DAIRY 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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Dairy Industry Manual

The Foreign Animal Disease Preparedness and Response Plan (FAD PReP) Dairy Industry Manual provides an overview of U.S. dairy production methods to enhance understanding of normal business operations and the inherent high risk disease transmission behaviors in order to effectively aid in containing or eradicating a highly contagious foreign animal disease outbreak 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.

The FAD PReP Dairy Industry Manual was last updated in March 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. For example, the 2001 FMD outbreak in the United Kingdom cost an estimated £8 billion ($13 billion) and reduced the British gross domestic product by 0.2 percent. Studies have projected a likely cost of between $6 billion and $14 billion for a U.S. outbreak contained to California. In addition to the economic impact, the social and psychological impact on both producers and consumers would be severe.

CHALLENGES OF RESPONDING TO AN FAD EVENT

An FAD outbreak will be challenging to 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 other countries have allowed us to learn important lessons that can be applied to preparedness and response efforts. To achieve successful outcomes in future FAD outbreaks, 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.
- Execute FAD tracing, which is essential for the efficient and timely control of FAD outbreaks.

FAD PREP MISSION AND GOALS

The significant threat and potential consequences of FADs and the challenges 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 de-conflict 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.*

FAD PReP DOCUMENTS AND MATERIALS

FAD PReP is not just one, standalone FAD plan. Instead, it is a comprehensive U.S. 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 Framework for Foreign Animal Disease Preparedness and Response:* This document provides an overall concept of operations for FAD preparedness and response for APHIS, explaining the framework of existing approaches, systems, and relationships.
- *National Center for Animal Health Emergency Management (NCAHEM) Stakeholder Coordination and Collaboration Plan:* This plan describes NCAHEM strategy for enhancing stakeholder collaboration and identifies key stakeholders.
- *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.

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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 strategic documents or disease-specific response plans.

Continuity of Business 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.

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 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 highly pathogenic avian influenza.

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

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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 Dairy Industry Manual" and provide further details when necessary. This document references the following APHIS documents:

- APHIS Framework for Foreign Animal Disease Preparedness and Response

- FAD PReP/NAHEMS Guidelines:
  - Appraisal and Compensation (2011)
  - Biosecurity (2011)
  - Cleaning and Disinfection (2011)
  - Disposal (2011)
  - 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):
  - Appraisal and Compensation (2011)
  - Biosecurity (2011)
  - Cleaning and Disinfection (2011)
  - Disposal (2011)
  - Surveillance, Epidemiology, and Tracing (2011)
  - Personal Protective Equipment (2011)
  - Mass Depopulation and Euthanasia (2011)
  - Vaccination for Contagious Diseases (2011)
  - Wildlife Management and Vector Control (2011)

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

- Secure Milk Supply (SMS) Plan Biosecurity Performance Standards (Draft 2011)

- VS Memo 580.4 Procedures for Investigating a Foreign Animal Disease/Emerging Disease Incident (FAD/EDI) October 2008

These documents are available on the FAD PReP collaboration website at: *https://fadprep.lmi.org.* Username and password can be requested.

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Purpose

This industry manual provides a broad overview of U.S. dairy 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 could severely impact industries with susceptible livestock as well as allied industries and service providers. A quick, effective, and well-coordinated response can minimize harm to the dairy industry. Wide dissemination of this information is encouraged to establish open communication between regulators and producers with the goal of reducing the probability that animals 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 dairy industry and appreciate 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 dairy operations should familiarize themselves with this manual. Livestock producers and any support personnel interacting with dairy operations 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 reduce the chance of becoming infected.

Scope

This manual is divided into two parts plus acronyms, glossary, and appendices.

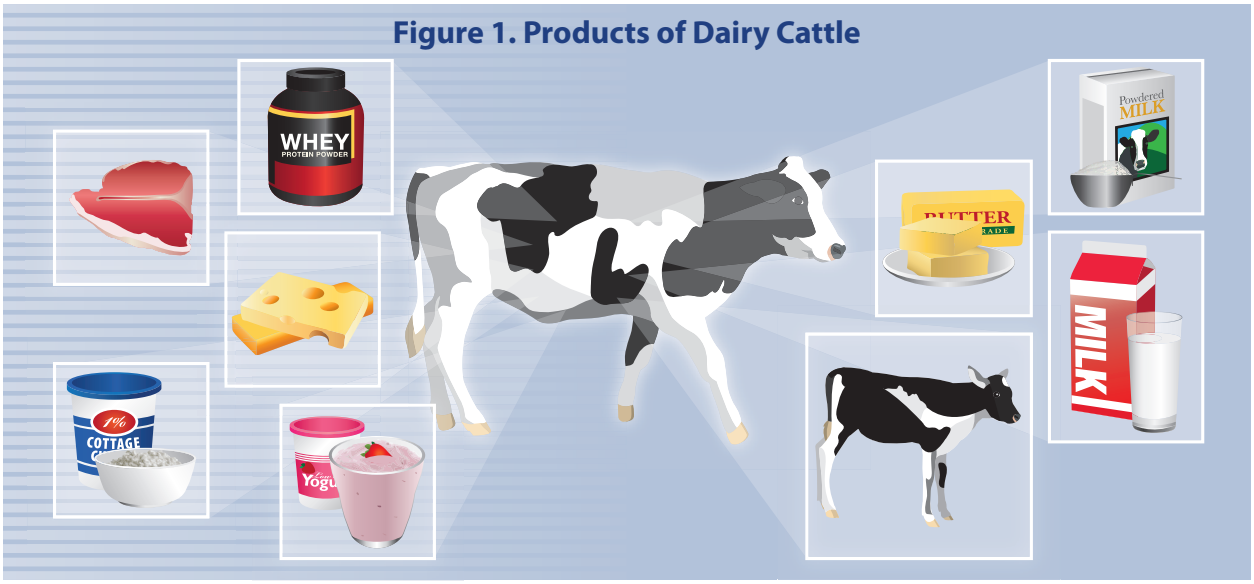
- Part I describes normal activities on U.S. dairy operations reviewing life stages and animal husbandry, facility types, and animal and product movement.
- Part II describes the response to prevent or mitigate the spread of a highly contagious foreign animal disease, such as foot-and-mouth disease (FMD) or Rift Valley fever (RVF) including designated zones and areas, providing animal care and options for product handling.
- Acronyms and glossary explain the terms used in the dairy industry and in emergency response.
- Disease specific biosecurity measures are found in the appendices: Foot-and-mouth disease prevention practices, Rift Valley fever prevention practices

Learning Objectives

Upon reviewing this manual, readers will be able to:

1. Recognize the various types of housing used for dairy calves, growing heifers and adult cattle;
2. Explain the animal care needs of dairy calves, heifers and adult cattle;
3. Illustrate FAD response zones and areas used in quarantine and movement control efforts and explain classifications of premises in a response;
4. Implement biosecurity measures and surveillance activities on a dairy farm to prevent highly contagious foreign animal disease entry and monitor its presence/absence;
5. Monitor the handling of milk product (treatment, disposal, transportation) during an animal health event;
6. Communicate with supervisory personnel and/or the regulatory officials regarding dairy farm status (animal needs, biosecurity measures in place, test results, tracebacks/traceouts, product movement); and
7. Determine biosecurity deficiencies that increase a premises probability of becoming infected or transmitting the highly contagious FAD.

Figure 1. Products of Dairy Cattle



PART I: UNITED STATES DAIRY PRODUCTION

1. SCOPE OF THE DAIRY INDUSTRY

The dairy industry is represented in each of the 50 states as well as Puerto Rico. Like many animal agriculture industries, the number of dairy operations has decreased over the last 10 to 20 years with more animals on remaining farms. The U.S. dairy industry is diverse in size and scope, from larger-sized, specialized operations that focus solely on milking cows to small and medium-sized operations that milk cows while farming crop ground for feed and raising all of their replacement animals on farm.

Dairy operations produce a safe food source for the United States and the world. Milk provides 73% of the calcium in the U.S. food supply. Dairy products include fluid milk, ice cream, butter, cheese, yogurt, cottage cheese, whey proteins, and skim milk powder as illustrated in Figure 1. Dairy operations also contribute to beef production from bull calves raised for veal or fed out as steers and market (cull) cattle. The dairy industry plays an important economic role in the U.S. with 2009 cash receipts from marketing 188 billion pounds of milk to processing plants and consumers totaling $24.3 billion. Allied industries, employment on farms, dairy processing plants, distributors, and local communities surrounding dairy operations all derive financial benefit from this important animal industry.

Regulatory authorities are encouraged to work with dairy operations to develop a common understanding of movement control procedures, premises biosecurity recommendations, and mitigation strategies in the event of a highly contagious FAD incursion. Interactions with key management personnel to understand their operation prior to an animal health event will help minimize the extra time, effort, and cost that will accompany a "one-size fits all" approach to containing and ultimately eradicating a highly contagious FAD.

1.1 Cattle Numbers

In 2009, there were 9.20 million dairy cows on 62,500 dairy premises in the United States. The top 5 dairy states based on cattle numbers are listed in Table 1. Individual cows produced, on average, 20,576 pounds a year in 2009 with overall milk production reaching 189 billion pounds. The majority of milk was sold as Grade A or fluid grade (188 billion pounds) with the remaining milk fed to calves on farm (89%) or consumed by producers (11%). In 2009, there were 10 states that reported sales of Grade B (manufacturing grade) milk. Table 2 lists the distribution of dairy cattle by operation size, percent inventory and production for 2010. There were 55,100 dairy operations with less than 200 head that accounted for 26.3% of the annual milk production. Herds with greater than 200 dairy cows produced the remaining 73.7% of milk.

Sources:

- *USDA NASS. Milk Production, Disposition and Income 2009 Summary, April 2010, p. 7, accessed March 6, 2011 at http://usda.mannlib.cornell.edu/usda/current/MilkProdDi/MilkProdDi-04-29-2010.pdf.*
- *Farms, Land in Farms, and Livestock Operations, 2010 Summary, February 2011, Accessed March 6, 2011 at http://usda.mannlib.cornell.edu/usda/current/FarmLandIn/FarmLandIn-02-11-2011_revision.pdf*

Table 1. Top Five Dairy Cattle States by Number of Head, U.S., 2009

State	*Cow Numbers (x1000)*	*Average Production per Cow Per Year (lbs.)*
California	1,796	22,000
Wisconsin	1,257	20,079
New York	619	20,071
Idaho	550	22,091
Pennsylvania	545	19,360

Source: USDA NASS Millk Production, Disposition, and Income 2009 Summary, April 2010, p. 7, accessed March 6, 2011 at *http://usda.mannlib.cornell.edu/usda/current/MilkProdDi/MilkProdDi-04-29-2010.pdf*

Table 2. Number of Dairy Operations, Percent Inventory and Percent Production by Size Group, U.S., 2010

Size Group	*Number of Operations*	*Percent of Inventory*	*Percent of Production*
1 - 29	20,000	1.7	1.1
30 - 49	11,000	4.9	3.5
50 - 99	15,500	11.8	10.4
100 - 199	8,600	12.3	11.3
200 - 499	4,000	12.8	12.7
500 - 999	1,700	12.6	13.0
1,000 - 1,999	920	13.3	15.5
2,000+	760	30.8	32.5

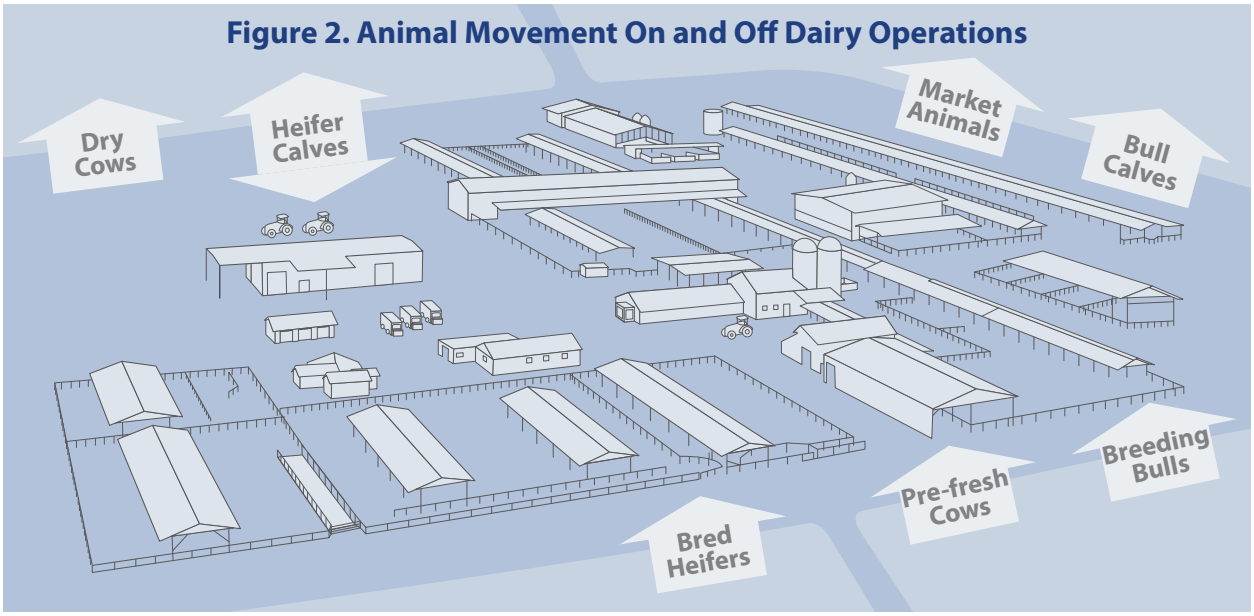
Source: Farms, Land in Farms, and Livestock Operations, 2010 Summary, February 2011, Accessed March 6, 2011 at *http://usda.mannlib.cornell.edu/usda/current/FarmLandIn/FarmLandIn-02-11-2011_revision.pdf*

1.2 Animal Production

1.2.1 Location and Movement

Dairy operations are located in all 50 states, any of which could be affected by a highly contagious FAD outbreak in cattle. Groups of animals that may move on and off dairies include calves, growing heifers, bred heifers, bred cows, dry cows, breeding bulls, and market (cull) animals to auctions or slaughter as depicted in Figure 2. Non-lactating young stock (heifer/bull calves and replacement heifers) may be moved off farm for rearing and the heifers returned to the operation by calving or before. Some dairy operations sell bull calves shortly after birth; others will raise them to weaning and sell them or keep them as fed steers on farm if feed and facilities are available. Dairy bull calves can either enter the veal market or be fed out as steers. Along with market (cull) cows, dairy bull/steer beef comprises 20% of the beef market in the United States. A small percent of dairy bulls are retained for natural breeding purposes or raised as breeding bulls and shipped singly or in groups to dairies throughout the U.S. Some high genetic merit bulls may be moved to a reproductive center for semen collection. Adult cows with reproductive merit can be moved to embryo transfer facilities. Animals of all ages may move off farm to fairs, shows (return to farm) or can also be sold to other operations (via private sale or purebred auctions) or auction markets.

Figure 2. Animal Movement On and Off Dairy Operations



Newborn calves can be moved to facilities which will rear them for various timeframes (ownership may or may not be retained). These facilities may raise just heifer calves, just bull calves or both. Off-site rearing facilities raise calves through weaning, up to breeding, or just before calving (for heifers) depending upon their business model and clients' needs. There are various levels of record keeping for these movements. Regulations require that animals moved out of state must be accompanied by a Certificate of Veterinary Inspection (CVI) serving as a record of animal movement unless moving to slaughter. In-state movements, especially those without a change in ownership or management, are not as commonly documented. Calf ranches in the western and southern U.S. can receive animals from dozens of states and may include feedlot facilities that also receive Mexican cattle. Midwest heifer raisers receive calves from western dairies, as well as Midwest operations. Eastern calf raisers typically receive calves from east of the Mississippi River. On any given day, you can find calves from multiple states on one given calf/heifer facility. With the decrease in required brucellosis vaccinations for heifers in many states, animal movement records and accountability have decreased in recent decades and data for actual movement numbers are unavailable.

In the National Animal Health Monitoring System (NAHMS) Dairy 2007 study conducted by USDA, 97% of all dairy operations reported they had some replacement animals enter the lactating herd in 2006. The replacements could have been heifers raised on-farm, retained ownership heifers raised off-site, as well as purchased animals from throughout the U.S. and Canada. In this same study, 11.5% of all replacement heifers in the U.S. were raised off-farm, the majority of which were commingled with animals from multiple sources during rearing. Almost 40% of all dairy operations introduced at least one new animal from an off-farm source during 2006, with lactating dairy cows being the most frequently introduced (13.8%). Some segments of the dairy industry are very mobile with animal movements occurring with or without documentation. It is likely to be challenging in a highly contagious FAD outbreak to rapidly identify potentially exposed animals and quickly contain disease spread.

Source:

- *NAHMS Dairy 2007 Part I: Reference of dairy cattle health and management practices in the United States, 2007. US Department of Agriculture: Animal and Plant Health Inspection Service: Veterinary Services, Center for Epidemiology and Animal Health, accessed Sep 14, 2008*

USDA NAHMS Dairy 2007 Study

Introduced replacement animals	**97.0%**
Replacements raised off-site	**11.5%**
At least one new animal	**40.0%**
• Lactating cows	**13.8%**

1.2.2 Diverse Workforce

Farm workers who speak English as a second (or third) language are employed on dairies throughout the United States. These workers may have recently arrived in the U.S. and live in communal arrangements with employees from other dairies or other livestock operations. Cultural and language differences may present a communication barrier and hinder response efforts in the event of a highly contagious foreign animal disease outbreak. Some workers may be skeptical and afraid of government officials and 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 dairy workforce, which in the U.S. consists of Anglo-Americans, people of Hispanic descent, Portuguese, South Americans, South Africans, Eastern Europeans, and immigrants from the Netherlands, can help establish a successful working relationship.

Some employees may not be comfortable with communicating with officials, so identifying the primary facility manager is important. Working with that person to communicate tasks to the other employees can help with acceptance and with coordination of the work. A translator can be very beneficial to overcome language and cultural barriers. If language barriers still exist, demonstrating concepts or tasks can be helpful. Having a variety of educational tools, the more visual the better (pictures, videos, demonstrations), can be an effective way of communicating. Being aware of ethnic and cultural differences is critical for effective communication so that disease prevention practices can be implemented.

Depending on the highly contagious FAD, strategies to control its spread could include mass depopulation of infected animals and subsequent disposal on farm 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 lives and a source of livelihood. Returning to an empty farm in subsequent days/weeks may also be another psychologically upsetting situation. Providing a support network for owners and their workers, again in an ethnically and culturally acceptable format, needs to be part of preparedness plans at the local level.

1.2.3 Business Continuity

The dairy industry relies on continuous animal and product movement (animals to/from the facility, feed delivery, supply delivery, milk to processing plants, animals to slaughter) as part of their normal business structure. In the event a highly contagious foreign animal disease is diagnosed in the U.S., stop movement orders may be implemented until an investigation can identify the infected, suspect and at-risk premises. This could involve a local community, an entire state or a large region of the country. During this time, dairy operations with uninfected animals will need to ensure the animals in their care continue to receive the necessary items to make sure they are fed, watered, healthy, and comfortable. If traffic flow is disrupted, milk movement off farm may not occur and plans for dealing with this situation should be discussed with processors prior to an event. Preparedness plans at the farm level, with suppliers, milk processors and state officials are essential to ensure animal welfare needs are met and milk movement returns as quickly as possible.

In order for business, which involves animal, people and milk movement, to continue, uninfected dairy operations in the Control Area (see Section 6. Designation of Zones, Areas and Premises) will need to cooperate with regulatory officials on many levels. The first critical control point for the business is biosecurity. The facility also needs to document they are not 'at-risk' of exposure to the highly contagious FAD. Records of animal movement, people movement, supplies received, milk pickup details, as well as documented cleaning and disinfection protocols are some examples of what will be needed to verify exposure status. Once that is complete, surveillance will be implemented to monitor the infection status of the animals through visual exams and diagnostic testing. For animals or milk to be moved, demonstrating negligible risk for the spread of the disease of concern is vital. This could be done through risk assessments or surveillance and diagnostic testing, if available. Permitting is the final step in the process. If the animals or milk needs to move to another in-state facility, this would involve the state officials for the farm of origin. If it is an interstate movement, officials from the origin and destination state, along with all states in between will need to be in agreement with

the movement. This is a difficult decision and one that will be considered fully; information provided by the dairy operation will aid in this effort. Business must continue to ensure the welfare of the animals, the livelihood of the producers caring for them, an outlet for milk products, and product availability to consumers, while ensuring that highly contagious FAD transmission will not occur. Record keeping, transparency, and cooperation on all levels will be vital.

