BEEF FEEDLOT 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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Beef Feedlot 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 Industry Manual is under ongoing review. This document was last updated **July 2011**. Please send questions or comments to:

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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 and Activities:* 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 Beef Feedlot 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)
  - Surveillance, Epidemiology, and Tracing (2011)
  - Personal Protective Equipment (2011)
  - Mass Depopulation and Euthanasia (2011)
  - Vaccination for Contagious Diseases (2011) with Appendix A: FMD Considerations and Strategies (2011)
  - Wildlife Management and Vector Control (2011)

- FAD PReP Standard Operating Procedures (SOP):
  - Biosecurity
  - Cleaning and Disinfection
  - Disposal
  - Surveillance, Epidemiology, and Tracing
  - Personal Protective Equipment
  - Mass Depopulation and Euthanasia
  - Vaccination for Contagious Diseases
  - Wildlife Management and Vector Control

- 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*

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Table of Contents

Table of Contents

Table of Contents

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Purpose

This industry manual provides a broad overview of U.S. beef feedlot production methods 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 impact to the cattle industry. Wide dissemination of this information is encouraged to establish open communication between regulators and producers with the goal of reducing the probability that cattle or their caretakers become infected with a highly contagious FAD.

Intent

Local, state, and national level officials involved in developing policy and/or managing a highly contagious FAD outbreak should read this manual to understand the normal business operations of the feedlot industry and the inherent high risk disease transmission behaviors 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 feedlots should familiarize themselves with this manual in order to understand the the risks and consequences of a disease outbreak and to more effectively communicate with all stakeholders involved. Livestock producers and any support personnel interacting with feedlots need to be aware of the procedures as described here that may be implemented in a highly contagious FAD event and the biosecurity procedures they would be expected to follow to minimize losses and reduce the chance of becoming infected.

Scope

- Part I provides an overview of U.S. beef cattle feedlot production, including feedlot 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 designated zones and areas and providing animal care.
- Acronyms and glossary explain the terms used in the feedlot industry and emergency response.
- The appendices contain disease prevention practices and biosecurity measures for FMD, RVF and heartwater disease as well as bioterrorism and high consequence pathogens of cattle.

Learning Objectives

Upon reviewing this manual, readers will be able to:

1. Explain feedlot animal care needs and the most humane methods to safely move and restrain cattle within the feedlot environment;
2. Recognize the management and operations of beef feedlots of various sizes including the personnel, supplies, and traffic arriving at and leaving a typical feedlot;
3. Differentiate normal cattle behavior and appearance from the abnormal behavior of a diseased animal;
4. Illustrate FAD response zones and areas used in quarantine and movement control efforts and explain classifications of premises in a response;
5. Implement biosecurity measures and surveillance activities on a cattle feedlot to prevent highly contagious FAD entry and monitor its presence/absence; and
6. Communicate with supervisory personnel and/or the regulatory officials regarding cattle feedlot status (animal needs, biosecurity measures in place, test results, tracebacks/traceouts).

PART I: UNITED STATES BEEF CATTLE FEEDLOT PRODUCTION

1. SCOPE OF BEEF CATTLE FEEDLOT INDUSTRY

1.1 Cattle Numbers

The United States is the world's leading producer of beef and has the largest fed-cattle industry. As of December 2010, the total U.S. inventory of all cattle on feed was 14.0 million head on over 75,000 feedlots. The majority of U.S. feedlots have less than 1,000 head capacity, but feedlots with 32,000 head or more marketed 41.3% of fed cattle in 2010 (Table 1). The top five cattle states based on inventory on feed are listed in Table 2, which includes the Great Plains and Corn Belt States. Fed-cattle are also raised in the Southwest and Pacific Northwest.

Feedlots feed cattle to add muscle and fat to tissues. Intramuscular fat in meat is referred to as marbling which gives consumers the taste and texture they desire from beef. Beef is given a quality grade based on the amount of intramuscular fat. The grading scale, from least amount of marbling to most amount of marbling, is utility, standard, select, choice, and prime. The most common grades found in stores are select and choice. Prime cuts generally bring higher prices and are primarily marketed to export markets or to the hotel and restaurant trade. In 2009, 33.3 million head of fed cattle were commercially harvested; 26.5 million steers and heifers and 6.2 million cull beef and dairy cows. The majority of U.S. beef produced is consumed domestically: 26.9 billion pounds in 2009 alone. Beef exports are an important component of the fed cattle industry as well. In 2009, the U.S. exported 1.87 billion pounds of commercial carcass weight, which amounted to 7.2% of production worth $2.828 billion dollars. The gross income from sales of cattle and calves totaled over $51.5 billion in 2010. A highly contagious FAD affecting cattle or allied industries could have a devastating economic effect on feedlot owners, processing plants, and consumers.

Sources:

- *United States Department of Agriculture Economic Research Service, Cattle: Background. Accessed May 9, 2011*
- *United States Department of Agriculture Economic Research Service, U.S. Beef and Cattle Industry: Background Statistics and Information. July 2010. Accessed May 9, 2011*

Table 1. Cattle on Feed: Number of Feedlot Operations, Inventory, and Marketed by Feedlot Capacity, U.S., 2010

Feedlot Capacity	*Number of Lots*	*Inventory (x 1,000 head)*	*Percent of Total Inventory*	*Cattle Marketed (x 1,000 Head)*
< 1,000 head	75,000	2,509	17.9%	4,032
1,000 - 1,999	790	454	3.2%	778
2,000 - 3,999	560	800	5.7%	1,400
4,000 - 7,999	335	1,030	7.3%	1,760
8,000 - 15,999	180	1,250	8.9%	2,470
16,000 - 23,999	85	1,130	8.1%	2,040
24,000 - 31,999	55	1,050	7.5%	2,050
32,000 - 49,999	71	2,050	14.6%	4,110
50,000 and Over	64	3,750	26.7%	7,470
All Feedlots	77,140	14,023	100.0%	26,110

Source: National Agricultural Statistics Service, Agriculture Statistics Board, U.S. Department of Agriculture, Cattle on Feed, February 2011, Accessed May 9, 2011 at *http://usda.mannlib.cornell.edu/usda/nass/CattOnFe//2010s/2011/CattOnFe-02-18-2011.pdf*

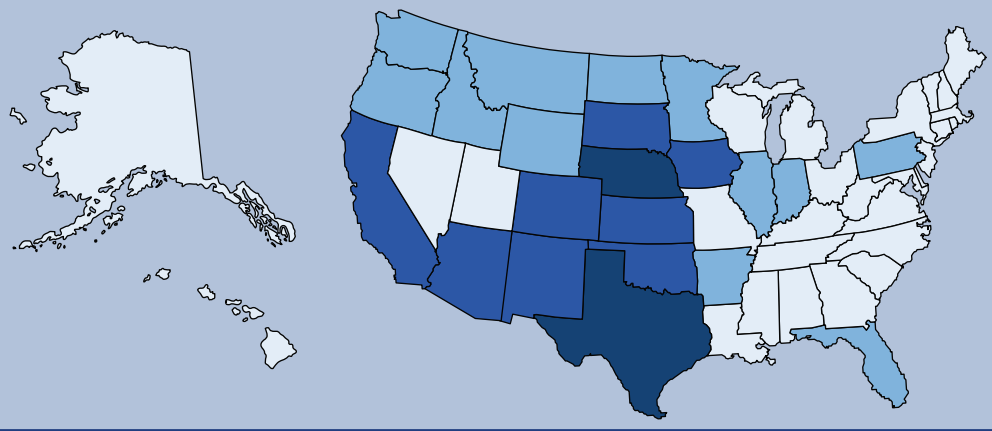
Table 2. Top 5 States for One-Time Beef Cattle Inventory on Feed, 2011		
State Rank	***State***	***Inventory***
1	Texas	2,850 thousand head
2	Nebraska	2,550 thousand head
3	Kansas	2,400 thousand head
4	Iowa	1,380 thousand head
5	Colorado	1,100 thousand head
Source: United States Department of Agriculture National Agricultural Statistics Service, Cattle January 2011; 10. Accessed May 9, 2011 at: *http://usda01.library.cornell.edu/usda/nass/CattOnFe//2010s/2011/CattOnFe-01-21-2011.pdf*		

1.2 Feedlot Production Systems

1.2.1 Location and Movement

Cattle in feedlots consist primarily of steers and heifers that originate from a wide variety of locations, and a small percentage of cull cows and bulls. Most cattle in feedlots are born in the U.S., but approximately 5% originate in Mexico and Canada. In 2010, the U.S. imported 1.06 million head of cattle from Canada and 1.22 million head from Mexico. The beef industry's supply chain is intricate with heavy reliance upon transportation of cattle and feed. Most beef feedlot cattle are not born on the same premises where they are fed out, generating the need for shipment of animals, mostly interstate. Calves can be sold right off the ranch to a feedlot within or out of state, be sold to order buyers, or at a livestock auction. Order buyers or livestock auctions function to accumulate enough calves from a number of producers to fill a semi-truck to sell to a feedlot. In 2010, there were over 21 million head of cattle moved interstate with Nebraska, Texas, Kansas, Colorado and Iowa receiving over 68% of the total inshipments. Figure 1 illustrates the inshipments in the U.S. for 2009.

Figure 1. Cattle Inshipments Across the U.S., 2009



Code	***Inshipments (million head)***	***States***
	Less than 0.10	AK, AL, CT, DE, GA, HI, KY, LA, ME, MD, MA, MI, MS, MO, NV, NH, NJ, NY, NC, OH, OR, RI, SC, TN, UT, VT, VA, WV, WI
	0.10 - 0.49	AR, FL, ID, IL, IN, MN, MT, ND, PA, WA, WY
	0.50 - 2.00	AZ, CA, CO, IA, NM, OK, SD, KS
	More than 2	NE, TX

Source: USDA National Agricultural Statistics Service, Meat Animals Production, Disposition, and Income 2010 Summary, April 2011 accessed at: *http://usda.mannlib.cornell.edu/usda/current/MeatAnimPr/MeatAnimPr-04-28-2011.pdf*

Cattle deliveries to feedlots are common. Cattle arrive from a variety of sources on livestock trailers or semi-trucks. These trucks deliver multiple loads of cattle to various destinations with inconsistent cleaning and disinfection procedures between deliveries, potentially transmitting pathogens between operations. Finished cattle are transported from the feedlots primarily using semi-trucks. The trucks used for the delivery and transport of finished cattle access the operation via the loading/unloading facilities which may be located on the edge of the premises or within the feedlot.

Sources:

- *United States Department of Agriculture Economic Research Service, Livestock and Meat Trade Data, Meat and livestock annual cumulative year-to-date U.S. trade. May 9, 2011*
- *United States Department of Agriculture Economic Research Service, Meat Animals Production, Disposition, and Income, 2010 Summary. April 2011. Accessed May 9, 2011 at: http://usda.mannlib.cornell.edu/usda/nass/MeatAnimPr//2010s/2011/MeatAnimPr-04-28-2011.pdf*

Cattle being moved long distances or in large groups are usually transported using semi-tractors pulling specialized trailers, sometimes referred to as 'pot loads'. These trailers have upper and lower decks and hold varying numbers of cattle depending on the size of the cattle, number of axles, and the weight classification of the trailer. Cattle being moved short distances or in small groups are usually transported using light trucks pulling stock trailers that hold fewer animals. Finished cattle are either transported directly to harvest facilities or resold at auction markets to buyers from harvest facilities. More information is provided in section 4.4, Methods for Safe Movement of Beef Cattle.

1.3 Types of Cattle Feeding Operations

Cattle feeding operations can be classified into three general categories: 1) Large-scale feeding operations, 2) backgrounders/stockers, and 3) farmer-feeders.

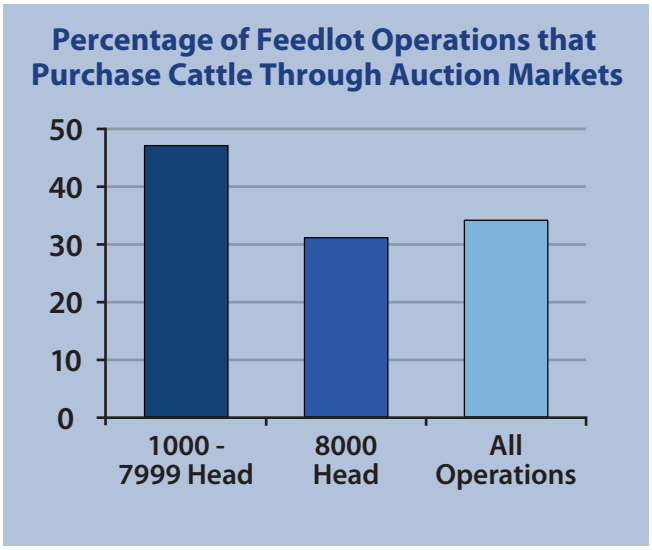
Large-scale feeding operations feed large numbers of cattle, 5,000 head or more; some exceed 100,000 head capacity. These feedlots are typically located in regions that are environmentally conducive to cattle production with less extreme climates and low levels of annual precipitation. This allows for continuous operation year round and turning over the population of cattle twice to 2.5 times per year. Moderate climates are less stressful for cattle and promote efficient feed use. Large-scale feeding operations can be located distant from cattle and feed sources, leading to reliance on long distance transportation to provide many necessary inputs for operation. Many operations in this category are present in the states listed in Table 1 above, especially Texas, Nebraska, Kansas, and Colorado.

Backgrounder/stocker feeding operations utilize a combination of pasture-based (grass, winter wheat), crop residues (corn stalks, wheat stubble), and dry lots to prepare weaned calves to be raised in a feedlot. Backgrounders/stockers take newly weaned calves and adjust them to eating feed from a bunk until they reach feeder weight (650-900 pounds). This may involve the calves spending some or all of their time on pasture. Both systems prepare calves to drink from man-made water sources. These operations vary tremendously in size, location, and intensity of management. Numbers of cattle on feed can vary from a few head to several thousand. These operations are generally located in between sources of cattle and feedlots where forage is plentiful. Backgrounder/stocker operations consequently can be found near almost any significant source of calves. In many cases, backgrounders have working relationships with the feedlots that will eventually finish the cattle from their backgrounder operations.

Farmer-feeders are generally smaller feedlots that are located near sources of feed, either their own or readily available to purchase. These operations often take advantage of their own source of cattle and locally grown feedstuffs to gain an economic advantage over large-scale feedlots that must transport feed. Farmer-feeders tend to be seasonal operations when there is less time competition with other activities like crop management. They either raise their own cattle or purchase weaned calves in the fall. These operations are more common in Midwestern and Plains states such as Illinois, Indiana, Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin. Since these feedlots operate primarily in the fall and winter months, climatic conditions require management tools to deal with adverse conditions such as extreme temperatures and high levels of precipitation.

