC BIOSECURITY MEASURES

It is important that excellent physical security and biosecurity be maintained on a regular basis to help mitigate the risk for accidental or intentional introduction of a highly contagious FAD. Animal biosecurity is the product of all actions undertaken by an enterprise to prevent *introduction* of disease agents on to a premises. Biosecurity on uninfected premises must be enhanced and more strictly enforced to minimize the risk of disease introduction. Exposure to disease can occur through five routes of transmission: aerosol, direct contact, fomite, oral, and vector-borne. Disease specific biosecurity measures are aimed at preventing exposure to highly contagious FADs of cattle. These biosecurity measures can also be applied to other diseases with similar exposure routes.

- FMD Prevention Practices (spread by aerosol, direct contact, fomite, oral)—Appendix
- Rift Valley Fever Prevention Practices (spread by vector)—Appendix
- Heartwater Prevention Practices (spread by vector)—Appendix
- Bioterrorism and High Consequence Cattle Pathogens—Appendix

Infected Premises will also need biocontainment protocols that focus on preventing spread (release) of the highly contagious FAD to other premises. Biocontainment measures will depend on the routes of transmission that apply to the particular infectious agent. Biocontainment protocols must be maintained from the initial diagnosis until the animal health emergency has been eradicated or controlled with vaccination.

Information on measures for containment of spread of a pathogen from a premises can be found in the *FAD PReP/NAHEMS Guidelines: Biosecurity (2011)*.

7.1 Zoonotic Diseases of Cattle

Cattle are susceptible to infection with a number of important zoonotic diseases, including anthrax and brucellosis. It is important for people working with cattle to have a basic understanding and awareness of the clinical signs, in both their animals and themselves, for each disease and appropriate precautions and actions needed to prevent exposure. It is important to recognize that other zoonotic pathogens such as *Salmonella* spp or *Cryptosporidium parvum* that infect cattle are not classified as an FAD but can cause serious human illness. Some zoonotic pathogens also have the potential to be used in bioterrorist activities. These diseases require that optimal biosecurity and personal hygiene be employed to help avoid the risk of contracting these diseases. More information on these diseases can be found in the appendix in "Bioterrorism and High Consequence Cattle Pathogens" and also at: *http://www.cfsph.iastate.edu/DiseaseInfo/*.

Response to a highly contagious FAD that is zoonotic will require special attention to health and safety of operation workers and all responders. Some level of personal protective equipment (PPE) will likely be required, depending on the routes of transmission of a particular zoonotic agent. For more information, please see the *FAD PReP/NAHEMS Guidelines: Health and Safety (2011)* and *PPE (2011)*.

8. PROVIDING ANIMAL CARE

During a disease response, producers may experience disruptions in supply deliveries and animal transportation. Producers and support industry personnel should develop plans prior to an outbreak to ensure animals continue to receive proper care during a highly contagious FAD response.

8.1 Provision of Feed and Water

During a highly contagious FAD response, the on-premises inventory of feed must be promptly ascertained along with the rate at which it will be depleted in order to determine when more feed will be needed. Transportation routes may be disrupted, so plans for alternate feed sources and delivery routes should be made before the situation arises. Provisions for feed delivery and a secure delivery site on the farm should also be identified at this time. Records should be maintained including the origin of the feed delivery, the date, and amount. Ration reformulation may be necessary to conserve stockpiles of feed on premises and minimize the need for feed deliveries. All alterations in feeding regimens should occur gradually to prevent digestive upsets.

In addition to provision of feed, the availability of water must be determined. All animals must have access to an adequate water supply. Animals should not be deprived of water for more than four hours. If adequate water is not available on-site, then plans to provide water using alternate water resources should be identified.

8.2 Vaccinating

8.2.1 Routine

In the cow-calf situation, there is typically a certain amount of routine vaccine product kept on hand for processing cattle. In the event routine vaccines are needed during a highly contagious FAD disease response, this stock of vaccines would be used first and then the cow-calf producer should contact their normal distributor to ensure the vaccines can still be delivered or to make other arrangements. If a disease-specific emergency vaccination is used as part of the outbreak response, timing of routine vaccinations may need to be modified to ensure the animals' immune system is not overwhelmed. Consultation with a veterinarian about vaccination schedules and protocols should be done.

Vaccination crews, either operation employees or contract crews, have the potential to introduce or spread disease among operations. If this service is used for routine vaccinations during a disease outbreak, biosecurity precautions should be followed and strict records should be kept pertaining to the crew. Recorded information should include, at a minimum, company name (if contract crews), crew member names and contact information, exposure to other livestock in the previous 5 days, name(s) of products, date(s) administered, and tag numbers of cattle vaccinated. This information may be needed to trace where a highly contagious FAD infection came from (trace back) or where it may have been spread to (trace forward).

8.2.2 Specific to Disease Event

Depending on the type of disease outbreak, the response may include vaccinating the animals in an attempt to limit disease spread. Optimal vaccination strategies will vary greatly by region of the country and depend on impacts to both the domestic economy and foreign trade. Additionally, vaccination protocols and strategies may also be influenced by location and extent of outbreak as well as species and population of animals. In the event of a national FAD outbreak, the USDA-APHIS Veterinary Services Deputy Administrator (U.S. Chief Veterinary Officer) will make the recommendation to vaccinate to the U.S. Secretary of Agriculture, whom then is responsible for authorizing emergency vaccination against the FAD in question. Proactive discussions as to the optimal vaccination strategies in a given region based upon livestock demographics and foreign trade impacts will better prepare decision makers and industry for real-time decisions of this nature. It is prudent to keep in mind that for vaccination-to-live strategies, tracking, and permitting of vaccinated animals will likely need to occur and may impact movement of other unvaccinated livestock in that vaccinated region.

If vaccination is implemented, the product will be distributed by regulatory officials. Guidance as to dose, delivery method, administration method, animal identification, and record keeping requirements will be provided. In some cases, the regulatory officials may require administration by official responders rather than contract or employee vaccination crews. Individual situations will be taken into consideration and may vary among operations depending on their proximity to the Infected Premises and Control Area.

Whenever vaccines need to be administered, follow the dosage and injection site recommendations provided with the vaccine. Ensure the animal is properly restrained and the needle changed as appropriate to maintain cleanliness and sharpness. When using needles, ensure they are all accounted for before and after administration. Intramuscular (IM) and subcutaneous (SC) injections should be given in the neck region of all ages of cattle. The injection should be given as ventrally and caudally as possible while remaining in the muscles of the neck. Injection sites should be as clean as possible. Please consult Table 9 for recommended needle lengths and gauges.

Table 9. Guidelines for Needle Selection for Cattle

	Route of Administration								
	Subcutaneous injection (1/2- to 3/4-inch needle) (cattle weight, lb)			***Intravenous injection (1 1/2-inch needle) (cattle weight, lb)***			***Intramuscular injection (1 to 1 1/2-inch needle) (cattle weight, lb)***		
Injectable Viscosity	**<300**	**300-700**	**>700**	**<300**	**300-700**	**>700**	**<300**	**300-700**	**>700**
Thin (e.g., virus vaccine)	18 gauge	18-16 gauge	16 gauge	18-16 gauge	16 gauge	16-14 gauge	20-18 gauge	18-16 gauge	18-16 gauge
Thick (e.g., oxytetracycline)	18-16 gauge	18-16 gauge	16 gauge	16 gauge	16 gauge	16-14 gauge	18 gauge	16 gauge	16 gauge

Some vaccines are quite viscous; using the recommended larger gauge needle is needed for delivery. Properly dispose of all used needles in a puncture-proof container. Additional disposal guidelines may be needed depending on the FAD.

A DIVA (Differentiating Infected from Vaccinated Animals) approach or marker vaccines may be used in the event of a highly contagious FAD outbreak. The DIVA approach utilizes a vaccine paired with a diagnostic test that distinguishes vaccinated animals from animals that have been infected by a field strain of the disease. This can be very useful in a test and slaughter situation. Foot-and-mouth disease is one of the few highly contagious FADs for which a manufactured DIVA vaccine and companion diagnostic test are available for field use.

Animals that receive emergency vaccine will be identified by metal ear clips similar to the ones used with brucellosis vaccination. These ear clips will help designate animals that may need to be slaughtered in order to regain OIE disease-free status from the highly contagious FAD. Ear tattoos or branding may also be used in conjunction with the ear clips.

Great care should be taken in the event of a highly contagious FAD outbreak like foot-and-mouth disease to make sure that people who vaccinate animals do not mechanically carry the disease from one premises to another. It is recommended that people in contact with positive animals or suspected positive animals should not have contact with naïve animals for at least 48 hours. Good records should be maintained that includes the names of the vaccinating crew, the vaccine name, vaccine lot number, dose given to each animal, animals' numerical identification number, and date administered.

For additional details, see *FAD PReP/NAHEMS Guidelines: Vaccination for Contagious Diseases (2011)*.

9. PRODUCT HANDLING

Cattle are the primary product that is moved into and out of a cow-calf operation. This activity is typically accomplished with pick-up trucks and stock trailers or, in the case of larger herds, semi-trucks and trailers. There are a variety of sizes and styles of semi-trailers. Lengths range from 44 to 53 feet. Some are single deck and others are pot-bellied, i.e., the bottom of the trailer is lower to the ground than the top of the tires - allowing for a double deck. Table 10 lists the types of trailers and number of head based on cattle weight that can be transported. In a highly contagious FAD outbreak, movement may be halted. At a minimum, all vehicles entering and exiting an operation will need to be externally cleaned and disinfected. It is a good biosecurity practice to internally and externally clean and disinfect the livestock trailer between every load of cattle. For information on available truck washes on a state-by-state basis, visit the National Biosecurity Resource Center for Animal Health Emergencies website at: *http://www.biosecuritycenter.org/truckwash.php*. Other cattle transporting resources are listed below.

Table 10. Size and Capacity of Livestock Trailers Based on Cattle Weight

Cattle Weight	*Trailer Length*	*Decks*	*Number of Head/Trailer*
1100 lbs.	44 feet	Single	25 without horns
675 lbs.	44 feet	Single	40 without horns
500 lbs.	44 feet	Single	55 without horns
1100 lbs.	44 feet	Double	40 without horns
675 lbs.	44 feet	Double	65 without horns
500 lbs.	44 feet	Double	88 without horns
1100 lbs.	53 feet	Single	30 without horns
675 lbs.	53 feet	Single	48 without horns
500 lbs.	53 feet	Single	66 without horns
1400 lbs.	44 feet	Single	18 without horns
675 lbs.	44 feet	Single	37 without horns
500 lbs.	44 feet	Single	50 without horns
1400 lbs.	44 feet	Double	28 without horns

Cattle Weight	Trailer Length	Decks	Number of Head/Trailer
1100 lbs.	44 feet	Single	58 without horns
675 lbs.	44 feet	Single	78 without horns
500 lbs.	44 feet	Single	22 without horns
1100 lbs.	44 feet	Double	45 without horns
675 lbs.	44 feet	Double	61 without horns

Source:

- *Grandin T. Livestock Management Practices that Reduce Injuries to Livestock During Transport, in Livestock Trucking Guide, Revised September 2001. Accessed July 8, 2010 at http://www.njintouch.state.nj.us/agriculture/humanetruckingguide.pdf*
- *Beef Quality Assurance. Stock Trailer Transportation.*
- *Master Cattle Transporter Guide.*

9.1 Animals in Transit

Live animals are often the greatest risk for introducing or spreading disease during an outbreak. Animals in transit are problematic whenever a highly contagious FAD outbreak occurs on a premises and movement restrictions are enacted. These in-transit animals, whether destined for other cow-calf operations, stocker/backgrounder operations, auction markets, feedlots or a harvest facility, are a potential source of disease for other non-infected, but susceptible species. Consequently, procedures must be in place that will expedite removing these animals from transportation routes while accounting for the welfare of the animals and minimizing exposure of susceptible species. Records pertaining to animal movement should include date, animal identification, and destination.

9.1.1 Calves

Movement of young stock off an uninfected premises may be halted during a highly contagious FAD outbreak depending on the proximity to the destination and whether travel through or within a Control Area is required. Provisions for their feeding and care on the home operation need to be planned in order to ensure adequate housing, protection from the elements, and appropriate feedstuffs are available.

9.1.2 Cull Cows

Cow-calf operations may sell cull cattle through an auction market/sale barn, which will then commingle them with animals from multiple operations prior to their transportation to slaughter. Cull cattle can also be purchased on-farm by a consolidator who travels a geographic area to acquire a semi-load of cattle for a slaughter facility. Larger producers may also market cull cattle directly to a packer.

Cull cattle movement off uninfected premises may be halted temporarily during a highly contagious FAD event depending on the proximity to an auction market or slaughter facility. If there is adequate housing, ambulatory animals should remain on-farm until movement controls permit transportation. Non-ambulatory animals should be humanely euthanized on the farm and disposed of properly.

9.1.3 Market Animals

Transportation of steers and heifers fed on uninfected premises destined for slaughter may also be halted for similar reasons. Contracts with order buyers need to be discussed in the event that cattle cannot be delivered on a specified date. Feedstuffs need to be acquired in a timely manner to ensure the cattle's nutritional needs are met until movement controls permit transportation.

9.2 Mortalities

Most cow-calf operations have determined their method of carcass disposal based on "usual" mortality rates. If a highly contagious FAD causes higher than average mortality rates, animals must be disposed of in the manner mandated by the Federal and State (and when applicable, local) governments and in a method that will mitigate the risk for disease spread. The method of disposal chosen will depend on the disease, the local conditions and regulations, and the number of animals.

Depending on the type of disease response, operations may be able to compost mortalities. Facilities utilizing on-premises compost piles may be able to adjust to accommodate the larger number of cattle. Additional space and compost materials will be necessary and the pile needs to be monitored to ensure carcasses are decomposing properly. Burying large numbers of animals on a particular site requires special permission and is usually under the jurisdiction of the state's environmental regulatory agency. Incineration may be an option in a disease outbreak if local jurisdictions approve. Rendering companies may be quickly overwhelmed by large numbers of cattle and if the disease is contagious, this option will not be used because motorized vehicles containing these dead animals will be traversing public highways.

For additional details, see *FAD PReP/NAHEMS Guidelines: Disposal (2012)*.

9.3 Manure

Waste management is vitally important in controlling pathogens because of the large number of diseases that are spread in feces. Most pathogens in fecal matter are destroyed if exposed to heat, desiccation and/or sunlight, but in cooler weather they may live in fecal matter for an extended period of time. Mechanical break up of manure patties on pastures using a harrow is an effective method of exposing these pathogens to sunlight and the heat and desiccation that it prompts. Composting of manure that is routinely removed from dry lots and barns is another management procedure that can help curb spread of pathogens.

During and after a disease outbreak, decisions will have to be made on how to decontaminate and dispose of manure. If chemicals are used to kill these pathogens, a concern is that subsequent plant growth may be adversely affected on crop ground where this treated manure is applied. Manure handling equipment must be considered a biosecurity risk and should be properly cleaned and disinfected between operations.

For additional details, see *FAD PReP/NAHEMS Guidelines: Disposal (2012), Cleaning and Disinfection (2011)*.

10. SURVEILLANCE

Within 48 hours of the identification of the index case, a surveillance plan will be implemented to define the extent of the highly contagious FAD outbreak. Surveillance is also used to detect unknown but Infected Premises and new cases quickly through a combination of observation and laboratory testing. This surveillance plan may include the susceptible wildlife population in the area. Information will also be gathered for a surveillance plan to identify disease-free zones so that this portion of the plan can be implemented within seven days of the identification of the index case.

Infected, Contact, Suspect and At-Risk Premises will all be involved in some level of surveillance in an effort to control and contain disease spread or determine freedom from disease. Initial surveillance of susceptible animals consists of visual inspection. As soon as practical, surveillance will include laboratory testing of susceptible animals. During the highly contagious FAD event, surveillance could include on-farm observation, and/or testing market animals, and at harvest.

10.1 People

Visitors, veterinarians, response personnel, and employees can introduce or spread disease to susceptible animals if steps are not taken to mitigate these risks prior to entry. Sanitation and hygiene practices are important to prevent disease agent spread and includes wearing clean clothing, coveralls, footwear, and washing hands before and after animal contact or glove removal. If the highly contagious FAD is zoonotic, or there is risk for other zoonotic pathogens to be present, additional personal protective equipment should be worn by all those handling animals.

Document the movement of people on and off the premises. It is critical to use a written log to record name, contact information, last contact with a susceptible animal species, and reason for being on premises including facilities/pens entered and animals contacted. Plans for employees should be clearly outlined and personnel on premises should be limited to those essential for day-to-day operation, making it easier to trace and minimize the risk of disease introduction and spread. For all employees, records should be kept that includes their name, address, phone numbers, emergency contact, and information pertaining to off-site animal contact. In the event of a zoonotic highly contagious FAD, public health officials may recommend human surveillance via diagnostic testing. Contacting employees will be critical.

10.2 Vehicle Traffic

Vehicles and equipment can indirectly expose susceptible animals through mechanical disease transmission. Installing a barrier that requires vehicles to stop before entering the premises provides an additional control point and can facilitate monitoring and recording vehicle details. Cleaning and disinfecting tires, wheel wells, and the undercarriage of all

vehicles which enter or leave a premises will likely be required on all Infected or Monitored Premises. It may be prudent to establish off-site parking for vehicles that are not required on the farm grounds. Movement of people and vehicles on and off an operation during a disease outbreak should be documented. A written or electronic record describing the vehicle, driver name and contact information, last farm(s) visited, and reason for visit should be maintained for tracking purposes.