1.3 Milk Production

1.3.1 Regulations/Inspections

The Food and Drug Administration (FDA) provides the regulatory oversight of all milk produced for commercial sale in the United States. The FDA, in combination with the U.S. Public Health Service, publishes the Pasteurized Milk Ordinance (PMO) which is the guideline that all 50 states have adopted as their regulation for the production of Grade A (fluid grade) milk and milk products. All fluid milk for commercial sale is Grade A which is produced and processed under rigid sanitary regulations in approved and inspected facilities. The USDA (under the guidance of FDA) assists states in establishing regulations for Grade B (manufacturing grade) milk. Grade B is also produced and processed under sanitary conditions, although less strict than Grade A, and can only be used in manufactured products like cheese or butter.

State regulatory agencies license dairy operations in their state. Annual inspections of dairy farms are conducted by the state or local agencies approved by the state. State employed inspectors ensure milk is collected on farm in a manner that promotes disease control, appropriate handling/storage of antibiotics, animal welfare, and food safety but they do not monitor animal health status. Contact information for all dairies that market milk in a State is kept by the licensing agency, typically the State Department of Agriculture or State Department of Health. This information may also be obtained from the dairy processing facilities.

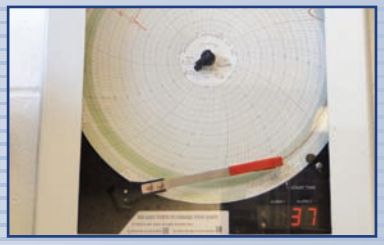
Raw milk transported from the dairy to the milk processing plant is carried in large bulk milk tankers with up to 8000 gallon capacity. The bulk milk hauler must be licensed by the State regulatory agency to perform the duties of measuring, sampling, pumping, and transporting milk. Haulers are evaluated at least once every two years to ensure they follow proper protocols and procedures as established by FDA. Milk haulers must possess a permit from the state(s) where milk is collected and sampled. One milk tanker can pick up one farm or as many as needed to fill the tanker before returning to the milk processing facility for delivery.

Source:

- *Bulk Milk Haulers Training Manual, Wisconsin Dept of Ag, Trade and Consumer Protection accessed July 3, 2009 at http://datcp.state.wi.us/fs/licenses/bmw&s_manual.pdf*

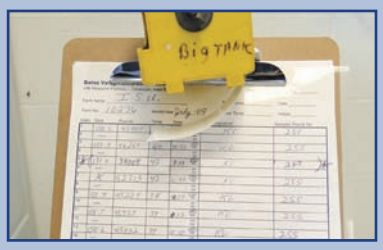
1.3.2 Transportation Methods and Protocols

Milk stored on farm in bulk tanks is picked up every other day, once a day or multiple times per day based on milk production and storage capability. Upon arrival of the bulk milk hauler, the following steps occur:



Read Milk Temperature

Attach Hose



Record Milk Weight

1. Bulk tank is opened and the milk's odor evaluated.
2. Temperature of the bulk tank is read and recorded (the Pasteurized Milk Ordinance states milk must be between 40° and 45°F [4.4-7.2°C] within 2 hours of milking – industry standards prefer a lower temperature of 36-40°F [2.2-4.4°C]).

3. Milk hose connected to truck is brought through port opening into milk room and attached to bulk tank.
   - Milk weight is determined using calibration instrument specific to bulk tank and recorded on weight ticket on farm, along with milk haulers name, license, time of sampling, temperature of milk, date of pick-up.
4. Milk is agitated and sample collected in a labeled container, placed in a cooler and later delivered to milk processing plant for antibiotic screening and components analysis.
5. Milk is pumped from bulk tank into tanker and hose disconnected when done.
   - Hose remains on farm and is sanitized with the rest of the equipment. **OR**
   - Hose is capped and placed in storage compartment on truck until used to unload milk on the next farm or to be cleaned and sanitized at the milk processing plant.
6. Bulk tank is rinsed with water.

Place Sample in Cooler

Disconnect Hose

Rinse Tank

A universal sampling system requires that samples are collected every time milk is picked up at the farm, permitting the Regulatory Agency to analyze samples collected by the bulk milk hauler at anytime without giving notice to the industry.

1.3.3 Viability of Product

Grade "A" raw milk and milk products for pasteurization or aseptic processing must be cooled to 50°F (10°C) or less within four hours or less from the start of the first milking and to 45°F (7.2°C) or less within two hours after the completion of milking. Bulk milk tanks on farm should be emptied at least every 72 hours.

Pasteurization of milk reduces the number of pathogens found in milk; however it does not sterilize it. Temperatures and holding times are specific for each pasteurization method (Table 3). High temperature, short time (HTST) pasteurization is the most common method because it allows for large quantities of milk to be pasteurized in a timely manner. With the exception of ultra-pasteurization and aseptic milk processing, different pasteurization techniques produce very similar results. When utilizing vat pasteurization, it is important to verify that the product was held at the minimum pasteurization temperature for 30 minutes. This time period should not include vat filling, preheating, emptying, or cooling steps/times.

Source:

- *2007 FDA Pasteurized Milk Ordinance (PMO) 2007, Food and Drug Administration website accessed June 9, 2009*

Table 3. Pasteurization Time, Temperature

Time	*Temperature*
30 minutes	145°F (63°C) Vat pasteurization
15 seconds	161°F (72°C) HTST pasteurization
1.0 second	191°F (89°C)
0.5 seconds	194°F (90°C)
0.1 seconds	201°F (94°C)
0.05 seconds	204°F (96°C)
0.01 seconds	212°F (100°C)

On Farm

Processing Plant

1.4 Disease Traceability in Dairy Cattle

Dairy animal traceability is used as part of health management plans (treatments and vaccinations), tracking reproductive status, and recording cattle inventory on many dairy operations. There are different forms of cattle traceability used (described below) and a uniform system for identifying all U.S. dairy cattle on farms does not exist. Record keeping systems vary by operation too, from chalk/white boards to hand written paper documents to computerized software programs. In the event of a disease outbreak, dairy animal 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 life". During an animal disease emergency event, it may be necessary to locate the source of the animal(s) in question, the other premises on which the animal(s) resided, other animals that were exposed, and animals at risk of exposure. However, most U.S. dairy operations may not have this information readily available, slowing response time. Producers are encouraged to document animal movements using on-farm records to expedite disease investigations.

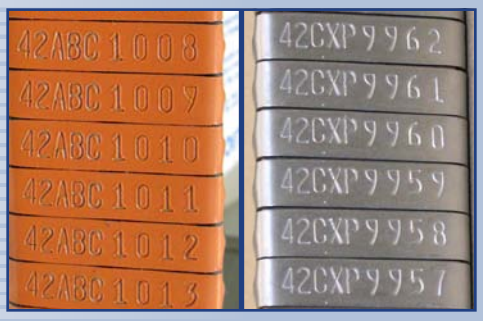
A variety of cattle identification methods exist on U.S. dairy operations. Individual animal identification methods for dairy cattle include ear tags, which may be a radio frequency identification (RFID) button tag, a plastic dangle tag, and/or a metal brucellosis vaccination tag in the right ear. In herds that do not vaccinate calves for brucellosis, a metal 'bright' tag can be placed in the right ear and serves as an official form of identification in cattle. Licensed veterinarians can obtain these tags from their State. The plastic dangle tags may be marked with homemade numbers, pre-printed through a commercial source, or purchased from a registered breed association. Some operations utilize neck collars for lactating cattle with radio frequency transponders that are read by a specialized reader in the parlor to record milk production data or interface with automatic feeders. Young animals on farm (calves, pre-breeding age) may or may not be individually identified. On farm records of the identification numbers may be kept for inventory or movement purposes; some farms may not keep accurate, up-to-date records. While not unique to the farm or the animal, animals that have received a brucellosis vaccine should have a tattoo in their right ear. Some purebred cattle will have a unique registration number tattooed in their left ear.

Individual identification is required for interstate commerce and cattle moving to harvest. 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.*

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: *http://www.aphis.usda.gov/traceability/*

Source:

- *OIE Terrestrial Animal Health Code 2009, Glossary, accessed February 5, 2010*



Orange Brucellosis Ear Tags and Bright Ear Tags

Dangle Tag, Metal Breed Registry Tag

Dangle Tag, Neck Collar

Dangle Tag, RFID Button Tag

2. LIFE STAGES AND ANIMAL HUSBANDRY NEEDS

There are typically two groups of dairy animals on an operation at any one time: lactating and non-lactating (dry cows, bulls, and young stock). Some operations will solely focus on lactating cows, working with off-site rearing operations to raise their young stock to post-weaning, breeding age, early bred, or just before calving. In general, replacement heifers and bulls should be housed away from adult cattle and in spaces that are suited to their age, size, feed intake, and reproductive needs. Bull calves are typically sold at an early age, pre-weaning, or just after weaning unless they are kept as breeding stock or castrated and fed out as steers. Bulls kept for breeding on farm can be dangerous and unpredictable; pens with bulls are not often marked or a bull(s) may be in the pens with milking cows and function to "clean-up" and breed cows that were missed with artificial insemination. Heightened awareness of surroundings when working cattle pens with breeding bulls in necessary for everyone's safety. The following sections describe the life stages and husbandry needs for the various life stages of dairy cattle.

2.1 Lactating

Lactating animals are the primary life stage on dairy operations. While lactating, cows eat different amounts of feed throughout their production cycle and may be separated into groups based on milk production, pregnancy status, or treatment needs. Likewise, heifers in their first lactation are still growing and have different nutrient requirements and may be housed separately from mature cows.

The first three weeks after calving is considered the "fresh" period where feed intake and milk production are increasing and the cows are most disease prone. The most prevalent diseases reported by producers for all cows included clinical mastitis (16.5%), lameness (14.0%) and infertility – not pregnant by 150 days in milk (12.9%) as reported in NAHMS Dairy 2007 study conducted by USDA. Cows are typically bred between 40 and 80 days after calving, either through artificial insemination or with a bull on farm. Pregnancy diagnosis is performed via rectal palpation, either manually or with the assistance of ultra-sound. A small number of dairies utilize a commercial blood test for diagnosis. On average, cows will lactate 300 to 360 days. Based on milk production and/or expected calving date, cows may be dried off (removed from the milking herd to cease milk production) to allow the mammary gland to involute, regenerate tissue, and prepare for colostrum production and subsequent lactations.

After calving, lactating cows produce colostrum (nonsaleable for human consumption) for the first two to three milkings (24 hours), at which time it is collected and fed to calves or sold to calf raisers (an off-farm disease transmission possibility). From 24 to 72 hours after calving, cows produce transition milk which is also nonsaleable. If cows were treated at the time of dry off with antibiotics in the udder, the milk should be tested prior to mixing with the rest of the herd's milk in the bulk tank. Milk containing antibiotic residues cannot be sold; it is either discarded or fed to pre-weaned calves. Fresh cows can be milked up to six times a day depending on management. The rest of the lactating cows are typically milked twice daily but can be milked three to four times per day.

2.2 Dry Cows

Dry cows are not currently producing milk and are expected to calve within 30 to 60 days. During this dry period, the mammary gland prepares for colostrum production and their next milk production cycle (lactation). An antibiotic approved for use in the mammary gland may be applied at dry off to help prevent mastitis in subsequent lactations. Dry cows eat less feed and are usually housed separately from lactating cows on or off the premises during the dry period. Replacement heifers due to calve are either introduced into this group or the pre-fresh group, depending on management and facilities.

Cows that were recently dried off should be housed in an area that is clean and dry so that organisms are not able to enter the teat end, as the sphincter is not tightly closed and the keratin plug does not form for several days to weeks after the final milking. An absorbent, clean bedding material (straw, kiln-dried sawdust, paper) or one that allows drainage (sand, pasture) should be provided for the cows to lie on so that pathogens are not able to enter the teat canal. A teat sealant (internal or external) may also be used in an attempt to prevent entry of disease causing organisms.

Dry cows remain together throughout this dry period, but in some operations at 3 to 4 weeks prior to calving, they are moved to the pre-fresh pen.

2.3 Pre-Fresh Cows

Within 3-4 weeks of their projected calving date, heifers/cows should be moved to a clean, dry area where they can be frequently monitored. If heifers are recently purchased or returning from an off-site rearing operation, competition and feed intake differences may dictate separate pens and rations for these heifers versus mature cows to maximize colostrum quality and ensure a healthy calf. Feed intake decreases during this time and it is important to provide nutrients for the near-term calf and for high quality colostrum production. Animals may be vaccinated during this phase. Once signs of calving are present (amniotic sac or feet visible), heifers/cows may be moved to an individual calving pen that is clean, well bedded, dry, and draft-free.

2.4 Calving

Dairy cows and heifers that are close to calving are often moved to special maternity pens (group or individual) for observation. The calving pen should be monitored often and the newborn calves removed promptly after birth and placed individually in a clean, dry, draft-free area. Deep straw bedding (1-2 feet ideal) in the calving pen helps drain away the birthing materials (amniotic fluid, placenta, and blood) and animal excrement. Deep bedding will also inhibit the newborn calf from standing and wandering around the pen, trying to nurse. Proper personal protective equipment, especially gloves, should be worn if assisting in the birth, particularly when handling the newborn calf and parturient materials/fluids due to the risk of zoonotic disease. After calving, the cow enters the lactating herd as a fresh animal. Newborn calves may be raised on or off-site.

Calves should be fed colostrum collected from its dam within 6 hours after birth and consume 12-15% of their body weight. Colostrum provides the essential antibodies needed for immunity in calves. Prior to colostrum collection, the udder and teats should be clean and dry to ensure the colostrum can be removed without fecal or environmental contamination. Large breed calves (90+ pounds) should receive 4 quarts in the first 6 hours after birth, and small breed calves (50-90 pounds) should receive 3 quarts. All calves should receive another 2 quarts 12 hours after birth. If the calf will not nurse a bottle, esophageal feeders can be used. This equipment should be thoroughly washed with warm soapy water after use, thoroughly rinsed and hung up to dry in an area where it will not become contaminated. Colostrum sources could be solely from the dam, pooled from cows' onsite, purchased from other premises or as pre-packaged colostrum substitute. Some operations have the ability to pasteurize colostrum prior to feeding. Some dairies will pool the milk produced during the first 72 hours and feed it indiscriminately to all calves or sour the milk and feed it throughout the pre-weaning phase. Highly contagious FAD transmission to pre-weaned calves could occur from pooling colostrum/transition milk on farm and purchasing colostrum/transition milk from another premises.

Source:

- *Calf Nutrition in Raising Dairy Replacements, Hoffman P.C. and Plourd R. Eds. Midwest Plan Service, 2003: pp 22-23*

2.5 Replacement Animals

The majority of heifer calves are raised as replacements for the dairy industry and a small percentage of dairy heifers may be marketed for beef production. In the NAHMS Dairy 2007 study conducted by USDA, 36% of the dairy cow inventory was replaced over the previous year. For a dairy operation to replace 36% of their animals every year, a 500 cow dairy would need 15 heifers entering the milking herd every month to remain a 500 cow operation. Dairies can develop heifers on farm, privately contract to have the heifers developed off farm at other sites while retaining ownership, or sell the heifers either privately or at public dairy sales. Animal movement on and off farm is a part of dairying in the United States.

Source:

- *NAHMS Dairy 2007 Part III: Reference of dairy cattle health and management practices in the United States, 2007. US Department of Agriculture: Animal and Plant Health Inspection Service: Veterinary Services, Center for Epidemiology and Animal Health, accessed Mar 6, 2009 at http://nahms.aphis.usda.gov/dairy/dairy07/Dairy2007_PartIII_rev.pdf*

A heifer's development can be broken down into five stages, which can occur on one or multiple premises: Pre-weaning (0-2 months), weaned (3-8 months), pre-breeding (9-12 months), bred (13-22 months or older), and pre-fresh (23-24 months or older). Depending on State regulations and management practices, there may or may not be any official documents or producer records for the movement of these animals.

2.5.1 Pre-Weaned (0-2 Months)

Pre-weaned calves are housed in individual hutches or pens, calf hotels, or small groups and fed milk replacer, soured milk, pasteurized or unpasteurized whole milk, while being introduced to solid feed (calf starter). Milk or milk replacer is offered in bottles, small buckets twice a day, or offered continuously in group feeding systems to ensure adequate nutrition and growth. Proper mixing of the milk replacer is critical for calf health and nutrition. If milk is pasteurized, time and temperature of the batch should be frequently monitored to ensure proper destruction of pathogens. Unpasteurized milk poses a risk for disease transmission.

Pre-weaned calves are the most disease susceptible age group on the farm and should be fed/handled before the older animals to minimize pathogen spread. If this cannot be done, clothing and footwear should be changed and hands washed before working with pre-weaned calves. A mortality rate of pre-weaned heifers was 7.8% in 2006, based on the USDA NAHMS Dairy 2007 study, with scours/diarrhea and respiratory problems being the cause most reported by producers. Proper personal protective equipment such as gloves, coveralls, and boots should be worn when feeding and handling neonatal calves. Milk bottles used to feed these animals should be removed after nursing and the nipples and bottle rinsed with water to remove all organic material, washed in hot water (150°F) with mild detergent, rinsed, inverted and allowed to dry completely before the next feeding. Milk buckets should be rinsed after all the milk is consumed to remove the residue and refilled with fresh, clean water until the next milk feeding. Calf starter should not build up in the buckets as it can become a breeding ground for bacteria and insects.

Source:

- *NAHMS Dairy 2007 Part I: Reference of dairy cattle health and management practices in the United States, 2007. US Department of Agriculture: Animal and Plant Health Inspection Service: Veterinary Services, Center for Epidemiology and Animal Health, accessed Sep 14, 2008*

2.5.2 Weaned (3-8 Months)

Weaned heifers are often raised from 3 to 8 months in a group housing environment with dry bedding, shade, fresh feed, and water. First groupings should be small, up to six animals, with 25-30 square feet per head. The calves are fed and watered from communal sources and as animals adjust to their new environment, group sizes may be increased.

Vaccinations are essential at this time because maternal antibody from the colostrum has waned. Based on the USDA NAHMS Dairy 2007 study, 1.8% of weaned heifers died in 2006, with respiratory problems being the primary cause reported by producers. A basic protocol to protect against common respiratory diseases and clostridial diseases should be based on endemic diseases, future breeding goals and transportation needs. In some cases, heifers between four and 12 months of age are vaccinated with RB-51 (brucellosis) by a USDA Accredited Veterinarian. Strategic deworming and control of external parasites should also be considered at this age.

Source:

- *NAHMS Dairy 2007 Part I: Reference of dairy cattle health and management practices in the United States, 2007. US Department of Agriculture: Animal and Plant Health Inspection Service: Veterinary Services, Center for Epidemiology and Animal Health, accessed Sep 14, 2008*

2.5.3 Pre-Breeding (9-12 Months or Older)

This group of animals is usually raised in large group settings with communal feed and water. Animal handling facilities may be less than ideal to adequately restrain and examine individual animals. If the operation has a chute or headlocks, pre-breeding exams may be done to remove heifers that do not meet criteria for breeding soundness. Initial vaccinations for reproductive diseases that can be a problem during pregnancy are administered during this phase. Vaccinations for common respiratory diseases are often boostered at this stage. Gestation is approximately 280 days and age at breeding is often based on calving at 23-25 months of age; this will vary by operation. Dairies in northern climates may breed heifers at an older age so as to avoid calving in the coldest winter months (January, February). Likewise, dairies in hot climates often delay breeding to avoid having heifers calving in the heat of summer (July, August).