1.4 Sources of Feedlot Cattle

Cattle in feedlots are sourced in a variety of ways. The most direct sourcing option is the sale of calves (heifers, bulls or steers) from a ranch or farm to a feedlot. In this situation, private sales are arranged that allow cattle to be picked up directly from ranches or farms and transported to a feedlot with no intervening marketing steps. This method generally has positive health implications for cattle as it avoids commingling and stress that are commonly associated with auction market situations. Direct sales are facilitated by video auction services, cattle buyers/brokers, and established relationships between calf producers and feedlots.



A 2000 USDA National Animal Health Monitoring System (NAHMS) study reported that 31% of operations with 8,000 head or more and 47% of operations with 1,000 to 7,999 head, or 34% of all operations, purchased through livestock auctions. Auction markets facilitate transfer of ownership from calf producers to feedlots on a local or regional level. Animals can be sold singly, by the dozen, or by the hundreds at auctions. Most auction markets conduct sales once a week; larger cattle auction markets may operate daily. Cattle are delivered to the auction market and sold to the highest bidder. Cattle are often extensively commingled during this process, especially if they originate from smaller herds that cannot produce enough calves to fill a single trailer load. Some calves may need to be transported long distances from the point of purchase to reach the feedlot. Overall, cattle sourced from auction markets have increased risk of disease exposure compared to cattle sourced from direct sales.

Source:

- *Changes in the U.S. Feedlot Industry: 1994-1999. United States Department of Agriculture, Animal and Plant Health Inpsection Service, Veterinary Services, Centers for Epidemiology and Animal Health, National Animal Health Monitoring System (NAHMS). August 2000. Accessed October 20, 2010 at: http://www.aphis.usda.gov/animal_health/nahms/feedlot/downloads/feedlot99/Feedlot99_dr_Changes.pdf*

Cattle buyers/brokers use both direct sale and auction markets to source cattle for feedlots. Buyers/brokers are individuals who accumulate cattle for feedlots as private contractors. They attend cattle auctions or negotiate private treaty sales with individual ranchers to arrange direct sales to feedlots. Some buyers/brokers have temporary holding facilities where they organize groups of cattle for shipment to feedlots. The use of buyers/brokers to purchase small numbers of animals can result in commingling and added stress in cattle with the potential to cause more challenges with disease upon arrival at a feedlot.

Large feedlots and backgrounders/stockers are likely to use all of the sourcing options listed above. Farmer-feeders also utilize these sourcing methods, but they rely more on auction markets and their own herds to provide animals for their feeding operations.

Cattle ownership in feedlots takes several forms. The most basic ownership arrangement is that of a farmer-feeder feeding out his/her own animals. Some feedlots are operated on a custom-feeding basis where ranchers/farmers or cattle buyers retain ownership of cattle throughout the feeding period, but do not actively participate in the day-to-day feeding operation. Many feedlots directly buy and subsequently own some or all of the cattle. There are many degrees of ownership present between feedlot owners and calf producers in cattle feeding at all levels. A large proportion of cattle on feed are fed as an investment, with as much as two-thirds of the money borrowed from a financial institution. In a highly contagious FAD outbreak, the financial aspect of cattle ownership could influence people's behavior as it relates to adhering to quarantine protocols or depopulation decisions. Appraisal and compensation for depopulated animals are covered in another FAD PReP/NAHEMS document, but indemnification on feedlots may be quite involved given the nature of their business structure.

1.5 Diverse Workforce

The workforce on United States feedlot operations can be very diverse. Farm workers who speak English as a second (or third) language are employed on feedlots throughout the United States. Cultural and language differences may present a barrier and hinder response efforts in the event of a highly contagious FAD outbreak. Some workers may be skeptical and resist government intervention which could complicate containment efforts if they leave the operation or area.

As a regulatory official or someone tasked with visiting an operation, effective communication with all involved will be necessary to conduct the disease investigation or to carry out eradication efforts. Awareness of the workforce in a given community and establishing relationships prior to an outbreak can help build trust. This should be a focus of preparedness efforts at the local level. Understanding some general concepts about the primary workforce, which in large feedlots in the U.S. often consists primarily of people of Hispanic descent, can help establish a successful working relationship.

Some employees may not be comfortable communicating with officials, so identifying the primary facility manager is important. Working with that person to communicate tasks to the other employees will help with acceptance and coordination of the work. A translator can be very beneficial to overcome language and cultural barriers. 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. Likewise, some terminology used in the feedlot industry is unique so a list of "Select Feedlot Industry Terminology" can be found in the Appendix.

Depending on the highly contagious FAD, strategies to control its spread could include mass depopulation of infected animals and subsequent disposal on the operation or in the community. Farm workers, owners, and outside labor may be directly involved in this process. Workers and owners may not be prepared to deal with the loss of animals that have been a part of their daily routine and source of livelihood. Returning to an empty feedyard in subsequent days/weeks may also be another psychologically upsetting situation. Providing a support network for owners and their workers, again in an ethically and culturally acceptable format, needs to be part of preparedness plans at the local level.

1.6 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. Feedlots 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 facilities 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.

Most beef cattle feedlots, and subsequently harvest facilities, would not be able to function for extended periods of time without movement of animals and supplies onto and off of the property. During a response effort, uninfected feedlots 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 animals to harvesting 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.

Feedlot owners and managers should have action plans developed in advance so they can ensure that feed and any other necessities related to animal care and husbandry will continue to be delivered in an outbreak. . 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. Integrated preparedness plans with suppliers, cattle buyers, and state officials are 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)*.

1.7 Disease Traceability in Beef Cattle

Beef cattle traceability is fundamental to health management plans (medical treatments and vaccinations), genetic improvements, marketability, and recording cattle inventory in many feedlots. Multiple forms of cattle identification and farm/ranch based numbering systems are in use (described below) for U.S. beef cattle. Some cattle may have no identification of any kind upon arrival at the feedyard, especially in smaller operations. Record keeping systems vary by operation too, from nothing to chalk/white boards to hand written paper documents to computerized software programs. In the event of a disease outbreak, beef cattle disease traceability can play a key role in disease surveillance, control, eradication, and continuity of business.

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 is often necessary to locate the source of the animal(s) in question, other premises on which the animal(s) resided, other animals that were exposed, and animals at risk of exposure. However, some U.S. feedlots may not have this information readily available, slowing response time. Feedlot owners and managers are encouraged to retain records of animal origin and movement prior to arrival at the feedlot to expedite disease investigations.

A variety of cattle identification methods exist on U.S. feedlots. Some are unique to the owner of the cattle, like brands. These are most often found on cattle originating in states west of the Mississippi River. Brand identification, used primarily for proof of ownership, is registered with an official state brand inspection agency and accompanied by an official brand inspection certificate. These cattle must be inspected by a brand inspector before the cattle can be shipped. Depending upon the state brand laws, brands can be located on either side of the animal and may be found on the shoulder, rib, or hip. They can sometimes be accompanied by unique ear notching when registered as part of the brand marking. 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.

While not unique to the farm or the animal, animals that have received a brucellosis vaccine should have an official brucellosis tattoo in their right ear. Some purebred cattle will have a unique registration number tattooed in their left ear. Most feedlots identify groups or pens of animals, which may involve a series of plastic dangle tags 'coded' for the pen.

Dangle Tags

Brucellosis & Bright Ear Tags

Radio Frequency ID (RFID) Tag

Individual animal identification methods are used for cattle receiving treatment and include ear tags, which may be a plastic dangle tag, a USDA metal brucellosis vaccination tag, a metal bright ear tag, or radio frequency identification (RFID) tags (commonly referred to as electronic ID, or EID, in the cattle industry). Producers in many states and

licensed veterinarians can obtain brucellosis or bright tags from their State. The first two numbers indicate the state code where the animals resided when the tags were placed in their ear. The plastic dangle tags may be marked with handwritten numbers, pre-printed through a commercial source, or purchased from a registered breed association (not considered USDA official unless the U.S. shield is stamped on the tag).

As of July 2011, cattle less than twenty-four months-of-age moving interstate directly to slaughter are not required to be USDA officially identified. To review all official forms of identification, see the *Code of Federal Regulations, Title 9, Chapter I, Part 71.18 Individual identification of certain cattle 2 years of age or over for movement in interstate commerce.* It is advised to contact the destination state or harvest plant to determine what official identification requirements exist.

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*

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 out, and finally they enter the feedlot where they are 'finished'. Cattle in the feedlot industry are derived from the U.S. and other North American countries and are the focus of this manual. The intermediate stage, referred to as backgrounders and stockers, is utilized to allow newly weaned calves to grow and prepare for life in a feedlot. The goal of feedlots is to produce wholesome beef for human consumption, which is harvested at a packing plant. An understanding of the interactions between these sectors is important when developing policies for highly contagious FAD(s) and during a response to an animal health emergency. Each sector relies 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. They may own bulls or utilize artificial insemination to breed the cows. Yearly, the heifer calves may be divided into two groups: one group is retained as replacements for cows leaving the herd and the other group is marketed for feeding. Unless retained as breeding stock, the bull calves are marketed for feeding as well. Operations vary in their management of the cow and calf herd. The calves destined for feeding may or may not be vaccinated, dehorned, implanted, castrated, and/or weaned prior to leaving the cow-calf operation. Calves that are properly prepared while on the cow-calf operation prior to transportation through marketing channels or directly to the feedlot tend to experience fewer health related challenges. Calves are typically weaned at six to ten months of age, weighing 300-600 pounds. The weaning period can range from a few days to a few weeks prior to movement off-farm. Once weaned, calves eat pasture grasses, ensiled forages with or without supplemental grain, depending on the region of the country, calf weight, time of year, and availability of pasture/forages. Calves from intensively managed cow-calf herds (those that wean, vaccinate, dehorn, and castrate with time to adjust on the operation prior to moving) may go directly to feedlots or be sent to backgrounders/stockers for a period of time prior to entering the feedlot.

2.2 Backgrounders/Stockers

Backgrounders and stockers provide an intermediate stage that grows the frame size of weaned calves without fattening and prepares them for the feedlot. Weaned calves are raised to feeder size, approximately 650-900 pounds which can take 60 to 300 days. The length of time calves stay at a backgrounder or stocker depends on the backgrounder/stocker goals, the size of the calves when they arrive, and the availability of pasture for stockers as determined by moisture conditions. Most cattle are born in the spring in the U.S. and some stockers will feed them at a lower rate of gain, keeping them longer and produce yearling cattle to feedlots year round.

At the stocker operation, calves may be raised on pasture 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. 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.

The goal of backgrounders is to acclimate calves to the conditions in a feedlot including feeding, watering, and exposure to 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; others may not have a way to restrain animals other than with a gate in a pasture pen.

Backgrounders/stockers may have a relationship with a feedlot who will feed them out when ready, or own a feedlot themselves and sell or transfer the calves when they are ready. If a relationship with a feedlot does not exist, the calves will likely return to the auction market to be sold again.

2.3 Feedlots

After the cow-calf and/or backgrounder/stocker stages, cattle are sent to feedlots (sometimes referred to as "feedyards") to grow to market weight (1,100 to 1,500 pounds), a process often referred to as finishing or fattening. Another source of feedlot cattle includes steers from the dairy industry, particularly Holsteins. These may be fed on dairies until they reach a certain size or raised at a calf ranch similar to backgrounders.

Feedlots feed highly palatable high energy rations for growth, muscle development, and fat deposition. One management term used in feedlots is average daily gain (ADG) – how much weight an animal gains per day while on the high energy ration. The goal is for cattle to gain 3.2 to 3.5 pounds per day. Another term is feed efficiency, the amount of feed consumed to produce a pound of gain. Typical rates of feed efficiency may be less than 6 pounds of dry-matter per pound of gain. This is accomplished by gradually decreasing the amount of forage in the diet and replacing the forage with concentrate feeds composed primarily of grain or by-product feeds, especially from the ethanol industry. Cattle typically remain in feedlots for 150 to 180 days but feeding up to a year may occur with Holstein calves and other very light-weight animals (~350 pounds upon arrival). This length of time is referred to in the industry as days on feed (DOF). Finished cattle will vary in size depending on breed and body frame size. The cost per pound of gain is something modern feedyards monitor closely.

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 "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.

Fat cattle need to be considered a perishable commodity in terms of disease outbreak response planning. Transportation may be disrupted and the destination of the packing plants may be outside the permitted travel area, thus affecting when and where cattle are moved to harvest. If cattle cannot be moved to market on time, they could reach heavier than normal weights, thus impacting the quality of the carcass and the number of animals that can be loaded onto a single semi-trailer. Some packing plants may have upper size limits for processing cattle due to the equipment used to handle them. Likewise,

the processing and marketing of fed cattle below market weight is another consideration for livestock owners and packing plants. Anytime carcass quality is affected (too heavy or too light), the price paid to the owners can significantly decrease. If cattle are held after the optimal slaughter period, the cost per pound of gain increases significantly.

Given the plants expectations of a certain number and size of cattle on set deadlines, redirecting market cattle from packing plant A to plant B is not an easy task. Feedlot management will need reassurance that plant A will allow them to void their contractual obligations without severe financial penalties. Likewise, plant B must be willing and able to process the cattle and compensate owners for them. Re-routing market weight cattle requires consideration of the economic concerns of the packing plants, feedlot operators, and regulatory officials so as not to cause undue financial hardship to any one sector.

2.5 Working Horses

Working horses are critical to the workforce of many beef operations, both cow-calf and feedlot. These horses are ridden by workers (cowboys) through pastures and pens to examine, move, and/or sort cattle. The horses may be housed permanently on the operation or return home with their owners. Some cowboys may transport and ride these horses in events (e.g., cattle roping competitions, rodeos, etc.) and/or train horses for other people, so working horses may have contact with horses on other premises. Documenting horse movement on and off the cattle premises will be necessary in a disease outbreak. Working horses are generally well maintained and are routinely vaccinated according to recommended standards and local disease challenges.

In the event of a disease outbreak affecting cattle and horses (e.g., vesicular stomatitis, surra), these horses should be quarantined to the operation on which they reside. 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 pasture could still occur unless regulatory officials advise otherwise. For other diseases spread via fomite (e.g., foot-and-mouth disease), a horse's tack (bridle, saddle, blanket) or their hooves could become contaminated with manure or saliva from infected cattle and may carry disease pathogens between groups of animals in different pastures and other areas of the operation.

3. BEEF CATTLE FEEDLOT FACILITIES

Beef feedlots can range in size from a few to many thousand head. Individual feedlots of all sizes may be owned by a single person; larger feedlots (several thousand head) may involve a group of investors (corporation). A group of large feedlots may be owned by the same parent company (corporation) and share executive personnel who travel from feedlot to feedlot. The level of workforce cooperation and knowledge may vary significantly from one feedlot to another.