10.3 Disease Monitoring

During an outbreak situation, susceptible animals on all operations must be closely monitored for clinical signs that meet the case definition of the highly contagious FAD. Animal caretakers on Contact, Suspect, Monitored, At-Risk, and Free Premises should be aware of these clinical signs and know whom to contact [i.e., Area Veterinarian-in-Charge (AVIC), State Animal Health Official (SAHO)], or the attending veterinarian that can, in turn, contact the AVIC or SAHO if disease is suspected. Routine animal care and monitoring for clinical signs of the FAD should continue during and after a disease outbreak. Expect public awareness campaigns, through public service announcements (PSA), to be used to address issues or concerns relating to food safety, public health, and animal welfare to animal producers and caretakers and the general public within the Control Area, Surveillance Zone, and Free Area.

Livestock operations within the Buffer Zone will be routinely monitored utilizing slaughter surveillance, serological surveys, and investigation of reports of suspect disease. Slaughter surveillance will also occur in the Surveillance Zone. Free Area surveillance will occur through normal surveillance channels. Surveillance results and approved biosecurity protocols as a "proof of negative" status may be required for permitted movements of susceptible animals within the Control Area.

10.4 Diagnostic Sample Collection

Diagnostic sample collection and testing should be performed within the context and parameters of the written surveillance plan (discussed in Surveillance section above). Veterinarians, animal health technicians, and stakeholders will collect samples to submit to the National Veterinary Services Laboratories (NVSL) or a National Animal Health Laboratory Network (NAHLN) facility for testing. It is crucial that correct diagnostic specimen collection and handling practices are employed to ensure valid results. In any FAD outbreak, strict adherence to biosecurity and infection control procedures is required. Depending on the disease, specific tissues and/or fluids will be obtained from animals on-farm and/or those in market channels and harvest facilities after performing a complete antemortem or postmortem exam (whenever possible). Guidelines will be provided to veterinary responders and animal health technicians regarding the specific type of tissues needed.

Personal protective equipment (PPE) such as coveralls and gloves must be worn by personnel handling the animals, tissues, and fluids. If the highly contagious FAD is zoonotic, enhanced PPE may include goggles and an appropriate respirator (N-95 or N-99) or a full face shield if aerosolization is not a route of human exposure. All equipment used on farm to collect and transport samples and protect the personnel should be properly cleaned and disinfected in the designated area prior to leaving the farm. Care should be taken not to contaminate diagnostic samples with disinfectant as the highly contagious FAD will be inactivated providing false negative results. See the *FAD PReP/NAHEMS Guidelines: Personal Protective Equipment (2011)*, *Biosecurity (2011)*, and *Cleaning and Disinfection (2011)* as well as the associated SOP for more information.

Source:

- *APHIS Foreign Animal Disease Framework documents, USDA-APHIS-VS National Center for Animal Health Emergency Management, 2011*

10.5 Diagnostic Sample Submission

Personnel collecting diagnostic samples are required to package and label them in accordance with Federal regulatory requirements. The packaging and labeling of biological substances for shipment requires familiarity and training with current rules and regulations, which frequently change. Shippers are responsible for proper packaging, marking, labeling, documentation, classification, and identification of each shipment. Failure to follow regulations can result in substantial financial penalties.

- Title 9 Code of Federal Regulations (CFR), Parts 121 and 122: These USDA regulations cover the transfer of select agents/toxins and the permits needed to ship organisms and vectors.
- Title 42 CFR Part 72: These U.S. Department of Health and Human Services regulations define terms such as biological products, diagnostic specimens, and etiologic agents, and provide requirements for packaging and labeling these materials for transportation in interstate commerce.

- Title 49 CFR Part 173: These U.S. Department of Transportation regulations contain general requirements for shipments and packaging. 49 CFR 173.134 defines infectious substances and related terms. 49 CFR 173.217 has additional requirements for shipments containing solid carbon dioxide (dry ice).

Additional information can be found at the following website: *http://www.aphis.usda.gov/animal_health/lab_info_services/packaging_labeling.shtml*.

Airline shipments also must comply with current International Air Transport Association regulations (*www.iata.org*) for dangerous goods.

More information can be found in the *FAD PReP Diagnostics SOP (Sample Collection, Surge Capacity, and Reporting)*.

Source:

- *APHIS Foreign Animal Disease Framework documents, USDA-APHIS-VS National Center for Animal Health Emergency Management, 2011*

For more information on packaging and shipping samples, please see the Packaging and Shipping Diagnostic Samples document in the appendix.

11. MASS DEPOPULATION AND EUTHANASIA (FAD PREP/NAHEMS GUIDELINES AND SOP)

In the event of a highly contagious FAD outbreak such as foot-and-mouth disease, mass depopulation of infected animals may be required. This will be performed by qualified personnel according to USDA-APHIS and with input from peer-reviewed documents, the American Veterinary Medical Association (AVMA) and the American Association of Bovine Practitioners (AABP). If handling animals individually, proper animal handling equipment, including alleyways, chutes, and head gates should be used in this process to help prevent injury to the cattle and workers. The method and procedures used for depopulation will depend on available resources and the population dynamics of susceptible animals on the premises. This requires location-specific planning and preparation.

Euthanasia of cattle will take longer than normal processing of cattle. Texas conducted a table top exercise in 2007 that explored the different possibilities and resources that would be needed in the event of a FMD outbreak. During this exercise, they calculated how many people and what equipment would be needed to euthanize a large number of cattle. The Operation Palo Duro Executive Summary document can be found at: *http://www.tahc.state.tx.us/emergency/May2007_OperationPaloDuro.pdf*. It is estimated that a crew of 5 people would be able to euthanize an animal every 4 minutes or 15 animals per hour. Using these numbers, thousands of people would be needed to depopulate some of the largest feedlots.

Larger feedlots typically have species specific animal handling facilities designed to efficiently and humanely handle cattle. In addition, a trained crew is on-site that manages cattle on a daily basis. In contrast to feedlots, many cow-calf operations have less than 50 cattle. In addition, the cow herd may not be confined to a smaller space as is typical with feedlots. They do not typically have working facilities comparable to a large, modern feedlot or workforce personnel devoted solely to cattle care and management. Although the National Veterinary Stockpile (NVS) has planned to make some mobile pens/chutes available, it will take increased time to transport, set-up, disinfect and breakdown this equipment. Thus, it is likely that depopulation times would be considerably longer for cow-calf operations when compared to feedlots.

Strategies to control the spread of a highly contagious FAD might include mass depopulation of infected animals and their disposal on farm or in the community. This action could be psychologically stressful to workers and owners that have cared for these animals as a part of their daily routine and source of livelihood. Individuals whom must deal with severe or prolonged stressful situations may require professional assistance. Thus, community mental health facilities and religious institutions may be helpful in providing educational, counseling, and referral services for such individuals. Their involvement, at the local level, should be part of preparedness plans.

For additional details, see *FAD PReP/NAHEMS Guidelines: Mass Depopulation and Euthanasia (2011)* as well as the associated SOP.

12. DISPOSAL (FAD PREP/NAHEMS GUIDELINES AND SOP)

Animal carcasses and associated contaminated materials (feed, bedding) must be disposed of in a way to limit disease spread, using State or locally approved methods. Specific personnel will be assigned to an operation to carry out these activities once euthanasia is complete. The overall goal of disposal operations is to eliminate in a timely, safe, biosecure, aesthetically acceptable, and environmentally responsible manner, all animal carcasses and related animal materials that result from an animal health incident.

For additional details, see *FAD PReP/NAHEMS Guidelines: Disposal (2012)*.

13. CLEANING AND DISINFECTION (FAD PREP/NAHEMS GUIDELINES AND SOP)

Facilities that housed infected animals and equipment used in their daily care must be cleaned and disinfected to prevent the spread of disease to live animals returned to the operation. USDA-APHIS-VS will coordinate equipment, supplies, and scheduling, and certify work completed by the producer, contractors, or animal health response teams. Items that cannot be adequately cleaned and disinfected should be properly disposed of once their value is determined.

For additional details, see *FAD PReP/NAHEMS Guidelines: Cleaning and Disinfection (2011)*.

14. APPRAISAL AND COMPENSATION

If the animal is part of an infected herd then they will likely be depopulated in accordance with government mandates that will be released in the event of a highly contagious FAD outbreak. Animals that must be euthanized for disease control will be compensated by the U.S. Government under 9 CFR Part 53. The 9 CFR Part 53 can be accessed at: *http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?sid=acfd62a8f38c5d11f451b33727e616a9&c=ecfr&tpl=/ecfrbrowse/Title09/9cfrv1_02.tpl*.

Animal health regulatory officials will create an inventory of animals designated for depopulation and appraise their fair-market value in order for compensation to be paid. Contaminated materials on farm (feed, bedding) will also be appraised as they may need to be disposed of in an effort to control disease spread. Compensation will only be paid if the producer follows all Government issued mandates for the disease outbreak.

15. INTERNATIONAL TRADE

In 2010, international exports of beef totaled nearly 2.3 billion pounds valued at over $3.89 billion USD. The top four countries receiving U.S. beef exports included Mexico, Canada, Japan, and South Korea. These markets are vital to the beef industry. In the event of a highly contagious FAD outbreak affecting cattle, international trade of cattle and cattle products will be halted. Compartmentalization may potentially play a role in an effort to retain markets during recovery from a highly contagious FAD, once zoning efforts have been exhausted or proven inadequate.

Source:

- *USDA Economic Research Service. U.S. Beef and Cattle Industry: Background Statistics and Information. Accessed July 2011*

Regionalization, also known as zoning, separates animal subpopulations to maintain disease-free status in one or more zones. Regionalization defines animal subpopulations primarily on a geographical basis. As an FAD response tool, regionalization can facilitate international trade, as well as FAD eradication.

For more information on regionalization, please see the *FAD PReP SOP: Overview of Regionalization for International Trade*, as well as 9 CFR 92.2, which lists 11 factors that should be evaluated in establishing a region.

Compartmentalization, which distinguishes between animal subpopulations by "management and husbandry practices related to biosecurity," has not yet been implemented within the United States with any trading partners (*OIE, Chapter 4.4*). Disease-free compartments must be recognized by trading partners prior to an outbreak for product movement. For further information on compartmentalization, please see the *OIE Terrestrial Animal Health Code (2011), Chapter 4.4*, as well as sections on compartmentalization in disease-specific chapters (for example, see Chapter 8.5, Article 8.5.6 on foot-and-mouth disease).

Acknowledgements

In addition to the sources listed throughout the manual, portions of this document were obtained from:

- Beef Biological Risk Management, March 2005, Center for Food Security and Public Health, Iowa State University
- FAD PReP Beef Feedlot Industry Manual, July 2011, Center for Food Security and Public Health, Iowa State University
- Foot-and-Mouth Disease (FMD) Response Plan: The Red Book, USDA-APHIS
- APHIS Foreign Animal Disease Framework documents

This industry manual for USDA Emergency Management and Diagnostics was prepared by the Center for Food Security and Public Health, College of Veterinary Medicine at Iowa State University. Authors and contributors include:

- Megan Smith, DVM
  Post-Doctoral Student, Center for Food Security and Public Health
- Renée Dewell, DVM, MS
  Clinician/Veterinary Specialist, Veterinary Diagnostic and Production Animal Medicine/Center for Food Security and Public Health, Iowa State University
- Shaine DeVoe, BS
  Educational Material Development Intern, Center for Food Security and Public Health
- Mike Rahe, BS
  Educational Material Development Intern, Center for Food Security and Public Health
- Terry J. Engelken, DVM, MS
  Associate Professor, Veterinary Diagnostic and Production Animal Medicine, Iowa State University

This manual was reviewed by:

- Tammy Beckham, DVM, Ph.D.
  Director, Foreign Animal and Zoonotic Disease Center
  Director, Texas Veterinary Medical Diagnostic Laboratory
- Danelle Bickett-Weddle, DVM, MPH, PhD, DACVPM
  Associate Director, Center for Food Security and Public Health
  Iowa State University
- Douglas T. Ensley, DVM MS
  Professional Services Veterinarian-Cattle, Boehringer Ingelheim Vetmedica, Inc.
  Member, AABP Biological Risk Management and Preparedness Committee
- Tom Field, PhD, PAS
  Executive Director Producer Education, National Cattlemen's Beef Association
- Timothy J. Goldsmith, DVM, MPH, DACVPM
  Assistant Clinical Professor, University of Minnesota College of Veterinary Medicine
  Member, AABP Biological Risk Management and Preparedness Committee
- Thomas B Hairgrove, DVM, DABVP
  Livestock and Food Animal Systems Coordinator, Texas AgriLife Extension Service
  Member, AABP Biological Risk Management and Preparedness Committee
- Carla L. Huston, DVM, PhD, ACVPM
  Associate Professor, Dept. of Pathobiology and Population Medicine, College of Veterinary Medicine, Mississippi State University
  Member, AABP Biological Risk Management and Preparedness Committee
- Thomas Kasari, DVM, MVSc, Diplomate ACVIM, Diplomate ACVPM (epidemiology)
  Analytical Epidemiologist, National Surveillance Unit
  USDA-APHIS-VS Centers for Epidemiology and Animal Health
- Jason Lombard, DVM, MS
  Dairy Specialist/Veterinary Epidemiologist, National Animal Health Monitoring System (NAHMS), USDA-APHIS-VS Centers for Epidemiology and Animal Health
  Member, AABP Biological Risk Management and Preparedness Committee
- William W. McBeth, DVM, MS
  Member, Academy of Veterinary Consultants

Acknowledgements

- Christine B. Navarre, DVM, MS, DACVIM
  President, American Association of Bovine Practitioners
  Extension Veterinarian, Louisiana State University AgCenter
- Elizabeth Parker, DVM
  Chief Veterinarian, National Cattlemen's Beef Association
- Herbert M. "Tim" Richards III, DVM
  AVCs Veterinary Practice Issues and Standards Committee
- David R. Smith, DVM, PhD, Diplomate ACVPM
  Epidemiology Specialty Professor and Extension Dairy/Beef Veterinarian
  University of Nebraska-Lincoln
- Kelly Still Brooks, DVM MPH DACVPM
  Member, AABP Biological Risk Management and Preparedness Committee
- Brian VanderLey, DVM
  Intern, Veterinary Diagnostic and Production Animal Medicine, College of Veterinary Medicine, Iowa State University
- Kurt Walters DVM
  Academy of Veterinary Consultants -Veterinary Practice Issues and Standards Committee
- Jonathan C. Wooster, BS,
  President, United States Cattlemen's Association

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Photo and Illustration Credits

Page ii Photo strip: Left to right: Feedlot cattle; chicks; Red Angus/Simmental cross beef cow with calf; Landrace pigs; and Holstein heifers. *Photo sources: Danelle Bickett-Weddle, Iowa State University; USDA; Beth Carlson, North Dakota; Iowa State University; and Mark Kirkpatrick, Idaho*

Page iii FAD PReP Suite of Documents and Materials *Graphic illustration by: USDA*

Page 1 The official logos of USDA, APHIS and OIE. *Graphic illustration of the USDA, APHIS, and OIE logos by: Dani Ausen, Iowa State University*

Page 2 Table 1. Number of Cow-Calf Operations and Percentage of Total U.S. Beef Cow Inventory by Cow-Calf Operation Size, 2010. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 3 ***(Top)*** Table 2. Beef Cow Distribution Throughout the Contiguous United States. *Graphic illustration by: Dani Ausen, Iowa State University*
(Bottom) Figure 1. Beef Cow Distribution Throughout the Contiguous United States (Thousand Head), 2007. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 4 Cow-calf pairs on a pasture. *Photo Source: Megan Smith, Iowa State University*

Page 5 ***(Top)*** Riders moving cattle. *Photo source: Alan Bishop, Hermosa, South Dakota*
(Bottom) A crossbred cow (top), and a purebred Black Angus cow (bottom). *Photo sources: Beth Carlson (top), and Megan Smith, Iowa State University (bottom)*

Page 6 A biosecurity sign on farm premises. *Photo source: Megan Smith, Iowa State University*

Page 7 Methods of cattle identification. A freeze brand on the hip of a cow (top), and a plastic dangle tag in a cow's ear (center). The orange brucellosis ear tags, also referred to as calf-hood vaccination tags, are an official form of identification (bottom left). The metal Bright tags can be used as an official identification in cattle of any age. The first two numbers indicate the state where the animals resided when the tags were placed in their ear. Iowa is 42 as pictured (bottom right). *Photo sources: Megan Smith, Iowa State University (top and center); Iowa Department of Agriculture and Land Stewardship (bottom left) and Andrew Kingsbury, Iowa State University (bottom right)*

Page 8 Different forms of record keeping. The NCBA red book (left), and white board record keeping (right). *Photo sources: Dani Ausen, Iowa State University (left); and Megan Smith, Iowa State University (right)*

Page 9 Weaned calves ready for backgrounding. *Photo source: Megan Smith, Iowa State University*