2.5.4 Bred to Pre-Fresh (13-22 Months or Older)

This group of animals is typically raised in large group settings with communal feed and water. Animal handling facilities may be less than ideal to adequately restrain and examine individual animals. The operation may have a head catch and gate, a portable chute or headlocks used for vaccinations, artificial insemination, and treatments. Early in this phase, prior to breeding (13 to 16 months), heifers may be booster vaccinated to prevent reproductive diseases that cause abortion. Heifers may be synchronized to come into heat at a specific time and bred naturally by bulls on farm or by artificial insemination. The same cautions apply to entering pens with bulls as described in the section Life Stages and Animal Husbandry Needs. As bred heifers get closer to parturition (within six weeks), they may be vaccinated against pathogens that cause mastitis and calf scours in order to pass immunity to the calf through colostrum.

Throughout this phase, heifers should be monitored daily for signs of illness and/or abortion. If an animal should abort, promptly remove her and her fetus along with all other birthing material, wearing proper personal protective equipment, especially gloves. A cow/heifer that aborts may or may not begin to lactate, depending on the stage of her gestation when she aborted.

One to two months prior to calving, heifers should be moved to the premises where they will be milked with the rest of the herd. Based on their expected calving date, they may be group housed with the dry cows or pre-fresh cows. Upon signs of calving, heifers should be moved to a calving pen.

3. DAIRY FACILITIES

Dairy cattle can be housed in a variety of ways. Size of herd, climate, and available good quality pasture all factor into the type of housing. Different housing types may be present on the same facility for different life stages. Older facilities may have been retrofitted or added onto as the herd expands. Typically facility type is based on climate, capital investment, labor requirement, and management expertise. The key to good dairy animal care depends more on the producer's ability to properly manage housing than it does on the specific type of housing provided.

3.1 Lactating Cattle

3.1.1 Tie Stall, Stanchion

Tie stalls and stanchions barns are common facility types for dairy farms that typically have less than 100 dairy cows. They consist of a covered barn, often with solid walls with windows or fans for ventilation (wall-mounted or at one end for tunnel ventilation) with rows of individual stalls for cows currently producing milk. A tether system is used to keep each cow in her stall; either the cow wears a loose-fitting collar around her neck and is loosely chained to the front of the stall (tie-stall) or there is a movable head catch at the front of the stall that restrains the cow around her neck (stanchion). There are feeding areas, or mangers, in front of every cow and a drinking cup at every stall or every other stall. Feed is delivered to this manger by hand (cart and pitch fork/shovel, bucket with a scoop) or using an automated feed cart for dispensing the forage and grain. During good weather, cattle are often turned out into a dirt lot, cement, or pasture area. Outdoor centralized feed bunks, covered or uncovered, and automatic water troughs are generally located in an area near the barn where the cows can be fed during warmer times of the year.

Cows are usually milked in the tie stalls or stanchions via portable milking units. Running the length of the stalls is an overhead milk pipeline and vacuum line with ports where a connector from the collection hose on the milking unit is attached. The vacuum line provides the vacuum or negative pressure to move milk from the milking unit on the cow to the pipeline and receiver jar, where it is then pumped to the bulk tank.

Stalls may be lined with rubber mats, cow mattresses, waterbeds, or filled with sand. The goal is to provide a soft surface for cows to lie on and bedded with a material that does not enhance organism growth and keeps the cows clean, dry, and comfortable. Bedding includes materials such as sand, wood shavings, shredded newspaper, straw, or other absorbent materials. The stalls should be groomed with shovels or rakes to remove manure and urine buildup at every milking and fresh bedding added frequently. Manure is manually scraped from the stalls into a conveyer at the back end of the stall (gutter). There are many moving parts in the manure conveyor system and people in the area should be made aware of the risk of injury should they accidentally step or reach into the gutter while it is operating. Manure is moved to the end of the barn where it can be piled on a cement pad or directly loaded into a manure spreader. Manure can then be spread on farmland or composted then spread or sold. For sanitary reasons, the Pasteurized Milk Ordinance recommends removal of the manure piles every four days. Records of manure movement to crop ground may/may not be available.

3.1.2 Grazing

Grazing is primarily found in herds under 500 dairy cows, although many dairy herds utilize pasture as a source of feed and exercise when the climate allows. Cows spend their time in between milkings on grass and forage-based pastures. There may or may not be a feed bunk in the pasture depending on the quality of the grasses and the need for supplemental feeding to meet nutritional needs of lactation. Wildlife interactions with grazing herds are not uncommon. Watering sources vary within this production method. There may be a natural stream in the pasture, automatic waterers may be set up near the fence lines, well water may be the primary source, or multiple livestock tanks that require manual filling multiple times per day. Cattle are moved to a covered milking facility through other pastures or dirt paths. Fencing is usually a series of high tensile wires, not permanent, so that it can be moved based on the growth patterns of the grasses. This method is used throughout the United States, but in northern climates it can only be utilized 4-5 months of the year. These animals are typically housed in tie-stall/stanchion or bedded pack barns the remainder of the year. Manure is allowed to remain in the pastures as a fertilizer, letting the sun dry it out.

3.1.3 Loose Housing (Bedded Pack and/or Compost, Free Stalls, Cross-Ventilated)

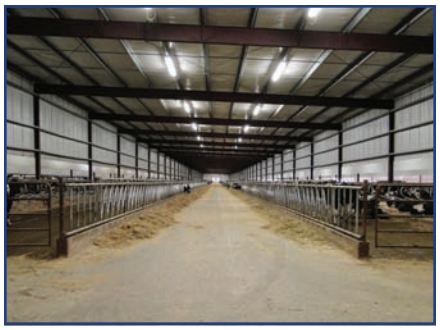
Loose housing facilities can be found on dairies with 30 head to tens of thousands. There are many different building designs, each with the same result of housing cows in one area (or a number of barns) and moving them to a centralized milking parlor verses milking cows where they are housed. Cattle generally travel on grooved concrete alleys to the milking parlor. Centralized parlors allow for more efficient harvest of milk with less bending and movement of equipment.

Bedded pack barns use compost, sand, or deep straw/corn stalks as the bedding source and when properly managed, serve as a clean, dry, comfortable place for animals to lie down. Compost barns are bedded pack barns where bedding is typically 8-12” deep. Recommended space requirements are 80 square feet per animal. Large side-wall openings or wall curtains with fans throughout the free-stall or bedded pack/compost barn provide ventilation. A cooling mechanism found in hotter climates is water misters/spray nozzles installed above the feed bunk to wet the cows’ backs as they eat. They are typically connected to a thermometer and when the ambient temperature reaches a set degree, they turn on for a period of time (60-90 seconds on every 5 minutes is common). When combined with air movement, evaporative cooling can be very effective for cattle. Separate misters that spray fly repellent may also be found over the feed bunk areas. People working in this area should be aware of the misters; fly spray can irritate human nostrils and eyes.

Free stall buildings can have multiple rows of stalls in the barn where the cattle freely enter and exit the stalls. These facilities may have headlocks along the feed bunk to restrain the animals for examination or sample collection.

Barns without headlocks may have a management rail near the parlor where multiple animals can be lined up at an angle for pregnancy examination. Individual animal restraints are not part of this management rail. Some operations may have a dedicated chute for handling individual animals.

Depending on the facility, stocking density may plan for one or more cow(s) per stall (number of cows divided by number of stalls should not exceed 1.2) which could be bedded with sand, wood shavings, shredded newspaper or other bedding materials to help keep the cows clean, dry, and comfortable. Some operations have deep bedded stalls and others have mattresses in the stalls with bedding covering the surface. Cattle housed in stalls lacking adequate bedding may have abrasions on their hocks (missing hair to swollen joints).

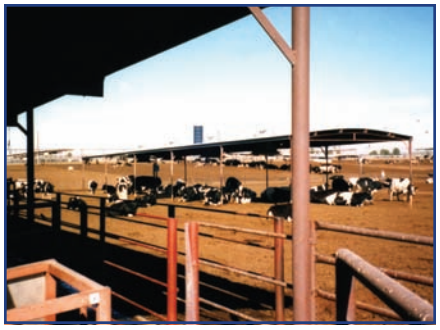


Cross-ventilated barns can have multiple (8-16) rows of free stalls. The walls are solid on the sides with one end having inlets with cooling cells and the other multiple fans. During hot weather months, air is drawn into the building by the fans through the cooling cells, and a series of ceiling baffles creates an air movement pattern depositing cooled air on the cows in the pens. In cool months, air movement continues via the fans and baffles but without the cooling cells.

The feed alley can be located in the center, along one side of the building, or in front of each pen in cross-ventilated barns. The feed wagon delivers feed to the manger one to multiple times per day. Cows are prevented from stepping into the feed manger by a curb and neck rail or headlocks. Automatic waterers should be located in the alleyways of each pen; there may be additional automatic water troughs in the parlor return lane(s).

When the cows are moved to the parlor, stalls should be groomed and re-bedded as needed or on a schedule. A tractor with a grooming tool is used to work the bedded pack. Manure handling systems vary from front-end loaders with a blade or rubber tire that scrapes the manure in the alleys to a central location for removal, automatic scrapers that run on a pulley system and move manure to the end of the alleys multiple times a day, water flush systems using gravity flow to wash the excrement down the length of the barn into an underground storage system, or vacuum trucks to suck up the manure into a holding tank and later deposit it into the storage system. Compost barns should be groomed two to three times per day, usually during milking, to turn over the top wet layer to aid in drying; new bedding is added as needed. Bedded packs should be completely emptied when the grooming can no longer provide a dry place for cows to lie down. This is also dictated by the time of year when it can be hauled to crop ground.

3.1.4 Dry Lot



Dry lots are most often located in warmer, low humidity climates and dairy cow numbers often exceed 500 head. Cows are raised on dirt lots with shade being provided by awnings or canopies. Cooling cells that spray water on cows' backs may be found under the canopies for additional heat abatement. The dry lots are separated by concrete or gravel alleys used for farm traffic.

The feed wagon delivers feed one to multiple times per day to a long concrete manger/bunk on the edges of the dry lot. Cows are prevented from stepping into the feed manger by a curb and neck rail or headlocks. Protective covers over the feeders may be present for shade and to keep the feed dry when it rains. A cooling mechanism found in hotter climates is water misters/spray nozzles installed at the feed bunk to wet the cows' backs as they eat. They are typically connected to a thermometer and when the ambient temperature reaches a set degree, they turn on for a period of time (60-90 seconds on every 5 minutes is common).

Automatic waterers are located in each pen; there may be additional automatic water troughs in the parlor return lane(s). The milking parlor is a covered structure, generally centrally located to all the lots, so the cattle are moved through the lots and up alleyways to be milked, returning by a separate set of alleyways. Water misters may also be installed over the exit lanes to wet the cows' backs.

The lots are groomed using a tractor and drag system a few times a week to multiple times per day when the cows are being milked. Manure is spread out so that the sun can dry it. Depending on weather conditions and animal density, lots may be scraped so that the top layer of dirt and excrement is removed. Manure storage options vary.

3.2 Calves (On-Farm, Custom Growers, Ranches)

Calves born on a dairy farm can either remain there for their entire life or be moved off-site to be raised. Length of time at an off-site operation will vary from shortly after birth returning at weaning, or returning for breeding, after breeding, or just before calving. Proper calf management requires considerable labor, appropriate housing, and is the second most costly enterprise on dairy operations. Terms that describe these off-site rearing facilities will vary by region of the U.S. and by the type of rearing provided. Collectively, they all rely on animal movement and in some cases, milk movement as a feed source. Off-site rearing operations are a vital part of the dairy industry and need to be considered in State high consequence animal disease plans.

Some dairy operations sell bull calves shortly after birth. Management style, market price, and available housing on the dairy operation generally dictate whether bull calves are kept or sold. Some off-site calf operations may focus solely on raising bull calves which may be processed as veal or go into feedlots and fed until slaughter weight as finished steers.

In the western and southwestern U.S., the terms calf nurseries and calf ranches or heifer ranches describe the off-site rearing operations that specialize in raising dairy calves to weaning, breeding, or just prior to calving. They may raise just heifer calves, just bull calves, or a mixture. Dairies may contract with calf ranches to pick up their calves daily, or every other day, along with nonsaleable milk. Additionally, "calf runners" provide the service of picking up, assembling, and delivering groups of calves to calf nurseries/ranches. All of these movements could be sources of transmission in a highly contagious FAD outbreak. Nurseries/ranches can be very large with well over 10,000 head at one location.Some ranches accept hundreds of animals a day from premises located in multiple states.

Throughout the rest of the U.S., the terms heifer raisers or growers describe the off-site rearing operations that specialize in raising dairy calves to weaning, breeding, or just prior to calving. Heifer raisers may raise calves for one specific dairy or multiple dairies, picking calves up as needed by the dairy operation. Some dairy operations transport their own calves to and from the developer for biosecurity reasons. The dairy may or may not provide nonsaleable milk for feeding to calves.

Some off-site rearing operations also house feedlot cattle from multiple sources that may have contact (shared equipment or nose-to-nose) with heifers returning to the dairy operation. This is a potential source of transmission in a highly contagious FAD outbreak.

3.2.1 Individual (Hutches, Hotels)

Newborn calves are susceptible to disease and need close monitoring during their first days of life. Individual housing, either hutches or hotels, should prevent close contact between newborn animals. Hutches can be made of plastic (easier to clean) in a dome or rectangle shape, or wood (less expensive, harder to clean) as single units. Hotels are typically made of wood with 3 to 5 individual units side by side. Calves can be kept inside the hutch or allowed to exit on a tether with a loose fitting collar or fenced in with wire-mesh panels. Fresh bedding should be added daily or as needed to keep a clean, dry, comfortable place for the calf to lie down.

For hutches or pens located outside, adequate shade and ventilation is necessary to avoid heat stress and dehydration of the calf during warm months. Calf hutches or hotels should be cleaned, sanitized, and disinfected between introductions of new calves to minimize disease spread. The ground underneath the calf hutch has the potential to harbor pathogens; organic bedding should be removed with the ground/concrete/gravel remaining idle with sunlight exposure.

Calves are fed milk (raw, pasteurized) or milk replacer via bottle or bucket in the hutch using a bottle/bucket holder or out in the pen if fenced or tethered in a hutch/dome. Calves can be introduced to solid feed by 2-3 days of age in

a bucket.Calves should have access to fresh water daily. In cold weather months, warm/tepid water offered after the milk feeding is often readily consumed prior to freezing in the buckets or bottles.

3.2.2 Group Housing

Some operations utilize group housing for pre-weaned calves. Calves are offered milk through an automated calf feeder that mixes milk replacer and water and dispenses milk. Another option for feeding large groups of calves are gang or mob-feeders which typically consists of a 50 gallon barrel with multiple nipples along its base that allows all calves in a pen to nurse at one time.

Some operations may wait and group house once calves have become accustomed to eating solid feed. Pens should be sized for 4-6 calves of similar age with adequate resting space for each calf. This small group size allows for easy observation of calf conditions as well as the ability to take quick action to maintain healthy calves. Fresh water should always be readily available and solid feed offered. Dirty bedding should be removed often and clean bedding added regularly to provide a clean and dry place for calves to lie down. Once eating 1.5 to 2 pounds of solid feed for 3 consecutive days, calves can be weaned and moved to larger group sizes.

3.3 Growing Heifers

3.3.1 Grazing

Heifers can be kept on pasture while they are growing. Pastures should be of high quality forage, typically grass, legume or grass-legume mix, in order to meet energy needs of the heifers to promote optimal growth and rumen development. Grazing can be continuous – on a single pasture for the entire season, or rotational – moving heifers to different paddocks on a set schedule. Natural or man-made shade should be available during warm weather months. If heifers are kept on pasture during cold/rainy weather months, natural or man-made windbreaks should be available.

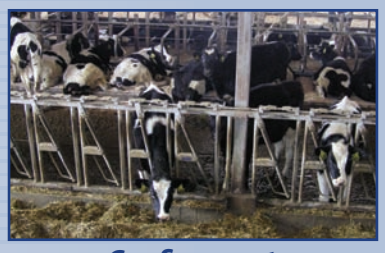
3.3.2 Confinement

Heifers can be housed together in groups on bedded packs or in free-stall barns. Resting surface is important for comfort and temperature regulation. Heifers should not lie on concrete or other hard surfaces and the bedding should allow the hair coat to stay clean and dry and prevent hock lesions (missing hair to swollen joints). Adequate resting space for each heifer (20-80 square feet depending on age and size) is recommended. In bedded-pack housing, at least 6 inches of bedding should be maintained to cushion surfaces. The bedded-pack should be “groomed”, either removing manure patties or turning the bedding mechanically, allowing wet materials to drain and air flow to assist in drying. In free-stall barns where mats or mattresses are used as padding, a layer of bedding should be used over the top to prevent sores on the hocks of cattle. Walk alleys between the resting space and feeding areas should be designed to prevent cattle slipping and for easy manure removal.

3.3.3 Dry Lot

Heifers can also be kept on outside dry lots. Typically a dry lot will have no vegetative growth so heifers are fed in feed bunks and/or self-feeding hay bale holders. Natural or man-made shade should be available during warm weather months. Access to dry lots should be limited in wet weather due to the build-up of mud. Muddy conditions can be limited by using concrete pads around feeding/watering areas or creating mounds. Concrete or other hard surfaces should be grooved to prevent slippage and scraped regularly to avoid manure build up and maintain a good walking surface. Mounds help manage wet conditions by creating a raised area that dries and drains faster than the rest of the lot. This provides a resting space for heifers out of the mud. With dry lots, manure runoff must be managed according to local rules and regulations for retention and clean up.

Grazing



Confinement

Dry Lot

3.4 Milking Systems

Milking is either done in the tie stall/stanchion using movable milking units or cows are moved to a milking parlor where the milking units are stationary. Dairies with less than 150 cows are often milked by the owner/operator and family members or some hired help. As dairies expand in size and cow numbers, milking may include employees that work in crews. Cows can be milked two or three times a day with fresh cows being milked up to six times per day. Smaller dairies may have more 'down time' between milkings where larger dairies only stop milking to clean the milking system which takes about an hour for each milking.

3.4.1 Tie Stall/Stanchion

Cows remain in the tie stalls or stanchions and are milked via portable milking units. Running the length of the stalls is an overhead milk pipeline and a separate vacuum line with ports where the connectors from the collection hose and vacuum line on the milking unit (claw) is attached. People milking the cows must bend down to place the milking unit on the cow from the side. The vacuum line provides the negative pressure to move milk from the milking unit on the cow to the pipeline where it is moved to the bulk tank for cooling, agitation, and storage until pick up.

The milking protocol is described in section 3.4.3. Once milking is complete, the vacuum is manually or automatically turned off and the milking unit removed. The milking unit is then moved to the next cow and the procedure repeated. Cows can be post-dipped as described below. If incorrect concentrations of dip solution are used, or chemicals used to clean the milking system are inadvertently used, cows can develop sores on their teat ends resembling ruptured vesicles. These could resemble a vesicular disease and further examination/testing is warranted. Please refer to the Foot-and-Mouth Disease (FMD) Prevention Practices in the Appendix for more information.

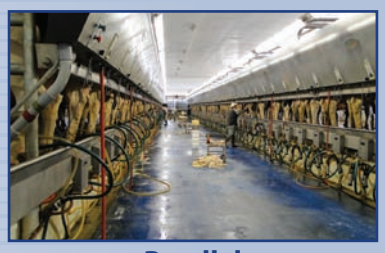
3.4.2 Parlor

Milking parlors vary in design, but the flow through the parlor and milking procedures are similar. Prior to milking, cows are moved into a holding pen that is adjacent to the parlor where they remain until it is their turn to be milked. Parlors can have as few as 4 milking stalls or as many as 150. There can be stalls on one side only or a mirror image with a single set of milking units that swing from one side to another (referred to as a swing-over parlor) or one milking unit per stall. Cows are elevated so that the milking units can be placed on the udder by the people milking at mid-chest to shoulder height, decreasing bending. The milking unit is placed on the udder from the side (herringbone or parabone parlors) or from behind the cow (between the legs as in parallel or external rotary parlors). Cows enter the parlor single file and exit single file or rapidly when the front restraint bar (index rail) opens.

