

Carcass Management Course Rendering Module



United States
Department of
Agriculture



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Overview

Welcome to the Rendering Module. While completing this module, you may encounter references to the Emergency Management Tools; Health, Safety, and Personal Protection Equipment; Secure Transport; and to Biosecurity, which are broadly covered in their own separate training modules. These modules are found in the Introduction Modules, beginning with the Orientation Module.

This training module is presented from the perspective that you have already used the MLCh Tool (Matrix, Decision Loop, and Checklist) explained in the Emergency Management Tools Module and selected rendering as the preferred carcass management option.

Effective management of animal carcasses and associated materials is a critical component of a successful response during an animal health emergency. Carcass management measures contain, treat, or destroy contaminated or potentially contaminated materials in order to:

- Prevent spread of a disease outbreak to protect the nation's agricultural industry
- Protect the environment by preventing carcass waste products from contaminating soil, water, and air
- Protect decaying carcasses from insects and scavengers which can transport pathogens to other locations
- Safeguard public health by removing potentially contaminated food products from the human food supply
- Safeguard animal health by removing potentially contaminated feed from the animal feed supply

Objectives

This module presents the material in four different lessons:

- Introduction
- Evaluation
- Planning
- Operations

Upon completing this module, you should be able to:

- Describe rendering as a method for carcass management
- Understand the advantages and disadvantages of rendering
- Consider environmental risks associated with rendering
- Obtain regulations governing rendering by consulting with state officials
- Identify factors used to evaluate rendering as a carcass management option
- List critical elements when planning use of rendering
- Recognize key components of rendering operations

Introduction Lesson Overview

Definition: Rendering is an off-site process that uses heat to convert animal carcasses into safe, pathogen-free feed protein and other valuable end products while reducing the negative effects of the carcasses on people and the environment.

The general process of rendering is as follows:

- Carcasses are transported to a rendering facility, reduced in size to facilitate processing, and slow fed into a cooking vessel
- The high temperature heating system kills microorganisms and removes excess moisture
- Fat, protein, and water are separated and sterilized into final products and byproducts (tallow, meat, bone meal, and wastewater)

Figure 1. Modern Rendering Facility



Introduction Lesson Contents

This lesson is divided into the following sections:

- Description – Presents the key features of the rendering process
- Processes – Contains information on the background of rendering and the operation procedures
- Processing Steps – Discusses the components and systems of continuous and batch rendering
- Advantages – Describes the benefits of using rendering as a carcass management option
- Disadvantages – Covers the difficulties and possible drawbacks associated with use of rendering

Figure 2. Rendering Facility



Description

Rendering plants may be either integrated with existing packing or poultry processing plants or independent, receiving animal carcasses from farms, ranches, or other entities. Integrated rendering plants may produce edible fats and proteins that are often used in the manufacture of gelatins or cosmetics if they conform to Food and Drug Administration (FDA) processing standards.

- These edible materials must come from USDA inspected and passed carcasses
- Edible rendering is completely separate from inedible rendering, even in integrated plants

If rendering is chosen as a carcass management option during an animal health emergency, careful consideration and planning are critical in developing a workable plan. Many rendering plants may be operating at or near capacity as part of normal business operations and as a result, their surge capacity may be limited.

Additionally, all parties need to be aware that rendered products may not be marketable if the rendering plant has been used to process infected carcasses, and a plan for the final disposal of that product must be developed as a part of the overall rendering process. The potential loss of revenue for the rendering plant may cause the rendering company to refuse receipt of infected carcasses unless the outbreak is large enough to eliminate all the routine business for the plant, making the processing of infected carcasses their only revenue stream. If rendering products cannot be sold for their normal purposes, they might be sold as biofuels if there are contractual arrangements in place to facilitate this. This implies that rendering as a carcass management option may be limited at the beginning of an outbreak, and only become available later in the outbreak if it encompasses a significant geographical area.

Process

The rendering process cuts and grinds accepted animal carcasses into small pieces, to be blended and cooked. A final process step involves the separation of fat (lard and tallow), protein materials (meat and bone meal), and wastewater. The concentrated protein is then dried, ground and stored for shipment.