Page 10 ***(Top)*** Feedlot cattle eating from a feedbunk. *Photo source: Renee Dewell, Iowa State University*
(Bottom) Table 3. Breed Comparisons: Heifer Age at Puberty. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 11 ***(Top)*** A yearling heifer (left), and a mature cow (right). *Photo sources: Danelle Bickett-Weddle, Iowa State University (left); and Megan Smith, Iowa State University (right)*
(Bottom) Table 4. Breed Comparisons: Bull Age at Puberty. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 12 ***(Top)*** A yearling bull (left), and a mature bull (right). *Photo source: Megan Smith, Iowa State University (both)*
(Center) Table 5. Average Duration of Bovine Reproductive Cycle Periods. *Graphic illustration by: Dani Ausen, Iowa State University*
(Bottom) A cow and calf. *Photo source: Megan Smith, Iowa State University*

Page 13 Table 6. Maximum Number of Cows Per Bull Under Ideal Conditions. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 14 A very young calf. *Photo source: Renee Dewell, Iowa State University*

Page 15 Figure 2. Percentage of Operations by Number of Months in Which One or More Calves were Born Alive in 2007. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 16 A suckling calf. *Photo source: Megan Smith, Iowa State University*

Page 18 A *Bos indicus* (left) and a *Bos taurus* (right). *Photo sources: USDA (left), and Renee Dewell, Iowa State University (right)*

Page 19 Figure 3. A Cow's Flight Zone, Point of Balance, and Blind Spot. *Content provided by: American Veterinary Medical Association, Emergency Response and Preparedness, April 2009; Graphic illustration by: Dani Ausen, Iowa State University*

Photo and Illustration Credits

Page 20 A bovine in a headgate. *Photo source: Renee Dewell, Iowa State University*

Page 21 A prepared working horse (top); and an all-terrain vehicle (bottom). *Photo source: Megan Smith, Iowa State University (both)*

Page 22 ***(Top)*** Three types of cow-calf feeding facilities: a lot (left) a pasture (center), and crop residue (corn stalks) (right). *Photo sources: Megan Smith, Iowa State University (left and right); Danelle Bickett-Weddle, Iowa State University (center)*
(Bottom) A salt and mineral tub. *Photo source: Megan Smith, Iowa State University*

Page 23 ***(Top)*** Types of water access: a pasture dam (left) and a windmill and water tank (right). *Photo source: Megan Smith, Iowa State University (both)*
(Bottom) A bovine in a head catch receiving a vaccination (left), and cattle vaccine syringes in a cooler along with a pen and paper method of record keeping (right). *Photo sources: Agricultural Research Services, USDA (left); and Beth Carlson, North Dakota (right)*

Page 24 ***(Top)*** Figure 4. Cattle Injection Sites. *Graphic illustration by: Dani Ausen, Iowa State University*
(Center) A pour-on parasite control system for cattle. *Photo source: Megan Smith, Iowa State University*
(Bottom) A sick calf. *Photo source: Geni Wren, Bovine Veterinarian, Vance Publishing Corporation*

Page 25 This is a graphic illustration of directions on a vaccine bottle. It is important to read the drug's label before administering its contents. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 27 Table 7. Summary of Premises Designations. *Content provided by: USDA-APHIS Graphic illustration by: Dani Ausen, Iowa State University*

Page 29 ***(Top)*** Table 8. Summary of Zone and Area Designations. *Content provided by: USDA-APHIS Graphic illustration by: Dani Ausen, Iowa State University*
(Bottom) Figure 5. Control Zones. *Graphic illustration by: USDA-APHIS*

Page 30 Table 9. Guidelines for Needle Selection for Cattle. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 31 Table 10. Size and Capacity of Livestock Trailers Based on Cattle Weight. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 32 Table 10. Size and Capacity of Livestock Trailers Based on Cattle Weight (continued). *Graphic illustration by: Dani Ausen, Iowa State University*

Acronyms

APHIS	Animal and Plant Health Inspection Service, a division of USDA
ARP	At-Risk Premises
AVIC	Area Veterinarian in Charge
BSE	Breeding Soundness Examination
BZ	Buffer Zone
CA	Control Area
CFR	Code of Federal Regulations
CP	Contact Premises
CVO	Chief Veterinary Officer
CVZ	Containment Vaccination Zone
DIVA	Differentiating Infected from Vaccinated Animals
EDI	Emerging Disease Incident
FA	Free Area
FAD	Foreign Animal Disease
FAD PReP	Foreign Animal Disease Preparedness and Response Plan
FDA	U.S. Food and Drug Administration
FMD	Foot-and-mouth disease
FP	Free Premises
IM	Intramuscular
IP	Infected Premises
IZ	Infected Zone
MP	Monitored premises
NAHEMS	National Animal Health Emergency Management System
NAHERC	National Animal Health Emergency Response Corp
NAHMS	National Animal Health Monitoring System
OIE	Office International des Epizooties' currently referred to as the World Organization for Animal Health

Acronyms

PVZ	Protection Vaccination Zone
RFID	Radio Frequency Identification
RVF	Rift Valley Fever
SAHO	State Animal Health Official
SC	Subcutaneous
SOP	Standard Operating Procedures
SP	Suspect Premises
SZ	Surveillance Zone
USDA	United States Department of Agriculture
VP	Vaccinated Premises
VS	Veterinary Services, a division of APHIS

Glossary

Animal and Plant Health Inspection Service (APHIS)
Agency within USDA responsible for protecting livestock and plant health.

Animal Husbandry
Basic animal care that is needed to produce a healthy animal.

At-Risk Premises (ARP)
Premises with susceptible animals, but none have clinical signs compatible with the FAD. Premises objectively demonstrates that it is not an Infected Premises, Contact Premises, or Suspect Premises. At-Risk Premises seek to move susceptible animals or products within the Control Area by permit. Only At-Risk Premises are eligible to become Monitored Premises.

Auction Market
A facility located near livestock concentrated areas that serves as a point to buy and sell livestock. Also referred to a sale barns and livestock markets.

Backgrounder
A producer that buys weaned calves from cow-calf operations and prepares them to eat, drink, and interact with other cattle in a feedlot situation. These cattle are raised to feeder size, approximately 600-900 pounds.

Banding
The application of a specific type of rubber band above the testicles of cattle for castration purposes. This should be used in conjunction with a tetanus shot. Banding results in necrosis of the sheath and sloughing of the testicles in about two weeks.

Biologicals
Any substance that is used as a vaccine or serum that is derived from animal products or biological sources and is used in the treatment or prevention of disease. These are typically regulated by the USDA-APHIS Center for Veterinary Biologics.

Biosecurity
A series of management practices designed to prevent the introduction of disease agents onto or prevents the spread from an animal production facility to other animals.

Brand
A permanent form of identification for livestock and horses used in most states west of the Mississippi River. Brands must be registered with the state where the animals reside. Brands may be applied with extreme heat or cold (freeze branding) to the hip, ribs, or shoulder.

Bud Box
A flow-through part of a cattle handling facility that allows the handler to position themselves correctly to facilitate cattle flow out of the box into either a crowd alley leading to a chute or to a trailer load out.

Buffer Zone (BZ)
Zone that immediately surrounds an Infected Zone or a Contact Premises.

Bull
Adult male bovine that has not been castrated.

Bunks/Feed Bunks
A long trough for feeding cattle. Can be made out of cement, steel, wood, or plastic.

Glossary

Calf
General term for cattle under 18 months of age. They may be weaned or unweaned from their mothers.

Castration
Complete removal of the testicles.

Cattle
General term for bovids raised for meat or milk. This term encompasses all ages and sexes of animals.

Cattle Buyer/Broker
Professional livestock buyer that purchases and sells large quantities of livestock for different producers, usually feedlots and backgrounders.

Chutes
Large metal apparatuses that are used to safely restrain cattle to administer vaccines and medication. Chutes can either be operated manually or by hydraulic power.

Composting
Method of using microbes to breakdown organic material such as manure and carcasses. The end product can be used for fertilizer or bedding.

Confirmed Positive Case
An animal from which a highly contagious FAD agent has been isolated and identified in a USDA laboratory or other designated laboratory.

Confirmed Positive Premises
A premises with at least one confirmed positive case (animal); an Infected Premises.

Contact Premises (CP)
Premises with susceptible animals that may have been exposed to the FAD agent, either directly or indirectly, including but not limited to exposure to animals, animal products, fomites, or people from Infected Premises.

Containment Vaccination Zone (CVZ)
Emergency Vaccination Zone within the Control Area. This may be a secondary zone designation.

Control Area (CA)
Consists of an Infected Zone and a Buffer Zone.

Cow
A female bovine that has given birth.

Crowding Pen/Crowd Gate
An area that can hold 10-15 cattle in a group with the purpose of getting them lined up to move single file through an alley leading to the chute for restraint. The gate is hinged so that it can be wide open to let cattle enter and then closed behind them in a manner that funnels them towards the single file alley. The term “tub” may be used synonymously.

Cull
To voluntarily remove from the herd and sell to a private individual, harvest facility, or another management facility.

Days on Feed (DOF)
The number of days cattle are fed in a feedlot prior to going to another facility or harvest.

Glossary

Ear Tags
Tags, usually plastic, put in cattle's ears to identify them. Every producer uses their own numbering system. They can easily be removed.

Feeder Cattle
Cattle of either sex that are ready to go to a feedlot (600-900 pounds) or are in a feedlot but have not reached full market weight (1,100-1,400 pounds). These cattle have been backgrounded, managed as stockers, or sent directly from a cow-calf operation. These may also be referred to as yearlings.

Feedlot
An area of land where cattle are fattened for harvest. Cattle are kept in groups/pens and fed custom diets that are designed to increase their rate of gain.

Finished or Live Cattle
Cattle that have grown to full market weight and are ready for harvest (somewhere between 1,100 pounds and 1,400 pounds).

Flight Zone
A variable area that surrounds an animal that, when entered by a person, will cause that animal to move away.

Fomite
An inanimate object or material on which disease-producing agents may be conveyed (e.g., feces, bedding, harness, clothes).

Free Area (FA)
Area not included in any Control Area.

Free Premises (FP)
Premises outside of a Control Area and not a Contact or Suspect Premises.

Graft
A method to encourage a cow/heifer to accept an unrelated calf (many times a twin or the calf of a cow with a bad udder or poor milk production) as her own calf, especially when her calf died at birth.

Hay
A high fiber crop (grass or legumes) that is mowed, allowed to dry in the field and made into bales (square or round) and moved to the operation to be fed to the cows as a roughage.

Haylage
Green forage such as alfalfa or other grasses that is chopped in the field with a tractor and transported in wagons to the operation where it is stored in a pile on the ground, blown into a silo, or blown into long plastic bags and packed to remove air so that it undergoes fermentation to prevent spoilage.

Heifer
A female bovine that has not given birth.

Highly Contagious Foreign Animal Disease (FAD)
A disease that spreads rapidly from animal-to-animal as well as herd-to-herd through direct contact, aerosol, oral, fomite or vector-borne transmission. Highly contagious FADs may be recognized by above normal morbidity or mortality per unit time, where morbidity could be characterized solely by a decrease in production.

Glossary

Horn Buttons
Small horn growths on immature animals.

Incineration
A process of completely burning carcasses so that all pathogens are destroyed and the animal turned to ashes.

Infected Premises (IP)
Premises where a presumptive or confirmed positive case exists based on laboratory results, compatible clinical signs, case definition, and international standards.

Infected Zone (IZ)
Zone that immediately surrounds an Infected Premises.

Monitored premises (MP)
Premises that objectively demonstrates that it is not an Infected Premises, Contact Premises, or Suspect Premises. Only At-Risk Premises are eligible to become Monitored Premises. Monitored Premises meet a set of defined criteria in seeking to move susceptible animals or products out of the Control Area by permit.

Nose Tongs
Large metal pincher tool that is placed into each nostril of a bovine and has a rope to grasp and tie to provide head restraint.

On Feed
Cattle on a managed feed program designed to increase their rate of gain to the proper finished weight.

Operation
Any place having one or more head of beef cows, excluding cows used to nurse calves, on hand at any time during the year.

Parturition
The action of giving birth to young.

Pharmaceuticals
Typically man-made preparations or products that are used for the treatment or prevention of disease. These are regulated by the U.S. Food and Drug Administration (FDA).

Polled
Animals without horns.

Preconditioning
The practice of weaning calves a few weeks before shipment, vaccinating them for common diseases, as well as introducing them to high concentrate feed. This process conditions the animal for an easier transition to a feedlot setting.

Presumptive Positive Case
An animal that has compatible clinical signs, fits a case definition or international standards consistent with a highly contagious FAD in addition to a positive laboratory result indicative of that disease.

Protection Vaccination Zone (PVZ)
Emergency Vaccination Zone outside the Control Area. This may be a secondary zone designation.

Radio Frequency Identification Device (RFID)
Ear tags in animals that have radio transmitters that can be read with special equipment to indicate the animal's individual number. Usually used in large-scale operations. Tags may include a 15 digit number starting with 840 which designates the animal as being from the U.S.

Glossary

Rate of Gain
The number of pounds (weight) an animal gains in a day, often averaged over the entire feeding period.

Rendering
A process of converting animal carcasses into a stable product that can be used for other purposes. By-products of cattle rendering include tallow and meat and bone meal.

Serving Capacity
The ability of the bull to complete the act of mating. Serving capacity is affected by age (i.e., younger bulls have a lower serving capacity than other bulls) and determines the bull-to-cow ratio that should be utilized.

Silage
Green forage such as field corn, alfalfa (referred to as haylage), grasses, oats, wheat, that is chopped in the field with a tractor and transported in wagons to the operation where it is stored in a pile on the ground, blown into a silo, or blown into long plastic bags and packed to remove air so that it undergoes fermentation to prevent spoilage.

Steer
A male bovine that has been castrated.

Stockers
Cattle of either sex that have been weaned and are put on pasture until they reach feeder size (about 600-800 pounds). Very similar, if not synonymous, with backgrounder cattle.

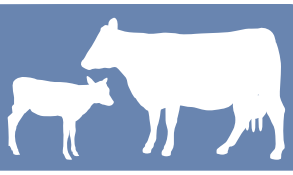
Surveillance Zone (SZ)
Zone outside and along the border of a Control Area.

Suspect Premises (SP)
Premises under investigation due to the presence of susceptible animals reported to have clinical signs compatible with the FAD. This is intended to be a short-term premises designation.

Vaccinated Premises (VP)
Premises where emergency vaccination has been performed. This may be a secondary premises designation.

Zoonotic Diseases
Diseases that are transmissible from animals to humans under natural conditions.

Bovine Routes of Transmission and High Consequence Disease Examples

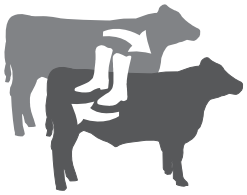


Disease causing agents can be spread from animal-to-animal or animal-to-human and vice versa, through a variety of transmission routes.

Aerosol: Exposure occurs when droplets are passed through the air from one animal to another. Examples include contagious bovine pleuropneumonia (CBPP), foot-and-mouth disease (FMD), malignant catarrhal fever (MCF), melioidosis, and vesicular stomatitis (VS).

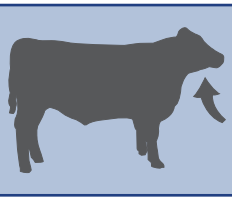
Direct Contact: A susceptible animal becomes exposed when the disease agent directly touches open wounds, mucous membranes, or the skin through blood, saliva, nose to nose contact, rubbing, or biting. Examples include CBPP, FMD, lumpy skin disease, MCF, rinderpest, VS.

Reproductive: A subtype of direct contact that includes diseases spread through mating or to the fetus during pregnancy. An example would be CBPP.

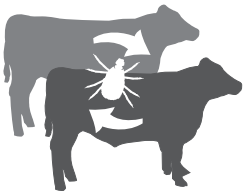


Fomite: An inanimate object carrying a disease agent from one susceptible animal to another. Examples include FMD, vesicular stomatitis.

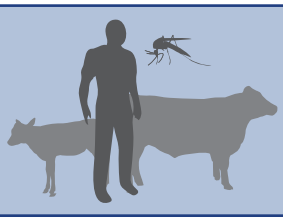
Traffic: A subtype of fomite transmission in which a vehicle, trailer, or human spreads organic material to another location.



Oral: Consuming disease causing agents in contaminated feed, water or licking/chewing on contaminated environmental objects. Examples include bovine spongiform encephalopathy and FMD.



Vector-borne: An insect acquires a disease agent from one animal and transmits it to another. Examples include akabane (mosquitoes), babesiosis (ticks), heartwater (ticks), lumpy skin disease (mosquitoes, flies), Rift Valley fever (mosquitoes), screwworm (fly larvae), vesicular stomatitis (mosquitoes).



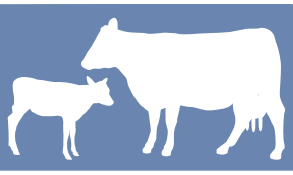
Zoonotic: Diseases transmitted from animals to humans. Examples include VS and Rift Valley fever.

Environmental Contamination must always be taken into consideration.

This information was developed by staff veterinarians at the CFSPH. For more information on these diseases, visit: *www.cfsph.iastate.edu.*

the Center for Food Security & Public Health
Iowa State University

Prevention Practices for Foot-and-Mouth Disease (FMD)



Foot-and-mouth disease (FMD) is a highly contagious viral disease of cattle and other cloven-hooved animals such as pigs, sheep, and goats. The last known outbreak in the United States was in 1929; however, the disease is common in other parts of the world and therefore poses a risk to U.S. beef cattle.