The area where the people milking stand is referred to as the pit because it is lower than the cows. In some parlors, the entire milking system is located in the pit and it can be quite loud. In newer parlors, everything but the milking unit (claw) and hoses are placed below the pit (basement/subway) making the parlor a quieter environment.

Rotary parlors milk the cows on a slow moving carousel. People milking cows can either be on the outside of the carousel (external) or inside the carousel (internal). The majority of carousel parlors are external rotaries where cows enter a milking stall at a 90 degree angle by walking forward and facing the inside of the carousel. The milking unit is placed on the udder from behind, in between the cow's back legs. People milking the cows remain in one general area to prep the cows as they start on the carousel and hang the milking units. Other people are located where the cows exit to ensure the udder was milked out and apply post-dip to the teats. The carousel can be stopped at any time to attend to a cow.

Herringbone



Parallel

External Rotary

3.4.3 Milking Protocol

Operations will differ in the specific protocols used for prepping cow's udders prior to milking. Dairies in warmer climates may utilize wash pens which consist of automated water sprayers that come out of the floor to rinse the udder and teats. Cows then 'drip dry' in the holding pen until entering the parlor for milking. Additional prep procedures may or may not occur, but if they do, they generally proceed as follows. Once cows are in a milking stall, the teats can be fore-stripped by hand to stimulate milk letdown and monitor for changes in milk appearance. Each teat is then cleaned with a dry towel or pre-dipped with a disinfectant allowing up to 15-30 seconds of contact time. Each teat is wiped to remove the pre-dip solution and to dry the teat before the milking unit is attached. Optimally the prepping process should take 60 to 120 seconds. The best practice is to use a new disposable wipe or clean washable towel on each cow and milkers wear gloves; this will vary by operation. It is during this time that teats can be examined for any lesions.

Dip Cup with Iodine

Attached Milking Unit (Claw)

Post-Dip Applied to all Teats

After prepping, the milking unit (claw - a set of four metal tubes with soft, pliable, synthetic liners) is attached, and the milk is removed by a pulsating vacuum that mimics the way a calf nurses. Milk from individual cows flow to a common milk line and this pooled milk flows by gravity to a receiver jar. From here the milk is pumped into designated stainless steel, and less commonly heat resistant glass, milk lines that carry the milk to the bulk tank to be cooled, agitated, and stored until pick up.

Once an individual cow's milking is complete, the vacuum is relieved and the milking unit is removed either automatically or manually. The teats are usually post-dipped using an antiseptic solution with skin conditioners and the cows released from the stall. In cold weather (10°F/12.2°C or with a wind chill), post-dip should be allowed 30 seconds of contact time and then blotted to remove excess, to prevent chapping and frost bite. Cows travel via designated return lane(s) where water may be offered prior to returning to their pen to eat and lay down. Cattle should be encouraged to eat by offering fresh feed and drink immediately after milking to allow the teat sphincter to close, thus decreasing the potential for pathogen contamination of the udder.

For more information about milking procedures, see: Milking procedures on U.S. Dairy Operations, 2007.

3.4.4 Robotic or Automatic Milking Systems (AMS)

Some dairy operations rely on robots or an automatic milking system (AMS) to milk their cows. Typically one AMS unit can milk 60 to 70 cows. Cows wear an identification collar and decide when they need to be milked. Cows may be milked once to six times daily. Cows walk from the pasture, dry lot or confinement barn to the stationary AMS unit in a small parlor area. The AMS will dispense feed based on the cow's identification tag (neck collar with RFID or implant device) and secure her in the stall. The AMS follows the same sanitary prepping protocol as described above. This system utilizes lasers to locate the teat and place the milking unit. Cows with dark teats, odd shaped udders, or missing teats cannot be milked in this system. Milk is moved through stainless steel pipelines to the bulk tank where it is cooled, agitated, and stored until pick up.

3.4.5 Milk Storage

Cow numbers and cost generally determine the type of bulk milk storage on farm. Permanent tanks (bulk tanks, milk silos) and direct load onto tankers are found throughout the U.S. The bulk tank resides in the milk house and is equipped with a cooling unit that, once turned on, cools the milk to 45°F within 2 hours of milking (usually stored at 36-40°F between milkings) and agitates it according to state and federal regulations. Some operations move the milk through a plate cooler or chiller to drop the milk temperature to <40°F and on some farms, load directly into a tanker truck. Some operations have upright milk silos to cool and store the milk until it is picked up. On-farm storage and handling of milk intended for commercial sale must follow the guidelines provided in the Pasteurized Milk Ordinance for public health and food safety reasons. Automatic bulk tank temperature readings are plotted on charts in the milk house and can be used to monitor raw milk cooling and water temperatures for cleaning.

Bulk Tanks

Milk Silos

3.4.6 Nonsaleable Milk

Nonsaleable milk that is not allowed to enter the commercial milk supply, usually due to antibiotic treatment or clinical mastitis, is collected separately and discarded, or stored and fed to dairy calves on or off the farm. Colostrum is also collected this way. Some operations group antibiotic treated or fresh cows together and milk them last during a milking cycle. Depending on the number of cows with milk being "dumped", the milk can be collected into a designated bucket in the parlor or the milk pipeline can be diverted from the bulk storage tank to a drain or other container to avoid potential contamination of the salable milk.

3.4.7 Cleaning

Cleaning of dairy milking, milk storage, and processing equipment is accomplished either through an automated clean-in-place (CIP) system, or a combination of CIP and manual cleaning. These protocols are necessary for dairy premises to clean and sanitize stationary milking equipment and milk pipelines as required by state and federal regulations. CIP systems use automated cycles to clean the milking system, which include a pre-wash rinse, detergent wash, acid rinse, and sanitizer. These chemicals are designed to clean rubber or silicone liners, seals, and plastic hoses. Over time these parts will need to be replaced due to the chemical damage.

The pre-wash rinse flushes water heated between 95°– 100°F (35°– 37.8°C) through the milking system to remove residual organic matter from the equipment. Pre-wash water is not re-circulated in the system; it goes directly down the drain. The wash cycle uses a solution of hot water (160°F/71.1°C) and chlorinated-alkaline cleaner that is circulated for 10 minutes to emulsify fat and remove protein. An acid rinse circulates (95° – 110°F [35° - 43.3°C] for 5 minutes) to neutralize chlorine and alkaline residues, preventing mineral deposits and to inhibit bacterial growth. Sanitizing is required 30 minutes prior to milking using an approved sanitizing agent to reduce the bacterial load on milking equipment.

Clean-out-of-place (COP) or manual procedures are used for non-stationary milking equipment that is cleaned and sanitized according to industry protocols. This manually-cleaned equipment is stored in clean, designated areas of the milk house between milkings or in designated areas of a dairy processing facility.

3.5 Feeding Systems Overview

As ruminants, cows utilize forages as a feed source. Corn silage, alfalfa haylage, small grain silages, legume or grass hay pastures, and baled dry hay comprise the main forages found on U.S. dairy operations. Corn grain, processed in a variety of ways, is the primary carbohydrate consumed by dairy cattle. Protein sources such as soybean meal, distiller's grains, brewer's

Upright Bulk Bins

Hay & Commodity Shed

Feed Silos

Plastic Feed Bags

Silage Bunker

grains, gluten feed, and a variety of other by-product feeds provide essential amino acids for milk production. Vitamin and mineral supplements are also necessary for dairy animals. Adult lactating animals can consume as much as 120 pounds of wet feed per day to produce 70 pounds or more of milk. Feed is the most expensive production cost on a dairy operation.

3.5.1 Feed Storage

Most dairy facilities rely on delivery and short-term storage of bulk feed ingredients for on-farm mixing with forages. Up-right metal bulk bins or commodity sheds (open front with a roof and side walls) can store grains, protein mix or complete feeds (those mixed at a commercial facility and delivered) on farm. In most cases, stored dry commodities should be used in a first-in, first-out manner, and new feed should not be added to or poured on top of older feed.

Large volumes of silage and hay are typically stored on site for feeding. Corn silage is harvested in the late summer or fall; alfalfa haylage can be harvested monthly during the growing season (northern climates up to four times per year; irrigated southwest up to 11 times). Wet forages can be stored in an upright silo, bunkers, piles, or in long plastic bags. If the silages become too acidic (improper fermentation) they can cause caustic lesions on the muzzle of the cows. These lesions could resemble a vesicular disease and further examination/testing is warranted. Please refer to the FMD Prevention Practices in the Appendix for more information about clinical signs of FMD in cattle.

The open face of silage must be maintained appropriately by removing an adequate amount each day to prevent spoilage using a tractor with a bucket or silage shaver. Generally, 6-12 inches should be removed off of the entire face each day; however, this will vary with weather conditions. Care must be taken when removing feed from large piles/bunkers. The face 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 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 (RVF) was introduced into the U.S. More information about RVF is available in the Appendix.

Bagged feed (minerals, vitamins, salt, buffer, milk replacer, calf feed) should be stored in an enclosed area to prevent rodent, fly, and bird access. Opened bags, especially milk replacer and calf feed, should be stored in a container that can be sealed, such as a large garbage bin with a tight fitting lid.

Spilled feed attracts rodents, wildlife, fosters spoilage, and serve as breeding grounds for other pests. As much as is practical, spillage, feed access and contamination from any animals which could urinate, defecate or otherwise introduce disease should be prevented.

3.5.2 Feed Delivery

3.5.2.1 Receiving Off-Farm Feed Products

Most dairy operations purchase a portion of their feedstuffs from outside suppliers. These can include grain, protein mixes, bagged feed (vitamins, minerals, milk replacers) and byproducts (whole cottonseed, distiller's/brewer's grains, bakery product, potatoes). Delivery frequency will depend on on-farm storage capacity, shelf-life of product, and herd size. All feeds on a dairy should be evaluated for their risk of introducing and/or transmitting disease. Purchased feeds should be accompanied by an acceptable quality assurance program and documentation. This should verify that reasonable measures have been taken to protect the feed from contamination with potential disease-causing material, including ruminant-derived protein. If contamination is suspected, a representative sample of the feed should be collected and frozen for diagnostics. A delivery log should be used to track who was on farm, what product and where it was delivered, and previous deliveries to other operations by the same trucking company.

3.5.2.2 Feeding Animals

The type of ration fed is dependent on available feedstuffs, production style, and facilities. The method by which the ration is mixed, delivered, and fed to cows varies by management style and location in the country. In most cases, the mixing and feeding of dairy rations can involve multiple movements of feed ingredients, feed equipment, delivery trucks, and personnel on and off any given dairy. In all dairies, equipment used to mix or deliver feed should be clean and free of organic matter (feces, urine, saliva, milk).

In order to meet the high intake demands of lactating animals, feed should be made available 20 out of 24 hours a day as cows are sporadic eaters and not all will eat at the same time every day. Some operations deliver a large amount of feed once a day and push up feed frequently (4-6 times/day) to encourage consumption. During hot weather, or on operations with smaller feed delivery equipment, fresh feed will be delivered multiple times a day, often at night in hot weather. Scraping feed bunks and mangers to remove all old feed should be done on a regular basis to prevent consumption of spoiled feed. Piling new feed on top of old presents an ideal environment for proliferation of spoilage and disease organisms (*Listeria monocytogenes, Clostridium perfringens*, and mycotoxins) during hot weather. Accumulation of old feed also serves as a breeding ground for flies and other pests which can spread disease.

Replacement animals eating forage-based rations may be offered feed daily or every other day, depending on herd size and proximity to feed storage. Monitoring feed quality and removing spoiled feed is essential for this group to ensure consumption of essential nutrients for growth and development.

Feed offered to cattle at ground level where people walk and drive can become contaminated with feces. At no time should anyone walk or drive through feed. Narrow openings (just wide enough for a person to pass through) near gates could be used so that personnel are able to enter the pens without climbing through the feed bunk or over fences. Again, the possibility of wildlife (birds), rodents, dogs, and cats introducing or spreading disease must be recognized, and access to feed bunks or stored feed areas minimized and eliminated if practically possible.

For animals on pasture, supplemental feed may need to be offered to meet nutrient requirements. Hay rings or wooden feed bunks will congregate animals in a small area, causing fecal and urine buildup. Frequent movement of the feeding area, appropriate grouping of age cohorts, and minimized stocking density will lessen environmental contamination. Avoid fertilizing pastures with high risk materials (non-composted manure, possibly poultry litter), frequently drag the fields to break up fecal pats in drier climates, and avoid overgrazing which forces animals to graze closer to the ground and nearer to fecal pats.

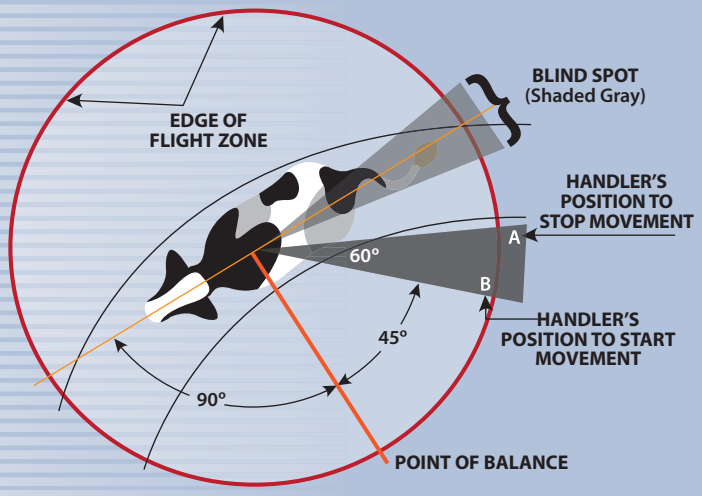
3.6 Bedding Overview

All life-stages of dairy animals require some form of bedding in their housing areas. Types of bedding are determined by life stage, geographic location of the operation, type of housing structure, manure handling system, and product availability/cost. Some bedding types are by-products of crops grown in the area: straw, corn stalks, bean/wheat stubble. If the operation has its own crop ground, these might be the most convenient and economical choices. Manure handling is covered later in this document, but once properly composted, dried manure can be used as a bedding source. Other bedding types come from purchased sources and include sand, soyhulls, ricehulls, wood shavings (kiln-dried), sawdust, and newspaper. A delivery log should be used to track who was on farm, what product and where it was delivered, and previous deliveries to other operations by the same trucking company.

4. ANIMAL MOVEMENT

Adult dairy cattle are used to daily movements within, to, and from their pens or pastures by humans. Quiet, calm handling by trained people is essential. Young stock may not be as accustomed to movements. Cattle tend to react to light/dark patterns, shadows, loud noises and sudden movements by balking, fleeing, or fighting the pressure that is being applied. Animal handlers should be trained to use behavioral principles of handling such as flight zone and point of balance, as illustrated in Figure 3, whether moving in a pen or loading onto a trailer. If necessary, plastic paddles are a movement aid but should not be used to strike an animal. Electric cattle prods should only be used as a last resort, and should never be applied to any area in front of the shoulder, or near the rectal region. The ears of calves should not be used to maneuver the animal; rather guide them with a hand under their jaw and the other hand on their rump to move them forward. Improper handling is very stressful for cattle and can have negative production and health consequences. Videos demonstrating proper handling techniques can be viewed 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

Moving cattle in extreme weather conditions warrants extra precautions. Factors to consider include distance traveled, ventilation (slats open or closed on the trailer), bedding (especially for young stock in cold weather), and density (number of animals for body heat). During hot conditions, cattle loading/transporting should occur during the coolest parts of the day. Documenting animal movements on and off a dairy premises occurs with various levels of accountability but can become important when tracing potential disease exposure.

4.1 Within the Same Operation/Ownership

Some dairy operations have multiple locations all under one ownership dedicated to raising animals in different life stages. Newborn dairy heifers may be removed from the milking operation and placed on another location for rearing. Bred heifers could be moved to pasture or another barn. Dry cows could also be moved to another location – out to pasture, another farm with facilities for feeding, monitoring. These animals could remain in this location until 2-3 weeks prior to calving or until they have calved. Herd bulls may be moved from the lactating animals to a group of breeding age heifers. Bull calves could be fed out in a feedlot setting. Producers should be encouraged to record these animal movements for inventory purposes and in the event of a disease outbreak to facilitate tracing exposure.

4.2 Off-Farm

Dairy animals may move off-farm permanently or temporarily, depending on their life stage. Permanent movements include heifers sold as reproductive stock, lactating animals sold to another dairy, bull calves sold at birth, bulls sold to artificial insemination centers, and market cattle (auction and slaughter). Only healthy animals should move into these markets. Temporary movements include calves moved to a calf nursery, heifer ranch/heifer raiser, herd bulls shared with other dairy operations, cows to embryo transfer facilities, heifers being implanted with embryos, animals to a veterinary clinic/hospital for treatment, overflow animals moved to another facility for milking, and livestock shows.

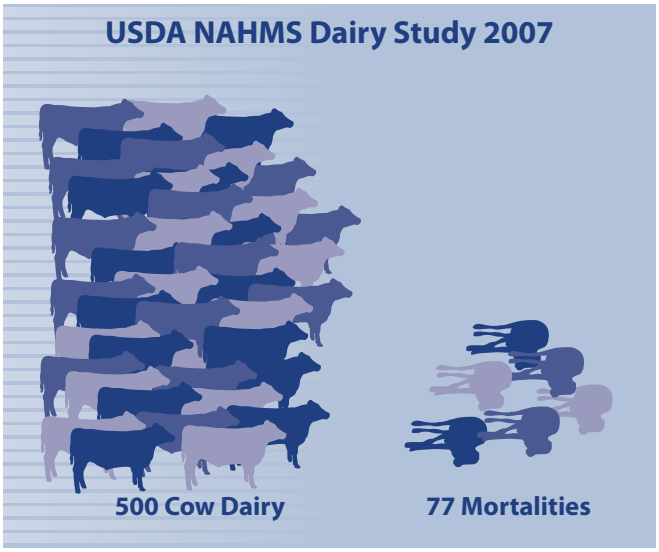
Animals taken off-farm and having contact with animals of different origins should be treated as a new introduction upon return to the home facility. Measures should be taken during their time away to limit their contact with other animals. This includes prohibiting sharing of trailers, stalls, feed, or water with animals from other operations. Other items to consider include: halters and lead ropes, grooming supplies, feed and water containers, reproductive equipment (artificial vaginas for semen collection, artificial insemination pipettes, uterine pipettes, etc.), needles and syringes, among others. If shared, they must be properly cleaned and sterilized between animals. People contact should also be minimized. If at a fair or show, do not allow the public to feed your animals.

4.2.1 Market/Cull Cattle

Dairy cows and bulls that have reached the end of their productive lives are removed (culled) from the herd. Common reasons for removal are low milk production, physical injury, feet problems, reproductive problems, poor body condition, udder health or conformation issues, and old age. Dairy market cows and bulls are either marketed directly to a slaughter facility or sold at an auction market.

4.2.2 Mortalities

The disposal of dead animals (carcasses) is regulated by the respective state where the farm is located. Based on the NAHMS Dairy 2007 study conducted by USDA, 5.7% of adult cows, 7.8% of pre-weaned heifers, and 1.8% of weaned heifers died in 2006. Using those percentages on a 500 cow dairy, expected number of dead animals in a non-highly contagious FAD situation would be 77 carcasses per year needing proper disposal.