Earthen Lot with Mound

Hoop Confinement Building

3.1 Feedlot Design

The methods used for care of the cattle and types of facilities may differ greatly from one feedlot to another. The key to good cattle care depends more on the feedlot manager's ability to manage the pens and feed than on the specific feedlot facility utilized.

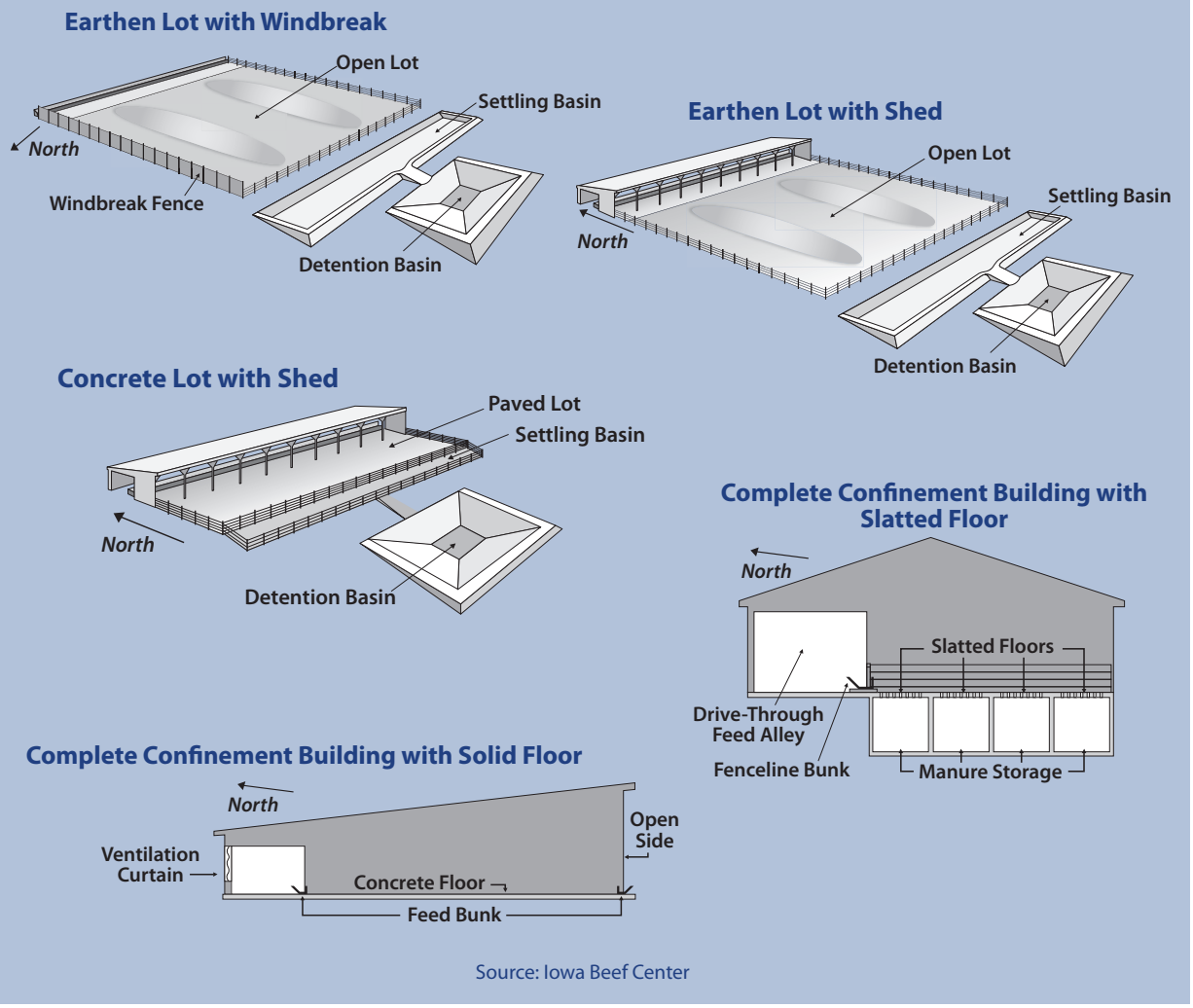
There are six general feedlot facility types (Figure 2):

1. Earthen lot with or without mounds,
2. Earthen lot with a windbreak or shed,
3. Earthen lot without a windbreak or shed,
4. Concrete lot with a shed,
5. Complete confinement building with solid floor (concrete or earthen), or
6. Complete confinement building with slotted floor.

Across all types of feedlots, there are common areas for loading, processing, and housing cattle as well as storing feed and manure. The layout and structures associated with these areas will vary, but the functions are similar. For

more information and diagrams on the different types of feedlot facilities, please refer to Beef Feedlot Systems Manual, available at: *http://www.extension.iastate.edu/Publications/PM1867.pdf*.

Figure 2. Feedlot Facility Designs



Source: Iowa Beef Center

3.1.1 Loading/Unloading

Cattle arriving or leaving a feedlot typically do so using a dedicated area on the operation with sorting or holding pens called slants and loading ramps or chutes. These can be as sophisticated as concrete and metal structures under cover to simple metal ramps and earthen pens with fences. The transportation process can be long for some cattle depending on their origin. After unloading, cattle are generally placed in receiving pens in this area and allowed to rest before moving to a feeding pen or processing. Cattle should have access to fresh water and, depending upon how long they have been in transit or will remain in the receiving pen, offered fresh feed (typically a palatable hay). Cattle are often weighed shortly after arrival.

3.1.2 Processing and Treatment Facilities

Most feedlots have some type of facility available to restrain cattle for routine processing (vaccination, deworming, applying identification, implanting, etc.) and for treatment of sick animals. After resting, new cattle arrivals may be weighed, vaccinated, identified with one or more ear tags, treated for parasites, and sometimes implanted with hormones to aid in growth.

Processing facilities vary widely based on the size of the operation. Very small feedlots may have no facilities. In contrast, very large feedlots may have facilities for routine processing and others for treatment. Generally, a working facility will contain a chute and a system of alleys that bring the cattle to and from their pens to the holding pen and chute. Chutes are designed to restrain one animal at a time. Some larger operations may have multiple chutes for processing several animals at a time; others will only be able to process one at a time through a single chute. The chute area may be located in a building or with a shade structure; others may be out in the open.

Sorting Tub

Alleyways

Chute

As more feedlots incorporate software tracking of animals, treatments, vaccinations, and other ancillary procedures, having a computer system in the processing and/or treatment facility is becoming more common. Feedlots administering medications to cattle should have some form of a record keeping system that includes the animal's identification number, date of treatment, reason for treating, name of product(s) administered, route of administration, and recommended slaughter withdrawal time based on the product label. Some feedlots will record much more information.

3.1.3 Pens

Large feedlots are usually divided up into dry lot feeding pens that share a fence line and may also share a watering source with a neighboring pen. Within the pens, mounds of dirt are formed that are steep enough to provide water drainage, while sloped enough to allow the cattle to lie down along its sides and top. Mounds aid in minimizing soil erosion in the pens and increase the available dry surface area for cattle to lie down. Large continuous feedbunks for holding the ration are usually present along one side of the pens. Pens will have a gate that opens into large alleyways. This system of alleyways, often referred to as a drover's alley or lane, is used to move animals between pens, to and from processing facilities, and to and from truck loading/unloading facilities. In drier climates, the drover's alley is often at the bottom of the pen because water drainage is less of an issue. In wetter climates, cattle may be moved along the feed alley or lane which is often located at the higher end of the pen.

Small feedlots may consist of one or more pens with or without shelter. Feeding can mirror larger operations or can be much simpler. Some small feedlots may use self-feeding systems in which enough feed for many days is loaded into a delivery device and cattle are allowed to eat as much or as little as they desire. The alleys to move cattle vary in their interconnectivity depending on the size of the feedlot and available labor to move cattle to processing and load/unloading.

3.1.3.1 Hospital Pens

Some feedlots have dedicated hospital pens for sick or lame cattle. In some cases, these pens are physically separated from pens housing healthy animals, but not always. These hospital pens are usually smaller in size than home pens so that sick cattle are closer to feed and water sources. They may have shelter and usually a forage based diet is offered. Some feedlots have no or very limited hospital facilities. Regardless of the availability of hospital pens, some feedlots routinely send sick animals back to their home pens after treatment. This may pose the risk of disease exposure to pen mates but that may be outweighed by decreasing the stress on treated animals by allowing them to stay in a known social structure. Depending on how cattle are marketed, it may also be necessary to keep one customer's animals all together as opposed to moving them to another pen.

3.1.4 Shelter

Shelter on feedlots will range from nothing (open dry lots) to windbreaks (natural or man-made) to sheds with open

fronts to full confinement buildings. This varies by region of the country and the climate and environmental challenges. Unless animals are in confinement, certain extreme weather conditions will be challenging such as sub-zero temperatures or a blizzard, extreme heat and humidity, or excessive rain which creates mud in the pens. These conditions can put stress on the animals and caretakers. Efforts are taken during these extreme weather events to ensure adequate access to feed and water, and supplemental cooling in the form of pen sprinklers can be utilized in extreme heat. Hot weather with high humidity is more stressful for fed-cattle than cold temperatures. Cattle handling should occur during the early morning hours to avoid additional stress on the animals during the hottest parts of the day.

Shade with Curtain at Bunk

Shade with Curtain in Pen

Hoop Shed

4. BEEF CATTLE APPEARANCE AND BEHAVIOR

4.1 Cattle Appearance

There are many different breeds and types of cattle in the U.S. Some breeds of *Bos indicus* descent have humps on their necks and naturally droopy ears. 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 the colder weather climates. Within the two species, 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 of all the cattle breeds with pictures.

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 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 alarming. Cattle will tend to escape if an alarming presence is detected within their flight zone – an area in which a threat is determined to be too close for comfort. 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. Cattle will usually cluster together in groups even on very warm days if they are being bothered by flies and other insects. Good pest management can help to alleviate this and also help to prevent cattle from becoming too warm while clustered together on hot days.

4.3 Sick Animals

Specific feedlot personnel, either on location or on contract, are trained to identify sick animals and most spend time daily walking or driving past the feedbunks at feeding time or walking/riding the pens on horses or all terrain vehicles. These personnel are often referred to as "pen riders". New cattle arrivals are often checked twice a day for the first few weeks. Sick animals are typically identified by their reluctance to come to the bunk to eat, standing at the bunk but not eating, separating themselves from the group, appearing lethargic, having an increased respiratory rate, nasal discharge, sunken eyes, or lameness. Feedlots vary in their handling of sick animals. As discussed under 3.1.3.1 Hospital Pens, some are moved out, treated, and separated into a dedicated pen for a period of time. Some will be sent back to their home pen immediately after treatment.

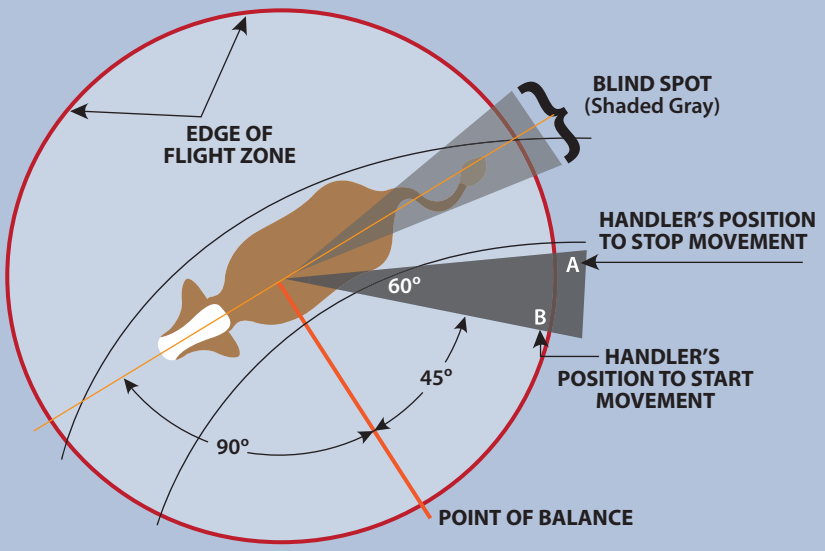
At the treatment facility, cattle are examined and treated with appropriate medications or other ancillary treatments if necessary. These animals are typically marked externally to indicate they have been treated. This could include a mark with livestock chalk on their forehead or body, the application of an additional different colored ear tag, or some unique identification to alert those monitoring the pens in subsequent days to pay extra attention to this animal. Animal identification and treatment information is recorded to ensure that proper withdrawal times for animal health products are observed.

Most feedlot managers work with their consulting veterinarians to develop treatment protocols and train feedlot staff to determine which animals get treated and how treatment is administered. These protocols may include criteria for initiating treatment, cessation of treatment, culling, and euthanasia. An important point to make about sick animal care is that chronic cases that are no longer eligible for treatment are often sold after clearing withdrawal times for any treatments. These animals, often referred to as railers or realizers, may be potential carriers of disease agents.

4.4 Methods for Safe Movement of Beef Cattle

Cattle behaviors can be utilized to handle them safely and effectively. When moving cattle, it is best to utilize their flight zone, or their personal space. By entering the flight zone behind the shoulder, cattle can be encouraged to move forward, whereas entering the flight zone in front of the shoulder will initiate backward movement. The shoulder is referred to as the point of balance. 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 near their point of balance and work back and forth parallel to the direction that you would like to move them in. Demonstration videos can be found at *http://www.youtube.com/user/TempleGrandin.*

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 cattle movement technique described in the preceding paragraph. 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 has production and health consequences.

When cattle are being handled in a confined area such as a crowding pen or sorting alley, handle small groups. Bring eight or ten cattle into a crowding pen (also referred to as a tub) instead of twenty. Overloading the crowding pen is a common handling mistake; cattle need room to move along the alley. A stick or whip with plastic streamers, a flag, 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 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 the serious handler injuries occur when an animal, separated from its herdmates, refuses to enter the single-file chute. When a lone animal refuses to move, the handler should release it from the crowding pen and bring it back with another group of cattle.

Cattle work done in extreme weather conditions warrants extra precautions. If the cattle get alarmed and excited, their body temperature will rise. Cattle can easily become hyperthermic; they are more sensitive to heat than humans. During hot conditions, cattle will retain heat for six to eight hours following peak temperatures. Therefore, cattle handling should occur during the coolest parts of the day. Working cattle in extremely cold weather can also induce stress on the animals. Ice/snow buildups in travel lanes require careful handling to avoid slips and falls of both cattle and people.