- Fats undergo additional purification and are also stored for further distribution
- Gases, odors, and wastewater, generated by the cooking process, are captured and treated
- Rendering processes may be categorized as either “edible” or “inedible,” if the final product is suitable for human consumption or not
- Products that are deemed inedible for humans may be used in some livestock feeds, soap, and other production processes
- Inedible rendering processes included both dry and wet rendering
 - Dry rendering is the only type of rendering process utilized in the U.S.
- Dry rendering processes are more efficient, generate less wastewater, and occur in either continuous or batch configurations
- Removal of feathers is part of the slaughter/food producing process
 - However, the much smaller volume of dead birds or spent hens rendered do not go through feather removal. The feathers are a small portion by weight and simply become filler or fiber—part of the small indigestible portion.
 - Feathers that are removed are processed under pressure or “hydrolyzed” which makes the material digestible and a high quality protein meal
- If hides cannot be removed efficiently, or if they have low value, they can be left on the carcass and go through rendering
 - The relatively small amount of hair is a small portion by weight and simply become filler or fiber—part of the small indigestible portion
 - Removed and separated hair could also be “hydrolyzed” which makes the material digestible and a high quality protein meal

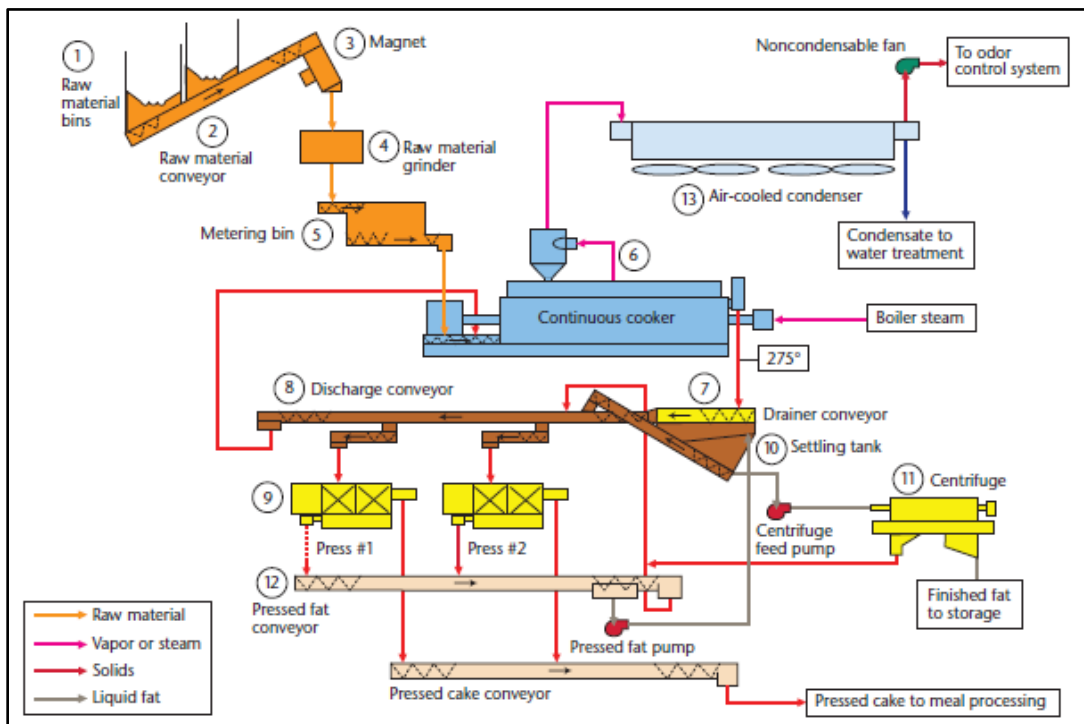
Continuous Rendering

In continuous rendering all the rendering processes are done simultaneously and consecutively. Most continuous rendering systems require little to no manual operation and finished products will be generated at a constant rate if there is a constant supply of carcasses.

- Carcasses are usually fed into the system with a manually operated end loader (tractor)
- Continuous rendering systems are generally equipped with automatic controls for both time and temperature
- More automated control is exercised over the crushing of big particles, uniform mixing of raw material, and the maintenance of required time and temperatures of the cooking processes

Compared to batch rendering configuration, continuous systems also generally offer greater flexibility, allowing a wider range of time and temperature combinations for cooking raw materials. This prevents over-cooking which decreases digestibility and quality of proteins.

Figure 3. Dry Rendering – Continuous System (Click to Enlarge Image It)



Dry Rendering Continuous System

As shown in Figure 3, animal carcasses are received in raw material bins (1), conveyed (2), and discharged across a magnet (3) to remove any ferrous metal contamination. A grinder (4) reduces the raw material to a uniform particle size for handling and improved heat transfer in the cooking step. The material is fed at a controlled rate from a metering bin (5) into a continuous cooker (6).

The discharge is transported to a drainer conveyor (7). The drainer conveyor separates liquid fat from the solids, which are then moved by a discharge conveyor (8). In the discharge conveyor, the solids are combined with the solids discharged from the settling tank (10) and from the decanter-type centrifuge (11). The solids from the discharge conveyor go to the screw presses (9), which reduce the fat content. The solids bypass the screw presses as pressed cake, then go to the conveyor for processing into meal.