If a case of FMD is confirmed anywhere in the United States, it could spread rapidly across the nation. If any animal on your cow-calf operation is confirmed to have FMD, all may be euthanized and disposed of to control the further spread of the disease.

This document describes biosecurity practices you can take to prevent FMD from entering your cow-calf operation. These measures should be put into place **IMMEDIATELY** on your operation *if FMD is confirmed anywhere in the U.S.* and continued until the U.S. is once again declared FMD free.

Transmission of the Disease

Understanding how FMD is spread to and between cattle can help highlight the importance of biosecurity measures needed on your cow-calf operation and help you recognize areas that may need additional work to prevent disease introduction and spread.

FMD can be spread **orally** by ingestion of contaminated feed. Transmission can also occur through **direct contact** with infected animals. The virus can be found in all body fluids of infected cattle, including expired air, nasal secretions, blood, urine, feces, saliva and even semen. The virus can also be spread reproductively. This can occur via semen (bull to cow) or during pregnancy (cow to calf).

FMD virus can also survive in the environment, contaminating equipment, pens, buckets, even footwear and clothing of people in contact with infected cattle. These items (termed "**fomites**") can serve as an additional source of virus for susceptible cattle. If infected cattle are transported in vehicles or trailers, these items can also become contaminated and serve as a source of the virus on the operation or to other operations, if not properly cleaned and disinfected.

Another less common route of transmission includes **aerosol** spread in closed areas.

General Precautionary Measures

Prevention measures to minimize the introduction and spread of FMD on your cow-calf operation fall into three general categories.

1. Use strict biosecurity measures for animals, animal products, vehicles, people and equipment.
2. Restrict or stop all animal movement to prevent entry or spread of the disease.
3. Detect and report any disease or unusual signs to your veterinarian as quickly as possible.

Specific steps to take if FMD is confirmed in the U.S. are listed below. Many should already be in place on your operation but should be enhanced and more strictly enforced if FMD is found in the U.S. These measures can help minimize the chance of FMD being introduced on your cow-calf operation.

Cow-Calf Operation Entrance

Limit access to your operation.

- The entrance to your operation is a major control point.
- Gates at entries should be locked when not in use.

Post signs at the operation entrance (Appendix A).

Signs inform unauthorized visitors to not enter your operation. When entry is necessary, signs give specific rules and biosecurity measures to follow while on your operation.

Restrict or limit visitors on your operation.

- At all times, limit the number of visitors to the operation.
- Visitors who have traveled internationally within the past five days should not be allowed to enter your operation.
- Post warning signs indicating entry onto the operation is not allowed without permission.

Strict biosecurity measures must be followed by any visitors to the cow-calf operation.

Some visitors are essential for the continued operation of the facility. Establish strict biosecurity procedures for these individuals, then inform them of the measures to follow while on your operation.

- Check-in with personnel upon arrival (direct visitors to "where" they should check in).
- Be accompanied by someone from the operation at all times to ensure biosecurity measures are

This information was developed by staff veterinarians at the CFSPH for use as educational materials in the event of a Highly Contagious Foreign Animal Disease outbreak in the United States.

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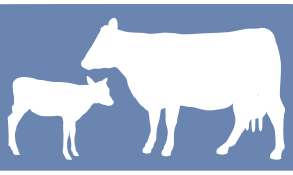


being followed.
- Visitors and vehicles should avoid contact with animals, animal feed, or animal areas unless absolutely necessary.
- If animal contact is necessary, wear clean premises-specific protective clothing (e.g., coveralls, boots) while on the operation. Guide visitors to where protective clothing is located. These items should remain on-premises when the visitor leaves.

Monitor and record all traffic on or off your operation.

Maintain a log sheet (Appendix B) of all visitors and vehicles that enter your operation. Accurate record keeping of traffic on your operation will help with disease surveillance and tracking if necessary. You should not rely on your ability to "recall" visitors and vehicles that were on your operation.

Vehicles

Minimize traffic onto your premises to only vehicles essential for continued operation.

- Vehicles should be parked at the operation entrance, away from animal areas, or in designated parking areas. These areas should preferably be concrete or paved areas.
- Off-premises vehicles should not be allowed to drive onto your operation unless necessary. If necessary, vehicles should be cleaned and disinfected or restricted to areas where vehicle traffic is allowed.
- Have deliveries left at the operation entrance whenever possible.

Clean and disinfect vehicles prior to entry and upon leaving.

- All vehicles entering the operation must spray their wheels, wheel wells and under-carriage with disinfectant after they have been cleaned.
- Facilities for washing and disinfecting vehicles should be provided at the perimeter of the operation in a location that accounts for drainage.

Do not share equipment or vehicles between operations or sites.

People

Limit employees to only those necessary for the continued operation of the operation.

Employees that have contact with swine, cattle, sheep or goats at other locations (including their own home) should use very strict biosecurity measures while on your operation.

Implement strict biosecurity measures for employees coming onto the operation.

- Clean boots, hats and coveralls must be worn while on the premises. These should be provided by your operation.
- Protective clothing should remain on your operation and be washed and/or disinfected before being worn again.
- Minimize contact with animals to only tasks necessary for the continued operation of the facility and health and well-being of the animals.
- Staff should be designated to handle incoming/quarantined cattle and not work with other cattle on the operation.
- Staff should be designated to handled isolated/hospital pen cattle and not work with other cattle on the operation.
- Staff working with incoming or isolated cattle should wear clean disposable protective footwear and change between each pen.
- Staff should wash their hands with a disinfectant soap and warm water after leaving quarantine or isolation pens.

Educate your employees on their role in preventing disease introduction and spread. They should:

- Understand how FMD can be spread;
- Understand the operation's biosecurity procedures and how to prevent the spread of the disease;
- Know the signs of illness in cattle with FMD; and
- Know who to contact if signs of disease are seen.

Animal Movement

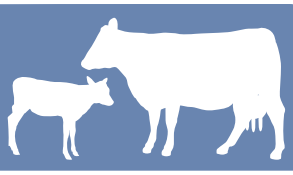
If FMD is confirmed in the U.S., movement restriction may be implemented locally, regionally and possibly nationally. Restrictions will depend on the scope of the outbreak.

Know the health status and the source of any animal(s) brought onto your cow-calf operation.

If animal movement is allowed in your area, thoroughly clean and disinfect the transport vehicle and trailer before loading and after unloading.

- Pay special attention to the tires and wheel wells.
- Avoid mixing cattle, especially young stock, from different sources when transporting.

Prevention Practices for Foot-and-Mouth Disease (FMD)



Working horses must remain on the premises during an FMD outbreak.

- A horse's tack (bridle, saddle, blanket) or their hooves can become contaminated with manure or saliva from infected cattle.
- Horses cannot be infected with FMD but can serve as mechanical vectors of the virus.
- Horses and their tack used in incoming/quarantine or isolation/hospital pens should not be used in other areas on the operation.
- Contaminated tack should be cleaned and disinfected.
- Hooves should be picked out after working in incoming/quarantine or isolation/hospital pens.

Maintain thorough and accurate records of animal movement.

- Document all animal movements, including the dates of introduction, where they came from and movements between separate units.
- Each animal location must be treated as a separate unit or premises. This information will be essential to help trace where the disease came from.

Animals

Farm dogs and other pets can also serve as mechanical vectors. Movement should be restricted until outbreak has subsided.

Do not allow your animals to have contact with wildlife.

- Feral swine, deer, bison, elk, and antelope are also susceptible to FMD and, if infected, could potentially spread the virus to domestic cattle.

Monitor animals closely and frequently for any developing illness or signs of disease.

Educate yourself and train your employees about FMD and the signs of illness (Appendix C).

- Fever
- Blistering or ulcers on the mouth, tongue, feet or teats
- Increased salivation or slobbering
- Dullness or weakness
- Refusal to eat
- Signs of lameness such as shifting leg lameness
- Refusal to walk or move

Isolate any animals showing the signs above and contact your veterinarian immediately to examine them.

Use separate facilities, equipment and staff to handle isolated livestock.

- If this is not possible, at a minimum, handle or visit the isolated animals LAST.
- Clean and disinfect all equipment, clothing, boots, etc. that come into contact with isolated animals.

Quarantine incoming cattle for at least 30 days.

- New animals can be infected with a disease with out showing any signs of illness right away.
- Cattle exposed to the FMD virus may take up to 14 days or more before signs of illness are seen.
- Quarantined animals should not share water, feed, facilities or bedding with your other animals.
- Ideally, animals should be quarantined at a separate location (premises).
- At a minimum, incoming cattle should be kept as far away from finished cattle as possible.

Wildlife and Other Animals

Prevent contact with free roaming animals (wildlife, cats, dogs).

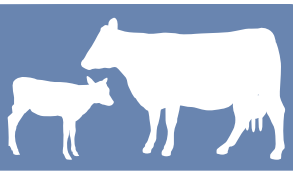
- Free roaming animals can potentially spread the FMD virus from infected to susceptible animals.
- Keep pets in a kennel or tied securely to avoid contact with livestock and feed areas.
- Ask your neighbors to do the same.

Control of wildlife will be difficult, but should be attempted.

- Keep premises access routes, parking areas, yards and storage areas clean and tidy to avoid attraction of birds or rodents.
- Implement rodent and vermin control measures to minimize the potential spread of disease by these animals (Appendix D).

Cleaning and Disinfection

The virus that causes FMD has shown to be stable in the environment. Virus stability increases at lower temperatures and with protection from sunlight. FMD virus is inactivated at pH below 6.5 or above 11. Effective disinfectants include sodium hydroxide (2%), sodium carbonate (4%), sodium hypochlorite (6.0%) and proprietary products. In addition to selecting an effective disinfectant, proper cleaning and disinfecting procedures



are essential in order to adequately and effectively control the spread of the virus.

Proper Cleaning Procedures

1. **Wear personal protective equipment:** Gloves, coveralls, rubber boots (or disposable boots) and possibly a mask if you are cleaning an area that will generate dust or aerosols.
2. **Dry clean:** Remove all visible material by brush ing, scraping and/or sweeping. This is the most important step as organic matter prevents many disinfectants from working effectively. Disposal of waste material should be handled in such a way as to prevent contamination of other areas such as feed, water or other animals.
3. **Soak:** Soak the area with hot water and a detergent or cleaning agent. Be sure to wash and soap down all equipment in the area: waterers, feed troughs, pails, etc.
4. **Wash:** Wipe, spray or scrub the area, starting with the dirtiest or highest area (ceiling), after it has soaked for a period of time. This step can be enhanced by the use of pressure washers when cleaning wood, cement, or other porous surfaces. Use caution when using high pressure washers (200-1000 psi) as they can aerosolize disease organisms and spread them to other areas.
5. **Rinse:** Remove all detergent residue by applying a low pressure water rinse on all surfaces, starting with the highest area and working your way to the floor. This is especially important as certain disinfectants are inactivated by detergents and soaps.
6. **Dry:** Allow the area to dry completely before applying a disinfectant so that it can work effectively.

Proper Disinfecting Procedures

1. **Read the product label:** This is important to make sure the solution is handled correctly. Personal protective equipment (gloves, mask) should be used when mixing up solutions. Other considerations to review before applying solutions to fomites include specific dilutions, water temperature, environmental temperature, the need for ventilation and the disease organisms killed by the disinfectant.
2. **Disinfect:** Apply the product at the correct dilution and let it "sit and work" for the suggested amount of time. Contact time of the disinfectant is important for the product to inactivate or kill the micro-organism(s) present.
3. **Final rinse:** Remove all disinfectant by applying a low pressure water rinse on all surfaces, starting with the highest area and working your way to the floor.
4. **Dry:** Allow the area to completely dry before allowing animals to contact the area or item that was just cleaned and disinfected.

Proper Boot Bath Procedures

1. Mix solution to the proper concentration according to the label instructions.
2. Clean all dirt, manure and debris off of boots BEFORE stepping into the disinfectant solution. The presence of organic material (dirt, manure, etc.) will prevent most disinfectants from working.
3. Allow the disinfectant solution to have ample contact time with the boot surface. This will vary with the disinfectant selected. Consult the product label.
4. Change solutions at least daily or when visibly dirty.

Proper Storage

If the equipment or area will not be used immediately, it is important to avoid contamination between uses. Small items can be placed into plastic bags and sealed; larger items can be placed into closed cabinets. Equipment and housing areas are more difficult to protect for long periods of time and may need to be rinsed again before allowing animal contact.

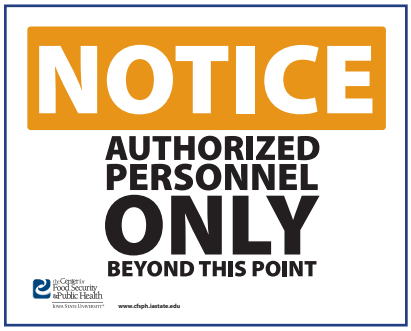
Barns and Buildings

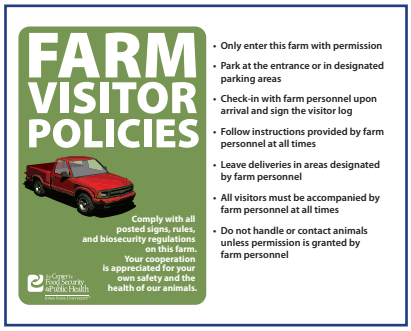
Clean and disinfect anything that has had contact with animals, manure or animal secretions.

- This includes barns and buildings, vehicles, trailers, equipment, and supplies.
- Tires and wheel wells of vehicles and trailers are especially important.
- Surfaces should be scraped, cleaned with high pressure hot water and detergent, and rinsed.
- The disinfectant should then be applied and allowed to "sit" for the optimal contact time.

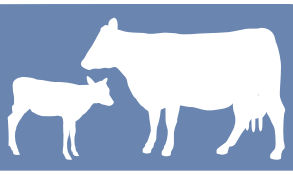
Appendix A - Sample Signs

Sample signs to post at the cow-calf operation entrance in the event of a FMD outbreak in the U.S. (Available from the CFSPH web site at *www.cfsph.iastate.edu*)





Signage is also available from private companies such as Gempler's.



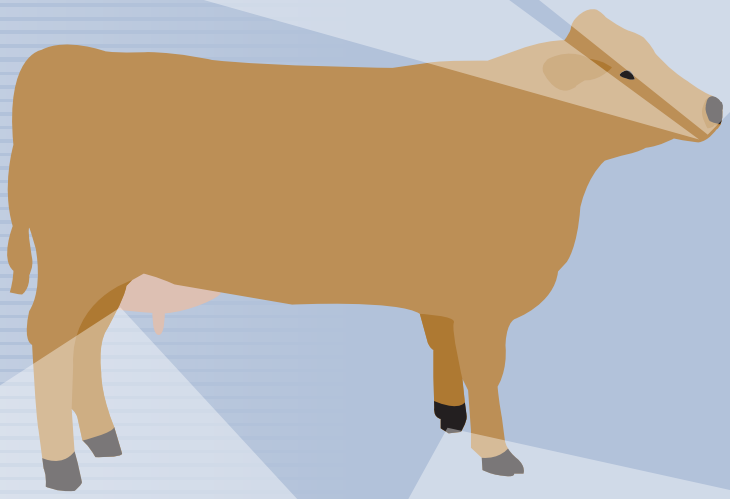
Appendix B - Daily Visitor Log

Visit Date	Name and Phone Number	Reason for Visit	Date and Location of Last Contact with Livestock	Time In	Time Out

Appendix C - Signs of Illness in Cattle

Excessive drooling following blistering and lesions in the mouth
Source: Pam Hullinger, California Department of Food and Agriculture

Ulcers on tongue
Source: Plum Island Animal Disease Center



Ruptured blister on the end of a teat
Source: Plum Island Animal Disease Center

Ulcer between the toes
Source: Plum Island Animal Disease Center

Appendix D - Bird and Rodent Control Measures

FMD virus may be spread on the fur, feathers, or feet of some animals. Birds and rodents may spread FMD for a short time and distance during an outbreak and can also contaminate feed and water sources. Control programs should be implemented to minimize their numbers and the risk of disease spread on your cow-calf operation.

Eliminate openings for rodents or birds to enter, especially feed storage or processing areas.

- Seal any opening greater than ¼ to ½ inch with a durable material such as steel wool packed tightly into openings.
- Use materials that cannot be easily gnawed or pecked through such as concrete, sheet metal, wire mesh, aluminum or brick. Plastic sheeting, wood, rubber will not be adequate.
- Check openings around augers, pipes and wires. Use mortar, masonry or metal collars in these areas.
- Doors, windows and screens should fit tightly. The distance between the bottom of the door and threshold should not exceed ¼ inch.
- Drainage pipes or sewage systems may be used by rodents as routes to enter buildings. Equip floor drains with metal grates (openings less than ¼").

Remove potential hiding, resting and nesting sites.

- Equipment (e.g., refrigerators, powerwashers, etc.) should be raised and easily movable to allow for easy cleaning behind and underneath them.
- Bagged feed should be stacked on pallets with adequate space around and under them to allow easy inspection for signs of rodent activity and trap or bait placement.
- Rats can burrow and nest under feed bunks placed directly on the ground. Use of a concrete base around feed bunks can eliminate habitat.
- Maintain the water level in livestock waterers so it is deep enough that birds cannot stand in it.
- Hanging strips of heavy plastic vertically in doorways of buildings will allow machinery and people to pass through but keeps birds out. This will not prevent rodent entry.
- Cover the undersides of rafters with netting to exclude birds from nesting sites.