Sources:

- *Hubert, Daniel 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, Temple. Recommended Basic Livestock Handling. Accessed July 8, 2010 at: http://www.grandin.com/behaviour/principles/principles.html*

Cattle are in very close contact during the shipping process to decrease the amount of movement of the group for their own safety. It is better to have closer contact in the winter to increase body heat for the cattle and less contact in the summer when it is warmer. Recommendations for the number of cattle that can be loaded onto a semi-trailer will vary depending on the cattle's weight, the size of the trailer compartment, the maximum legal load limit for the roads traveled, and the outside temperature, humidity, and wind. Table 3 below provides guidelines only.

Table 3. Guidelines for Cattle Weight on Semi-Trailers for Over-the-Road Transport

Compartment Weight (lbs.)	Average Weight of Cattle (lbs.)											
	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
1,500	3	3	2	2	1	1	1	1	1	1	1	1
4,000	10	8	6	5	5	4	4	3	3	3	2	2
4,500	11	9	7	6	5	4	4	3	3	3	2	2
6,000	15	12	10	8	7	6	6	5	5	4	4	4
8,000	20	16	13	11	10	8	8	7	6	6	5	5
9,000	22	18	15	12	11	10	9	8	7	6	6	6
20,000	50	40	33	28	25	22	20	18	16	15	14	13
21,000	52	42	35	30	26	23	21	19	17	16	15	14

Source: Loading Suggestions in Master Cattle Transporter Guide, National Beef Quality Assurance Guide for Cattle Transporters, 2007.

4.5 Methods for Safe Restraint of Beef Cattle

Squeeze chutes are the most common method 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, most chutes have mechanisms to gently 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 allow access to the animal's feet, if needed, or that will further restrain the head and neck for procedures like tagging or blood collection. Chutes 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 small, it can squeeze the animal's neck tight enough to asphyxiate the animal.

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 is an excellent tool to keep cattle quiet for many procedures. There are many 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. Records must be kept for any chemical restraint administered and meat withdrawal times followed.

Handling and restraint of cattle requires substantial training and experience to be carried out effectively. Many dangerous situations commonly arise, especially if cattle are excitable. These situations require experienced personnel and good facilities for a satisfactory outcome.

5. ANIMAL HUSBANDRY NEEDS

5.1 Nutrition and Feeding

Feedlot cattle are on special diets as compared to the grazing cattle because of the need to grow muscle mass for meat production. Fiber, energy, protein, vitamins, and minerals are important components of a balanced diet. Feedlot diets tend to be high in energy and low in fiber for adequate muscling and marbling. Corn, in many different forms, is the most common energy source for feedlot cattle, but other cereal grains are also used. Dietary fiber in feedlot rations comes from a variety of forage sources including dry hay, alfalfa, and ensiled hay or corn. Protein is provided mainly by soybean meal, cottonseed meal, and corn processing co-product feeds (distillers grains, gluten feed). Many rations deliver macro and microminerals along with vitamins through commercially produced products.

An increasingly common feed ingredient is ethanol co-product feed. These co-products vary in composition, but are typically high in protein and digestible fiber. These feeds also tend to concentrate non-starch nutrients and any toxins that may be present, such as mycotoxins, and sulfur can reach high levels in some co-product feeds. Toxins can cause a variety of clinical conditions that may need to be distinguished from a highly contagious FAD.

Hay

Flaked Corn Feed

Ethanol Co-Product Feed

Various feed additives are commonly used in feedlots. These additives may include antibiotics, partitioning agents, ionophores, and melengestrol acetate (MGA) for heifers. In some cases, antibiotics are fed at sub-therapeutic levels to prevent disease and subsequently maximize feed efficiency. Partitioning agents may also be used to optimize feed conversion to muscle mass, particularly later in the feeding period. Ionophores prevent diet related disease conditions such as bloat and acidosis; they also maximize feed efficiency and control coccidiosis. Ionophores can generate profound clinical disease or death when excessively high concentrations (accidental overfeeding) are fed to cattle; accidental ingestion of small doses by horses can result in death. The primary clinical sign of ionophore toxicity in cattle is heart failure which may mimic the foreign animal disease – heartwater. Melengestrol acetate (MGA) is commonly added to the rations of heifers to aid in the prevention of estrus. This leads to increased feed efficiency and rate of gain while improving animal health performance. MGA works in a mechanism similar to progesterone, a hormone naturally produced by animals.

Source:

- *Parish, Jane A. and Justin D. Rhinehart. Mississippi State University Extension. Feed Additives for Beef Cattle Diets. 2008. Accessed October 21, 2010 at: http://msucares.com/pubs/publications/p2518.pdf*

5.1.1 Feed Storage

Depending on where the feedlot is located in the U.S., some are able to produce enough feed without purchasing feed. This is not the case for large feedlots. A portion of the feed may be raised on nearby farms but the balance is purchased, with large amounts delivered frequently. This delivered feed can be stored in a variety of ways and is typically limited to a few days' supply. Large upright bulk bins (plastic, metal or cement) may be used to store corn and other flowable feedstuffs (protein, minerals, other additives). There can be semi-loads of feed delivered at a given time to be stored in these bins; some feedlots also receive deliveries by rail.

Dry hay stored in bales or ground piles may be outside, uncovered or under a tarp or shade/rain structure. Some feedlots have a commodity shed consisting of a three-sided building with an open front and one to multiple bays separated by walls to store feed. Bagged feed is often stored in commodity sheds. Built large enough, a bay can hold a semi-load of feed. Wet co-product feeds may be stored in commodity sheds or piled on the ground uncovered.

Silage and haylage can be stored in piles above ground, in bunkers above ground, in earthen bunkers, in silos, or in long plastic bags (e.g., ag bags). Some producers will store their silage in large pits, allowing feed equipment to drive in and scoop out what is needed. Care must be taken when removing feed from large piles/bunkers. The face of the pile can become unstable and if piled high, the top portion could fall, crushing a human being or filling an open tractor cab. As feed is used, silage piles covered with plastic tarps and tires (whole or half) require tire removal and plastic cutting. While working to remove plastic tires, personnel should remain 6 feet (2 meters) back from the edge of the silage face. Whole tires in the winter can be filled with snow/ice; exercise caution in removing them. Whole tires in the summer hold water; a perfect environment for mosquito-egg-laying; a risk if Rift Valley Fever was introduced into the U.S.

Many large feedlots have on site feed mills. These mills utilize basic feed ingredients stored on the operation and process them to produce cattle rations. Feed mills process grain and mix vitamin and minerals to form balanced supplements. Some on site feed mills may process corn (steam-flake) or other feed ingredients for off-site feedlots. Smaller feedlots are more likely to purchase commercially available supplements or to use local feed mills that deliver pre-mixed feed to many producers in the area. Truck traffic to and from the commercial, cooperative, or feedlot owned mill must be considered in the event of a highly contagious FAD outbreak.

5.1.2 Feed Delivery to Animals

The type of ration fed is dependent on available feedstuffs, stage of production, and equipment. The mixing and feeding of feedlot rations can involve multiple movements of feed ingredients, feed equipment, delivery trucks, and personnel

on and off the operation. The feed stuffs are typically mixed on-site to form balanced rations. In all feedlots, equipment used to mix or deliver feed should be clean and free of organic matter (feces, urine, saliva) as these can harbor disease agents, spreading it from one location to another.

Feed is offered once to three times a day to cattle in some form of a long bunk. These bunks vary in construction and can be made of wood, plastic, steel, or concrete. Most large feedlots have concrete bunks running along the edge of the pen at ground level. Feed is delivered to the feed bunks by a truck or a tractor-drawn wagon that drives down an alleyway running next to the bunk and augers the feed into the bunk. These feed delivery trucks do not enter the cattle pens. Some smaller feedlots and backgrounder operations may feed in bunks made of the other materials, either stationary at the pens edge as described above, or moveable bunks within the pen. These delivery vehicles can transport manure between pens if they do not clean their equipment after exiting the pen.

5.1.3 Feedbunk Management

Feedbunk management is a key component of feedlot management. Feed is the second most expensive input on the operation and most operations monitor or "read" the bunks closely for consumption. Barring weather extremes, cattle tend to follow a regular eating pattern. Monitoring intakes daily allows recording of how much is fed per pen for inventory and billing purposes, especially for feedlots that do not own the cattle. These records can be simple paper recordings to sophisticated software programs. Monitoring daily intakes also allows for early identification of illness in the cattle. This is especially important during a highly contagious FAD outbreak, especially if foot-and-mouth disease is involved. Due to the lesions caused on the feet and in the mouth from this virus, cattle intakes could decrease, triggering an alert and the need for closer investigation. Feedyard managers and pen riders are very knowledgeable about the normal eating patterns for their cattle and could be a great resource during surveillance for FADs.

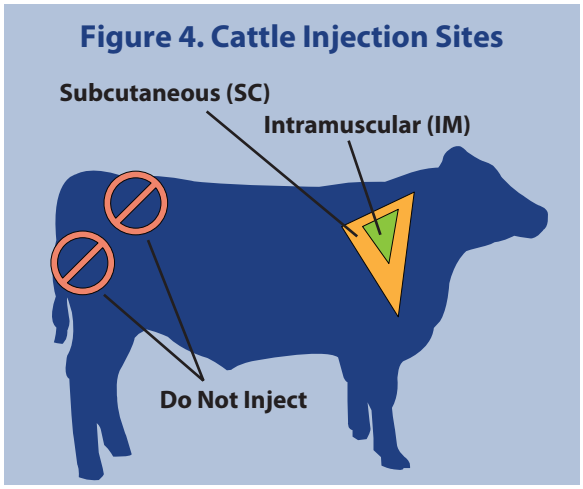
5.1.4 Water Access

Cattle need to have access to fresh water all day every day. This is provided through fenceline waterers or large receptacles in each pen. Waterers are checked daily like feedbunks to ensure they are functioning and clean. Shared fenceline waterers are found in some feedlots and can serve as a source for orally spread diseases between pens of cattle. Waterers should be cleaned on a regular basis to remove organic matter buildup.

5.2 Routine Vaccinations

Use of vaccinations in a feedlot is an important component of animal health. Vaccine protocols will vary depending on the prevalence of disease both in the feedlot area and in the origin of the cattle. These protocols are typically referred to as receiving or processing programs. 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 cattle in feedlots receive vaccinations for common respiratory pathogens and for clostridial diseases. These pathogens include bovine herpes virus 1, parainfluenza 3 virus, bovine viral diarrhea virus types 1 and 2, and bovine respiratory syncytial virus. Clostridial diseases cause blackleg, malignant edema, black's disease, enterotoxemia, and redwater; all common diseases in various areas of the country.

Figure 4. Cattle Injection Sites



When administering any type of injection to cattle, it is important to administer 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, thigh, and loin (between the ribs and hip) region; by giving injections in the neck, any damage to surrounding tissue minimizes loss of meat at harvest. Always follow the product labels of all injectables and when possible, give the injection subcutaneously instead of intramuscularly.

When vaccinating, it is important to have epinephrine readily available in case of anaphylactic reactions to the injections. Have a plan and a set protocol to be used in case of anaphylaxis. 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 or medication; 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 15 to 20 minutes after the initial dose if the animal has not recovered sufficiently.

Source:

- *Berrier, Randall 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.*

5.3 Parasite Control

Internal and external parasite control is very important on feedlots 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 finish an animal. Parasites have also been shown to have a detrimental effect on immune function in calves.

Antiparasitics are used routinely to control these parasites. Some antiparasitics work against external and internal parasites. Since parasite types and burdens differ depending on geographic origin, 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 must be followed.

Feed additives and/or parasitic wasps can be released into the environment to help reduce the numbers of adult flies by disrupting larval development in manure. Manure management, avoiding spilled feed, and keeping areas of vegetation surrounding pens mowed are other components in adequate pest control.

5.4 Implants

Implanting is a widely practiced management tool for cow/calf operations, backgrounder/stocker and feedlot enterprises. Implants are small pellets that contain growth promoting hormones that are slowly released over a period of time. They supplement the hormones already present in the animal's system to increase both growth and feed efficiency. Implants are placed in the middle third of the back side of the ear of cattle, just under the skin. Implants come in many different combinations that are specially formulated for use in heifers and steers or at different ages. Implants have no withdrawal times before animals can go to harvest.

5.5 Withdrawal Times for Pharmaceuticals and Biologics

Withdrawal time consideration is very important when medicating, vaccinating, or supplementing feedlot cattle. Withdrawal time is the time that it takes for residues from substances introduced into the animals' system to fall below acceptable levels so that the meat from the animal can be safely consumed by humans. These withdrawal times are determined as part of the drug and vaccine approval process and are published on the product label. Withdrawal times must be observed when emergency harvest is considered as a control measure in a highly contagious FAD outbreak.

Because of withdrawal times, feedyards keep precise records on every animal that is given any drug, vaccine, or feed additive. Records for each animal should include the substance, quantity, and duration of withdrawal along with reason for administration. Drugs and vaccines should be used according to label directions except under the direction of a licensed veterinarian within the bounds of a valid veterinarian-client-patient relationship. 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.

Gentian violet is an example of a substance that is prohibited from use in animal food or feed (21CFR589).
Source:

- *Code of Federal Regulations Title 21 http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=530.41*

It is very important to read the 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 Record Keeping

Good record keeping when administering vaccines, parasite control, implants, and antibiotics, either prophylactically or therapeutically is very important on both an individual and herd basis. Records should be kept in a uniform manner in a location that is readily accessible to the owner and manager of the herd. They should be updated anytime an animal or the herd is treated. A good source for record keeping forms for both individuals and herds is from North Dakota's Beef Quality Assurance Program. This information can be found at: *http://www.ag.ndsu.nodak.edu/bqa/manual/appendix/app1.htm*. Also popular with some producers is the IRM Redbook (pictured at right) which is a pocket-sized record book that allows for easy organization of important management data.

Although good records are considered essential to successful cattle feeding, not all operations will maintain adequate records. Record systems vary from simple notebook records to complex computer based systems, which may require the knowledge of the operator for proper interpretation.

6. PEOPLE AND PRODUCT MOVEMENT

Many large feedlots have employees that assist in the operations ranging from feeding to maintenance to animal health. These employees routinely travel through all parts of the feedlot and have access to many cattle. Some feedlots also use contract crews that work for multiple feedlots doing seasonal or sporadic work like vaccinating, administering antibiotic treatments, or implants. In large feedlots, these processing crews consist of specially trained lay workers; in smaller feedlots, veterinarians may provide these services. There are also pen riders that can be hired on a contract basis to work on a number of feedlots. Documenting people movement on a daily basis is not routinely done on most feedlots, but some will record products entering the operation (load scales are set up at the entrance for feed deliveries), processing crews, cattle transports, and vendors. At a minimum, records with the names and contact information for all employees should be kept. During an outbreak, recording all people and product movement is essential.