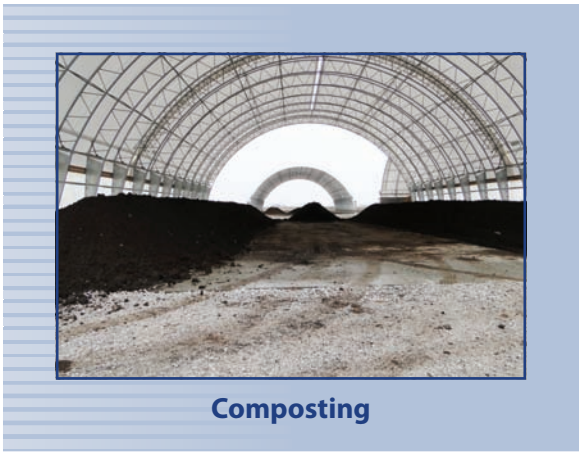


Source:

- *NAHMS Dairy 2007 Part I: Reference of dairy cattle health and management practices in the United States, 2007. US Department of Agriculture: Animal and Plant Health Inspection Service: Veterinary Services, Center for Epidemiology and Animal Health, accessed Sep 14, 2008.*

In normal situations, four methods of carcass disposal are generally permitted: rendering, composting, burial, and incineration. It is important to realize that each State has specific laws regulating the proper disposal of livestock. Environmental and legal regulations need to be considered for each option. State departments of environmental protection and natural resources must be consulted when planning widespread disposal of carcasses. Listed here are potential options:

1. Rendering of carcasses is a common method for farms located in an area where the service is available. This can be an expensive option, but is offset by the benefit of having a third party take the responsibility for managing the carcasses in an environmentally sound manner. Rendering is nearly always carried out by a business independent from the farm and often includes "pickup" service at a designated location on the farm; preferably at the edge of the farm away from main traffic area. Rendering collection trucks going from farm-to-farm can present a biosecurity risk. Rendering services are not available in all areas. In situations involving massive depopulation, rendering services can be quickly overwhelmed. If a highly contagious FAD was involved, this will likely not be an option.
2. Composting on farm is an inexpensive option in some climates/localities and it may require a large space, access to water, and co-composting materials (carbon-rich sources such as sawdust, wood shavings, hay bales, etc.) when incorporated into a sizable dairy farm. Well-described techniques are widely available at *http://www.abe.iastate.edu/cattlecomposting/* and *http://tammi.tamu.edu/largecarcassE-422.pdf*;



equipment needed and protocols will vary. States will regulate whether this is an allowable disposal method; proximity to groundwater and prevention of run on to and runoff from composting area must be considered. Producers using this method must have a plan in place for utilizing the finished compost (spread on crop ground, bedding). When done properly, composting can destroy most infectious disease agents.

3. Animal burial is a common procedure on some farms, particularly smaller facilities. Timeliness of burying, impermeable soil, greater depth to water table from trench/pit bottom, and prompt covering of the carcasses are critical to maintaining a biosecure and aesthetically acceptable burial site.Most states regulate separation distances of burial site from wells, surface water and the property line, and limit the number of animals that can be buried in an area. Some states have maps that show where animals can be buried safely and lawfully. In a large-scale disease outbreak, this may be the method of choice for the disposal of large numbers of cattle depending on risk to groundwater contamination and available land. Alternatively, Type I landfills may be suitable for burial of massive mortality. However, prior arrangements with the landfill operator to accept non-contagious carcasses should be made during planning for this disposal method.
4. Controlled incineration of the carcass on farm works well for a small number of animals. The process of incineration takes several hours to complete and the burning odor and smoke pollution can be a public concern. Thus open pyre burning should be the method of last resort. Incineration is often not suitable or cost-effective for larger animals but it will destroy most of the pathogen and leave minmal byproducts.

Please refer to the *FAD PReP/NAHEMS Guidelines and SOP: Disposal (2011)* for specific details on each of the above described options in the event of a highly contagious FAD outbreak. Another resource on animal mortality management is Managing Contaminated Animal and Plant Materials: A Field Guide on Best Practices available at: *http://tammi.tamu.edu/MortalityTSWGguide-2008.pdf*.

5. PRODUCT MOVEMENT

Dairy operations produce a number of products: saleable raw milk, colostrum, non-saleable milk, embryos, manure, calves, and market (cull) cattle. Each of these can be moved off farm as marketable products; they also have the potential to spread disease in the event an operation becomes exposed and subsequently infected with a highly contagious FAD. Market cattle were discussed in Part I, section 4.2.1.

Milk Tanker

Truck Seal

5.1 Raw Milk to the Processing Plant

Dairy operations either sell their milk on contract to a dairy processing company or join a milk cooperative that buys their milk and sells it to processors. A few operations own their own processing plant. The dairy processing company or milk cooperative contracts with a milk hauling company for milk pick up; some operations own their own milk tankers. One milk tanker can pick up one farm or as many as needed to fill the tanker before returning to the milk processing facility for delivery.

On farm, the milk hauler collects one to three small plastic vials from the bulk tank where the milk has been properly agitated. These samples are tested for antibiotic residues, somatic cell count, milk components, bacteria, and potentially other metabolites. This information is reported back to the operation for each bulk tank pick up. It is the basis for regulatory testing as well as a basis for premium payments, if the processor includes milk price with milk components into the dairy's contract. In the event multiple farms have milk picked up by the same tanker, these individual samples are important in the event an antibiotic residue is found through tanker testing at the processing plant. The samples allow identification of the responsible operation. In a highly contagious FAD outbreak, this same process could be used for disease testing and positive farm identification if a validated milk test is available.

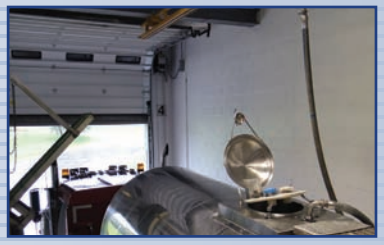
After loading the tanker at the farm, seals are put in place on all access points on the milk storage portion of the tanker. The milk hauler records all seal numbers on the load manifest (bill of lading); copies are kept by the hauler and processing plant. Seals remain in place until milk is picked up at the next operation or until the tanker arrives at the plant for unloading. Any seals removed by the driver during the loading process are replaced. The used seals are maintained by the driver and reconciled against the written seal record at the time of delivery by receiving facility employees prior to off-loading.

Once the milk route is complete, the milk hauler delivers the raw milk to a transfer station or milk processing facility. Transfer stations function to load milk from smaller tankers into a larger tanker which is then transported over the road to a processing facility. Transfer stations must meet the same requirements for handling milk as all dairy processing facilities.

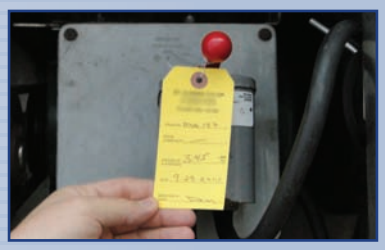
At the processing plant, the tanker enters the receiving bay (usually enclosed except in California, the southwest U.S. and parts of the south) to begin the unloading process. A sample of milk is taken from each compartment of the tanker and may be analyzed for a number of things. Most commonly protein, fat content, bacterial count, and antibiotic residue are monitored. After approval, the tanker is unloaded and the raw milk piped into raw milk storage to await the pasteurization process. Some plants will reload raw milk for shipping to other plants for processing (a term referred to as balancing). Minimum standards for pasteurization are set by federal regulations, but it is common for dairy processing facilities to exceed times and temperatures according to their own protocols based on the finished product being made.

Depending on plant policy and scheduling, the interior of the milk tanker goes through a cleaning process (clean-in-place) that removes the residual milk, cleans, sanitizes, and rinses it. If the tanker is delivering another load of milk to the same plant on the same day, cleaning may not be done between pickups but occur at the end of the day. All access points are sealed after cleaning and the seal numbers are recorded on the wash tag. Wash tags indicate when and where the tanker was cleaned. Milk tankers not used for 72 hours after cleaning must be rewashed before picking up milk.

Areas of the external tanker, especially where raw milk may have spilled should also be cleaned. Depending on plant policy, tanker trucks may go through an external wash or rinse while milk is being off-loaded or once the truck leaves the receiving bay prior to leaving the plant. Not all plants have the capabilities for external tanker washing. The hauling company, not the PMO, determines the frequency of cleaning the exterior of the milk tanker.



Clean-in-Place (CIP)



Wash Tag

Wash Tag and Seals

5.2 Raw Milk to Consumers, Pet Food

In a survey conducted by the National Association of State Departments of Agriculture in January of 2008, there were 29 states that allowed the sale of raw milk to consumers by some means. Thirteen of those states restricted legal sales to the farm where the cow's milk was produced (four additional states restricted sales to goat milk). Twelve states allowed raw cow's milk sales at retail stores separate from the farm (one additional state allowed retail sale of goat milk). In 33 states, consumers may purchase an animal 'share' from a dairy producer, thus allowing those owners or co-owners to acquire raw milk from that dairy. This occurred in states where the sale of

raw cow's milk was legal and illegal. Raw milk is also sold off farm as pet food in some states. Because unpasteurized milk can harbor disease organisms, these off-farm movements need to be considered in a highly contagious FAD outbreak.

Source: National Association of State Departments of Agriculture (NASDA) Releases Raw Milk Survey, April 21, 2008 accessed March 6, 2011 at http://www.nasda.org/cms/0/0/0/-3/9061.aspx?qsearch=raw+milk+survey

5.3 Raw Milk/Colostrum for Calf Feeding

Calf nurseries/ranches, heifer raisers, and even some beef cattle operations acquire their milk and colostrum supply from dairies. This liquid product can be transported from the dairy to its destination in small bulk tanks (<400 gallons) fitted onto trucks, stainless steel milk cans with lids (7 to 10 gallons), or individual containers (plastic sealed baggies, gallon milk jugs, nipple bottles) depending on volume and how it will be handled. This product has a shelf-life and is an excellent growth media for bacteria if not cooled to 45°F (7.2°C) or less within 2 hours of milking and stored at that temperature. Documentation of milk transported off farm varies if not for commercial sale. This can be important information during a disease outbreak and traceability could be difficult.

Some operations have batch pasteurizers on farm to process the milk or colostrum before feeding to calves to decrease on-farm disease spread. Time and temperature must be monitored carefully to ensure sustained, uniform heating. For more information on managing on-farm pasteurizers, please read, "Managing a Pasteurizer System for Feeding Milk to Calves" published by Bovine Alliance on Management and Nutrition (available here: *http://nahms.aphis.usda.gov/dairy/bamn/BAMNManaging_pasteur_sys.pdf*).

5.4 Non-Saleable Milk (NSM) to Calves

Cows that have been treated with antibiotics requiring a milk withdrawal are milked separately, preventing the milk from entering the commercial supply. The milk is discarded or used for feeding pre-weaned calves. Like saleable milk, proper storage and cooling is essential to limit bacteria growth. This product can also be pasteurized on farm to reduce pathogen load.

5.5 Embryos

Cattle with high genetic merit can serve as a source of embryos to propagate additional high producing animals. Recovery of embryos is primarily through non-surgical techniques in a process taking less than 30 minutes. The embryos can be transferred immediately to a recipient animal or frozen in liquid nitrogen and transferred later. Frozen embryos can be marketed domestically and internationally (requires health certification and communication with the destination country on requirements). This can be a significant source of income for a dairy operation. Recording the destination of embryos leaving the farm could be important information in the event of a highly contagious FAD outbreak.

5.6 Manure Handling

Manure is an inevitable by-product of dairy production. It has been estimated that a well-fed dairy cow can produce 1.2 to 1.6 cubic feet of manure per day per 1000 pounds of body weight. Cattle manure contains nutrients that can support crop production and enhance the soil's chemical and physical properties. Manure can be an asset to a dairy operation if its nutrient value is maximized.

Source:

- *Dairy Freestall Housing and Equipment, Midwest Plan Service-7, 2007, p. 92*

Manure management has become a major factor in determining the location and herd size limits of operations. Poor manure management can result in increased disease in the cattle, odor issues, and potential environmental and water

quality issues. State and local environmental agencies determine the approved methods for handling manure and it is becoming mandatory for operations of a certain size to have manure management plans on file. Dairy producers select a manure handling system based on state and local regulations as well as farm location, the number of animals on site, type of animal housing and bedding used, and the type and use of their cropland. Many producers still scrape, haul, and spread manure daily due to limited or no manure storage facilities. Common manure management systems include:

- Solid manure handling
- Slurry manure handling, including sand separation
- Liquid manure handling
- Anaerobic lagoons, including digesters* for methane burning
- Composting**

*Digesters are used on some operations as a component of anaerobic lagoons that utilize bacteria to break down manure. The manure is fed into a digester and separated into liquid and solids. Methane and carbon dioxide generated can be captured with specialized equipment to generate electricity and heat.

**Composted manure can be used as a marketable product to greenhouses, landscaping companies or used as bedding on the operation.

The capacity of the other types of storage facilities are determined by state regulations based on their size and the estimated amount of manure being produced by the cattle. Storage facility capacity is generally designed for removal and draining twice a year, when convenient for crop production. Crop types and harvest times greatly affect the timing of manure application. Liquid manure is applied to the soil by direct injection or through spray from an irrigation sprayer, a spreader, or injector. Solid manure is hauled to the fields with tractors and spreaders. The amount of manure that can be applied to any specific area of ground and the type of ground (banned on frozen ground in some areas) is regulated by the state's environmental regulatory agency. Spreading manure certain times of the year can involve a large number of tractor/equipment traffic on and off the farm. In some parts of the U.S., manure application can only be done by people or companies that are certified or pre-approved by their state agency. Manure can harbor disease organisms and management of this dairy by-product must be considered in a highly contagious FAD outbreak due to fecal contamination and subsequent spread of disease.

PART II: RESPONSE TO A HIGHLY CONTAGIOUS FOREIGN ANIMAL DISEASE

6. DESIGNATION OF ZONES, AREAS, AND PREMISES

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

Table 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.

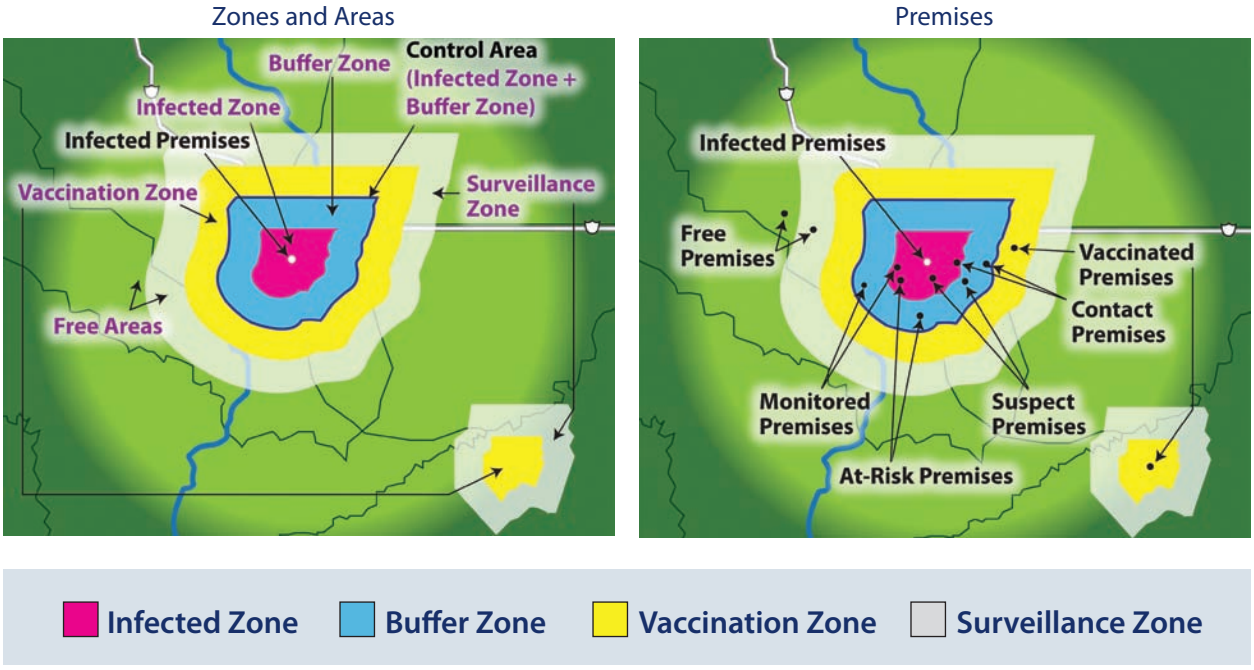
Table 4. Summary of Premises Designations

Animal 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 is 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 Containment Vaccination Zone (typically inside the Control Area) or Protection Vaccination Zone (typically outside Control Area). This is a secondary zone designation.

Figure 4 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 4. Control Zones



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*.

7. DISEASE-SPECIFIC BIOSECURITY MEASURES

Biosecurity measures in the event of a highly contagious FAD outbreak must be enhanced and more strictly enforced to minimize the risk of disease introduction and spread. Exposure to disease can occur through five main routes of transmission: aerosol, direct contact, fomite, oral, and vector borne. Humans are exposed to zoonotic diseases via the same five routes of transmission. Disease specific biosecurity measures aimed at preventing exposure to FMD and Rift Valley fever (RVF) and definitions of the disease routes are provided as appendices. These biosecurity measures can also be applied to other diseases with similar exposure routes.

- *Bovine Routes of Transmission – Appendix A*
- *FMD (spread by aerosol, direct contact, fomite, oral) – Appendix B*
- *Rift Valley Fever (spread by vector – mosquito; zoonotic via contact with infected body fluids) – Appendix C*

In order for an epidemiological investigation to determine potential exposures during a highly contagious FAD event, operations should keep an inventory of animals in the herd including identification numbers, breed, age, origin, and location. Animal movement to and from the farm should also be recorded including date, animal ID, origin, destination, reason for movement, driver, vehicle used, previous owner's name(s), and phone number. Likewise, movement logs for equipment, feed, milk, semen, and embryos should include dates, origins, destinations, delivery person, salesman, and the inseminator's name. Finally, pets and other animals located on the premises should be documented. While ideal, this may not be achievable on U.S. dairy operations; the depth of record keeping really varies by operation.

8. PROVIDING ANIMAL CARE

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

8.1 Feeding

During a disease 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. Table 6 provides general estimates of the amount of feed consumed per day by each animal in various life stages on an as fed basis. 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.

Table 6. General Estimates of Average Feed Consumption

Animal Category	*Amount of feed consumed per head, per day (as fed)*
Pre-weaned Calves	16-24 oz. milk replacer or 4-5 quarts whole milk; 0.5# calf starter
Weaned Calves	2-4# calf grain; 5-7# hay
Bred Heifers	25-30# silage, hay, grain
Dry Cows/PreFresh	35-45# silage, grass hay, grain
Lactating	100-125# silage, hay, grain, protein
Mature, Adult Bulls	30-40# silage, hay, grain, protein (when housed with lactating cows)

Source: extrapolated from Nutrient Requirements of Dairy Cattle, National Research Council, 2001; and Hutjens M., Feeding Guide Third Edition, 2008. Refer to these resources for more specific details.

Should feed delivery be delayed for an extended period of time, alterations in normal feeding regimens should occur gradually to prevent cows/calves going off feed. Farms with their own silage and dry hay supply can still meet the maintenance needs of cattle without purchased feed, but milk production will decrease. For pre-weaned calves on farm, whole milk may be a viable option if purchased feed supplies are unattainable for a period of time.

Calf nurseries/ranches/heifer raisers relying on milk from the source dairy need to have a contingency plan in place. In a disease outbreak, transportation of unpasteurized milk may be regulated and may not be allowed in certain areas. Milk replacer products should be substituted until a whole milk source can be acquired. Nutrient content varies between whole milk and milk replacer so gradual changes are ideal. Weather conditions will affect feeding rate and total solids offered. Consult with a nutritionist for recommendations to prevent calves from going off feed.

8.2 Bedding

In the event of a highly contagious FAD, stop movement orders may disrupt delivery of bedding supplies. The on-farm inventory of the various types of bedding must be promptly ascertained along with the rate at which it will be depleted in order to determine when more will be needed. Factors such as environmental conditions (temperature, moisture, humidity) need to be considered in the planning process. Certain times of the year require more bedding for the welfare of the animals. Transportation routes may be disrupted, so plans for alternate bedding sources and delivery routes should be made before the situation arises. Harvesting or moving bedding (straw, corn stalks) may be disrupted temporarily and authorities consulted to obtain movement permission in low risk areas. Records should be maintained including the origin of the bedding delivery, the date, and amount.

8.3 Milking

Uninfected cows should be milked according to the farm's schedule regardless of the zone in which they are located. On-farm milk storage is a limiting factor in an outbreak, never longer than 48 hours; often less than 24 hours on large operations that direct load onto tanker trucks or operations with small bulk tanks. Bulk tank storage capacities vary from farm to farm with smaller operations having a single 250 gallon tank to large farms with one or multiple tanks of several thousand gallons each. Milk silos can hold 5000 to 8000 gallons each and direct load tanker trucks store up to 8000 gallons. Cows in late lactation with lower milk production could be dried off (milk production ceased) in an effort to increase storage capacity on farm, but this will only have minimal short term effects.