Eliminate potential food sources.

- Store feed in well sealed containers (preferably metal with tight fitting lids).
- Use covered feeders that exclude birds.
- Clean up any spilled feed immediately.

Establish a rodent barrier around buildings.

- A 3 foot wide weed-free area with a gravel rock perimeter can be used to prevent weed growth and discourage rodents from burrowing.
- Gravel (at least 1 inch diameter) should be placed in a band at least 3 foot wide and 6 inches deep.
- Grass and weeds surrounding building should be kept cut short to discourage rodent habitats.

Trap rodents to reduce vector transmission.

- Proper placement of traps and baits is important. Set traps close to walls, behind objects, in dark corners, in places where rodent activity is evident.
- Use talc or flour patches to track where rodents are active.

Bait rodents when trapping is not possible or effective.

- When using rodenticide baits, first read the label carefully and fully follow the directions.
- Use the amount of bait indicated on the package. Requirements differ between products.
- Protect baits from the weather.
- Be sure baits are not accessible to children or domestic animals and birds.
- Inspect baits regularly. Check often for dead rodents and burn or bury those you find.

Contact a wildlife pest control operator in your state for further assistance. Other control methods are available, but beyond the scope of this document.

Check local legislation for allowable bird control measures. Many birds are protected by state and/or federal law.

Appendix D - Bird and Rodent Control Measures

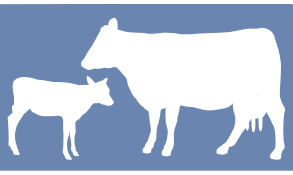
For More Information

- Pierce RA. Bait Stations for Controlling Rats and Mice. University of Missouri Extension. *http://muextension.missouri.edu/explore/agguidees/wildlife/g09444.htm.*

- Brittingham MC, Falker ST. Controlling birds around farm buildings. Pennsylvania State University Extension. *http://pubs.cas.psu.edu/FreePubs/pdfs/uh126.pdf.*

- See T. Controlling rodents. North Carolina State University Extension. *http://www.thepigsite.com/Featured Article/Default.asp?Display=1015*.

- Baker RO, Bodman GR, Timm RM. Rodent- proof construction and exclusion methods. University of Nebraska.



Appendix E - EPA and USDA Approved Disinfectants for FMD

Note: Before disinfecting, all surfaces must be cleaned. This includes removing any visible material such as manure, bedding, and feed.

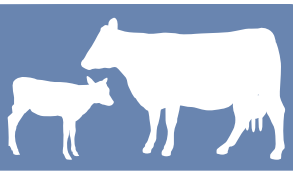
Product	*Dilution*	*Mixing Instructions*	*Comments*
Sodium carbonate* (soda ash)	4%	Add 5.33 ounces sodium carbonate to 1 gallon of hot water (or 1 pound to 3 gallons). Mix thoroughly.	Recommended contact time is 10 minutes. Can be deactivated by hard water. Mildly caustic (irritate skin) and dulls paint/ varnished surfaces.
Sodium hydroxide* (lye, NaOH)	2%	Add 1/3 cup of NaOH pellets (2.7 ounces of lye) to 1 gallon of cold water. **Warning: Always add the lye to water** - NEVER pour water over lye.	Recommended contact time is 10 minutes. Highly caustic (skin burns, damages metals). Use water-resistant protective clothing, gloves, safety glasses.
Sodium hypochlorite 6.0%* (NaOCl) (household bleach)	1000 ppm	Add 1/3 cup of chlorine bleach to 1 gallon of water. Mix thoroughly.	Recommended contact time is 10 minutes. Must be mixed fresh prior to each application; unstable in warm, sunny conditions (above 59°F).
Proprietary products		Follow label directions.	As of December 2011, there are 5 products registered by EPA with a claim to inactivate FMD virus.

*These products may be applied by certified applicators or under the supervision of USDA-Plant Protection and Quarantine, USDA Veterinary Medical Officers, or State officers that are certified applicators (EPA Quarantine Exemption to USDA, 2002).

USDA-APHIS has an exemption in place for sodium hypochlorite (bleach), sodium hydroxide and sodium carbonate in the event the proprietary products are not available. As with all disinfectants, all label use directions and safety precautions must be followed.

Sources: Personal communication, Jeff Kempter, Senior Advisor Antimicrobials Division, Office of Pesticide Programs, Environmental Protection Agency Proprietary products are listed at: *https://www.aphis.usda.gov/aphis/ourfocus/emergencyresponse/SA_Tools_And_Training* - select "Pesticides to use against selected foreign animal diseases"

Prevention Practices for Rift Valley Fever (RVF)



Rift Valley Fever (RVF) is a fever-causing viral disease that severely affects cattle, sheep, goats and humans. There is a very high rate of abortion and death in infected newborn animals. RVF is spread between animals and humans by mosquitoes. A mosquito will feed on blood from an animal/person with RVF and spread RVF to a new animal when it feeds again. The virus is not present in the United States but the mosquito capable of carrying it is found here. The virus is found in other parts of the world (most of Africa) and therefore poses a risk to U.S. beef cattle.

If a case of RVF is confirmed anywhere in the United States, mosquitoes could spread it across the nation. If any animal on your operation is confirmed to have RVF, all may be euthanized and disposed of to control the further spread of the disease.

This document describes biosecurity practices you can take to prevent RVF from entering your operation. These measures should be put into place **IMMEDIATELY** on your operation *if RVF is confirmed anywhere in the U.S.* and continued until the U.S. is once again declared RVF free.

Transmission of the Disease

Mosquitoes (**vectors**) are the most important way that RVF is spread between animals and to humans. RVF virus can be spread during pregnancy (**direct contact** from cow to calf). The virus has also been found in semen and raw milk.

In humans, exposure to the virus can occur via **aerosols** being inhaled while assisting with the birth of infected animals, during a necropsy or slaughter. The virus could also enter abrasions on the skin (**direct contact**) during one of the above procedures.

General Precautionary Measures

Prevention measures to minimize the introduction and spread of RVF on your operation fall into four general categories.

1. Restrict or stop all animal movement to prevent entry or spread of the disease.
2. Observe, detect and report any disease or unusual signs to your veterinarian as quickly as possible.
3. Mosquitoes are the most important way that RVF is spread. Control mosquito breeding sites (stock tanks, ponds, old tires, etc.) to prevent spread of the disease.
4. Humans can get Rift Valley Fever. Protect yourself against mosquito bites and use personal protective equipment (respirator, gloves, eye protection, etc.) when handling tissues from animals that have aborted (placenta, fetus, etc.).

Specific steps to take if RVF is confirmed in the U.S. are listed below. Many should already be in place on your operation but should be enhanced and more strictly enforced if RVF is found in the U.S. These measures can help minimize the chance of RVF being introduced on your operation.

Premises Entrance

Limit access to your operation.

- The entrance to your operation is a major control point.
- Gates at premises entries should be locked when not in use.

Post signs at the operation entrance(s) (Appendix A).

Signs inform unauthorized visitors to not enter your operation. When entry is necessary, signs give specific rules and biosecurity measures to follow while on your operation.

Restrict or limit visitors on your operation.

- At all times, limit the number of visitors to the operation.
- People can get RVF. Infected humans may serve as a source of the virus for mosquitoes which could spread the disease to animals or humans. Visitors who have traveled internationally within the past five days should not be allowed to enter the cow-calf operation.
- Post warning signs indicating entry onto the premises is not allowed without permission.

Strict biosecurity measures must be followed by any visitors to the cow-calf operation.

Some visitors are essential for the continued operation of the facility. Establish strict biosecurity procedures for these individuals, then inform them of the measures to follow while on your operation.

- Check-in with personnel upon arrival (direct visitors to "where" they should check in).
- Be accompanied by someone from the operation at all times to ensure biosecurity measures are being followed.

This information was developed by staff veterinarians at the CFSPH for use as educational materials in the event of a Highly Contagious Foreign Animal Disease outbreak in the United States.

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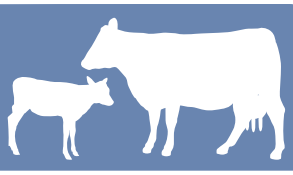
Prevention Practices for Rift Valley Fever (RVF)



- Visitors and vehicles should avoid contact with animals, animal feed or animal areas unless absolutely necessary.
- If animal contact is necessary, wear clean premises-specific protective clothing (e.g., coveralls, boots) while on the operation. Guide visitors to where protective clothing is located. These items should remain on-premises when the visitor leaves.

Monitor and record all traffic on or off your operation.

Maintain a log sheet (Appendix B) of all visitors and vehicles that enter your operation. Accurate record keeping of traffic on your operation will help with disease surveillance and tracking if necessary. You should not rely on your ability to "recall" visitors and vehicles that were on your operation.

People

People can get RVF several ways (see Appendix C):

- Being bitten by a mosquito.
- Handling infected animal tissues or fluids.
- Breathing in the virus when handling infected animal fluids (blood, birthing tissues, and milk).

Protect yourself against mosquitoes.

- When outside, wear long pants and long sleeves to cover skin.
- Use insect repellants on exposed skin. Repellants with N, N-diethyl-meta-toluamide (commonly known as DEET) are the most effective. DEET is an insect repellant that is safe to use on people but not on pets. Make sure to follow all label directions.
- Make sure screens on windows and doors are in good repair.

Sick animals should not be processed for meat or necropsied during a RVF outbreak.

- This can release the virus into the air. People who necropsy the animals or process meat may become sick by breathing in the virus or by handling the meat and organs.

Wear personal protective equipment, such as gloves, coveralls, boots, protective eyewear and a respirator when handling aborted fetuses or birthing tissues.

Do not allow ill people on your operation.

- People with RVF can have a fever, headache, muscle and joint pain, nausea and vomiting. These people could spread RVF to a mosquito that could then bite and infect another person or animal.
- RVF cannot be passed from person to person; it requires a mosquito.

Limit employees to only those necessary for the continued operation of the facility.

Livestock

Monitor animals closely and frequently for any developing illness or signs of disease.

Educate yourself and train your employees about RVF and the signs of illness in cattle:

- Abortions at any stage of pregnancy, up to 85% of pregnant animals
- Adult cattle: Fever, snotty nose, watery eyes, runny nose, excessive salivation, refusal to eat, bloody or foul-smelling diarrhea
- Calves: Fever, depression, bloody or foul-smelling diarrhea, sudden death

Contact your veterinarian immediately to examine sick animals.

Quarantine incoming cattle for at least 7 days.

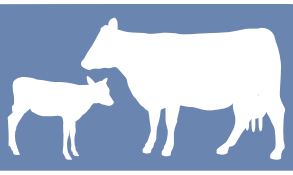
- New animals can be infected with a disease with out showing signs of illness right away.
- Cattle exposed to the RVF virus may take up to 3 days to show signs of illness.
- Ideally, animals should be quarantined at a separate location (premises).

Other Animals

Prevent free roaming animals (dogs, cats) from coming onto your operation.

- Dogs and cats can get RVF, and it can be fatal in puppies and kittens.
- Infected dogs and cats could serve as a source of the RVF virus for mosquitoes to pass the disease to your livestock.
- There are topical insecticide products for dogs, applied monthly, that protect against mosquitoes; consult your veterinarian for more details.
- Keep pets in a kennel or tied securely.
- Ask your neighbors to do the same.

Prevention Practices for Rift Valley Fever (RVF)



Animal Movement

If RVF is confirmed in the U.S., movement restrictions may be implemented locally, regionally and possibly nationally. Restrictions will depend on the scope of the outbreak.

Know the health status and the source of any animal(s) brought onto your operation.

- Do not bring animals onto your operation unless they are proven to be from RVF-free areas.

Maintain thorough and accurate records of animal movement.

- Document all animal movements, including the dates of introduction, where they came from and movements between separate units.
- Each animal location must be treated as a separate unit or premises.
- This information will be essential to help trace where the disease came from.

Mosquito Life Cycle and Control

Mosquitoes are the most important way that RVF is spread. It is only the female mosquito that feeds on blood as she needs the protein to produce eggs. Mosquitoes will lay their eggs on or near the edge of water. The mosquito eggs will hatch into larvae (also known as "wigglers") which turn into pupae (also known as "tumblers"). The larvae and the pupae need to live in water to survive. The pupae will change into adult mosquitoes. See Appendix C.

Control of Mosquito Egg Laying Sites (See Appendix D)

- Egg laying site control is the best way to control mosquitoes since they lay eggs in specific areas and that can be managed.
- Mosquitoes can lay their eggs any place that can hold water. This includes ponds, old tires, tarps, tree holes, bird baths and flower pots.

Control of Mosquito Larvae ("wigglers")

- Mosquito larvae need to live in water to survive. They can be found in any amount of standing water including ponds, old tires, tarps and bird baths.
- Since mosquito larvae remain in the same water where they hatched from eggs, control of this stage focuses on continued management of mosquito egg laying areas.
- The use of pesticides should only be used as a supplement to controlling mosquitoes through the reduction and management of mosquito egg laying sites.
- Check with your local extension office or department of pest management to determine which pesticides are approved for use in your area.

Control of Mosquito Adults

- Control of adults is the least effective way to control mosquitoes. Attempting to control adult mosquitoes can be difficult and costly.
- Control of adult mosquitoes focuses on the use of pesticides.
- The use of pesticides should only be supplemental to controlling mosquitoes through the reduction and management of mosquito egg laying areas.
- Check with your local extension office or department of pest management to determine which pesticides are approved for use in your area.

Cleaning and Disinfection

RVF virus is can survive in dried blood up to three months and aerosols at the right temperature (75°F) and humidity (50-85%). It is destroyed by strong sunlight/ultraviolet (UV) radiation and is quickly destroyed by acidic conditions, including decomposing carcasses. Proper cleaning and disinfecting procedures are essential in order to adequately and effectively control the spread of the virus. Lipid solvents, detergents and sodium or calcium hypochlorite solutions are effective at inactivating the virus. A U.S. Environmental Protection Agency (EPA)-registered product must be used; USDA-APHIS may have exemptions in place for the use of certain products against specific foreign animal diseases. For proper guidance in selecting an effective, approved disinfectant against Rift Valley Fever, see the *FAD PReP/NAHEMS Guidelines: Cleaning and Disinfection (2011)*.

Remove any organic material before cleaning or disinfection.

- Most disinfectants are ineffective when dirt, manure and other visible material is present.

Clean and disinfect anything that has come in contact with birthing tissues or fetuses before it is used for another purpose.

Clean isolation areas and replace bedding regularly.

- Dispose of bedding and manure from isolation areas and store it in a fenced off area so that live stock or other animals do not have access to it.

References

- Food and Agriculture Organization of the United Nations (FAO). Manual on Procedures for Disease Eradication by Stamping Out, Part: 3 Decontamination procedures. Accessed on January 28, 2010

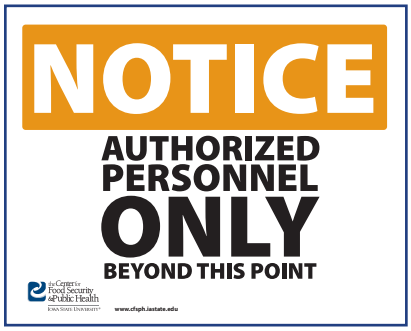
- International Office for Epizootics (OIE). Animal diseases data: Rift Valley Fever. Accessed on October 21, 2010

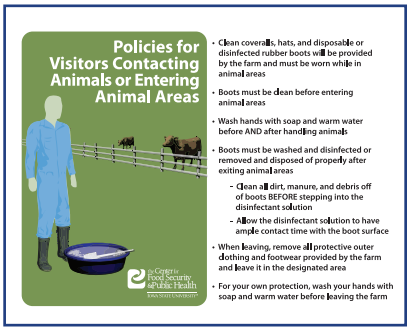
- Rift Valley Fever fact sheet, Center for Food Security and Public Health, Iowa State University, November 8, 2006, available at: *http://www.cfsph.iastate.edu/Factsheets/pdfs/rift_valley_fever.pdf*

- Zoonoses and Communicable Diseases Common to Man and Animals. Rift Valley Fever. Published by the Pan American Health Organization. 2003.