The fat removed in the screw presses goes to the pressed fat conveyor (12), which separates the large particles from the liquid fat and returns them to the discharge conveyor. The fat from the pressed fat conveyor is pumped to the settling tank (10). Fat discharged from the drainer conveyor (7) goes into the settling tank (10).

In the settling tank, insoluble impurities- that include bits of bone, soil, etc., but not much protein if operating correctly- settle to the bottom, where they are discharged by the screw conveyor into the discharge conveyor (8). Liquid fat from the settling tank is pumped into the centrifuge (11), which removes the residual solid impurities. The solids from the centrifuge go to the discharge conveyor (8). The clarified fat is transported for further processing or for storage as finished fat.

Water vapor exits the continuous cooker (6) through a vapor duct system that generally includes an entrainment trap to separate and return the entrained particles to the continuous cooker. The vapor duct system transports the vapor stream to an air-cooled condenser (13), which condenses the water vapor. Non-condensable gases are removed from the condenser by a non-condensable fan. Odorous gases are collected by a ductwork system and transported along with the non-condensable gases from the condenser to an odor-control system to neutralize odors.

Batch Rendering

Batch rendering involves the transfer of the heated product to another cooking cylinder before completion of the cooking process. A batch cooker is like a large pressure cooker in many kitchens. The heating process normally takes 2-3 hours. In terms of loading, some plants discharge raw materials to the batch cooker when the batch maximum temperature is reached; others use a holding time of up to 30 minutes. After the heating process, the tallow is drained and the solids are emptied.

Figure 4. Cooking Cylinder



Advantages

When considering rendering as an option for carcass management following an animal disease outbreak, the following summarize the advantages of the rendering process:

- Renderers often have leak-proof transport vehicles designed for carrying carcasses which can be very helpful in minimizing disease spread
- Rendering facilities have treatment procedures in place for dealing with process by-products such as air/odor emissions and wastewater from infected carcasses which might otherwise be discharged to the environment
- The rendering process inactivates many viruses and bacteria
- The temperatures typically produced during rendering can kill many pathogens such as *Salmonella* spp. *Escherichia coli*, as well as other pathogens that cause botulism, tuberculosis, plague, and tetanus
- Proper rendering inactivates most biological contaminants, except prions
 - Although the risk of spreading prions has been very low, feeding proteins of mammalian origin to cattle and other ruminant animals (such as sheep and goats) is prohibited, to prevent emerging problems. Refer to [9 CFR 310.22](#) for additional information.
- Rendering achieves a two-thirds reduction in biomass and yields a safe, easily transportable product for landfilling or burial
- Rendering can be cost-effective compared to other management options
- Raw materials used by independent rendering plants include the relatively fresh carcasses of cattle, pigs, goats, sheep, poultry, and other animals that perish during transport, natural disasters, or of disease on farms

Disadvantages

The following disadvantages should also be considered during selection of carcass management options:

- Independent rendering facilities may not be able to process large numbers of animal carcasses or handle certain items such as whole carcasses or feathers
- Some renderers may decline carcasses and will not participate in emergency carcass management operations
- Without cold-storage capacity, the time window for getting carcasses to rendering plants is on the order of 1-2 days
 - Decaying or decomposed carcasses are generally unacceptable for the rendering process
- Handling of raw diseased animal carcasses may release pathogens to the air which can increase risk of disease agent spread
- Handling of diseased animal carcasses may require additional rendering plant decontamination and re-certification measures, even though the rendering process can destroy the pathogens, and no pathogens are expected in the rendered products. However, pathogens could be transported throughout the plant during the process of receiving the carcass material and preparing it for feeding it into the cooker.
- Negative public perception may influence renderers to refuse carcasses from an animal health emergency
 - Handling of diseased-animal carcasses in rendering facilities may require additional decontamination and re-certification measures, thereby adding to the cost, complexity and long-term business viability of the rendering operation
 - Rendering products from diseased animals will not be marketable and can increase the cost and need for landfilling or burial of the rendered products
- The number and capacity of integrated and independent rendering plants in the affected locality may be limited
- Rendering is not an appropriate method of deactivation for prion-infected animal carcasses
 - Dispose of prion-infected carcasses by incineration or alkaline hydrolysis
 - Diseases include bovine spongiform encephalopathy (BSE), chronic wasting disease, scrapie, and other transmissible spongiform encephalopathies (TSE)

Evaluation Lesson Overview

This lesson contains information to help you further evaluate use of a rendering facility as a carcass management option and determine if facilities have the necessary safeguards and protection measures to reduce the risks to the environment. During an animal health emergency or other event resulting in catastrophic animal loss, rendering facilities may not be able to process the carcasses as fast as they can be delivered.