A significant proportion of the routine traffic to a feedlot is related to deliveries. Feedlots depend on transportation modalities for the delivery of cattle, feed, equipment, and animal health supplies. Some feedlots acquire nearly all feedstuffs from outside sources while others require only protein or micronutrient supplements. Delivery vehicles are potential fomites for disease agents due to their route and stops at multiple destinations with variable to non-existent cleanup between sites.

6.1 Manure

Manure is an inevitable by-product of feedlots. Regular removal has the potential to reduce health issues (decreasing the infectious burden of animal disease pathogens), odor, and fly breeding ground. However, manure removal can also contribute to the spread of disease because pathogens can survive in the right environmental temperatures. Manure is periodically removed from pens depending on accumulation and weather conditions. Pen cleaning and manure hauling can be done by contract companies who supply the heavy equipment. Ideally, pens should be cleaned after each group of cattle, before introducing new animals. This strategy can aid in breaking the disease cycles from pathogens spread via the fecal-oral route. Manure that is removed from pens may be stockpiled for a period of time. Stockpiled manure is either spread on neighboring pasture or cropland or composted. Composted manure is either sold or spread in the same manner as raw manure.

When it rains, surface runoff containing trace amounts of manure from the animal pens enters ditches and ends up in lagoons or ponds. A runoff management plan is very important for pens and the manure storage area. The plan should include preventing runoff to flow across other feedlot pens or into waterways. All runoff water, both waste and storm, must be collected and stored. See Figure 2. Diagrams of Different Feedlot Designs for illustrations of manure settling and detention basins. Solids should be removed from runoff to reduce odors and prevent the collecting area from filling up with solid mass. This water can later be evaporated or treated and applied to cropland for irrigation and fertilizer. Runoff management is extremely important because of the concern for runoff contaminating water supplies. Feedlots obtain permits from the Environmental Protection Agency (EPA) and/or states that govern runoff from feedlots and handling of manure.

Source:

- *Davis, J.G., et al. Feedlot Manure Management. Management Livestock Series. 2002. Accessed May 26, 2009 at: www.ext.colostate.edu.*

6.2 Mortalities

Most feedlots have less than 2% death loss and have procedures in place to handle dead cattle. Once identified in a pen, the carcass should be removed from the pen and placed in a designated area. The disposal of livestock mortalities (carcasses) is regulated by the state in which the feedlot is located. Four primary methods of disposal are typically considered: burial, rendering, open air burning, and composting. There may be limitations, restrictions, or environmental and legal regulations governing each of these options. When planning for the 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 feedlots, 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. 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. In some cases, off-site burial is the disposal option of choice. Some types of commercial or industrial landfill may provide a reasonable option for carcass disposal if they meet specific design and operating standards. Prior arrangements should be made during planning with the landfill operator to accept non-contagious carcasses.
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 feedlots located in an area where the service is available. Rendering is nearly always carried out by a business independent of the feedlot and often includes a “pickup” service at a designated location; preferably at the edge of the facility away from main traffic area. Rendering can be an expensive option; this 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 necropsied carcasses or those with the brain removed. Rendering collection trucks moving between different types of animal related enterprises can present a biosecurity risk if not considered in a feedlot's biosecurity plan. In situations involving mass depopulation, rendering services can be quickly overwhelmed. If a highly contagious FAD was involved, this will likely not be an option.

3. On-site open air burning and other thermal methods use high-temperature combustion to destroy animal carcasses and associated animal materials. Using this method, small numbers of 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 should 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. Composting on-site allows for decomposition of the carcass resulting in a nutrient rich product that can be applied to land as a fertilizer. Composting on farm may be an inexpensive option in some climates/localities. However, it requires a large space when incorporated into a sizable operation. Equipment needed and composting protocols will vary among states and animal populations. This method requires prolonged management, maintenance, and monitoring. Care should 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 should 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.

PART II: RESPONSE TO A HIGHLY CONTAGIOUS FOREIGN ANIMAL DISEASE

7. 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 4 summarizes the premises designations that would be employed in an FAD outbreak response. Table 5 summarizes the zone and area designations that would be used in an FAD outbreak response.

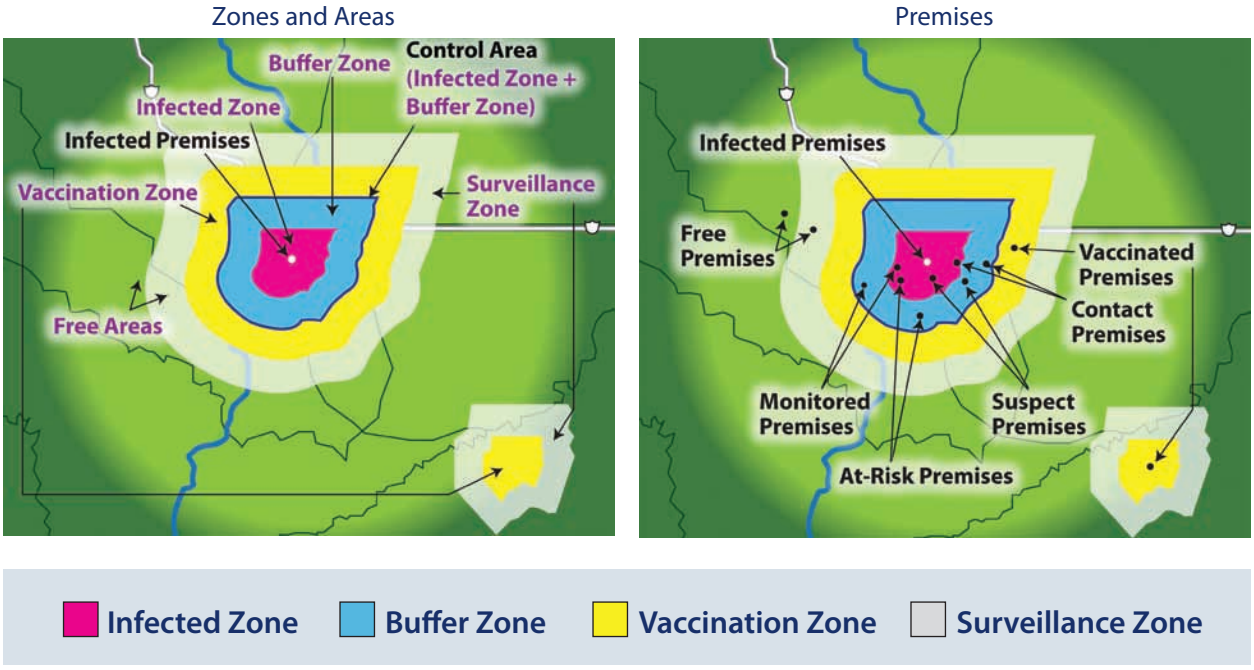
Table 4. Summary of Premises Designations

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 5. 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 Framework for Foreign Animal Disease Preparedness and Response*. 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*.

8. BIOSECURITY MEASURES FOR A FOREIGN ANIMAL DISEASE OUTBREAK

Due to the open nature of most feedlots, and the way cattle are acquired from a variety of sources over weeks to months, disease introduction and spread is an inherent challenge. 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 during an FAD outbreak 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 (spread by aerosol, direct contact, fomite, oral)—Appendix
- Rift Valley Fever (spread by vector) —Appendix
- Heartwater (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 biosecurity measures for containment of spread of a pathogen from a premises can be found in the *FAD PReP/NAHEMS Guidelines: Biosecurity (2011)*.

8.1 Zoonotic Diseases of Cattle

Cattle may be a source of several diseases for humans (zoonotic). It is important for people working with cattle to have a basic understanding and awareness of the clinical signs and appropriate precautions and actions needed for each disease. Some of these diseases also have the potential to be used in bioterrorist activities. These diseases require good biosecurity and personal hygiene be employed to help avoid the risk of contracting these diseases. More information on specific diseases can be found 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 feedlot 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)*.

9. 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.

9.1 Feeding

During a highly contagious FAD response, the on-farm 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. 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 a premises but feed deliveries will be essential to provide nutrition for the cattle. All alterations in feeding regimens should occur gradually to prevent cattle from going off feed.

9.2 Vaccinating

9.2.1 Routine

In the feedlot situation, there is usually a certain amount of routine vaccine product kept on hand for processing incoming cattle. In the event routine vaccines are needed during a highly contagious FAD response, this stock of vaccines would be used first and then the feedlot should contact its 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. Consult with a veterinarian about vaccination schedules and protocols.

Vaccination crews, either feedlot 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. Details such as company name (if contract crews), crew member names and contact information, exposure to other livestock in the previous five* 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).

*For highly contagious FADs affecting cattle, five days would be the maximum time span that should be accounted for regarding potential exposure. This is based on the length of time humans can carry foot-and-mouth disease virus in their nasal passages in a high exposure, research setting. Field conditions will vary, but five days is the common recommended time frame.

Source:

- *United States Animal Health Association. Foreign Animal Diseases. pp261-275 http://www.cfsph.iastate.edu/Factsheets/pdfs/foot_and_mouth_disease.pdf*

9.2.2 Specific to Disease Event

Depending on the type of disease outbreak, the response may include vaccinating the animals in an attempt to limit spread. Optimal vaccination strategies will vary greatly by region of the country and depend on impacts to both the domestic economy and foreign trade. This decision will be made by the Chief Veterinary Officer (CVO) at the federal level. 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 for the life of the animal and may impact movement of other unvaccinated livestock in that vaccinated region. It may also affect the ability to export (vaccinated) animals.

If vaccination is implemented, the product will be made available by regulatory officials. Guidance as to dose, delivery method, how to store and administer the product, animal identification, and record keeping requirements will be provided. In the event of an FAD outbreak in concentrated areas of livestock production, it is unlikely that a sufficient number of official responders will be available to complete this task in a timely manner to maximize vaccination efficacy. Feedlot employees will likely be utilized to assist with vaccination.

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 and subcutaneous injections should all be given in the neck region of all ages of cattle. The injection should be given as ventrally and as caudally as possible while staying in the muscles of the neck. Injection sites should be as clean as possible. Please consult Table 6 for needle lengths and gauges. 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.

Table 6. Guidelines for Needle Selection for Feedlot 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)	18-16 gauge	16 gauge	16 gauge	18-16 gauge	16 gauge	16-14 gauge	18-16 gauge	18-16 gauge	18-16 gauge
Thick (e.g., oxytetracycline)	16 gauge	16 gauge	16 gauge	16 gauge	16 gauge	16-14 gauge	16 gauge	16 gauge	16 gauge

A differentiating infected from vaccinated animals (DIVA) approach (marker vaccines) may be used in the event of a highly contagious FAD outbreak. The DIVA approach utilizes a paired vaccine and diagnostic test that allows for vaccinated animals to be distinguished 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 that currently has DIVA vaccines and companion diagnostic tests.

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 free status from the highly contagious FAD. It will also identify vaccinated-to-live animals, if that approach is chosen. 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 transmit the disease from one premises to another. People in contact with positive animals or suspected positive animals will be prohibited from having contact with naïve animals for a period of time specified by the responsible authorities. Good records need to be maintained and should include: 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)* and the *Appendix A: Foot-and-Mouth Disease (2011)*.

10. PRODUCT HANDLING

The primary product that needs to be moved off feedlots is finished cattle. This is typically accomplished with semi-trucks and trailers. There are a variety of sizes and styles of semi-trailers. Length ranges from 44 to 53 feet. Some are single deck and others are pot-bellied, meaning the bottom of the trailer is lower to the ground allowing for a double deck. Table 7 lists the types of trailers and number of head based on cattle weight that can be transported in ideal conditions. Additional considerations will need to be made for horned animals. In a highly contagious FAD outbreak, movement may be controlled. 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*.

Table 7. Size and Capacity of Livestock Trailers Based on Market Weight Cattle

Cattle Weight	*Trailer Length*	*Decks*	*Number of Head/Trailer*
1100 lbs.	44 feet	Single	25 without horns
1100 lbs.	44 feet	Double	40 without horns
1100 lbs.	53 feet	Single	30 without horns
1400 lbs.	44 feet	Single	18 without horns
1400 lbs.	44 feet	Double	28 without horns
1400 lbs.	53 feet	Single	22 without horns

Source: Grandin T. Livestock Management Practices that Reduce Injuries to Livestock During Transport, Livestock Trucking Guide, Revised September 2001. Accessed July 8, 2010 at *http://www.njintouch.state.nj.us/agriculture/humanetruckingguide.pdf*

10.1 Market Weight Animals

Live animals are the greatest risk for introducing or spreading disease during an outbreak. Movement of uninfected finished cattle off farm may be halted during a highly contagious FAD outbreak depending on the proximity to the harvest facility and whether travel through or within a Control Area is required. In order for permits to be issued for movement, visual inspections will likely be required, as well as diagnostic testing, if available. Requirements for use of the closest harvest facility may be implemented if the facility is capable of processing the cattle (based on

weight and size). If contracts exist between the feedlot and a harvest facility, and the transportation required to reach the destination crosses Control Areas, modifications may be required. Communication with the harvest facility and regulatory authorities will be key throughout this process.

10.2 Animals in Transit

Animals in transit present a difficult issue in the event of a highly contagious FAD outbreak. When a highly contagious FAD is first discovered in the U.S., state or federal animal health officials may issue an immediate restricted and/or stop movement order. This will require communicating with drivers on the road with cattle and the destination, either the feedlot or harvest facility, to determine the route that minimizes the chance of exposure while accounting for the welfare of the animals. Federal and state mandates will be issued and must be followed in order for the cattle owners to be considered for compensation of losses of infected cattle.

10.3 Unfinished Cattle

Cattle still on feed and not ready for market are referred to as unfinished. These animals on uninfected feedlots in a Control Area during a highly contagious FAD outbreak could remain on feed and be finished to normal market weight. Alternatively, depending on their proximity to Infected Premises and risk of exposure, regulatory officials may decide to send them to harvest early to help control disease spread. Withdrawal times for all products used on the animals will need to be taken into consideration. Depending on the highly contagious FAD, these animals may be vaccinated against the disease, finished, and then sent to harvest. Withdrawal times for the vaccine will need to be followed if the animals are harvested for human consumption. It is required that at least 60 days elapse between the time of vaccination and that of harvest, unless otherwise specified by vaccine manufacturer.

10.4 Mortalities

Most feedlots 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 governments and in a method that will mitigate the risk for disease spread. The method of disposal depends on the disease, the local conditions and regulations, and the number of animals. In 2007, "Operation Palo Duro" was conducted as a tabletop exercise looking at multiple issues in an FMD outbreak in the Texas Panhandle. Two large feedlots (55,000 and 70,000 head) were 'infected' and cattle had to be depopulated and disposed of. This posed challenges to timely depopulation and finding enough land mass to bury them. Contingency plans must be considered in areas with large cattle operations.