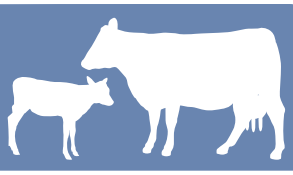
Appendix A - Sample Signs

Sample signs to post at the cow-calf operation entrance in the event of a RVF outbreak in the U.S. (Available from the CFSPH web site at *www.cfsph.iastate.edu*)





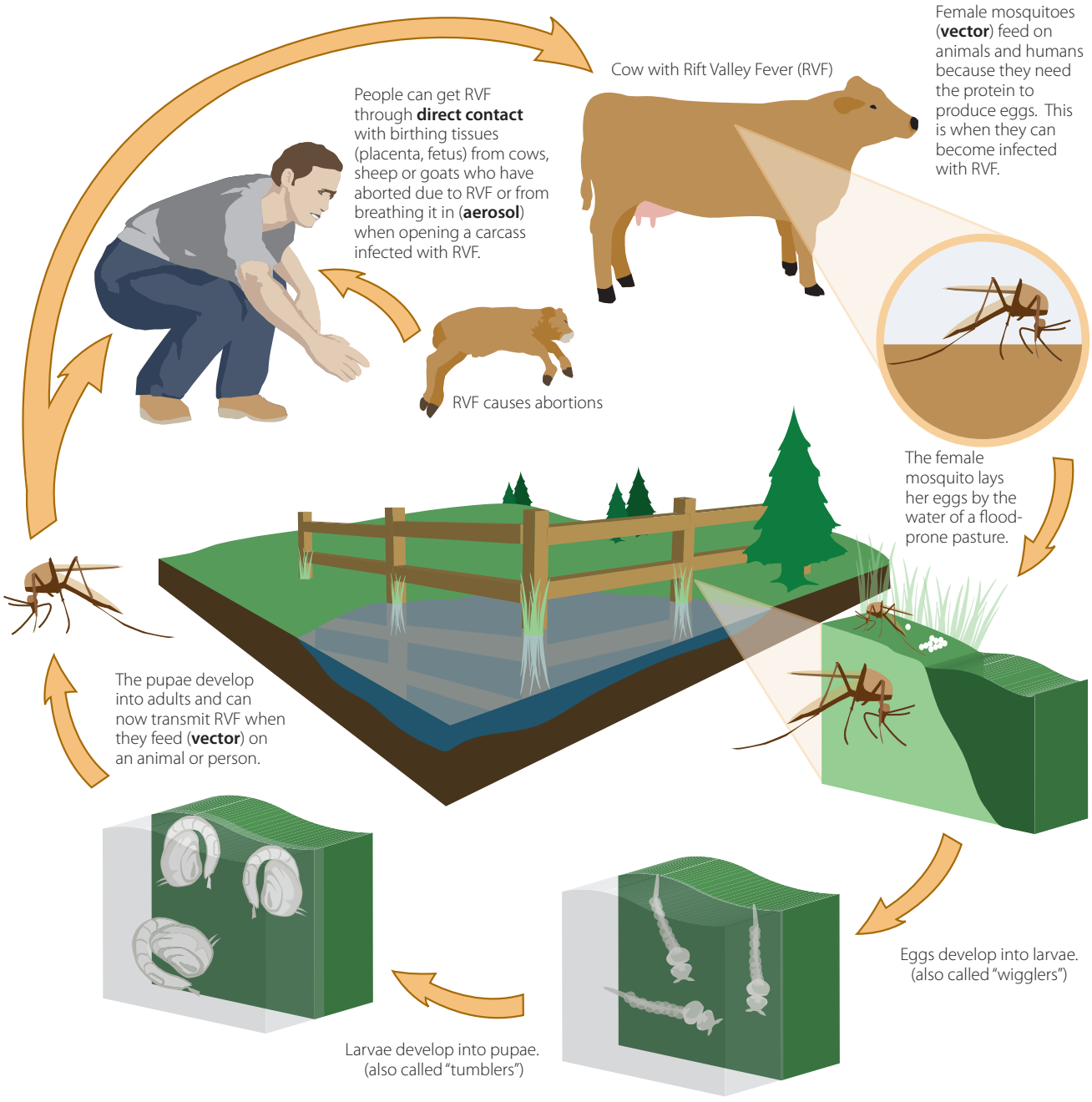
Signage is also available from private companies such as Gempler's.



Appendix B - Daily Visitor Log

Visit Date	Name and Phone Number	Reason for Visit		Time In	Time Out

Appendix C - Transmission Routes of Rift Valley Fever



Graphic illustration by Clint May and Dani Ausen, Iowa State University

Appendix D - Mosquito Control Measures

Rift Valley Fever virus is spread by mosquitoes. Control programs should focus on decreasing their numbers to minimize the risk of disease spread on your cow-calf operation.

Control of Mosquito Egg Laying Sites

- Control of mosquito egg laying sites is the best control method since they lay eggs in specific areas and these areas can be managed.
- Add drainage holes to structures and containers that may trap water (barrels, old tires).
- Change or circulate the water in stock tanks, pet bowls and birdbaths at least once a week.
- Drain tarps and covers of collected rainwater after a rain (e.g., silage covers).
- Pick up and properly dispose of all trash, especially anything that could hold water.
- Thin out weeds and remove old leaves from ponds. This will allow natural mosquito-eating fish to easily access areas where mosquitoes lay their eggs.
- Grade areas where road ruts, potholes and hoof-prints exist (around stock tanks, ponds).
- Grade newly developed land to prevent standing water. These areas create areas for mosquitoes to lay eggs.
- Fill tree holes with sand, mortar or place drainage holes to prevent standing water.
- Clean roof gutters to prevent them from becoming clogged and holding water.

Control of Mosquito Larvae ("wigglers")

- Check with your local extension office or department of pest management to determine which pesticides are approved for use in your area.
- The use of pesticides should only be supplemental to controlling mosquitoes through the reduction and management of mosquito egg laying areas.
- Do not apply pesticides to moving water (e.g., streams).
- Products labeled only for home and garden mosquito larval control may be used. Follow all label directions.
- Non-chemical pesticides can be used.
  - **Always follow all label directions**
  - BTI (*Bacillus thuringiensis israelensis*) pronounced ba-SILL-us THUR-in-GEN-sus IZ-real-EN-sus.
  - BTI granules can be spread over an area of pasture that is flood-prone. Use at the beginning of the mosquito season and re-apply in the middle of the season.
  - BTI dunks can be used to treat stock tanks. One dunk can treat up to 100 square feet of water surface and can last up to 30 days.
  - Methoprene products can be used to treat areas that collect water. These include bird baths, urns, old tires, flower pots, abandoned swimming pools, etc.

Control of Mosquito Adults

- Control of adult mosquitoes is the least efficient control method.
- Special equipment is needed to apply pesticides to kill adult mosquitoes (adulticides). Small droplets are produced that drift through the air and contact adult mosquitoes to kill them.
- Check with your local extension office or department of pest management to determine which pesticides are approved for use in your area.
- The use of pesticides should only be supplemental to controlling mosquitoes through the reduction and management of mosquito egg laying sites.
- Individuals may use hand-held Ultra Low Volume foggers, portable or fogging attachments for tractors or lawn mowers.
- Pyrethrin or 5% malathion can be fogged outdoors. Follow all label directions.
- Contact your local extension agent for assistance in developing a mosquito management plan.

Personal Protection

- People can get Rift Valley fever by being bitten by an infected mosquito.
- Protect yourself against mosquitoes.
- When outside, wear long pants and long sleeves to cover skin.
- Use insect repellants on exposed skin. Repellants with DEET (N,N-diethyl-meta-toluamide) are the most effective.
- DEET is an insect repellant that is safe to use on people but not on pets.
- Make sure screens on windows and doors are in good repair.

Appendix D - Mosquito Control Measures

It is a violation of state and federal law to use a pesticide in any manner that differs from the product label. Use only according to label directions to avoid meat or milk residue hazards, environmental damage, and animal or human injury.

Mosquito References:

- Lawler SP, Lanzaro GC. Managing Mosquitoes on the Farm. Department of Entomology, University of California, Davis. *http://axp.ipm.ucdavis.edu/PDF/MOSQ/mosquitoesonfarm.pdf*

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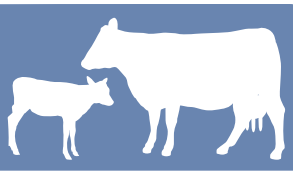
- Stringham M, Watson W. Managing Waste Lagoons to Control Mosquito Breeding. North Carolina State University Department of Entomology. *http://www.ces.ncsu.edu/depts/ent/notes/MedVet/wnv-manage.htm*

- Larvicides for Mosquito Control. United States Environmental Protection Agency.

Prevention Practices for Heartwater



Heartwater is a rickettsial disease spread by the Gulf Coast tick to cattle and other livestock such as sheep and goats. The agent that causes disease is not present in the United States but the ticks capable of carrying it are found here. Heartwater is endemic in much of Africa and the Caribbean and poses a risk to U.S. beef cattle.

If a case of heartwater is confirmed in the United States, it could spread to other parts of the nation through infected ticks. If any animal on your cow-calf operation is confirmed to have heartwater, all animals on the operation that could get sick may be removed and isolated or euthanized and disposed of to control the further spread of disease.

This document describes biosecurity practices you can take to prevent heartwater from entering your operation. These measures should be put into place **IMMEDIATELY** on your operation if heartwater is *confirmed anywhere in the U.S.* and continued until the U.S. is once again declared heartwater free.

General Precautionary Measures

Prevention measures to minimize the introduction and spread of heartwater onto your operation fall into three general categories.

1. Restrict or stop all animal movement to prevent entry or spread of the disease.
2. Examine cattle for the Gulf Coast tick, the tick that spreads heartwater disease.
3. Observe, detect, and report any disease or unusual signs to your veterinarian as quickly as possible.

Specific steps to take if heartwater is confirmed in the U.S. are listed below. Many should already be in place on your operation but should be enhanced and more strictly enforced in the event heartwater is found in the U.S. These measures can help minimize the chance of heartwater being introduced on your operation.

Gulf Coast Tick Distribution

The Gulf Coast tick (*Amblyomma maculatum*) is a tick species that could spread heartwater disease to cattle, sheep, goats, and white-tailed deer.

It is NOT found in all parts of the U.S.

- It has been reported in Kansas south to Texas, east across the Gulf Coast States to the Atlantic sea board, approximately 100 miles in from the coast. (See Appendix A)

Gulf Coast ticks do not feed on people but could travel on them or other animal species to other areas.

- These ticks will also feed on wildlife, horses and dogs. Horses and dogs will not develop heartwater disease.
- White-tailed deer are VERY sensitive to heartwater disease and die if infected.

The African tortoise tick (*Amblyomma marmoreum*) has established itself in Florida.

It prefers to feed on tortoises but is a known spreader of heartwater disease.

There are other *Amblyomma* ticks that are not present in the U.S. (as of January 2012) that also spread heartwater disease.

- The tropical bont tick (*Amblyomma variegatum*) lives in the Caribbean and could travel to Florida and beyond on cattle egrets, a wild bird.
- The bont tick (*Amblyomma hebraeum*) from Africa could survive in Florida and Texas and easily spread heartwater disease if it were introduced into the U.S.

Premises Entrance

Limit access to your operation.

- The entrance to your operation is a major control point.
- Gates at premises entries should be locked when not in use.

Post signs at the operation entrance (Appendix B).

Signs inform unauthorized visitors to not enter your operation. When entry is necessary, signs give specific rules and biosecurity measures to follow while on your operation.

Restrict or limit visitors on your operation.

- At all times, limit the number of visitors to the operation.
- Post warning signs indicating entry onto the premises is not allowed without permission.

Strict biosecurity measures must be followed by any visitor to the cow-calf operation.

Some visitors are essential for the continued operation

This information was developed by staff veterinarians at the CFSPH for use as educational materials in the event of a Highly Contagious Foreign Animal Disease outbreak in the United States.

the Center for Food Security & Public Health
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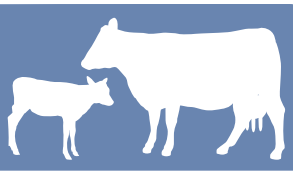


of the facilty. Establish strict biosecurity procedures for these individuals, then inform them of the measures to follow while on your operation.

- Check-in with personnel upon arrival. (Direct visitor to "where" they should check-in).
- Be accompanied by someone from the operation at all times to ensure biosecurity measures are being followed.
- Visitors and vehicles should avoid contact with animals or animal areas unless absolutely necessary.
- If animal contact is necessary, wear clean premises-specific protective clothing (e.g., coveralls, boots) while on the operation. Guide visitors to where protective clothing is located. These items should remain on-premises when the visitor leaves.

Monitor and record all traffic on or off your operation.

Maintain a log sheet (Appendix C) of all visitors and vehicles that enter your operation. Accurate record keeping of traffic on your operation will help with disease surveillance and tracking if necessary. You should not rely on your ability to "recall" visitors and vehicles that were on your operation.

Animals

Monitor animals closely and frequently for any presence of ticks or developing illness (see Appendix D for examples of the Gulf Coast tick).

- Nymph stage ticks can be found around the withers, along the top of the back, near the tail head and on the soft tissue between the hooves.
- Adult ticks can be found near the udder, inside the legs, around the testes or prepuce, and above and under the tail.
- Contact your veterinarian immediately if ticks are noticed.
- Following exposure to the tick, an animal usually shows illness in 2 to 4 weeks.

Record the location of any ticks found on animals - head, ears, back, legs, etc.

- Indicate if the ticks were blood filled (engorged) or newly attached (unengorged).

Educate yourself and train your employees about heartwater and the signs of illness (photos found in Appendix E).

The name heartwater is due to the fluid that forms around the heart during the disease and is seen on post mortem exams. Signs result from injury to the blood vessel walls which causes "leaking".

There are different forms of heartwater disease, the most common form can cause:

- Sudden death
- Sudden high fever (up to 107°F)
- Death in less than one week after onset of fever
- Loss of appetite
- Depression, recumbency leading to death
- Rapid, difficult breathing
- Fluid in lungs, chest cavity
- Neurologic signs in some cases: chewing, eyelid twitching, tongue sticking out, walking in circles with a high stepping gait, convulsions

Isolate any animals showing the signs above and contact your veterinarian immediately to examine them.

- If these animals are carrying heartwater disease, they should be euthanized and destroyed as they will serve as a source of disease on the operation for other ticks to spread.
- Treat the herd with tetracyclines and dip them in an acaricide to prevent ticks.
- Tetracycline antibiotics are only effective if given EARLY in the course of the disease, by day 2 or 3 after fever appears and before nervous signs appear.

Use separate facilities, equipment and staff to handle isolated livestock.

- If this is not possible, handle or visit the isolated animals LAST.
- Since heartwater is carried in the blood of animals, NEVER share needles or syringes between animals.

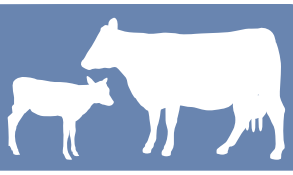
Quarantine incoming cattle for at least 30 days.

- New animals can be infected with heartwater without showing signs of illness right away.
- Cattle exposed to heartwater can take 2-4 weeks before signs of illness are seen.
- Ideally animals should be quarantined at a separate location (premises).

Animal Movement

If heartwater is confirmed in the U.S., movement restrictions may be implemented locally, regionally and possibly nationally. Restrictions will depend on the scope of the outbreak.

Prevention Practices for Heartwater



Maintain thorough and accurate records of animal movement.

- Document all animal movements, including the dates of introduction into the herd and where they came from and movements between separate units.
- Each animal location must be treated as a separate unit or premise.
- This information will be essential to help trace where the disease came from.

Know the health status and source of any animal(s) brought onto your operation.

- Do not bring animals onto your operation unless they have been proven to be from heartwater-free areas, especially if they are imported from the Caribbean or Africa.

Wildlife and Other Animals

Limit exposure to free roaming animals (wildlife, birds, small mammals).

- Wildlife, birds and small mammals can carry the ticks that spread heartwater.
- White-tailed deer are very sensitive to heartwater disease and die if infected; alert your veterinarian immediately if you notice multiple dead deer in your area.
- Dogs should be restricted to the premises (tied up, kenneled) and examined daily for ticks as they could introduce infected ticks to the cattle.
- There are topical products available for dogs, applied monthly, that protect against certain species of tick infestation; consult your veterinarian for more details.

Control of wildlife will be difficult, but should be attempted.

Keep operation access routes, parking areas, yards, and storage areas clean and tidy to avoid attraction of birds or small mammals.

Tick Life Cycle

Gulf Coast ticks are considered 3 host ticks, meaning they attach to a different animal to blood feed for each of their life stages (see Appendix D).

- The first stage is the egg; the second is a larva with 6 legs; the third is a nymph with 8 legs and the fourth stage is adult.

Each life stage, besides the egg, attaches itself to an animal, feeds on blood, and then drops off to change (molt) to the next stage.

- The tick will carry heartwater disease through its entire life, spreading it each time they feed.

Ticks molt on the ground in grass or areas with lots of vegetation.

- Nymphs, larvae and adult ticks "quest" or seek out animals by climbing to the top of a blade of grass and latching on to animals legs as they pass by.

Adult Gulf Coast ticks can be found on animals at various times of the year.

- Oklahoma, Kansas, and Midwestern states:
  - Adults- winter active
  - Larvae, nymphs - late spring, summer active
- Texas and Gulf Coast states:
  - Adults- August through October active
  - Larvae, nymphs- winter active

Tick control strategies must be applied accordingly.

Acaricides

Acaricides are products aimed at killing ticks and should be applied to cattle every 2-4 weeks (see Appendix F) in affected areas.

- These are available as direct applications to animals as pour-ons, sprays or impregnated ear tags.

Employees and Visitors

Employees or visitors that have contact with livestock at other locations (including their own home), should check themselves for ticks and remove them before entering your operation.

- All visitors should be accompanied by someone from the operation at all times.
- Visitors should avoid livestock areas, pens, and barns unless absolutely necessary.

Neighbors

Discuss the threat of heartwater with your neighbors.

Determine steps you can take together to protect your area and operation from becoming infected.