The financial stability of a dairy is due to income derived from milk sales and lost production on uninfected operations does not qualify for indemnity payments. Therefore, producers need to work with milk haulers and processors to develop a contingency plan to collect, transport, and process milk in a manner that prevents the transmission of the disease to susceptible animals. Options for handling raw milk will be dependent upon premises designation, zone, and proximity to processing facilities. For milk that is allowed to move, strict adherence to movement controls and biosecurity measures for milk haulers, milk tanker trucks and processing plants is essential to prevent disease spread. Processing plants coordinate milk pick-up and delivery routes and these schedules vary depending on market demands. States should keep up-to-date contact information for processing plants in a given region to track milk hauler routes and to coordinate milk movement in the event of a highly contagious FAD outbreak. See Section 9.1, Product Handling: Milk for more information.

8.4 Vaccinating

8.4.1 Routine

Depending on the length of the disease response (days, weeks), routine vaccinations may be discontinued temporarily to decrease additional traffic from product distributors entering the operation. In temporary stop movement situations, commingling of animals from other herds may be prevented and the overall risk of exposure to a domestic disease decreased.

If the outbreak is long lasting (months, greater than 1 year), routine vaccinations and other normal business procedures may need to continue utilizing good biosecurity measures. In the event routine vaccines (respiratory disease, clostridial diseases, reproductive diseases, mastitis prevention) are needed during a highly contagious FAD response, the dairy producer should contact their normal distributor and obtain the products. If a disease-specific emergency vaccine 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.

8.4.2 Specific to Disease Event

Depending on the type of disease outbreak, the response may include vaccinating animals in an attempt to limit spread. Optimal vaccination strategies will vary greatly by region of the country infected 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

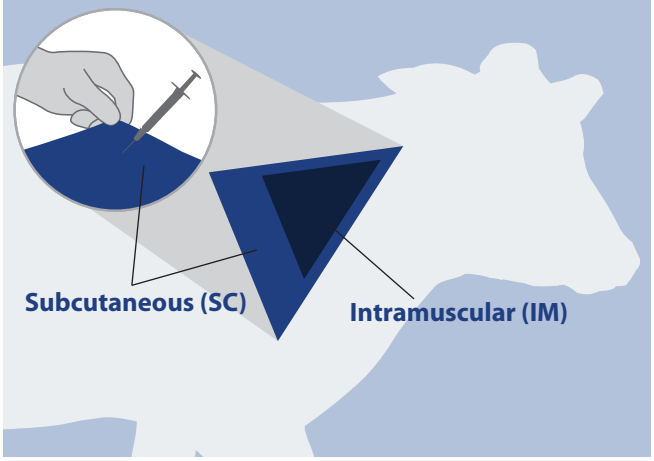
decisions of this nature. It is prudent to keep in mind that for vaccination-to-live strategies, tracking and permitting of vaccinated animals will likely need to occur for the life of the animal and may impact movement of other unvaccinated livestock in that vaccinated region.

If vaccination is implemented, the product will be made available by regulatory officials. Guidance as to dose, delivery method, and how to administer the product will be provided. In some cases, the regulatory officials may require administration or supervision by state/federal personnel rather than on-farm personnel. Individual situations will be taken into consideration and may vary among operations depending on their proximity to the Infected Premises and Control Area.

Whenever vaccines need to be administered, follow the dosage and injection site recommendations provided with the vaccine. Ensure the animal is properly restrained and change the needle between every animal. When using needles, ensure they are all accounted for before and after administration. 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.

Subcutaneous injections in cattle should be given in the neck area in front of the shoulder in the loose skin. Ensure the animal is properly restrained. The goal is to use an appropriate needle length to deposit the product in the area below the skin, but not as deep as muscle. Some references recommend using one hand to "tent" the skin while the other hand guides the needle under the skin and away from the site of skin puncture before depositing the vaccine. Exercise caution when "tenting" so as to prevent inadvertent injection into your free hand. If the situation does not allow for safe skin tenting, it should NOT be done. Intramuscular injections should be given in the neck just in front of the shoulder. Figure 5 illustrates these concepts. Needle-free injection systems have been researched and may be an option in an outbreak situation, depending on the type of vaccine and availability of resources.

Figure 5. Proper Injection Sites in Cattle



Vaccines for highly contagious FADs are likely to have a withdrawal time before animals can go to slaughter for human consumption. The slaughter withdrawal time will be indicated on the vaccine label. Some vaccines may have a withdrawal time for milk consumption. If there is a withdrawal time for milk, it will be indicated on the label. Please refer to the *FAD PReP/NAHEMS Guidelines and SOP: Vaccination for Contagious Diseases (2011)* and *Appendix A: FMD Considerations and Strategies (2011)* for additional details.

9. PRODUCT HANDLING

9.1 Milk

Raw milk produced on a dairy operation typically has four outlets:

1. Picked up daily or every other day and transported to a dairy processing facility.
2. Nonsaleable milk may be fed on site, pasteurized or unpasteurized prior to feeding.
3. Nonsaleable milk may be transported to another premises, pasteurized or unpasteurized prior to feeding.
4. Premises may process milk on site and sell a pasteurized finished product for human consumption.

- Where legal, premises may sell unpasteurized milk or milk products for animal or human consumption.

Milk movement is regulated by individual States and highly contagious FAD contingency plans need to account for transportation of raw product from uninfected farms in the Control Area. In 2004, the International Dairy Foods Association and National Milk Producers Federation developed guidelines for dairy processors to move raw milk from uninfected dairy farms and transport to processing facilities where it can be pasteurized. The Secure Milk

Supply (SMS) Plan is updating these protocols based on input from researchers, scientists, risk assessors, producers, milk haulers, processors, and state and federal government partners. More information about the SMS plan can be found at *https://fadprep.lmi.org*. Pasteurization of milk has the ability to reduce organism concentration; it does not sterilize the product. In a study by Tomasula et al., HTST pasteurization reduced foot-and-mouth disease viral titer in milk by 99.99%. Further processing of pasteurized milk into processed products may further reduce or eliminate any residual virus. Additional safeguards must be taken to move raw, potentially contaminated product into market channels to ensure susceptible animals and people (if it is a zoonotic highly contagious FAD) are not exposed. Collection routes should be altered to minimize traffic in and out of a Control Area.

Source:

- *P.M. Tomasula, M.F. Kozempel, R.P. Konstance, D. Gregg, S. Boettcher, B. Baxt, L.L. Rodriguez. Thermal Inactivation of Foot-and-Mouth Disease Virus in Milk Using High-Temperature, Short-Time Pasteurization. Journal of Dairy Science, 2007;90:3202-3211*

Some highly contagious FADs may go undetected for an indefinite period of time, allowing infected but unidentified animals to produce milk that enters market channels. Once these premises are classified as Infected or Suspect, vehicle movement records should be used to notify all drivers, transfer stations, and other premises where vehicles containing potentially infected product stopped so an exposure assessment can be done and decontamination can occur as needed. Product from the Infected Premises should be traced forward and the risk of highly contagious FAD spread to people or animals consuming that product be assessed.

Movements of suspected contaminated product from the dairy plant into commerce or as waste milk products should be halted until that dairy plant can test for the presence of the highly contagious FAD. A dairy plant that has received highly contagious FAD contaminated raw milk may have to stop production to do clean-in-place (CIP) and clean-out-of-place (COP) procedures if not already done. Trace-outs of waste milk or waste milk products (e.g., liquid whey from cheese making plants or milk permeate) should be undertaken to ensure that the contaminated product was not fed to susceptible animals for the duration of two-times the incubation period of the highly contagious FAD. Dairy processing plants vary in the types of products produced and how the milk is pasteurized and further processed. If further processing capabilities exist at the plant that remove the risk of highly contagious FAD agent spread and the procedures are accepted by regulatory officials, the plant may be able to continue receiving, processing, and shipping product. This could vary by state and dairy plant.

Milk from Infected Premises must be disposed of in a manner that does not expose susceptible animals nor contaminate the environment. Some dairy operations have on-farm pasteurizers to process nonsaleable milk for calves; very few U.S. operations have the ability to pasteurize a day's worth of milk on farm. Operations should have procedures in place for disposal of a bulk tank capacity of milk based on local and state environmental regulations. If on-farm disposal cannot be safely accomplished, state and/or federal officials will need to permit movement off-site to an authorized disposal area using designated routes and following entry/exit biosecurity procedures.

Once contaminated with a highly contagious FAD, special handling may be required to inactivate the organism in milk. The procedure is organism specific but could include acidifying milk in the bulk tank or a manure storage tank using citric acid, acetic acid, hypochlorite, or alkalinizing it with sodium hydroxide. Once decontaminated, the milk could be drained into the manure slurry store, the effluent pit, an on-farm lagoon, a burial pit, pumped into a manure spreader to be knifed into agricultural ground, or hauled to a solid waste landfill. Disposal options will vary with amount of milk to be disposed, dairy location, State highly contagious FAD plans, and environmental temperatures and regulations. The amount of milk disposed should be recorded for reimbursement at fair market value. Please refer to the *FAD PReP/NAHEMS Guidelines and SOP: Disposal (2011)* for additional details.

9.2 Dairy Animals

Live animals are the greatest risk for introducing or spreading disease during an outbreak. Movement of young stock off farm from uninfected premises for rearing at a calf nursery/ranch/heifer raiser may be halted during a highly contagious FAD outbreak depending on the proximity to the destination and whether travel through or within a Control Area is required. Provisions for their feeding and care on the home operation need to be planned for to ensure adequate housing, protection from the elements, and appropriate feedstuffs are available. Prior to an event, dairy operations should establish contacts with calf ranches/heifer raisers in the immediate area so that clean and disinfected housing units, feed/water bottles/buckets and treatment equipment can be acquired/rented/shared.

Identify suppliers of this equipment if heifer ranches/raisers are not located near the dairy operation.

Movement of animals to pasture or to different locations owned by the same operator may be halted during a highly contagious FAD event. Likewise, heifers or pre-fresh cows due to calve may not be able to move to the home dairy. Operations and their animals located in two different response zones may be unable to move animals for a period of time. Provisions for the care and feeding of these animals groups must be considered. Preparedness plans at the local level should include emergency sheltering options for dairy animals in case of a disease outbreak.

9.3 Culls/Slaughter

Dairies may sell cull cattle through an auction market/sale barn on specified days where they are commingled with animals from multiple operations before transporting to slaughter. Cull cattle are also purchased on farm by a consolidator who travels a geographic area to acquire a semi-load of cattle for a slaughter facility. Records pertaining to animal movement should include date, animal identification, and destination. Cull cattle movement off uninfected premises may be halted temporarily during a highly contagious FAD event depending on the proximity to an auction market or slaughter facility. If there is adequate housing, ambulatory animals should remain on farm until movement controls permit transportation. Non-ambulatory or injured animals should be humanely euthanatized on farm and disposed of with other carcasses.

Dairy steers fed on uninfected premises destined for slaughter may also be halted for similar reasons. Contracts with order buyers need to be discussed in the event the cattle cannot be delivered on a specified date. Provisions for feed need to be acquired to ensure the cattle meet their nutritional needs until movement controls permit transportation.

9.4 Mortalities

Animals that die or are removed from the herd should be recorded in farm records. A necropsy and appropriate testing to determine cause of death should be done on all animals that die on the farm of unknown or suspicious causes and a report included in the farm inventory records. Most dairy operations have determined their method of carcass disposal based on "usual" mortality rates. If a highly contagious FAD causes higher than average mortality rates, animals must be disposed of in the manner mandated by the Federal and State 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.

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. Please refer to the *FAD PReP/NAHEMS Guidelines and SOP: Disposal (2011)* for additional details.

9.5 Manure

Many disease organisms are shed in bodily secretions, including manure. Pathogen survival in manure varies and is affected by environmental temperatures. Cold weather usually increases pathogen survival. Solid manure can be composted to increase core temperature and kill most pathogens. Some dairy operations contract with manure pumping services to clean out their lagoon or slurry stores and spread manure on agricultural ground which increases the possibility of exposure to many different operations in the area. Manure application/movement logs should be kept including dates, origin, application sites, volume applied per site, and application method.

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 is an option with 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. Please refer to the *FAD PReP/NAHEMS Guidelines and SOP: Disposal (2011)* for additional details.

10. SURVEILLANCE

Within 48 hours of the identification of the index case, a surveillance plan will be implemented to define the extent of the highly contagious FAD outbreak 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.

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 milk (if validated tests are available), market animals, and at slaughter. Please refer to the *FAD PReP/NAHEMS Guidelines and SOP: Surveillance, Epidemiology, and Tracing (2011)* for additional details.

10.1 People

Visitors and employees can introduce or spread disease to susceptible animals if steps are not taken to mitigate these risks prior to entry. 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 glove removal. 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 to aid exposure assessments. Table 7 lists the types of personnel movement onto a dairy operation during normal business. Some of these will change based on the size of the operation. Using a written log to record name, contact information, last contact with a susceptible animal species, and reason for being on farm including facilities entered/animals contacted is crucial. Prior to a disease event, records of this information may not be as readily available on all operations, slowing the response and possibly permitted movements off-farm. Visitor logs are available in the Appendices.

Table 7. Type and Frequency of Vehicle/Personnel Movement Onto Dairy Operations

Daily	*Weekly*	*Monthly*	*Seasonal/Variable*
Employees	Veterinarian	Veterinarian	Milk equipment repair personnel
Milk hauler	Feed delivery	Nutritionist	Feed, equipment, seed, and pharmaceutical sales personnel
Calf pick up	Calf pick up	Heifer delivery	Hoof trimmers
Reproduction technician (artificial insemination)	Reproduction technician (artificial insemination)	Dairy cooperative field representative	Embryo transfer
	Cull cattle buyer	Cull cattle buyer	Manure removal
	Rendering	Diesel fuel delivery	Propane delivery
	Supply delivery (towels, dips, milk liners, vaccines)	Garbage pick up	Harvest equipment
		Utility meter reader	

During an outbreak, personnel on farm should be limited to those essential for the day-to-day operation, making it easier to trace and minimize the risk of disease introduction. 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.

Higher risk personnel on a dairy operation are those individuals that visit multiple premises within a given day and have contact with animals or their feed/housing/milking areas. This includes employees having off-farm

animal contact, veterinarians, milk haulers, heifer raisers, and service providers such as hoof trimmers, AI technicians, milk equipment repair personnel, rendering truck drivers, feed delivery persons, sales persons, and dairy cooperative field staff. Strict adherence to biosecurity protocols should be required for farm entry and animal contact during a highly contagious FAD event.

10.2 Vehicle Traffic

Vehicles and equipment can indirectly expose susceptible animals through mechanical disease transmission. Installing a barrier that requires vehicles to stop before entering the premises provides an additional control point and can facilitate monitoring and recording vehicle details. Cleaning and disinfecting tires, wheel wells, and the undercarriage of all vehicles which enter or leave a farm will likely be required on all Infected or Monitored Premises. It may be prudent to park vehicles off-site that are not required on farm. People and vehicle traffic on and off an operation during a disease outbreak should be documented; vehicular traffic related to the personnel listed in Table 7 is a starting point. 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.

Milk tanker trucks pose the same or higher risks as all other vehicles, but are not allowed to travel through cattle housing areas or have direct contact with the dairy herd. However, they pose unique risks of disease transmission through the movement of raw milk. In many cases, milk haulers pick up milk from multiple premises for delivery to a processing plant. If, within a multi-stop route, raw milk that contains an infectious disease agent is picked up, the premises on the latter part of that route are at risk for exposure if contaminated milk spills onto that operation. Specific biosecurity performance standards for milk haulers/tanker drivers and the milk tanker are being developed as part of the SMS Plan. The bullets below outline common risks posed by milk tanker trucks.

- Milk tanker truck exteriors are not routinely cleaned between premises on the same route.
- Milk tanker trucks contaminated externally with mud/manure/organic material containing infectious virus can serve as a fomite and transmit the disease to subsequent farms.
- Milk tanker trucks may also transmit disease by spreading raw milk aerosols that may be generated during loading and movement between dairy farms and to processing facilities (more research is needed to quantify this risk).
- Milk haulers may mechanically transmit disease through raw milk spillage during sampling, loading, and unloading.
- Licensed milk truck drivers are required by the PMO to exit the truck and perform all milk pick up steps (described previously) which could result in contamination of their skin, clothing, outerwear, and milk collection equipment.
- The interior of the tanker is not usually cleaned and sanitized between each load unless they only pick up one load per day.

10.3 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. Examples of clinical signs for FMD and RVF are found in the Appendices. 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" status may be required for permitted movements of susceptible animals within the Control Area.

10.4 Sample Collection

Premises with the highest risk of infection will have animals sampled for disease testing. Handling tissues and fluids from cattle on these operations requires strict adherence to biosecurity and infection control procedures. Cattle at harvest facilities may also have samples collected. Unless otherwise specified, samples will be collected by trained

animal health personnel (veterinarians, animal health technicians – private or government). Depending on the disease, specific tissues and/or fluids will be obtained on farm from live animals or after performing a full post-mortem exam on mortalities (whenever possible). Guidelines will be provided to veterinary responders and animal health technicians regarding the specific type of tissues needed, fresh or fixed, fluids (serum, whole blood, vesicular fluids), and details related to how to label and package them appropriately. See *VS Memo 580.4 Procedures for Investigating a Foreign Animal Disease/Emerging Disease Incident (FAD/EDI) October 2008* for more information.

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 to avoid contaminating diagnostic samples with disinfectant as the highly contagious FAD will be inactivated providing false negative results. See the *FAD PReP/NAHEMS Guidelines and SOP: Personal Protective Equipment (2011), Biosecurity (2011), and Cleaning and Disinfection (2011)* for more information.

10.5 Sample Submission

Early in the disease outbreak there may be a single laboratory or a select group of laboratories that can perform the diagnostic testing. Guidance will be provided regarding sample submissions to laboratories. Personnel at the receiving laboratory should provide specifics related to sample submission. This may change as the outbreak continues and other laboratories are able to perform the specific tests or if on-farm diagnostic tests are available and approved. There are some fundamental principles that must be adhered to in the event of a highly contagious FAD investigation to ensure accurate, rapid results.

Once samples are obtained, proper labeling is PARAMOUNT to ensure results are correctly reported. Submit samples with the appropriate paperwork (hard copy or electronic). This may consist of forms provided by the laboratory or animal health authority. All individual animal identification numbers should be recorded. The premises must be properly identified on all paperwork and sample packaging using a premises identification number, if available. Again, proper completion of the paperwork is essential so that the results are accurately reported to the submitting veterinarian or animal health authority. In some cases, samples could be submitted to prove negative status for permitted animal movement and accurate, timely result reporting is essential.

Samples obtained in the field should be properly packaged to prevent leakage (individually sealed plastic bags around each fluid tube) and thus contamination of samples within or external to the box/cooler. Completed paperwork should also be placed in a sealed plastic bag. Cold packs are recommended instead of ice for transporting samples. Be aware of environmental temperatures and provide enough cold packs to keep tissues from degrading in transport.

11. APPRAISAL AND COMPENSATION (FAD PREP/ NAHEMS GUIDELINES AND SOP)

Animal health regulatory officials will collect an inventory of animals designated for depopulation and appraise their fair-market value in order for compensation to be paid. Contaminated materials on farm (milk, feed, bedding) will also be appraised on-site as they will need to be disposed of in an effort to eradicate the disease. Facilities and equipment that cannot be properly disinfected must also be destroyed and fair market value assessed. Please refer to the *FAD PReP/NAHEMS Guidelines and SOP: Appraisal and Compensation (2011)* for specific details on this process.

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

To control disease spread, infected and exposed animals may be depopulated by qualified personnel according to USDA-APHIS and AVMA guidelines. The method of depopulation and procedures used will depend on

available resources and population dynamics of susceptible animals on the premises. This requires location-specific planning and preparation which is addressed in the *FAD PReP/NAHEMS Guidelines and SOP: Mass Depopulation and Euthanasia (2011)*.