Source:

- *Giovachino M.,et. al. Operation Palo Duro: Policy and Decision-making in Response to an FMD Outbreak. The CAN Corporation. May 2007*

Operations utilizing on-farm 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 monitored to ensure carcasses are decomposing. 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.

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

10.5 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 susceptible to heat, desiccation and sunlight if exposed. Organisms protected by fecal matter may live for an extended period of time, especially in cold weather. Dragging the pens to break up the manure and regular manure removal is extremely important to curb disease spread.

Runoff Ditch

Detention Basin

During and after a disease outbreak, decisions will have to be made on how to decontaminate and dispose of manure. The future application of this manure on crop ground must be considered as disinfectants and chemicals that change manure pH may affect subsequent plant growth. Returning decontaminated manure to a stable pH prior to application has associated costs but may be the best option in certain situations. The application of untreated manure has the potential to spread disease to other livestock (e.g., cattle grazing) and possibly wildlife. 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 (2011), Cleaning and Disinfection (2011)*.

11. 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 and 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. Once established as a disease-free zone, movement restrictions and disease monitoring requirements lessen, easing the response effort in this area.

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 will be visual inspection. As soon as practical, surveillance will include laboratory testing of susceptible animals. Contact and Suspect Premises should be inspected at least three times per maximum incubation period for the disease under investigation. During the highly contagious FAD event, surveillance could include on-farm observation, and/or testing market animals, and at harvest. Please refer to the *FAD PReP/NAHEMS Guidelines and SOP: Surveillance, Epidemiology, and Tracing (2011)* for additional details.

11.1 People

Visitors and employees can introduce or spread disease to susceptible animals if steps are not taken to mitigate these risks prior to entry. Some feedlot workers may have livestock at home that could become infected with disease organisms carried home on clothing and vice versa – introducing disease to the feedlot cattle. Sanitation and hygiene practices are important to prevent disease agent spread and include wearing clean clothing, coveralls, footwear, and washing hands before and after animal contact or changing gloves. If the highly contagious FAD is zoonotic, additional personal protective equipment must be worn by all those handling animals.

The movement of people on and off the farm during a disease event must be documented. Using a written log to record name, contact information, last contact with a susceptible animal species, and reason for being on the farm including facilities/pens entered/animals contacted is crucial. Personnel on farm 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.

11.2 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 farm will likely be required on all Infected or Monitored Premises. It may be prudent to park vehicles that are not required on farm off-site. People and vehicle traffic 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.

11.3 Disease Monitoring

During an outbreak situation, susceptible animals on all operations must be closely monitored for clinical signs of the highly contagious FAD that meet the case definition. Animal caretakers, especially on Contact, Suspect, or At-Risk Premises should be aware of the clinical signs and who to contact if disease is suspected. Accurate and rapid public awareness campaigns will be used to disseminate disease recognition and reporting information to animal producers and caretakers within the Control Area and Surveillance Zone.

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" disease status may be required for permitted movements of susceptible animals within the Control Area.

11.4 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 an National Veterinary Services Laboratory (NVSL) facility or an National Animal Health Laboratory Network (NAHLN) facility for testing and study. 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 may be inactivated providing false negative results. See the *FAD PReP/NAHEMS Guidelines: Personal Protective Equipment (2011), Biosecurity (2011)*, and *Cleaning and Disinfection (2011)* and associated SOP for more information.

Source:

- *APHIS Foreign Animal Disease Framework documents, USDA-APHIS-VS National Center for Animal Health Emergency Management, July 2010*

11.5 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 HHS 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 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: *https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/lab-info-services/sa_diagnostic_tests/ct_packaging_labeling.*

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 (2011)*.

Source:

- *APHIS Foreign Animal Disease Framework documents, USDA-APHIS-VS National Center for Animal Health Emergency Management, July 2010*

For more information on packaging and shipping samples, please see the Appendix for Packaging and Shipping Diagnostic Samples.

12. 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 AVMA guidelines. 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.

Depopulation of cattle will take much longer than when normally processing cattle. Texas conducted tabletop exercises in 2003 and 2007 that explored the different possibilities and resources that would be needed in the event of an FMD outbreak. They calculated how many people and what equipment would be needed to depopulate tens of thousands of cattle. Depopulation and disposal of 55,000 and 70,000 head of cattle on two 'infected feedlots' and subsequent disposal was deemed logistically impossible within the time constraints to stay ahead of FMD virus spread. Adequate personnel and resources for depopulation and disposal will be essential for areas of high concentration of large feedlots if this option is selected for disease control and eradication.

Sources:

- *Burnham S., et al. After Action Report on The Panhandle Exercise, April 2003, sponsored by Texas Animal Health Commission, USDA APHIS VS, and Texas Cattle Feeders Association. Accessed July 15, 2009 at: http://www.tahc.state.tx.us/emergency/exercises/Panhandle_Exercise_Report.pdf*
- *Giovachino M.,et al. Operation Palo Duro: Policy and Decision-making in Response to an FMD Outbreak. The CAN Corporation. May 2007*

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

13. 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 depopulation is complete.

For additional details, see *FAD PReP/NAHEMS Guidelines: Carcass Disposal (2011)*.

14. 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. Coordination of equipment, supplies, scheduling, and certifying work completed by the producer, contractors, or animal health response teams will be carried out by USDA-APHIS-VS. 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)*.

15. APPRAISAL AND COMPENSATION

If the animal is part of a positive herd then they will probably need to be destroyed 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 for 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, manure cleaned from pens) 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 mandates issued for the specific disease outbreak.

16. INTERNATIONAL TRADE

In 2010, international exports of beef totaled nearly 2.3 billion pounds valued at over $3.8939 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. In an effort to retain markets during recovery from a highly contagious FAD, once zoning efforts have been exhausted or proven inadequate, compartmentalization may potentially play a role.

Source:

- *USDA Economic Research Service. U.S. Beef and Cattle Industry: Background Statistics and Information. Accessed July 2011 at: http://www.ers.usda.gov/news/bsecoverage.htm*

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 (2010), 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

- Feedlot Facility Manual (draft 2005 by Dr. Scott MacGregor with support of USDA-APHIS-VS NAHEMS and CEAH staff)
- Beef Biological Risk Management, March 2005, 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

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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 ***(Top)*** Cattle in a feedlot. *Photo source: Danelle Bickett-Weddle, Iowa State University*
(Bottom) Table 1. Cattle on Feed: Number of Feedlot Operations, Inventory, and Marketed by Feedlot Capacity, U.S., 2010. *Content provided by: National Agricultural Statistics Board, U.S. Department of Agriculture, Cattle on Feed, February 2011; Graphic illustration by: Dani Ausen, Iowa State University*

Page 3 ***(Top)*** Table 2. Top 5 States for One-Time Beef Cattle Inventory on Feed, 2011. *Content provided by: United States Department of Agriculture National Agricultural Statistics Service, Cattle, January 2011; Graphic illustration by: Dani Ausen, Iowa State University*
(Center) This photo depicts a cattle liner. *Photo source: Heather Sanchez, Iowa State University*
(Bottom) Figure 1. Cattle Inshipments Across the U.S., 2009. *Content provided by: USDA; Graphic illustration by: Dani Ausen, Iowa State University*

Page 4 Backgrounder calves on crop residue (rye grass). *Photo source: Terry Engelken, Iowa State University*

Page 5 Percentage of Feedlot Operations that Purchase Cattle Through Auction Markets. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 6 Gated entrance to a feedlot allows for visitor tracking and restricted entry – an important part of biosecurity. *Photo source: Jeff Sarchet, DVM, Hugoton, Kansas*

Page 7 ***(Top)*** A livestock trailer is backed up to a chute. *Photo source: Renee Dewell, Iowa State University*
(Bottom) Identification tags in use. Dangle tags on a steer (left), orange brucellosis tags (second from left) and bright ear tags (third from left) and a wand is being used to read the radio frequency identification device (RFID) in a steer's ear (right). *Photo source: Danelle Bickett-Weddle, Iowa State University (left); Iowa Department of Agriculture and Land Stewardship (second from left); Andrew Kingsbury, Iowa State Univeristy (third from left); and USDA (right)*

Page 8 A cow and calf. *Photo source: Agricultural Research Services, USDA*

Page 9 ***(Top)*** This photo depicts cattle in a pen at an auction market. *Photo source: Renee Dewell, Iowa State University*
(Bottom) This photo is of cattle in a feedlot. *Photo source: Agricultural Research Services, USDA*

Page 10 ***(Top)*** A man rides a horse through a feedlot pen. *Photo source: Heather Sanchez, Iowa State University*
(Bottom) These photos depict different feedlot designs: an earthen lot with a mound (top), and a hoop confinement building (bottom). *Photo sources: Danelle Bickett-Weddle, Iowa State University (top), and Terry Engelken, Iowa State University (bottom).*

Page 11 ***(Top)*** Figure 2. Feedlot Facility Designs including illustrations of an earthen lot with windbreak, an earthen lot with shed, a concrete lot with shed, a complete confinement building with slatted floor, and a complete confinement building with solid floor. *Illustrations provided by: Iowa Beef Center; Adapted by: Dani Ausen, Iowa State University*
(Bottom) Cattle being loaded onto a trailer. *Photo source: Renee Dewell, Iowa State University*

Page 12 ***(Top)*** These photos all depict different feedlot processing and treatment facilities: a sorting tub (left), alleyways (center), and a chute (bottom). *Photo sources: Danelle Bickett-Weddle, Iowa State University (all)*
(Bottom) This photo depicts the drover's alley in the foreground with cattle pens in the back ground. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 13 ***(Top)*** These photos all depict different shelters on feedlots: a shade with curtain at the bunk and in a pen (left and center), and a hoop shed (right). *Photo sources: Dee Griffin, University of Nebraska, Lincoln Great Plains Veterinary Education Center (left and center); Terry Engelken, Iowa State University (right)*

Photo and Illustration Credits

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

Page 14 ***(Top)*** A sick calf. *Photo source: Geni Wren, Bovine Veterinarian, Vance Publishing Corporation*
(Bottom) 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*

Page 15 Table 3. Guidelines for Cattle Weight on Semi-Trailers for Over-the-Road Transport. *Content provided by: Loading Suggestions in Master Cattle Transporter Guide National Beef Quality Assurance Guide for Cattle Transporters, 2007. Graphic illustration by: Dani Ausen, Iowa State University*

Page 16 ***(Top)*** A bovine in a head catch. *Photo source: Agricultural Research Services, USDA*
(Bottom) Types of cattle feed: hay (top); flaked corn feed (center); and ethanol co-product feed (bottom). *Photo sources: Danelle Bickett-Weddle, Iowa State University (top), Center for Food Security and Public Health, Iowa State University (center); and Terry Engelken, Iowa State University (bottom)*

Page 17 ***(Top)*** A silage pile stored in a bunker. *Photo source: Danelle Bickett-Weddle, Iowa State University*
(Bottom) On-site feed mill at a large feedlot operation. *Photo source: Center for Food Security and Public Health, Iowa State University*

Page 18 ***(Top)*** Feed truck delivering feed to the bunk. *Photo source: Center for Food Security and Public Health, Iowa State University*
(Center) Cattle around an automatic waterer. *Photo source: Center for Food Security and Public Health, Iowa State University*
(Bottom) Figure 4. Cattle Injection Sites. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 19 Antibiotics, like those pictured here, and other medications used in cattle generally have withdrawal times that must be adhered to prior to harvest. *Photo source: Dani Ausen, Iowa State University*

Page 20 Record keeping forms from National Cattlemen's Beef Association. *Photo source: Dani Ausen, Iowa State University*

Page 21 This photo depicts a compost pile. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 23 Table 4. Summary of Premises Designations. *Content provided by: USDA-APHIS Graphic illustration by: Dani Ausen, Iowa State University*

Page 24 ***(Top)*** Table 5. 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 26 Table 6. Guidelines for Needle Selection For Feedlot Cattle. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 27 Table 7. Size and Capacity of Livestrock Trailers Based on Market Weight Cattle *Content provided by: Grandin T. Livestock Management Practices that Reduce Injuries to Livestock During Transport, in Livestock Trucking Guide, Revised September 2001. Graphic illustration by: Dani Ausen, Iowa State University*

Page 28 This photo depicts lightweight calves on feed. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 29 A feedlot runoff ditch (left), and detention basin in the background of the feedlot pens (right). *Photo sources: Agricultural Research Services, USDA (left); and Danelle Bickett-Weddle, Iowa State University (left)*

Page 30 ***(Top)*** A foaming disinfectant being applied to the undercarriage and truck tires before entering a farm. *Photo source: Buddy Gaither, North Carolina*
(Bottom) Samples packed for shipping in separate bags. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 32 Cleaning and disinfection measures on equipment. *Photo source: Carla Huston, Mississippi State University*

Acronyms

APHIS	Animal and Plant Health Inspection Service, a division of USDA
ARP	At-Risk Premises
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
FADD	Foreign Animal Disease Diagnostician
FAD PReP	Foreign Animal Disease Preparedness and Response Plan
FDA	U.S. Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FMD	Foot-and-Mouth Disease
FP	Free Premises
IM	Intramuscular
IP	Infected Premises
IZ	Infected Zone
MGA	Melengestrol Acetate
MP	Monitored premises
NAHEMS	National Animal Health Emergency Management System
NAHERC	National Animal Health Emergency Response Corps
OIE	Office International des Epizooties' currently referred to as the World Organization for Animal Health

Acronyms

PVZ	Protection Vaccination Zone
RFID	Radio Frequency Identification Device
RVF	Rift Valley Fever
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 or stocker operations and prepares them to eat, drink, and interact with other cattle in a feedlot situation. These cattle are raised to feeder size, approximately 600-800 pounds.

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 United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (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.

Brands
A permanent form of identification for livestock and horses required by much of the western United States. 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.

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

Bull
Adult male bovine that has not been castrated. A “bull calf” is a young bull that has not been weaned from its mother.

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

Calf
General term for cattle that have not been weaned from their mother.

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

Castration
Complete removal of the testicles.

Glossary

Cattle Buyer/Broker/Order Buyer
Professional livestock buyer that buys 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.

Compartmentalization
The practice of defining subpopulations of animals, by management and husbandry practices related to biosecurity, for the purpose of disease control.

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

Contact Premises (CP)
Premises with susceptible animals that may have been exposed to the Foreign Animal Disease (FAD) agent, either directly or indi-rectly, 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.

Control Area (CA)
The area consisting of an Infected Zone and a Buffer Zone; established to ensure the rapid and effective containment of disease.

Cow
An adult female bovid, especially one that has given birth, usually over two years of age.

Crowding Pen/Crowd Gate/Tub
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.

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.

Ear Tags
Tags, usually plastic dangle, put in cattle's ears to identify them. Every producer uses their own numbering system. They can easily be removed. These differ from official ID tags such as brucellosis and bright tags.