- Keep vegetation mowed short to eliminate tick habitats.
- Prevent free roaming dogs.

References

- Auburn University Highlights of Ag Research, Volume 47, Number 3, 2000. Alabamians vulnerable target for ticks accessed November 4, 2005 at *http://www.aaes.auburn.edu/comm/pubs/highlightsonline/fall00/tick.html*

- Kansas Insect Newsletter, Department of Entomology, Kansas State University, Gulf Coast ticks make their presence felt in Kansas accessed November 4, 2005 at http://www.oznet.ksu.edu/dp_entm/extension/KIN/KIN_2005/kin-8/05ksnew8.htm

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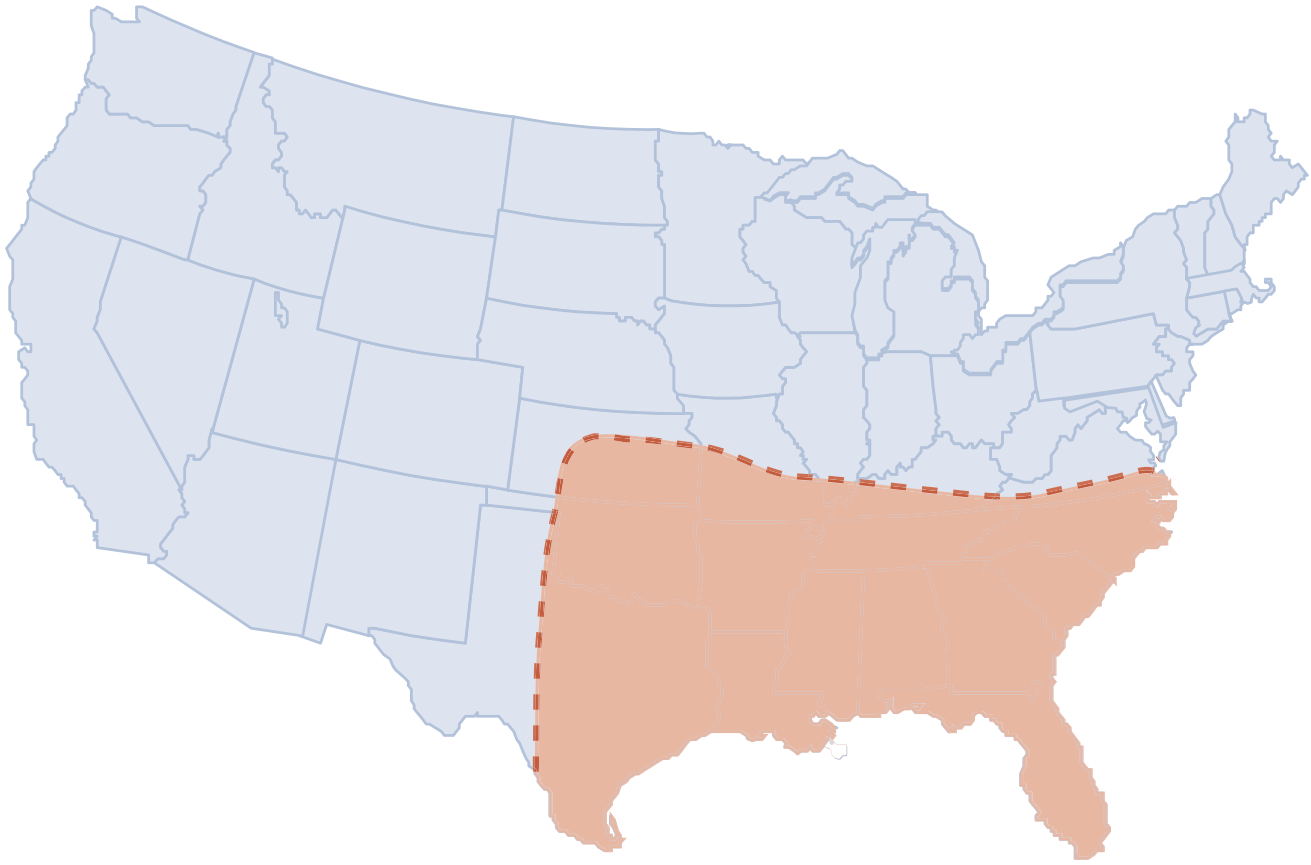
- USDA APHIS. 2008. Assessment of change in risk for release of Ehrlichia ruminantium (Heartwater) into the continental United States following discontinuation of the Tropical Bont Tick (Amblyomma variegatum) eradiation program on St. Croix, U.S. Virgin Islands. Centers for Epidemiology and Animal Health. Ft. Collins CO.

- Williams HR, Teel PD, Strey OF, Wright RE, Mock DE. Zoogeography of the Gulf Coast tick, Amblyomma maculatum Koch accessed July 7, 2005 at *http://ticsys.tamu.edu?HEATHERSPROJ.htm*

Appendix A - Distribution of Gulf Coast Ticks

Approximate Distribution of the Gulf Coast Tick

(*Amblyomma maculatum* Koch)

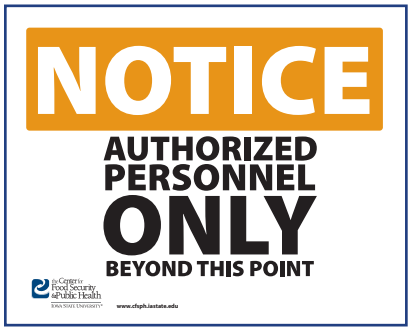


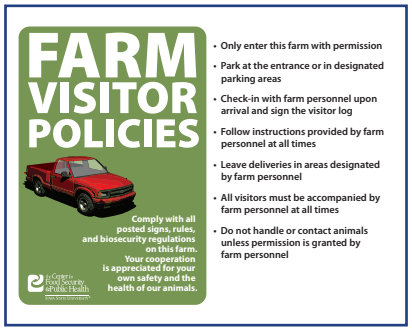
Gulf Coast Ticks have been identified in the environment and on animals in specific areas in the shaded region *(as of January 2012)*.

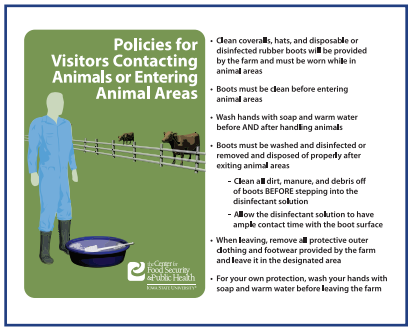
Definitive boundaries uncertain

Appendix B - Sample Signs

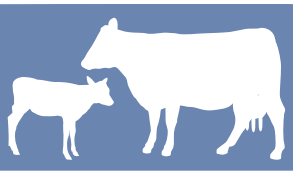
Sample signs to post at the premises entrance in the event of a Heartwater outbreak in the U.S. (Available from the CFSPH web site at *www.cfsph.iastate.edu*)







Signage is also available from private companies such as Gempler's.



Appendix C - Daily Visitor Log

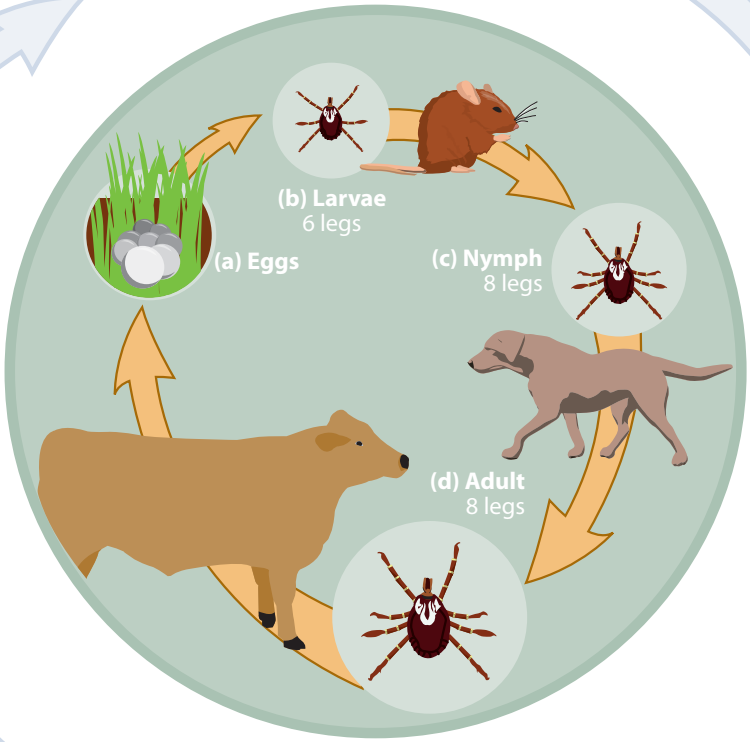
Visit Date	Name and Phone Number	Reason for Visit	Date and Location of Last Contact with Livestock	Time In	Time Out

Appendix D - Life Cycle of the *Amblyomma* Tick - 3-Host Tick

b) Larvae with 6 legs hatch from the eggs on the ground.

To feed, a larva climbs to the top of a grass blade and holds onto it with three legs and "quests" by waving the other three legs to attach to small rodents or ground dwelling birds (quail, cattle egrets, meadowlarks) as they pass by.

After feeding on their blood, the larva falls to the ground to molt to the next stage.



a) Eggs: 15,000-18,000 laid on the ground

c) Nymphs with 8 legs molt from larvae on the ground.

To feed, a nymph quests again and attaches to animals or birds similar to those fed upon by larvae, but also dogs or larger mammals.

After feeding on their blood, the nymph drops to the ground to molt to the next stage.

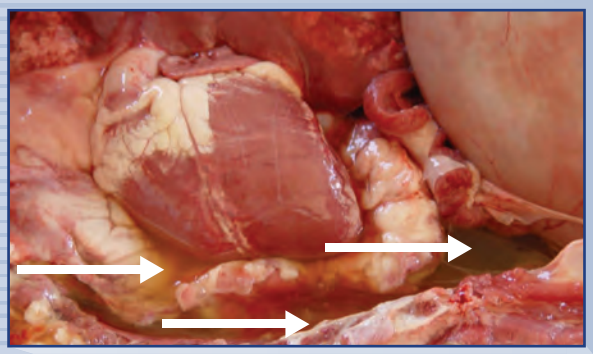
d) Adults with 8 legs molt from nymphs on the ground.

To feed, an adult quests to attach to dogs, bobcats, coyotes, rabbits, rodents, deer or humans but prefer livestock such as cattle, horses, pigs, and goats.

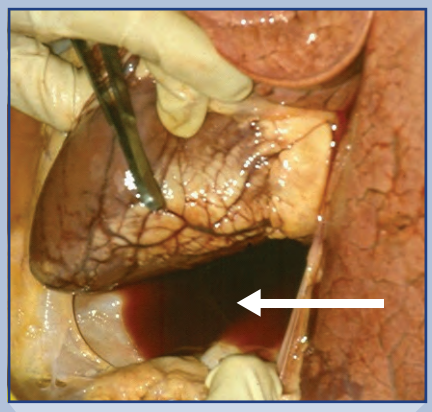
After feeding and mating, the female adult will drop to the ground and lay her eggs.

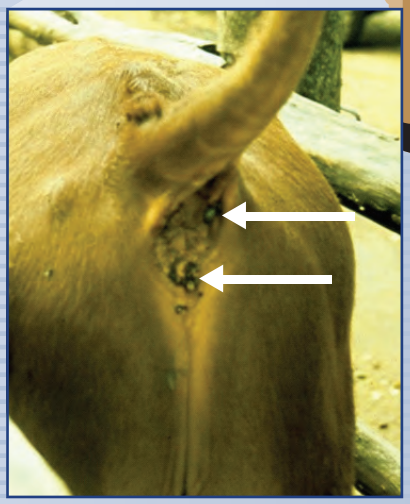
Appendix E - Signs of Illness in Cattle

Fluid in chest cavity



Heart with fluid in the sac around it





Blood-filled ticks can be found under the tail

Blood-engorged ticks can also be found inside the front legs and on the underbelly region - hard to groom areas

all photos courtesy of Dr. Suman Mahan, University of Florida

Appendix F - Tick Control Measures

Acaricides: Products that Kill Ticks

Many products are available; check with your veterinarian or local extension office for approved products in your area.

Directly applied animal products

- Pour-ons or sprays with amitraz, coumaphos, or permethrins should prevent the Gulf Coast tick on cattle for 2-3 weeks depending on environmental conditions (rain, level of tick infestation).
- Read all label directions and apply accordingly including the use of proper personal protective wear, like gloves (if indicated).
- Since Gulf Coast ticks attach to areas that are hard to groom (ears, tail area, inside of legs, top of back), spray acaricide to get adequate coverage (hair coat must be thoroughly soaked to make sure the skin is wet with product). Dipping is also effective.
- **It is a violation of state and federal law to use a pesticide in any manner that differs from the product label. Use only according to label directions to avoid meat or milk residue hazards, environmental damage, and animal or human injury.**

Insecticide cattle ear tags

- Ear tags should contain an organophosphate (OP), a pyrethroid or combination OP-pyrethroid to be effective against the Gulf Coast tick.
- There is a new class of insecticide tags that contain abamectin (macrocyclic lactone) and piperonyl butoxide labeled to control the Gulf Coast Tick for up to 4 months when 2 tags are applied per head.
- Read all labels and apply accordingly. One tag in each ear is recommended for Gulf Coast tick prevention.
- Examples of OP containing tags include ethion 36%, diazinon 20 or 40%, coumaphos 20% with diazinon 20%, or chlopyriphos 10% with diazinon 30%.
- Examples of pyrethroid ear tags include beta-cyfluthrin 8%, fenvalerate 8.6%, permethrin 10%, and zeta-cypermethrin 10%.
- Examples of combination ear tag products include cypermethrin 7% with clorphyriphos 5%.
- Work with your herd veterinarian to select the best impregnated ear tags for your cattle.

Animals, Pastures

Cattle in affected areas should be examined daily, especially parts of the body difficult to groom, for the presence of the Gulf Coast tick.

Dogs and other small mammals can transport the Gulf Coast tick and should also be examined daily.

- There are topical products available for dogs, applied monthly, that protect against certain species of tick infestation; consult your veterinarian for more details.

Pastures should be inspected weekly for the presence of the Gulf Coast tick.

- Walk through pastures wearing light colored clothing (long pants tucked into socks) and watch for the dark little ticks to attach. See below for removal and identification information.

Keep pastures short by grazing or mowing to minimize vegetation where ticks could live.

Tick Removal and Identification

To remove a tick attached to an animal, apply slow steady pressure near its mouthparts with a narrow-tip tweezers.

- Never squeeze an attached tick as it will inject its body fluids into the animal and it could be carrying heartwater disease.
- Humans cannot get heartwater disease, but if you find a tick attached to a person, use the same removal technique. Leaving part of the tick embedded in the skin can cause an infection.

Place the tick in a sealed container with a small piece of a damp paper towel.

- Place the container in a sealed bag and give it to your local veterinarian or extension office for identification.
- To make identification easier, only place the ticks from the same species (cattle separate from dogs or humans) into the same container.
- Identification of the actual Gulf Coast tick is important because they are small and many can look alike. Other tick species do not spread heart water disease.

Appendix F - Tick Control Measures

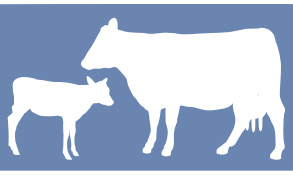
For More Information

- University of Nebraska-Lincoln Neb Guide on Controlling Ticks published electronically August 1995 and accessed November 7, 2005

- D.P. Furman and E.C. Loomis. 1984. The Ticks of California. University of California Publications, Bulletin of the California Insect Survey, Vol. 25. University of California Press, California.