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

Animal carcasses and associated contaminated materials (milk, feed, bedding) must be disposed of in a way to limit disease spread, using State or municipality approved methods. Specific personnel will be assigned to an operation to carry out these activities once depopulation is complete. Please refer to the *FAD PReP/NAHEMS Guidelines and SOP: Disposal (2011)* for specific details on this process.

14. CLEANING AND DISINFECTION (C&D) (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 information, see *FAD PReP/NAHEMS Guidelines and SOP: Cleaning and Disinfection (2011)*.

15. WILDLIFE MANAGEMENT AND VECTOR CONTROL (FAD PREP/NAHEMS GUIDELINES AND SOP)

Wildlife susceptible to the highly contagious FAD can complicate eradication/control efforts. A coordinated effort of local, state, Tribal and federal agencies with U.S. Fish and Wildlife Services, the Department of the Interior and State wildlife agencies is necessary to accomplish control without jeopardizing environmental ecosystems. Producers' knowledge of area wildlife and potential exposure will be vital in this assessment and management process. Please refer to the *FAD PReP/NAHEMS Guidelines and SOP: Wildlife Management and Vector Control (2011)* for specific details on this process.

16. INTERNATIONAL TRADE

In 2010, international exports of dairy products including milk solids, whey proteins, skim milk powder (non-fat dry milk), butter and cheese was valued at over $3.71 billion USD. This was a 63% increase over 2009 exports. Countries receiving these exports vary by commodity; by volume, Mexico was the top importer of ice cream and cheese, Southeast Asia imported the most skim milk powder, and Europe (Soviet Union, Russia, and European Union) was the top importer of butter in 2010. Export markets are important to the dairy industry. In the event of a highly contagious FAD outbreak affecting dairy cattle, international trade of animals and animal products would be halted for the affected zones or regions.

Source:

- *U.S. Dairy Export Council, 2010 Export Data accessed March 3, 2011*

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

For more information on regionalization, please see the *FAD PReP SOP: Overview of Regionalization for International Trade (2011)*, 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:

- Dairy Industry Facilities Manual (draft August 2003 by S. Amass on behalf of the FMD Dairy Working Group; November 2005 by P. Webb with support of the FMD Dairy Research Working Group; and March 2007 by USDA-APHIS-VS NAHEMS staff)
- Dairy 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 Framework for Foreign Animal Disease Preparedness and Response (FAD PReP), USDA-APHIS

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Photo and Illustration Credits

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

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 Figure 1. Many different dairy products come from cattle such as milk, cheese, yogurt, butter, cottage cheese, whey proteins, and skin milk powder. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 3 ***(Top)*** Table 1. Top Five Dairy Cattle States by Number of Head, U.S. 2009. *Content provided by: USDA NASS; Graphic illustration by: Dani Ausen, Iowa State University*

(Bottom) Table 2. Number of Dairy Operations, Percent Inventory and Percent Production by Size Group, U.S., 2010. *Content provided by: USDA Farms, Land in Farms, and Livestock Operations, 2008 Summary; Graphic illustration by: Dani Ausen, Iowa State University*

Page 4 ***(Top)*** Figure 2. Schematic of a large dairy operation with barns, milking facility, corrals, and equipment storage. Arrows depict the movement of different animal groups on and off the farm. *Graphic illustration by: Dani Ausen, Iowa State University*

(Bottom) Data from the USDA NAHMS Dairy 2007 Study. Content provided by: USDA; Photo of a Holstein dairy heifer being loaded into a trailer to be moved to a different location. *Photo source: Danelle Bickett-Weddle, Iowa State University; Graphic illustration by: Dani Ausen, Iowa State University*

Page 5 ***(Top)*** Bulk milk hauler picking up milk from a dairy farm. *Photo source: Danelle Bickett-Weddle, Iowa State University*

(Bottom) A biosecurity sign at a dairy farm entrance warning visitors not to enter without an appointment. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 6 ***(Top)*** Bulk milk hauler with an 8000 gallon capacity picking up milk from a dairy farm. *Photo source: Danelle Bickett-Weddle, Iowa State University*

(Bottom) These photos depict typical procedures done when the milk hauler arrives at the farm The temperature of the milk must be read from the tank thermometer that monitors temperature 24 hours a day, 7 days a week (left). The milk hauler is connecting the milk hose from the truck to the bulk tank (center). The volume of milk (milk weight) is recorded on farm (right). *Photo source: Danelle Bickett-Weddle, Iowa State University (all)*

Page 7 ***(Top)*** These photos depict some of the typical procedures done by the milk hauler before departing the farm with a load of milk. A small sample of the milk must be taken, labeled, and put in a cooler (left). The milk hose is disconnected from the tanker (center). The farms bulk tank must be rinsed with water (right). *Photo source: Danelle Bickett-Weddle, Iowa State University (all)*

(Bottom) Table 3. Pasteurization Time, Temperature. Photo of a small pasteurizer on a farm (left). A series of pipelines leading to and from a pasteurizer in a milk processing plant (right). *Content provided by: US Food and Drug Administration, Pasteurized Milk Ordinance; Photo source: Danelle Bickett-Weddle, Iowa State University (left): Pam Hullinger, University of California, Davis (right); Graphic illustration by: Dani Ausen, Iowa State University*

Page 8 The orange brucellosis ear tags, also referred to as calf-hood vaccination tags, are an official form of identification (top left). The metal Bright tags can be used as an official identification in cattle of any age. The first two numbers indicate the state where the animals resided when the tags were placed in their ear. Iowa is 42 as pictured (top right). Holstein heifer calf with pre-printed plastic dangle tags in each ear. There is a metal tag in the calf's left ear which is associated with a breed registry; it is NOT a brucellosis metal tag as that should be in its right ear (second from top). A Holstein cow with a plastic dangle identification tag and a neck collar (third from top). A close up of a cow with a plastic dangle tag and a button Radio Frequency Identification (RFID) tag (bottom). *Photo sources: Iowa Department of Agriculture and Land Stewardship (top left) and Andrew Kingsbury, Iowa State University (top right) Vicky Olson, Quality Milk Production Services (second from top); Danelle Bickett-Weddle, Iowa State University (third from top); Pat Gorden,*

Photo and Illustration Credits

Veterinary Diagnostic and Production Animal Medicine, Iowa State University (bottom)

Page 9
(Top) Two dairy cows being milked in a parallel parlor. *Photo source: Danelle Bickett-Weddle, Iowa State University*
(Bottom) A handler artificially inseminating a cow. *Photo source: Mark Kirkpatrick, Kuna, Idaho*

Page 10
(Top) A pregnant cow in a calving pen with deep straw bedding which helps drain away the birthing materials (amniotic fluid, placenta, and blood) and animal excrement. *Photo source: Pam Hullinger, California Department of Food and Agriculture*
(Bottom) A photo of newborn calf being fed from a bottle. The person is wearing gloves and coveralls to minimize contamination. *Photo source: Chris Mondak, Iowa State University*

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(Top) A photo of pre-weaned calves in outdoor individual hutches with a fenced in exercise area in front of them. *Photo source: Brandi Huddle, Iowa State University*
(Center) A photo of pre-weaned calves in indoor individual pens made of washable plastic and buckets for feed and water out front. *Photo source: Danelle Bickett-Weddle, Iowa State University*
(Bottom) A photo of four-month old calves in a group housing environment with dry bedding and shade. *Photo source: Danelle Bickett-Weddle, Iowa State University*

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(Top) Yearling (12 months old) heifers in an outdoor pen with mounds in the background and head locks at the feed bunk in the foreground. *Photo source: Danelle Bickett-Weddle, Iowa State University*
(Bottom) A photo of dairy cows eating in tie stalls in a covered barn. *Photo source: Tara Wellman, Iowa State University*

Page 13
(Top) A photo of a Holstein dairy cow on pasture. *Photo source: Danelle Bickett-Weddle, Iowa State University*
(Bottom) Dairy cows resting in loose housing with composted manure bedding. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 14
(Top) Photo taken down one feed alley in a cross-ventilated dairy barn. There are baffles above the stalls that deliver air down on the stalls where the cows lay down. *Photo source: Danelle Bickett-Weddle, Iowa State University*
(Center) Holstein cows laying in a dry lot dairy in the southwest U.S. with shade structures available. *Photo source: Danelle Bickett-Weddle, Iowa State University*
(Bottom) While the cows are being milked, a tractor grooms the dry lots where the cattle lay down. The person driving is wearing a dust mask to protect against the dust being stirred up. *Photo source: Pat Gorden, DVM, Dairy Veterinary Services*

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(Top) Rows of calves housed in individual outdoor wooden hutches with feed and water buckets in front of their pens. *Photo source: Mark Kirkpatrick, Kuna, Idaho*
(Bottom) Three Holstein calves being fed milk bottles in individual outdoor hutches with an exercise area out front. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 16
Dairy heifers grazing a pasture (left). Heifers in free stalls in a confinement barn (center). Heifers in a dry lot environment with shade structures in the background and a feed bunk in the foreground (right). *Photo sources: Danelle Bickett-Weddle, Iowa State University (left); Loren Wille, St. Anna Veterinary Clinic (center); Mark Kirkpatrick, Kuna, Idaho (right)*

Page 17
(Top) Cows in a stanchion barn where they will be milked with portable milking units. *Photo source: Tara Wellman, Iowa State University*
(Bottom) Examples of a cow in a herringbone (left), parallel (center) and an external rotary dairy parlor (right). *Photo sources: Brandi Huddle, Iowa State University (left); Danelle Bickett-Weddle, Iowa State University (center and right)*

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(Top) Photo of a dip cup filled with iodine that is used to disinfect teats prior to milking (top). Milking unit attached to the teats of a cow from between her back legs (center). After milking, the teats have been dipped with an antiseptic solution with skin conditioners (bottom). *Photo sources: Danelle Bickett-Weddle, Iowa State University (top); Mark Kirkpatrick, Kuna, Idaho (center and bottom)*
(Bottom) Cow standing in a robotic stanchion with her head facing the right side of the photo and the robotic milker connected to her teats. *Photo source: John Barlow, University of Vermont*

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Page 19 ***(Top)*** Bulk milk tanks of two different sizes in a milk room on a dairy farm (top). Upright milk silos used for raw milk storage on a dairy farm (bottom). *Photo source: Danelle Bickett-Weddle, Iowa State University (all)*
(Bottom) Front end loader dumping feed into a feed wagon to be mixed and then delivered to the cows as a total mixed ration. *Photo source: Tara Wellman, Iowa State University*

Page 20 These photos depict the various ways to store feed such as: upright bulk bins that auger feed into a wagon (top). Hay, straw and commodities such as whole cottonseed and bagged feed are shown in this open front commodity shed (second). Upright concrete silos store silage, haylage, and high moisture corn on a dairy farm (third). Long plastic bags, called ag-bags, can store silage or high moisture corn (fourth). Corn silage is stored on a concrete pad with concrete side walls and covered with plastic and cut tires to keep moisture out. (bottom). *Photo sources: Travis Hawkins, Iowa State University (top); Brandi Huddle, Iowa State University (second); Tara Wellman, Iowa State University (third); Danelle Bickett-Weddle, Iowa State University (fourth); Amanda Neighbours, Iowa State University (bottom)*

Page 21 ***(Top)*** Holstein cows housed in a free stall barn eating feed in concrete bunks with a neck rail to prevent them from stepping through. *Photo source: Danelle Bickett-Weddle, Iowa State University*
(Center) Jersey cows housed in a dry lot eating feed with their heads through individual head locks. *Photo source: Danelle Bickett-Weddle, Iowa State University*
(Bottom) This photo depicts a man-pass between the wooden post and the metal fence, which is located at one end of the pen of cattle. It allows people to enter the pen without climbing fences, opening gates, or stepping on feed. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 22 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, Page 207; Interpreted by: Dani Ausen, Iowa State University*

Page 23 ***(Top)*** A barn used to compost bedding and dead carcasses. *Photo sources: Danelle Bickett-Weddle, Iowa State University*
(Bottom) USDA NAHMS Dairy Study 2007. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 24 A milk tanker at a dairy picking up raw milk for transport to processing (top). A close-up photo of the top of a milk truck vent showing two blue plastic seals (bottom). *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 25 ***(Top)*** Stainless steel pipes used for transporting milk throughout a milk processing facility. *Photo Source: Pam Hullinger, University of California, Davis*
(Center) A milk tanker in a receiving bay at a processing plant hooked up to the Clean-in-Place (CIP) procedure (left). The wash tag displays the truck number, time and date washed and sanitized as well as the employees name who performed the CIP. (center) Each seal number must be recorded on the wash tag (right). *Photo source: Danelle Bickett-Weddle, Iowa State University (all)*
(Bottom) Photo of a farm sign where raw milk is sold direct to consumers. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 26 ***(Top)*** Cow being milked into a separate bucket because the milk cannot enter the bulk tank on farm and mix with the saleable milk. *Photo source: Heather Thyen, Oat-Hill Dairy in Minnesota*
(Bottom) Five gallon buckets of non-saleable milk. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 27 ***(Top)*** Above ground manure storage on a dairy farm. *Photo source: Chere Stephen, Iowa State University*
(Bottom) A concrete lined manure storage pit with fencing around it. *Photo source: Brandi Huddle, Iowa State University*

Page 28 Table 4. Summary of Premises Designations. *Content provided by: USDA-APHIS Graphic illustration by: Dani Ausen, Iowa State University*

Page 29 ***(Top)*** Table 5. Summary of Zone and Area Designations. *Content provided by: USDA-APHIS Graphic illustration by: Dani Ausen, Iowa State University*
(Bottom) Figure 4. Control Zones. *Graphic illustration by: USDA-APHIS*

Photo and Illustration Credits

Page 30 Table 6. General Estimates of Average Feed Consumption. *Content extrapolated from: Nutrient Requirements of Dairy Cattle, National Research Council 2001. Graphic illustration by:Dani Ausen, Iowa State University*

Page 32 ***(Top)*** Figure 5: Proper Injection Sites in Cattle. *Graphic illustration by: Dani Ausen, Iowa State University*

(Bottom) Photo of milk trucks delivering milk to a processing plant. This image is taken in the southwest U.S. where the receiving bay is not fully enclosed. *Photo source: United Dairymen of Arizona*

Page 35 Table 7. Type and Frequency of Vehicle/Personnel Movement Onto Dairy Operations. *Content provided by: Danelle Bickett-Weddle, Iowa State University; Graphic illustration by: Dani Ausen, Iowa State University*

Page 36 On farm delivery of fuel to storage tanks on a dairy farm. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 37 ***(Top)*** A veterinarian wearing personal protective equipment (Tyvek®, powered-air purifying respirator, gloves) collecting samples from a dead animal in the field. *Photo source: John Wenzel, New Mexico State University*

(Bottom) Samples packaged for shipping with the completed paperwork. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Acronyms

AMS	Automatic Milking System
APHIS	Animal and Plant Health Inspection Service
ARP	At-Risk Premises
AVIC	Area Veterinarian-in-Charge
BZ	Buffer Zone
C & D	Cleaning and Disinfection
CA	Control Area
CBPP	Contagious Bovine Pleuropneumonia
CFR	Code of Federal Regulations
CIP	Clean-in-place
COP	Clean-out-of-place
CP	Contact Premises
CVI	Certificate of Veterinary Inspection
CVO	Chief Veterinary Officer
DIVA	Differentiating Infected from Vaccinated Animals
EDI	Emerging Disease Incident
EPA	U.S. Environmental Protection Agency
EZ	Exclusion Zone
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
HTST	High temperature, short time pasteurization

Acronyms

ID	Identification
IM	Intramuscular
IP	Infected Premises
IZ	Infected Zone
MLV	Modified Live Vaccine
MP	Monitored Premises
NASS	National Agricultural Statistics Services
NAHEMS	National Animal Health Emergency Management System
NAHERC	National Animal Health Emergency Response Corps
NAHMS	National Animal Health Monitoring System
NSM	Non-saleable milk
NCAHEM	National Center for Animal Health Emergency Management
OIE	Office International des Epizooties' currently referred to as the World Organization for Animal Health
PPE	Personal Protective Equipment
PMO	Pasteurized Milk Ordinance
RFID	Radio Frequency Identification
RFV	Rift Valley Fever
SMS	Secure Milk Supply
SOP	Standard Operating Procedures
SP	Suspect Premises
SC	Subcutaneous
SZ	Surveillance Zone
USDA	United States Department of Agriculture
VP	Vaccinated Premises
VS	Veterinary Services; a division of APHIS

Glossary

Aseptic processing
Method of processing milk to prevent organism contamination. Commonly used for sterile milk products to improve shelf life.

Bulk tank
Stainless steel milk receptacle located in the milk house on farm that stores, cools and periodically agitates milk until it is picked up by the milk hauler.

Bull
An intact male bovine.

Calf hotel
A structure designed to house multiple calves in individual pens but the pens are attached side-by-side; sizes range from 3 to 6 pens in one hotel. Calves do not typically have direct contact except at the front of the pen where they can touch noses.

Calf nursery
An operation dedicated to the raising of calves from birth through weaning; calves still on milk. These can include just heifers, just bulls or both. Calf nurseries typically raise calves for 2 months on milk and 2 months on solid feed. Heifers return to the home dairy or move to a calf/heifer ranch. The bulls are moved to feedlots. Calf nurseries are typically found in the western and southwestern United States and can contain thousands of calves from multiple dairies in multiple states.

Calf/heifer ranch
An operation that raises heifer calves, and possibly bull calves, from birth or from weaning depending on the facility. Heifers are raised through breeding age or just before calving based on the needs of the home dairy. Bulls are often sold at weaning. Calf/heifer ranches are typically found in the western and southwestern United States and can contain thousands of calves from multiple dairies in multiple states.

Calf starter
A grain mix fed to calves as their first 'whole food'. It typically consists of corn, a protein pellet with or without a sweetener like molasses.

Colostrum
The first milk produced by a cow that has just calved. It is rich in nutrients and proteins that the newborn calf needs to establish immunity against disease pathogens. This milk is non-saleable for human consumption.

Cooling cells
These are evaporative cooling devices that consist of a series of baffles where water passes through and when air is drawn across them, the air is cooled.

Cow
A female bovine that has given birth.

Cull
To voluntarily remove from the herd and sell to a slaughter facility. Sometimes referred to as 'market' cattle.

Dam
The female parent of a calf.

Dry cow
A female cow that is no longer lactating; typically these animals are in the last 60 days of their pregnancy.

Glossary

Early bred heifer
A heifer that is less than 3 months pregnant; early in her gestation.

Esophageal feeder
An apparatus with a long tube and a bag (attached or unattached) designed to feed calves that will not suckle on their own. The tube is inserted into the calf's esophagus and milk or electrolyte solution can be fed via the bag.

Forage
A crop that is high in fiber and fed to ruminant animals (e.g., corn silage, alfalfa hay).

Fore-stripped
Manual removal of streams of milk from the teat prior to milking machine attachment to determine visual quality and stimulate milk "letdown".

Fresh cow
A cow that has recently given birth (calved).

Free stall
An individual cattle stall in a barn where the cattle can freely enter and exit the stall.

Grade A milk (also called fluid grade)
Milk that is produced and processed under rigid sanitary regulations (temperature, bacterial limits, somatic cell count) in approved and inspected facilities. All fluid milk for commercial sale must meet this inspection standard.

Grade B milk (also called manufacturing grade)
Milk that does not meet fluid grade standards; less stringent standards for somatic cell count and bacterial count apply. Grade B milk can only be used in manufactured products, like cheese and butter.

Hauler
The business contracted by a milk processing plant to pick up raw milk at a dairy and transport it to the processing facility.

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 dairy to be fed to cows as a roughage.

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

Heifer
A female calf that has not given birth.

Heifer raiser/grower
An operation dedicated to the raising of heifer calves from birth or weaning through breeding and in some cases, just before calving. These operations will raise calves from only one operation or from several dairies. Ownership of the calves could be retained by the dairy operation that provided the heifers or the developer could purchase the calves.

Glossary

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.

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.