Feeder Cattle
Cattle of either sex that are ready to go to a feedlot (600-800 pounds) or are in a feedlot but have not reached full market weight (1,100-1,500 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.

Glossary

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.

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).

Foreign Animal Disease Diagnostician (FADD)
A veterinarian who has taken the APHIS foreign animal disease training course at Plum Island and who receives continuing education in FADs and animal health emergency management.

Foreign Animal Disease/Emerging Disease Incident (FAD/EDI) Investigation
On-site assessment conducted by a foreign animal disease diagnostician, as part of the national surveillance program for exotic or emerging animals diseases.

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.

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 and stored such 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.

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.

Glossary

Inshipments
Total number of animals moved into a state for feeding or breeding purposes, excluding animals brought in for immediate slaughter. Also known as received shipments.

Maximum Incubation Period
The longest period which elapses between the introduction of the pathogen into a susceptible animal and the occurrence of the first clinical signs (or other epidemiological evidence) compatible with the FAD agent.

Melengestrol Acetate (MGA)
Progesterone-like feed additive that is used to prevent estrus (coming into heat) in heifers.

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.

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.

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).

Protection Vaccination Zone (PVZ)
Emergency Vaccination Zone typically 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.

Rate of Gain
The number of pounds (weight) an animal gains in a day or 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.

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.

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

Glossary

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.

Unfinished Cattle
Cattle still on feed and not ready for harvest.

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.

Select Feedlot Industry Terminology

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 scrotum and sloughing of the testicles in about two weeks.

Cattle Liners/Pots
Large trailers usually pulled by semi-trucks that are specially designed for the transport of cattle.

Chronic
An animal that has failed to recover satisfactorily from a disease. These animals usually become realizers/railers.

Horn Buttons
Small horn growths on immature animals.

Finished or Live Cattle
Cattle that have grown to full market weight and are ready for harvest (somewhere between 1,100 pounds and 1,500 pounds).

In the Beef
Finished cattle that were marketed to a packing plant based on carcass weight.

Pen Rider
Feedlot employee or contract laborer who walks or rides through a pen of cattle monitoring them for signs of illness.

Polled
Animals that possess the 'polled' gene which prevents cattle from growing 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.

Pull
Term used to describe an animal identified as sick and removed from its home pen and taken to treatment area by a pen rider.

Realizers/Railers
Undesirable cattle that are sold and processed for purposes other than human consumption.

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.

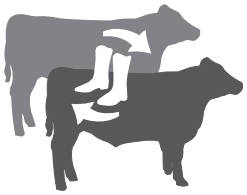
Bovine Routes of Transmission and High Consequence Disease Examples

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).

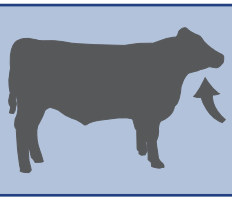
Direct Contact: A susceptible animal becomes exposed when the disease agent directly touches open wounds, mucous membranes, or the skin through blood, saliva, nose to nose contact, rubbing, or biting. Examples include CBPP, FMD, lumpy skin disease, MCF, rinderpest, VS.

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

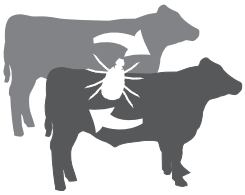


Fomite: An inanimate object carrying a disease agent from one susceptible animal to another. Examples include FMD, VS.

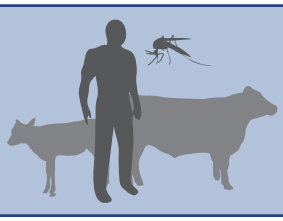
Traffic: A subtype of fomite transmission in which a vehicle, trailer, or human spreads organic material to another location.



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.*

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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 feedlot 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 feedlot. These measures should be put into place **IMMEDIATELY** on your feedlot *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 feedlot 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 feedlot or to other feedlots, 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 feedlot 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 feedlot 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 feedlot.

Feedlot Entrance

Limit access to your feedlot.

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

Post signs at the feedlot entrance (Appendix A).

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

Restrict or limit visitors on your feedlot.

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

Strict biosecurity measures must be followed by any visitors to the feedlot.

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

- Check-in with feedlot personnel upon arrival (direct visitors to "where" they should check in).
- Be accompanied by someone from the feedlot 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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- Visitors and vehicles should avoid contact with animals, animal feed, or animal areas unless absolutely necessary.
- If animal contact is necessary, wear clean feedlot-specific protective clothing (e.g., coveralls, boots) while on the feedlot. Guide visitors to where protective clothing is located. These items should remain on-feedlot when the visitor leaves.

Monitor and record all traffic on or off your feedlot.

Maintain a log sheet (Appendix B) of all visitors and vehicles that enter your feedlot. Accurate record keeping of traffic on your feedlot 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 feedlot.

Vehicles

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

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

Clean and disinfect vehicles prior to entry and upon leaving.

- All vehicles entering the feedlot 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 feedlot in a location that accounts for drainage.

Do not share equipment or vehicles between feedlots or sites.

People

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

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 feedlot.

Implement strict biosecurity measures for employees coming onto the feedlot.

- Clean boots, hats and coveralls must be worn while on the feedlot. These should be provided by your feedlot.
- Protective clothing should remain on your feedlot and be washed and/or disinfected before being worn again.
- Minimize contact with animals to only tasks necessary for the continued operation of the feedlot 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 feedlot'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 feedlot.

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.

Working horses must remain on the feedlot 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 pens on the feedlot.
- 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 feedlot 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 feedlot 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 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

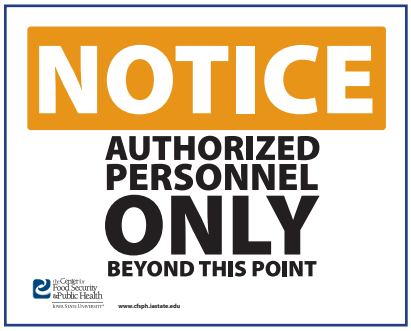
Clean and disinfect anything that has had contact with animals, manure or animal secretions.

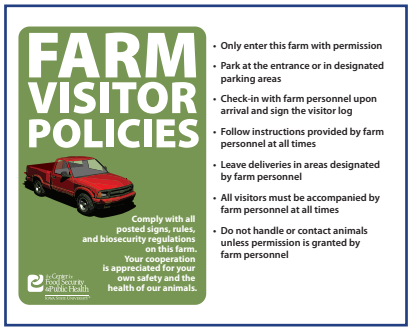
- This includes barns and buildings, vehicles, trailers, equipment, and supplies.
- Tires and wheel wells of vehicles and trailers are especially important.
- Surfaces should be scraped, cleaned with high pressure hot water and detergent, and rinsed.
- The disinfectant should then be applied and allowed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

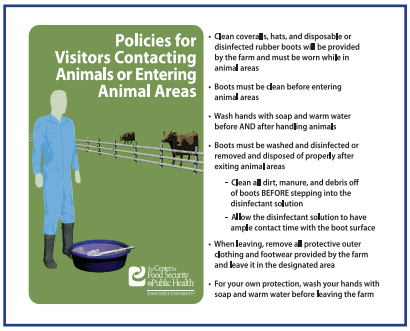
Appendix A - Sample Signs

Sample signs to post at the feedlot 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.

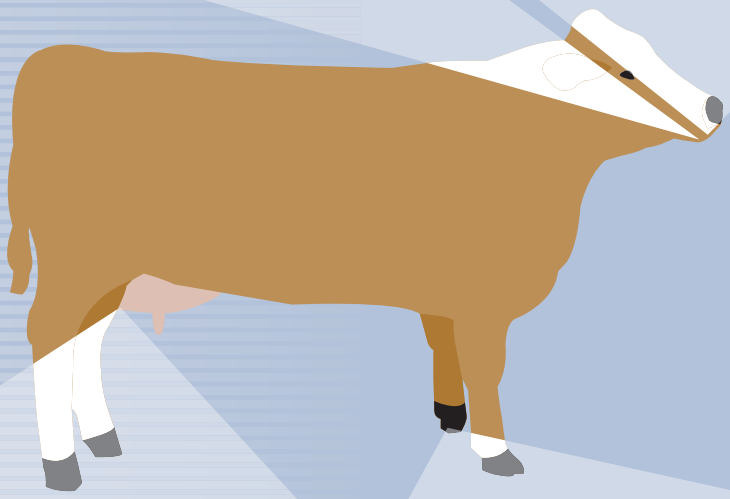
Appendix B - Daily Visitor Log

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 feedlot.

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, feedlot 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/FeaturedArticle/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 were 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 feedlot that could get sick (cattle, sheep and goats) 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 feedlot. These measures should be put into place **IMMEDIATELY** on your feedlot *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 feedlot 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 feedlot 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 feedlot.

Feedlot Entrance

Limit access to your feedlot.

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

Post signs at the feedlot entrance (Appendix A).

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

Restrict or limit visitors on your feedlot.

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

Strict biosecurity measures must be followed by any visitors to the feedlot.

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

- Check-in with feedlot personnel upon arrival (direct visitors to "where" they should check in).
- Be accompanied by someone from the feedlot at all times to ensure biosecurity measures are being followed.
- Visitors and vehicles should avoid contact with animals, animal feed, or animal areas unless absolutely necessary.

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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Iowa State University®

- If animal contact is necessary, wear clean feedlot-specific protective clothing (e.g., coveralls, boots) while on the feedlot. Guide visitors to where protective clothing is located. These items should remain on-feedlot when the visitor leaves.

Monitor and record all traffic on or off your feedlot.

Maintain a log sheet (Appendix B) of all visitors and vehicles that enter your feedlot. Accurate record keeping of traffic on your feedlot 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 feedlot.

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 feedlot.

- 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 feedlot.

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 feedlot.

- 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.

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.

Prevention Practices for Rift Valley Fever (RVF)

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

- Do not bring animals onto your feedlot 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 feedlot 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 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 livestock 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

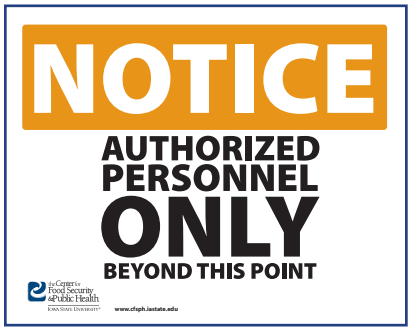
- Rift Valley Fever fact sheet, Center for Food Security and Public Health, Iowa State University, November 8, 2006, available at: *http://www.cfsph.iastate.edu/Factsheets/pdfs/rift_valley_fever.pdf*

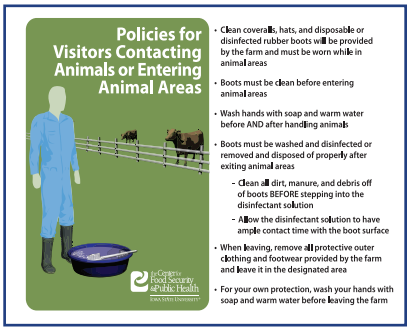
- Zoonoses and Communicable Diseases Common to Man and Animals. Rift Valley Fever. Published by the Pan American Health Organization. 2003.

Appendix A - Sample Signs

Sample signs to post at the feedlot entrance in the event of a RVF outbreak in the U.S.

(Available from the CFSPH web site at *www.cfsph.iastate.edu*)



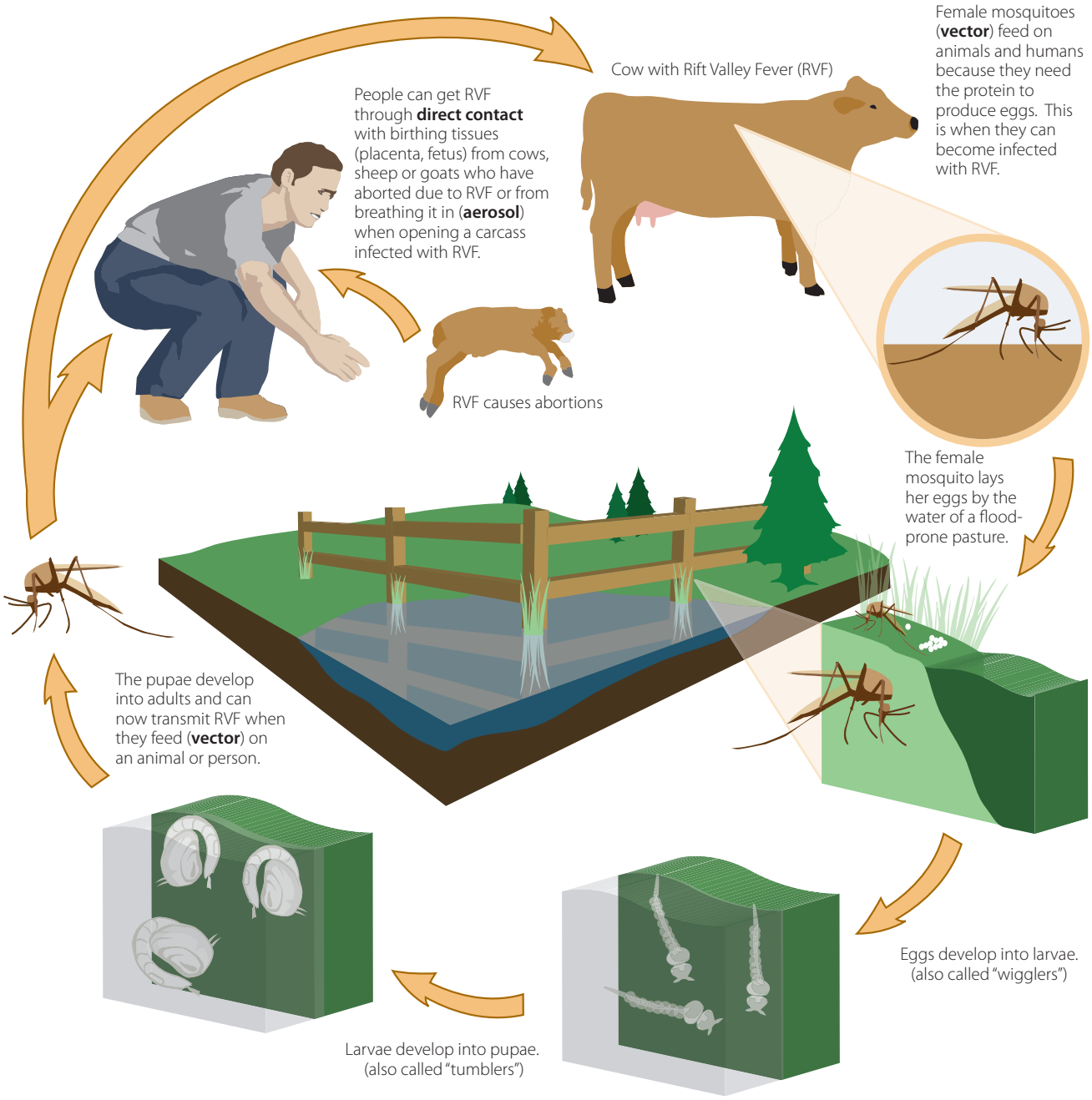


Signage is also available from private companies such as Gempler's.