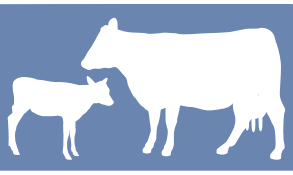
- Kansas Insect Newsletter, Department of Entomology, Kansas State University, Gulf Coast ticks make their presence felt in Kansas accessed November 4, 2005 at *http://www.oznet.ksu.edu/dp_entm/extension/KIN/KIN_2005/kin-8/05ksnew8.htm*

Bioterrorism and High Consequence Pathogens of Cattle



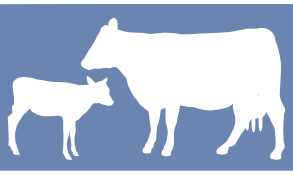
Disease or Agent	Route of Transmission	Incubation Period		Clinical Signs	
		Humans	Cattle	Humans	Cattle
Anthrax *Bacillus anthracis*	Infected animal; inhalation; contaminated food	1-7 days	3-7 days	Flu-like signs; pustules; scabs; respiratory distress; wide mediastinum on x-ray; bloody vomit and diarrhea; abdominal distress; sepsis; shock; death	Sudden death from septicemia with lack of rigor mortis and blood fails to clot; excitement followed by depression or stupor; blood from mouth, nose, anus; edema, especially neck, shoulders, and throat
Botulism *Clostridium botulinum* toxin	Contaminated food; inhalation	1-5 days	24-72 hours	Weakness; dizziness; dry mouth; nausea; vomiting; cranial nerve deficits; double vision; drooping eyes; slurred speech; symmetrical paralysis; respiratory paralysis; death	Muscle paralysis: progressive symmetrical to flaccid; apparent disturbed vision; unable to swallow or chew; death from respiratory or cardiac paralysis
Brucellosis *Brucella melitensis*, *B. abortus*	Contact with infected animal tissue; inhalation; contaminated food	1-21 days	Variable	Flu-like signs; cyclic fever; arthritis; orchitis; epididymitis; hepatomegaly Chronic: neurological; endocarditis	Abortions; stillborn or weak newborns; retained placentas; placentitis; orchitis; epididymitis; arthritis; lameness
Melioidosis *Burkholderia pseudomallei*	Inhalation; infected body fluids; wound contamination	2 days to years	Variable; latency	Flu-like signs; pustules; prostatic abscesses; chest pain; pneumonia; bronchitis; acute sepsis; death	Signs vary with site of lesion; suppurative or caseous lesion in lymph nodes, lungs, and viscera; pneumonia-signs; possibly nasal discharge, arthritis or lameness

Bioterrorism and High Consequence Pathogens of Cattle



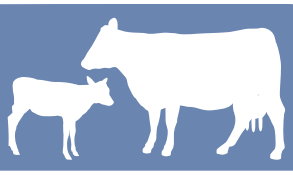
Disease or Agent	Route of Transmission	Incubation Period		Clinical Signs	
		Humans	Cattle	Humans	Cattle
Q fever *Coxiella burnetii*	Tick; inhalation; infected animal body fluids (urine, milk, blood, birthing fluids)	10-40 days	1-3 weeks	Flu-like signs; severe sweats; weakness; retrobulbar headache; pneumonitis but no cough or chest pain; granulomatous hepatitis; osteomyelitis; arteritis; endocarditis; neurological signs; thrombocytopenia; in-utero death; placentitis	Typically asymptomatic. Infertility; sporadic abortion
Toxins *Ricinus communis*, *Clostridium perfringens*, *Staph. aureus*	Contaminated food; inhalation	<1 day	12-72 hours	Flu-like signs; vomiting; bloody diarrhea; abdominal cramps; kidney failure; shock; death	**Ricin:** violent vomiting or regurgitation; bloody diarrhea; salivation; trembling; incoordination; **Clostridium:** necrotic enteritis; bloody diarrhea; septicemia; acute death, esp. in young; **Staph:** diarrhea, vomiting; pulmonary edema
West Nile Fever *West Nile Virus*	Mosquito	3-12 days	3-14 days	Flu-like signs; vomiting; lymphadenopathy; periocular pain; conjunctivitis; encephalitis; death	Fever; encephalitis; ataxia; weakness of limbs; partial paralysis; death
Rift Valley Fever virus	Mosquito; infected animal tissue	3-12 days	12-36 hours in young	Flu-like signs; petechiae; hemorrhagic fever; retinopathy; encephalitis; death	Fever; encephalitis; ataxia; weakness of limbs; partial paralysis; death

Bioterrorism and High Consequence Pathogens of Cattle



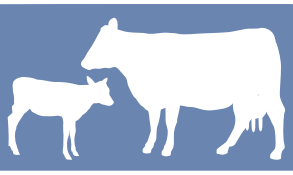
Disease or Agent	Route of Transmission	Incubation Period		Clinical Signs	
		Humans	Cattle	Humans	Cattle
Akabane Virus	Unknown; thought to be various species of mosquitoes	Does not infect humans	1-6 days	No symptoms	**Adults:** asymptomatic; abortions; stillbirths; dystocia **Young:** congenital abnormalities (arthrogryposis, ankylosis, hydranencephaly); nystagmus; blindness; death
Bluetongue virus (exotic)	*Culicoides* midges; ticks, sheep keds; fomites	Does not infect humans	5-10 days	No symptoms	Erosions and ulcers of mucous membranes cyanotic tongue; salivation; dyspnea; fever; petechiae; edema of head; lameness; hyperemic coronary bands; abortion
Bovine spongiform encephalopathy agent	Ingestion of infected cattle products (meat, bone-meal, nervous tissue)	10 years	4-5 years	Depression, schizophrenia-like psychosis; unsteadiness, ataxia; dementia	Neurological and behavioral changes; nose licking; sneezing; teeth grinding; exaggerated menace and corneal reflex; ataxia; hypermetria; paresis; coma; death
Coccidioidomycosis *Coccidioides immitis*	Inhalation	1-3 weeks	1-4 weeks	Usually asymptomatic; flu-like; fever, cough, muscle and head ache, fever	Inapparent; chronic respiratory disease; focal lesions in the lungs and thoracic lymph nodes

Bioterrorism and High Consequence Pathogens of Cattle



Disease or Agent	Route of Transmission	Incubation Period		Clinical Signs	
		Humans	Cattle	Humans	Cattle
Contagious bovine pleuropneumonia *Mycoplasma mycoides mycoides*	Close contact with respiratory droplets and other body fluids	Does not infect humans	20-123 days	No symptoms	Dyspnea; tachypnea; cough; fever; calves may have polyarthritis with or without pneumonia. **Post mortem lesion:** fibrinous, thickened, hyperemic "marbled" lung tissue; thickened interlobular septa
Foot-and-mouth disease virus	Aerosol; direct contact; ingestion; fomites	Rare	1-5 days	Rare	Fever; vesicles and erosions in mouth and nares, muzzle, and feet (interdigital, coronary band) or teats; depression; anorexia; salivation; nasal discharge; sloughing of hoof; abortion
Heartwater *Ehrlichia (Cowdria) ruminantium*	Tick	Does not infect humans	7-16 days	No symptoms	Fever; respiratory distress; lacrimation; neurologic signs (tongue protrusion, circling, high stepping gait); convulsions; death; Post mortem lesions; hydropericardium; ascites; hydrothorax; petechiae
Lumpy skin disease virus	Mosquito; flies; body fluids	Does not infect humans	2-5 weeks	No symptoms	Inapparent; fever; painful, deep, skin nodules (1-5 cm diameter) with inverted conical necrosis, scabs and crusts; lymphadenopathy

Bioterrorism and High Consequence Pathogens of Cattle

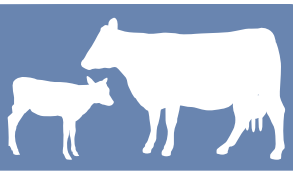


Disease or Agent	Route of Transmission	Incubation Period		Clinical Signs	
		Humans	Cattle	Humans	Cattle
Malignant catarrhal fever virus (exotic)	Aerosol; close contact	Does not infect humans	9-77 days	No symptoms	Sudden death; depression; diarrhea; dysentery; disseminated intravascular coagulopathy; dyspnea; bilateral corneal opacity; oculonasal discharge; hyperemic oral mucosa; ulcerated, scabbed skin
Rinderpest virus	Direct or close contact with body fluids	Does not infect humans	3-15 days	No symptoms	High fever; tachypnea; tachycardia; oculonasal discharge; respiratory distress; bronchopneumonia; necrotic stomatitis; diarrhea; death
Screwworm myiasis *Cochliomyia hominivorax*	Eggs laid in wounds	3 days	5-7 days	Larvae visible in wound; bloody discharge; foul-smelling odor; general discomfort	Variable diameter openings containing migrating larvae; death can occur from toxicity or secondary infection
Vesicular stomatitis virus (exotic)	Sand flies; black flies; direct contact; fomites; aerosol	1-6 days	1-21 days	Flu-like signs; fever; retrobulbar pain; malaise; nausea; limb and back pain; oral vesicles	Fever; vesicles in oral cavity, on coronary band or interdigital cleft; salivation; lameness

Source: Dvorak, Glenda. Bioterrorism and High Consequence Pathogens wall chart, Center for Food Security and Public Health, Iowa State University, 2008.

the Center for Food Security & Public Health
Iowa State University®

Packaging and Shipping Diagnostic Samples



Definitions

- **Infectious substances, Category A** means an infectious substance which is transported in a form that is capable of causing permanent disability, life-threatening, or a fatal disease when exposure occurs. Practitioners may never deal with samples that fit this classification. If you think you are dealing with specimens that fit Category A, contact your state veterinarian and/or your USDA-APHIS Area Veterinarian-In-Charge before shipping the samples.
- **Biological Substances, Category B** means any human or animal material being shipped for diagnostic purposes.
  - These specimens must have both a "Biological Substance" label and a UN3373 diamond logo on the shipping container
- **Primary or inner package** refers to a container holding the material to be shipped. For example, a vial or plastic bag.
- **Secondary package** refers to a package enclosing the primary package. A secondary package may be a second plastic container, but it cannot be a plastic bag.
- **Outer package** refers to a container holding and protecting the inner and secondary packages (usually a cardboard box).
- **Hazardous Material (or Dangerous Good)** Any article or substance designated by the U.S. DOT as being capable of posing unreasonable risk to health, safety, and property during transit.

Regulatory Agencies

- US Department of Transportation (DOT) regulates ground and air transportation of diagnostic specimens, infectious substances, medical waste, and chemical and radioactive materials. *www.hazmat.com*
  - Samples shipped by ground (courier, bus, postal service, etc.) follow the U.S. DOT Code of Federal Regulations (49CFR)
- International Air Transport Asso. (IATA), while not an agency, does write the requirements for all air transportation

Non Compliance

- Packages can be refused by the carrier
- Specimens could be damaged or destroyed
- Citations may be issued to the **sender**

Common Carriers and Package Suppliers

Carriers

Federal Express	*fedex.com*	800-463-3339
U.S. Postal Service	*usps.com*	800-275-8777
UPS	*ups.com*	800-742-5877

Package Suppliers:

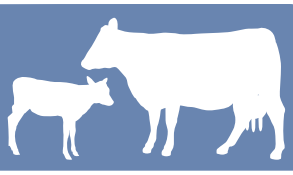
Lab Safety Supply	*labsafety.com*	800-356-0783
ULine	*uline.com*	800-958-5463
Saf-T-Pak Inc.	*saftpak.com*	800-814-7484

Shipping Good Management Practices

- Place coolant packs in zip lock bags in case of coolant leakage or rupture
- Avoid overfilling liquid containers
- Avoid exceeding ⅓ of the container capacity
- Tape zip lock bags & rubber stoppered tubes
- Double check for potential leakage of all containers
- Avoid breakable specimen containers… if they must be used, adequately pad them to minimize breakage
- Put paperwork in water proof bag
- If shipment questions, contact carrier and/or lab

Authors are Karen Shuck and Dee Griffin,
University of Nebraska, Great Plains Veterinary Educational Center

Packaging and Shipping Diagnostic Samples



"Exempt Animal Specimens"

- For patient specimens for which there is minimal likelihood that pathogens are present,
  - e.g. nutritional, biopsies, serology, swabs, etc.
- Shipped in a box marked with the words: **"Exempt Animal Specimens"**
- Must follow standard DOT packaging requirements
  - … three leak proof layers (primary, secondary containing absorbent and a third sturdy container)
- Less than 1 liter total liquid or < 4 kg total solid with limits for primary individual containers of < ½ liter or < ½ kg solids.
- Air transportation follows IATA (International Air Transport Asso.) requirements. These typically the same as DOT regulations for Exempt Animal Specimens.

Packaging Diagnostic Specimens (Biological Substances, Category B)

- **Diagnostic specimens must be Triple packed as follows:**
  - Primary container, for example screw cap tubes, taped red top blood tubes, Whirl-Paks –wrapped and tie ends twisted together. Zip lock bags are not suitable for liquid primary containers.
  - Secondary container must be watertight and have sufficient absorbent, such as paper towels, should primary container leak or rupture. An itemized list (submission form) in a plastic bag is then placed on top of this container.
  - Outer package (third layer of the specimen shipment container) should be at least as durable as sturdy card board. While Styrofoam is an excellent container, it should never be used as a shipping container without residing in a sturdy card board box. Styrofoam coolers are not acceptable as the exclusive outer container due to the potential for rupture if dropped or impacted in a transportation accident.
  - USPS limits < 1 L liquid / primary container with total of < 4 liters or < 4 kg solid per shipment. USPS requires Biohazard logo. Some carriers limit shipment to < ½ liter or < ½ kg solids.
  - Shipper contact info should be on the label. Including the shipper's phone number is always appropriate.

BOTTOM LINE: Diagnostic specimens must be packaged in Triple packaging consisting of;

1. **Primary container, for example screw caps, plastic bags**
2. **Secondary container must be watertight**
3. **An itemized list specimens (submission form), sealed in a plastic proof bag between 2º & outer container**
4. **Outer package, usually sturdy card board (Do Not Use Styrofoam coolers as the outer container)**

Shipping Formalin Fixed Tissues (10% formalin, with or without buffer = 3.7% formaldehyde)

Formalin-fixed tissues are not generally considered "diagnostic specimens" because they have been biologically inactivated. Thus, the possibility for these materials to pose an infectious disease risk is extremely low. Even so, these materials should be packaged in a manner that will prevent any possibility for release of liquids while in transit. This can be achieved through the following actions:

- Limit the amount of 10% formalin to not more than one liter per shipping container if sent by ground or air trans portation. Tissue samples of ~1/8 inch thick are adequate. Label container with a four inch diamond UN3334 content logo.
- Use non-breakable primary containers with a leak-proof seal and reinforce the seal with Parafilm or sealing tape.
- Package primary containers and enough absorbent material to absorb all liquids (in the event of a leak) in a secondary container (e.g., larger plastic container or sturdy sealed plastic bags, etc.).
- Use a sturdy outside container such as a heavy duty card board box as the final structure holding the specimens.
- Other required labeling; include "Preserved Biological Samples" or something similar to the outer package.

Additional Notes

- If specimens are being shipped to a different state, it is best to assume some part of the trip will be by air and therefore requiring packaging to meet IATA (International Air Transport Association) shipping requirements … eg: one liter of 10% formalin per properly packaged sample container, or 30 ML per sample container if it includes formaldehyde of > 10% concentration. Multiple 30 ML samples may be included in the secondary

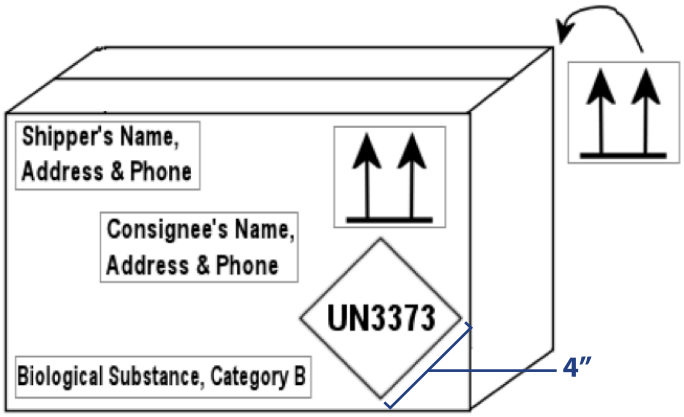
sealed container. ALL samples in primary containers must be double bagged (secondary container) and adequate absorbent placed in the secondary container.

- All personnel involved in packaging shipping biological samples should be trained & tested/evaluated every three years.
- Training & testing of the regulations, safety, and specimen security can be done in your work place.
- Trainee's name, date trained, a copy of the training materials, trainer, and testing records for verification (certification)
- Shippers (your clinic) must retain shipping records for at least two years.
  - Records must include items shipped and transport media (Copies of Dx lab submission forms satisfy requirement)

Shipping Samples by Ground Transport

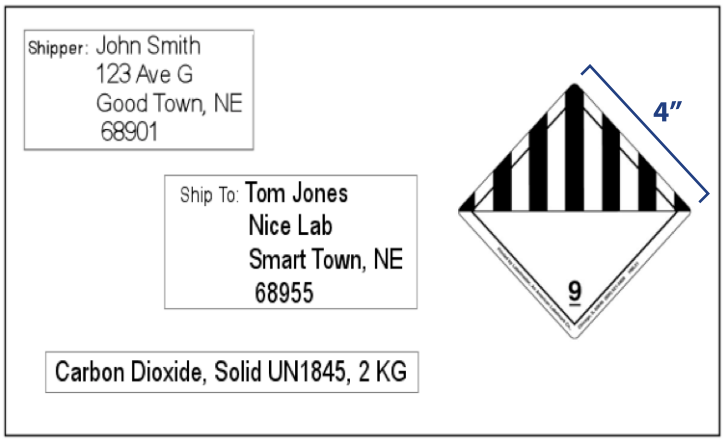
Postal Service regulations require that all clinical specimens sent by U.S. Mail be shipped:

- With a minimum of First Class postage
- With a label indicating Biological Substance, Category B, UN3373 (if samples packaged in formalin)
- Packages containing diagnostic specimens must be marked with a diamond marking as shown below. When shipping liquid diagnostic specimens, orientation arrows must be applied to two sides of the package.



Shipping with Dry Ice

- Only relevant markings are allowed on the outer package. All other markings must be obliterated.
- The package must be marked with the following information:
  - Proper shipping name: Carbon Dioxide, Solid or Dry Ice.
  - UN Identification number: UN1845
  - The full name and address of the shipper and consignee.
  - The net weight in kilograms, of the Carbon Dioxide must be marked on the outside of the package.
  - For Carbon Dioxide, Solid, a Class 9 label is required.



References:

- Title 42 CFR Part 72
- Title 49 CFR Part 173
- International Air Transport Association (IATA) regulations

LABEL TEMPLATES (print, cut and tape or glue onto specimen outer packaging)