Milking unit (claw or cluster)
The apparatus that connects to the teats of a cow to collect milk using pulsation and vacuum pressure. It consists of 4 individual milking cups that have rubber or silicone liners. They drain into a central cup that drains into one hose connected to the stainless steel milk line.

Milk permeate
A high lactose, soluble protein and mineral by-product of cheese manufacturing that can be used as an energy, protein and mineral source for livestock.

Milk replacer
Powdered milk product that when mixed with warm water provides nutrients to a pre-weaned calf.

Mortality
Death of an animal; dead animals can be referred to as mortalities.

Nonsaleable milk (NSM)
Milk from cows that cannot be sold commercially. Often referred to as waste milk. This milk may have antibiotic residues in it from treating the lactating cow for a disease condition or the milk could contain infectious cells from mastitis or transition milk after calving.

Off-site rearing facility/operation
Facilities that house calves (heifers and bulls) moved off the dairy operation where they were born to be raised. There are regional differences in terms used to describe these operations and the length of time they keep the animals. See calf nursery, calf ranch, heifer raiser/grower for more information.

Pre-fresh
The 3 to 4 weeks just prior to calving. Cows and heifers in this part of their gestation are referred to as pre-fresh and often housed and fed separate from other pregnant animals.

Ruminant
Animals (cattle, sheep, goats, deer and camels) with a four-compartment stomach (rumen, reticulum, omasum, abomasum) that digests forages and grains and turns it into energy. Ruminants chew their cud (regurgitate forages from the rumen) to aid in digestion.

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 dairy 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.

SOP
Standard Operating Procedures that provide specific details related to various topic areas.

Glossary

Stanchion
An individual cattle stall in a barn where the cow is tethered by a movable head catch at the front of the stall that restrains the cow around her neck.

Steer
A castrated male bovine.

Tie-stall
An individual cattle stall in a barn where the cow is tethered by a loose-fitting collar around her neck which is attached to the front of the stall.

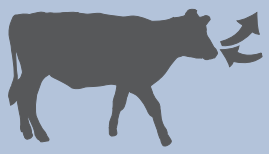
Ultra-pasteurization
Process of heating milk to 125-138°C for 2-4 seconds and cooling it below 7°C in an effort to extend the shelf life beyond what is traditionally expected. It does not sterilize the milk; the milk will eventually spoil.

Whey
A byproduct of cheese making that contains protein and minerals that can be fed to livestock. It is available liquid or as a dried product and as sweet whey or acid whey, depending on the cheese being manufactured.

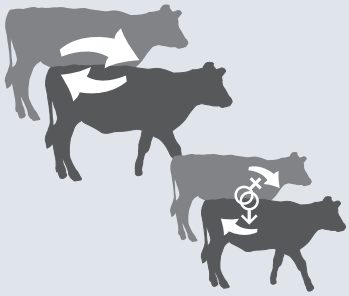
Zoonotic disease
Those diseases spread between animals and humans through direct contact with infectious fluids (at calving, during urination, defecation), drinking unpasteurized milk or through vectors such as ticks or mosquitoes.

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.

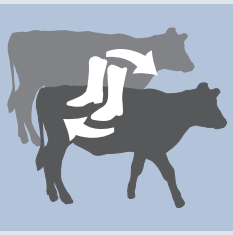


Aerosol: Droplets are passed through the air from one animal to another. Examples include contagious bovine pleuropneumonia (CBPP), foot-and-mouth disease (FMD), malignant catarrhal fever, melioidosis, and vesicular stomatitis.



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, malignant catarrhal fever, rinderpest, vesicular stomatitis.

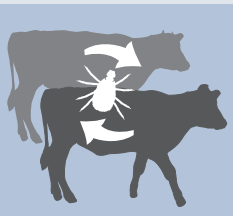
Reproductive: A subtype of direct contact that includes diseases spread through mating or to the fetus during pregnancy. An example would be CBPP.



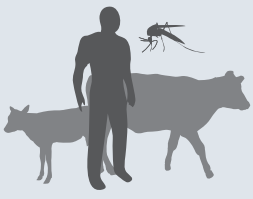
Fomite: An inanimate object carrying a disease agent from one susceptible animal to another. Examples include FMD, vesicular stomatitis.

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

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



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



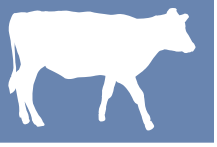
Zoonotic: Diseases transmitted from animals to humans. Examples include vesicular stomatitis and Rift Valley fever.

Environmental Contamination must always be taken into consideration.

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

the Center for Food Security & Public Health
Iowa State University

Prevention Practices for Foot-and-Mouth Disease (FMD) on U.S. Dairies



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. dairy herds.

If a case of FMD is confirmed anywhere in the United States, it could spread rapidly across the nation. If any animal on your farm 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 farm. These measures should be put into place **IMMEDIATELY** on your farm *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 farm 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 farm or to other farms, 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 farm 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 herd 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 farm 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 farm. Specific biosecurity performance standards for dairy premises, milk tankers, and dairy processing plants are being developed as part of the SMS Plan.

Farm Entrance

Limit access to your farm.

- The entrance to your farm is a major control point.
- Gates at farm entries should be locked when not in use.
- By having only one gated entrance to the farm, you can better control and monitor all visitors and vehicles arriving at your farm.

Post signs at the farm entrance (Appendix A).

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

Restrict or limit visitors on your farm.

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

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

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

- Honk before getting out of their vehicle (to announce their arrival).

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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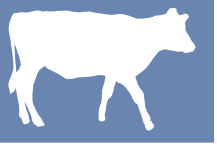


- Check-in with farm personnel upon arrival (direct visitors to "where" they should check in).
- Be accompanied by someone from the farm at all times to ensure biosecurity measures are being followed.
- Visitors and vehicles should avoid contact with animals or animal areas unless absolutely necessary.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

Monitor and record all traffic on or off your farm.

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

Vehicles

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

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

Clean and disinfect vehicles prior to entry and upon leaving.

- All vehicles entering the farm must first clean off then spray their wheels, wheel wells and undercarriage with disinfectant.
- Facilities for washing and disinfecting vehicles should be provided on-farm at the perimeter, accounting for drainage.

Do not share equipment or vehicles between farms or sites.

People

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

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 farm.

Implement strict biosecurity measures for employees coming onto the farm.

- Clean boots, hats and coveralls must be worn while on the farm. These should be provided by your farm.
- Protective clothing should remain on your farm and be washed and/or disinfected before being worn again.
- Disinfect footwear **before entering** AND **after leaving** any animal housing area.
- Boot baths should be provided at the entrance/exit of all animal areas. The disinfectant solution should be changed at least daily or when visibly soiled.
- Hands must be washed with soap and warm water **before entering** AND **after leaving** animal areas even when gloves are used.
- Minimize contact with animals to only tasks necessary for the continued operation of the farm and health and well-being of the animals.

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

- Understand how FMD can be spread;
- Understand the farm'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

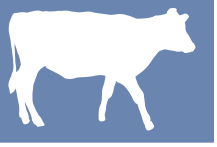
If FMD is confirmed in the U.S., movement restrictions may be implemented locally, regionally and possibly nationally. Restrictions will depend on the scope of the outbreak.

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

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.

Maintain thorough and accurate records of animal movement.



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

Animals

Do not feed unpasteurized milk to calves.

Do not allow your animals to have contact with wildlife.

- Feral swine, 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
- Refusal to walk or move

Isolate any animals showing the signs above and contact your herd 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 any newly purchased or newly arriving animals for at least 30 days.

- New or returning animals (e.g. shows, competitions) can be infected with a disease without showing any signs of illness right away.
- Quarantining the animal(s) before introducing them with the rest of the herd, allows time for any signs of disease to develop in the animal, **without exposing your entire herd** to the disease agent.
- 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).

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 farm 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%), acetic acid (5%), 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.
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 microorganism 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

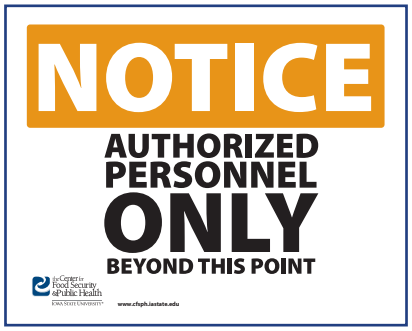
Clean and disinfect anything that has had contact with animals, manure or animal secretions.

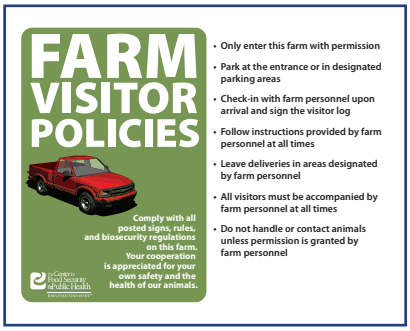
- This includes barns and buildings, vehicles, trailers, equipment, and supplies.
- Tires and wheel wells of vehicles and trailers are especially important.
- Surfaces should be scraped, cleaned with high pressure hot water and detergent, and rinsed.
- The disinfectant should then be applied and allowed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

Appendix A - Sample Signs

Sample signs to post at the farm entrance in the event of a FMD outbreak in the U.S.

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





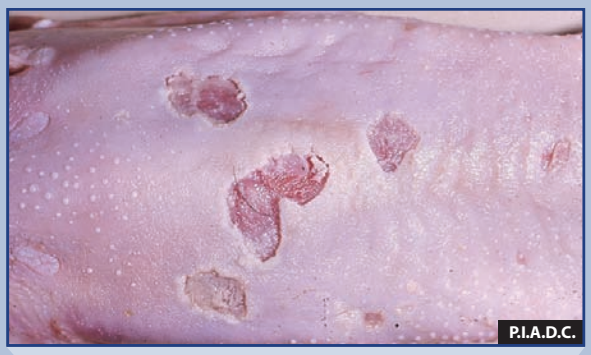
Signage is also available from private companies such as Gempler's.

Appendix B - Daily Visitor Log

Visit Date	Name and Phone Number	Reason for Visit	Date 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 farm.

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.

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, farm or domestic animals and birds.
- Inspect baits regularly. Check often for dead rodents and burn or bury those you find.

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

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

Appendix D - Bird and Rodent Control Measures

For More Information

- Pierce RA. Bait Stations for Controlling Rats and Mice. University of Missouri Extension. *http://muextension.missouri.edu/explore/agguidees/wildlife/g09444.htm.*
- Brittingham MC, Falker ST. Controlling birds around farm buildings. Pennsylvania State University Extension. *http://pubs.cas.psu.edu/FreePubs/pdfs/uh126.pdf.*
- See T. Controlling rodents. North Carolina State University Extension. *http://www.thepigsite.com/*Featured Article/Default.asp?Display=1015.
- Baker RO, Bodman GR, Timm RM. Rodent- proof construction and exclusion methods. University of Nebraska.

Appendix E - EPA and USDA Approved Disinfectants for FMD

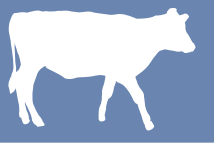
Note: Before disinfecting, all surfaces must be cleaned. This includes removing any visible material such as manure, bedding, and feed.

Product	*Dilution*	*Mixing Instructions*	*Comments*
Acetic acid* (vinegar)	5%	Add 8 ounces of glacial aceticl acid to 1 gallon of water. Mix thoroughly.	Household vinegar is a 5% solution of acetic acid. Always add acid to water - NEVER add water to acid.
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.	Can be deactivated by hard water. Mildly caustic (irritate skin) and dull 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.	Highly caustic (skin burns, damages metals). Use water-resistant protective clothing, gloves, safety glasses. **Warning: Always add the lye to water** - NEVER pour water over lye.
Sodium hypchlorite 6.0%* (NaOCl) (household bleach)	1:10	Add 1.5 cups of chlorine bleach to 1 gallon of water. Mix thoroughly.	Must be mixed fresh prior to each application; unstable in warm, sunny conditions (above 59°F).
Proprietary products		Follow label directions.	As of August 2010, there are 7 products registered by EPA with a claim to inactivate FMD virus.

*USDA-APHIS has an exemption for use of this chemical to inactivate FMD and only USDA personnel may use it as described.

Sources: USDA. National Emergency Response to a HIghly Contagious Animal Disease, Executive Summary. Appendix III - Disinfectants for Foot-and-Mouth Disease, Field Use. March 30, 2001. At *http://www.aphis.usda.gov/emergency_response/tools/cleaning/htdocs/images/Annex09_Cleaning.pdf*
Personal communication, Jeff Kempter, Senior Advisor Antimicrobials Division, Office of Pesticide Programs, Environmental Protection Agency
Proprietary products are listed at: *http://www.aphis.usda.gov/emergency_response/downloads/nahems/Selected%20FAD%20table%20Oct%2008.pdf*

Prevention Practices for Rift Valley Fever (RVF) on U.S. Dairies



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 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. dairy herds.

If a case of RVF is confirmed anywhere in the United States, mosquitoes could spread it across the nation. If any animal on your farm is confirmed to have RVF, all animals on the farm that could get sick (cattle, sheep and goats) 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 farm. These measures should be put into place **IMMEDIATELY** on your farm *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 farm 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 herd veterinarian as quickly as possible.
3. Mosquitoes are the most important way that RVF is spread. Control of mosquito breeding sites (stock tanks, ponds, old tires, etc.) is the key 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 farm 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 farm.

Farm Entrance

Limit access to your farm.

- The entrance to your farm is a major control point.
- Gates at farm entries should be locked when not in use.
- By having only one gated entrance to the farm, you can better control and monitor all visitors and vehicles arriving at your farm.

Post signs at the farm entrance (Appendix A).

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

Restrict or limit visitors on your farm.

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

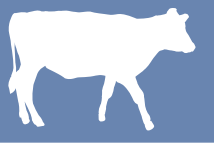
Strict biosecurity measures must be followed by any visitors to the farm.

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

- Check-in with farm personnel upon arrival (direct visitors to "where" they should check in).
- Be accompanied by someone from the farm 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.

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



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

Monitor and record all traffic on or off your farm.

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

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, birthing tissues, or milking potentially infected animals.

Do not allow ill people on your farm.

- 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 farm.

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 herd veterinarian immediately to examine sick animals.

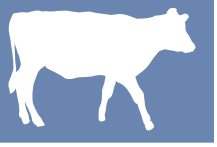
Quarantine any newly purchased or newly arriving animals for at least 7 days.

- New or returning animals (e.g., shows, competitions) can be infected with a disease without showing signs of illness right away.
- Cattle exposed to the RVF virus may take up to 3 days to show signs of illness.
- Quarantining the animal(s) before introducing them to the rest of the herd allows time for any signs of disease to develop in the animal, without exposing your entire herd to the disease agent. The animal can then be examined, diagnosed and treated (if it is not RVF).
- Ideally, animals should be quarantined at a separate location (premises).

Other Animals

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

- 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.

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

- Do not bring animals onto your farm 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 into the herd, where they came from and movements between separate units.
- Each farm 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 live stock or other animals do not have access to it.

References

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

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

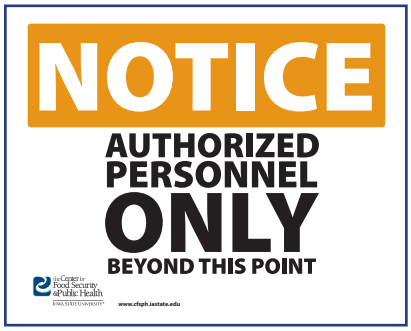
- Rift Valley Fever fact sheet, Center for Food Security and Public Health, Iowa State University, November 8, 2006, available at: *http://www.cfsph.iastate.edu/Factsheets/pdfs/rift_valley_fever.pdf*

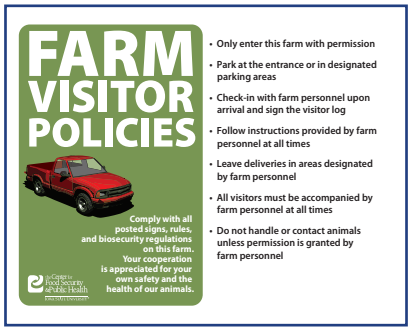
- Zoonoses and Communicable Diseases Common to Man and Animals. Rift Valley Fever. Published by the Pan American Health Organization. 2003.

Appendix A - Sample Signs

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

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



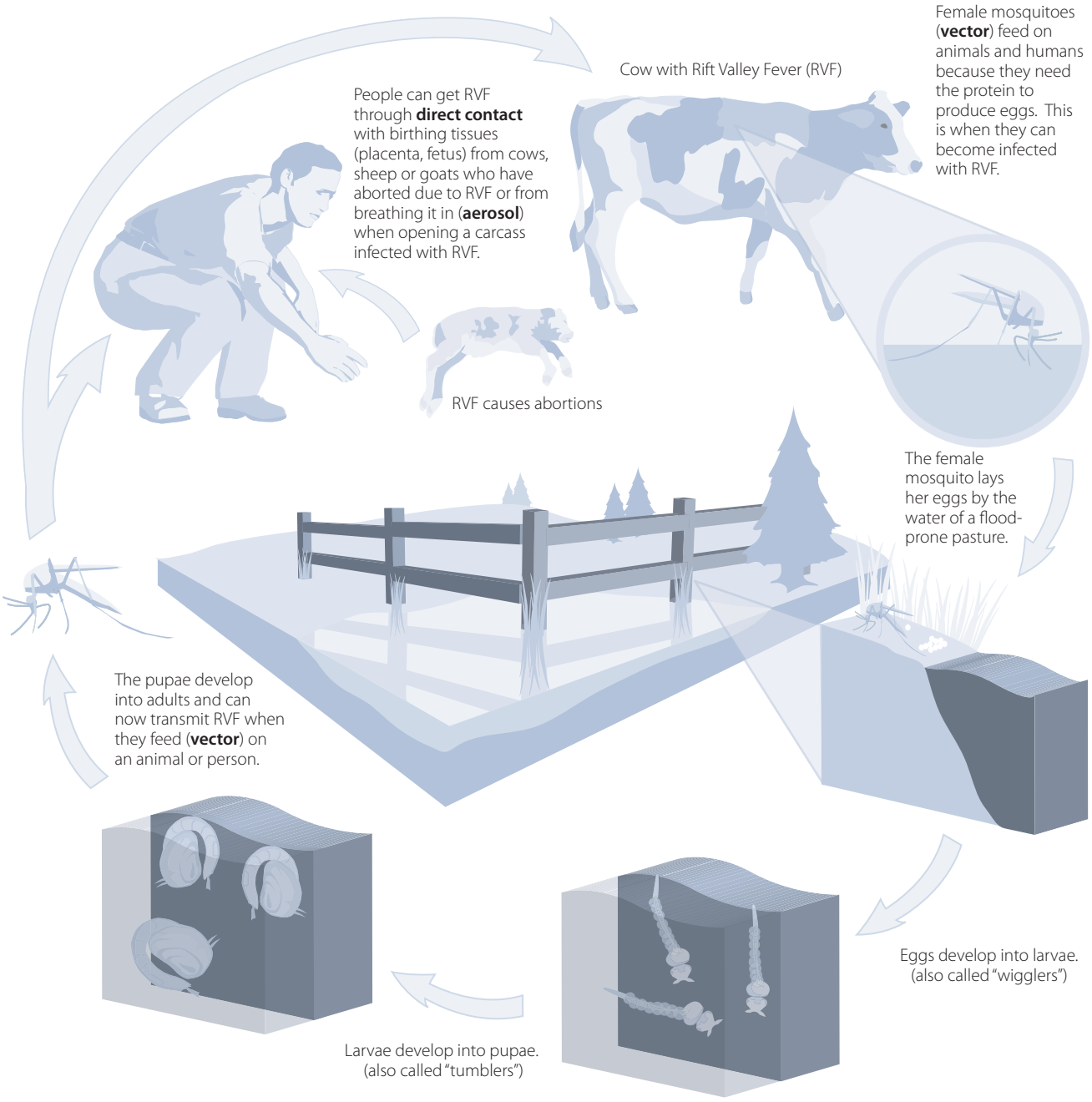


Signage is also available from private companies such as Gempler's.

Appendix B - Daily Visitor Log

Visit Date	Name and Phone Number	Reason for Visit	Date 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 farm.

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.