Appendix B - Daily Visitor Log

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

Appendix C - Transmission Routes of Rift Valley Fever



Graphic Created by Clint May, CFSPH

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 feedlot.

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*

- Potter MF, Townsend L, Knapp FW. Mosquitoes: Practical Advice for Homeowners. University of Kentucky Department of Entomology. *http://www.uky.edu/Agriculture/Entomology/entfacts/misc/ef005.htm*

- 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 feedlot is confirmed to have heartwater, all animals on the feedlot 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 feedlot. These measures should be put into place **IMMEDIATELY** on your feedlot 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 feedlot 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 feedlot 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 feedlot.

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 July 2011) 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.

Feedlot Entrance

Limit access to your feedlot.

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

Post signs at the feedlot entrance (Appendix B).

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

Restrict or limit visitors on your feedlot.

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

Strict biosecurity measures must be followed by any visitor to the feedlot.

Some visitors are essential for the continued operation of the feedlot. Establish strict biosecurity procedures for

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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these individuals, then inform them of the measures to follow while on your feedlot.

- Check-in with feedlot personnel upon arrival. (Direct visitor to "where" they should check-in).
- Be accompanied by someone from the feedlot 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 feedlot-specific protective clothing (e.g., cover-alls, boots) while on the feedlot. Guide visitors to where protective clothing is located. These items should remain on-feedlot when the visitor leaves.

Monitor and record all traffic on or off your feedlot.

Maintain a log sheet (Appendix C) of all visitors and vehicles that enter your feedlot. Accurate record keeping of traffic on your feedlot 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 feedlot.

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 feedlot 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 feedlot 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 feedlot.

- Do not bring animals onto your feedlot 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 feedlot (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 feedlot 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 feedlot.

- All visitors should be accompanied by someone from the feedlot 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 feedlots 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/kin8/05ksnew8.htm*

- Sumner, J. W., Durden, L. A., Goddard, J., Stromdahl, E. Y., Clark, K. L., Reeves, W. K., Paddock, C. D. 2007. Gulf Coast ticks (Amblyomma maculatum) and Rickettsia parkeri, United States. *Emerg. Infect. Dis.* 13: 751-753.

- Texas A&M Discover Entomology website. 'Honey, I'm Ready': Signals of Gulf Coast Tick accessed November 4, 2005 at *http://insects.tamu.edu/feature/tick/*

- Trout, R.T., Steelman, C.D., Szalanski, A.L., Loftin, K. 2010. Establishment of Amblyomma maculatum (Gulf Coast Tick) in Arkansas, U.S.A. Florida Entomologist .93:120-122.

- USDA APHIS VS Heartwater Fact sheet July 2002 accessed November 4, 2005 at *http://www.aphis.usda*.

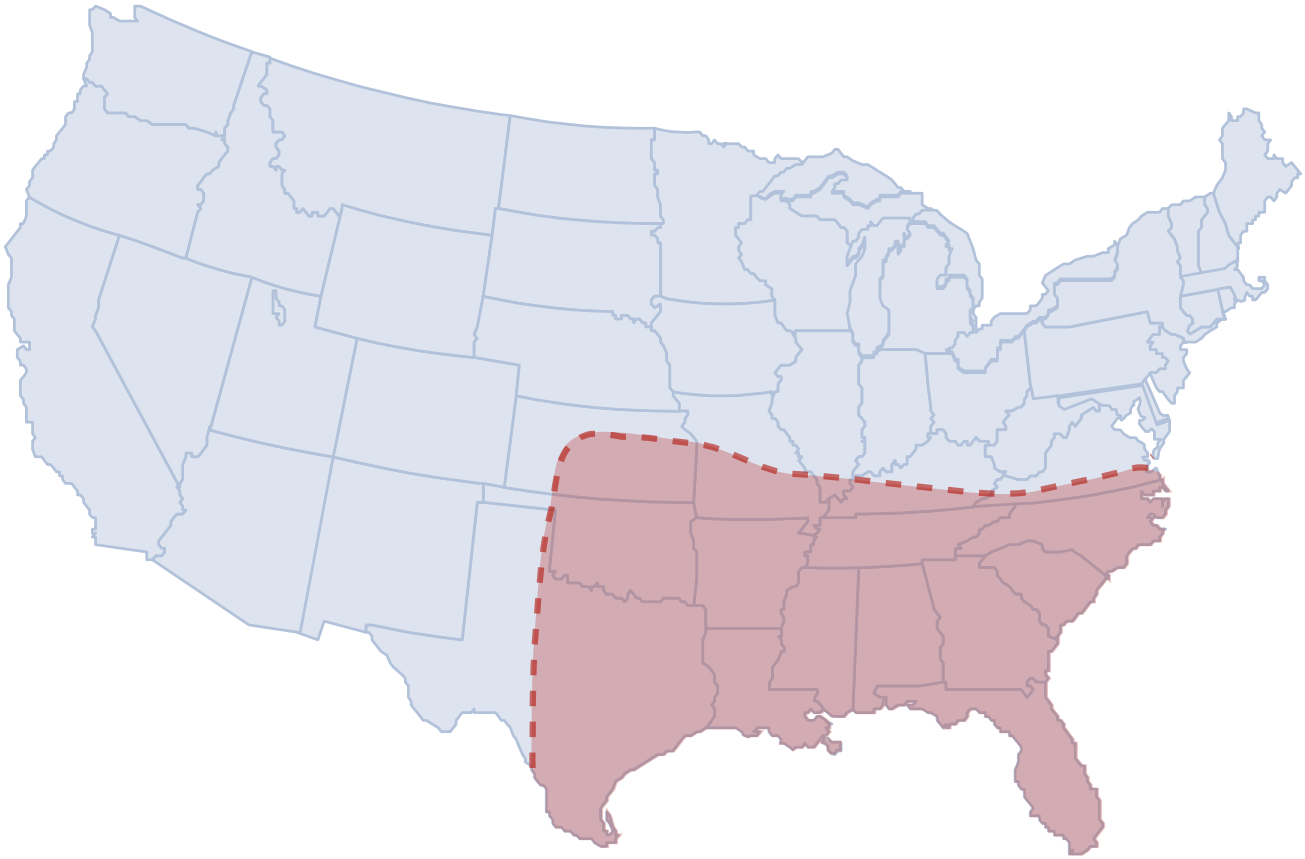
- USDA APHIS. 2008. Assessment of change in risk for release of Ehrlichia ruminantium (Heartwater) into the continental United States following discontinuation of the Tropical Bont Tick (Amblyomma variegatum) eradiation program on St. Croix, U.S. Virgin Islands. Centers for Epidemiology and Animal Health.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

Approximate Distribution of the Gulf Coast Tick

(*Amblyomma maculatum* Koch)

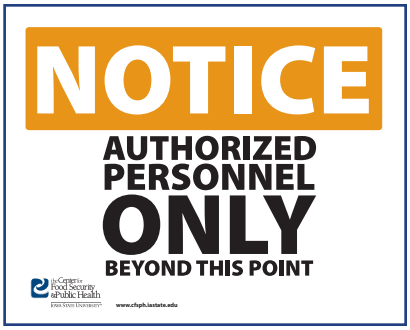


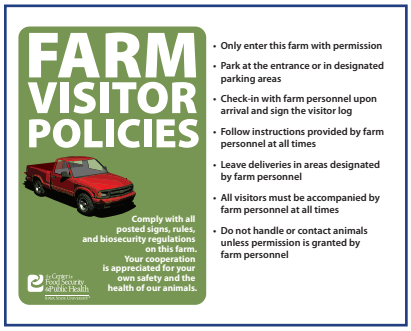
Gulf Coast Ticks have been identified in the environment and on animals in specific areas in the shaded region *(as of July 2011)*.

Definitive boundaries uncertain

Appendix B - Sample Signs

Sample signs to post at the feedlot 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

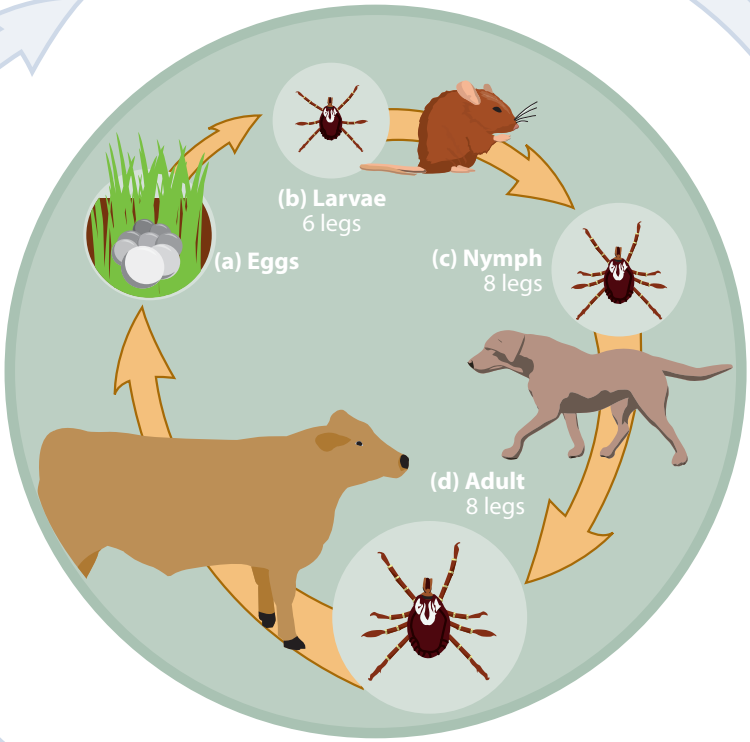
Visit Date	Name and Phone Number	Reason for Visit	Date and Location of Last Contact with Livestock	Time In	Time Out

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.

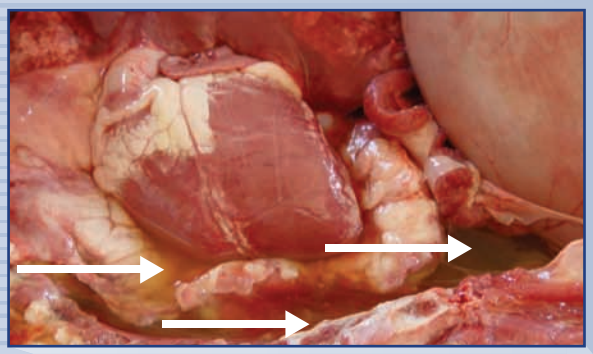
d) Adults with 8 legs molt from nymphs on the ground.

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.

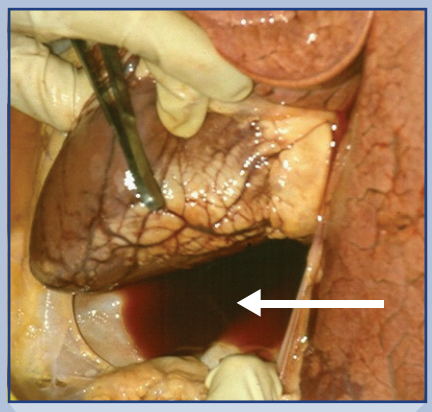
After feeding and mating, the female adult will drop to the ground and lay her eggs.

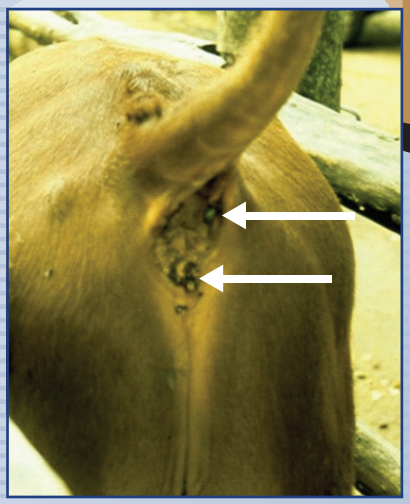
Appendix E - Signs of Illness in Cattle

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 chlopyrifos 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 chlopyrifos 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 infection: 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 lesions:** 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.

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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**
- Sender could be fined from $250-$500,000
- Sender could face up to 5 years in prison

Common Carriers and Package Suppliers

Carriers

Federal Express	*fedex.com*	800-463-3339
U.S. Postal Service	*usps.com*	800-275-8777
UPS	requires Hazmat Account	

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 &/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

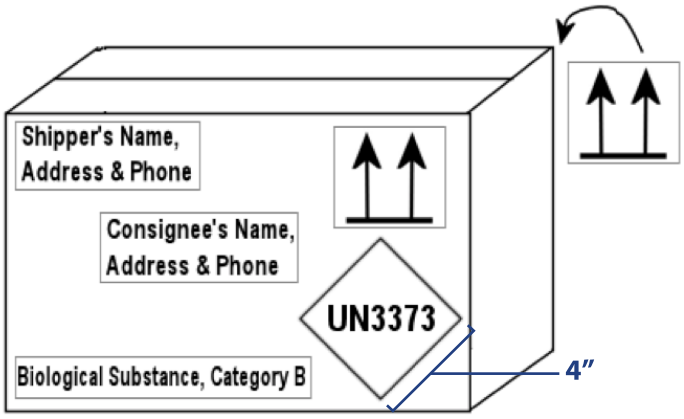
sealed container. ALL samples in primary containers must be double bagged (secondary container) and adequate absorbent placed in the secondary container.

- 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

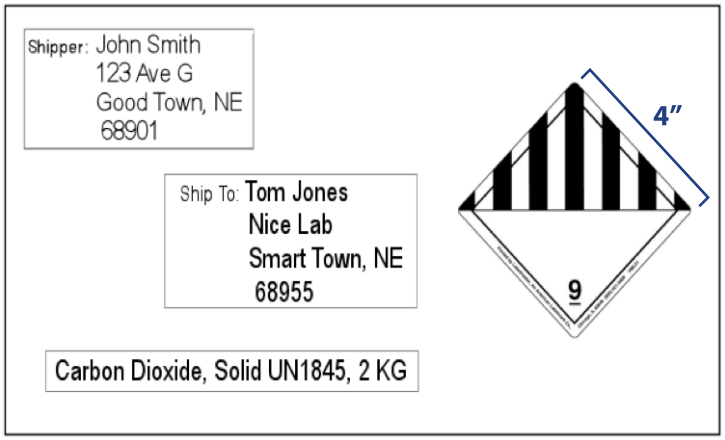
Postal Service regulations require that all clinical specimens sent by U.S. Mail be shipped:

- 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 <u>two sides</u> 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)