Factors in the evaluation include:

- Knowing and understanding applicable regulations
- Identifying the waste stream
- Evaluating the rendering facility
- Recognizing the environmental impact

Evaluation Lesson Contents

This lesson presents the following information:

- Regulations – Covers the regulations governing rendering operations
- Waste Stream Evaluation – Contains questions one can use to assess the materials on the infected premises to determine suitable management options
- Rendering Facility Evaluation – Has information including questions to assess whether or not rendering is suitable for carcass management
- Public Health – Presents a discussion of potential environmental impacts, important biosecurity considerations, and public health considerations

Regulations

The rendering process is closely regulated for product quality and environmental compliance; however, biosecurity during handling and transportation can be problematic. If rendering is chosen as an option, selection of a facility with optimal biosecurity protocols is critical to further limit the spread of highly contagious animal diseases.

Rendering plant personnel should be familiar with the [North American Rendering Industry's Code of Practice](#). These practices were principally developed for preventing pathogens from entering animal feed and pet food supplies; however, they are also applicable to processing waste materials during an animal health emergency.

The following Federal and State agencies routinely inspect rendering facilities for compliance with various regulations:

- Food and Drug Administration (FDA) ([Food Safety Modernization Act](#)) -Inspects rendering facilities for compliance. Before FSMA, there were Feed Rules related to BSE (established in 1997, and strengthened in 2004). Renderers are inspected at least annually for compliance to these rules.
- USDA APHIS – Inspects rendering plants for compliance with restrictions on rendering products imposed by importing countries and issues export certificates for rendered products
- [State Feed Control Officials](#) or State Animal Feed Regulators – Inspect and test rendered products for quality, adulteration, and compliance with feed safety and labeling policies
- Environmental Protection Agency (EPA) – Provides guidance and regulation for air emissions, odor, sludge, and wastewater treatment

Regulations (cont.)

All waste materials slated for carcass management and/or transport must be correctly classified by a certified waste management professional prior to carcass management to assure that appropriate carcass management and transportation methods are selected. The [Gateway to State Resource Locations](#) provides access to a variety of state resource locator tools, including state environmental regulations.

Below are some of the considerations for classifying and transporting waste:

- Solid waste - Most animal related waste generated during a response to an animal health incident will be classified as solid waste for management purposes
- Medical and infectious (solid) waste - A portion of the waste material associated with a response to an animal health emergency may be classified as medical and/or infectious waste, such as used sharps or needles, and will be subject to state regulations
- Hazardous materials - If carcasses are moved under US Department of Transportation authority, infectious waste (including carcasses, bedding, etc. which can cause disease or death in animals or humans) is classified as hazardous material unless a special classification is obtained. Hazardous material will require special packaging, manifesting, and transport to an appropriate facility approved to accept the materials.
- Permitted Movement – When infected carcasses are permitted to move under APHIS/state authority, they will require DOT designation as hazardous material
 - In compliance with [49 CFR 105.5](#) and [49 CFR 173.134](#), as well as, other related 49 CFR requirements, and
 - In compliance with incident-specific state and federal requirements for biosecurity, transport method, chain of custody, and cleaning/disinfection (e.g., using APHIS VS Form 1-27)
 - Refer to the [NAHEMS Guidelines: Quarantine and Movement Control](#) for additional information

Waste Stream Evaluation

Different facilities may only be able to process certain materials and not others. The sooner carcasses are disposed of; the easier they will be to transport. The following are issues one should consider before contacting rendering facilities:

- What types of affected material?
 - Carcass: type, size, number and condition
 - In-barn manure/litter: type, volume, moisture content, density
 - Stored manure/litter: type, volume, moisture content, density
 - Feed? Quantity and location
 - Eggs? Quantity and condition
 - Bedding? Non-infected manure compost?
 - Paper products? Other debris?

- In what physical state are the materials?
 - Putrefaction results in the gradual dissolution of tissues into gases and liquids
 - Landfills are restricted from accepting wastewater from rendering facilities. A landfill needs a Research, Development and Demonstration (RD&D) approval to take liquids per [40 CFR 258.4](#) of RCRA.

- How much material needs to be disposed of?
 - If you have more material than rendering facilities are able or willing to take, you may have to locate facilities outside the control area
 - The material from a large outbreak may have to be sent to multiple facilities as capacities are reached

Facility Evaluation

Independent full-service rendering companies efficiently transport and process one million pounds or more per day of raw animal by-products and mortalities. Only rendering facilities that comply with applicable regulations should be considered for the rendering process. As a part of advance planning, efforts should be made to negotiate contracts with rendering facilities that can enable an effective and efficient response.

Many rendering facilities are not set up to handle the number and type of mortalities produced during a major animal health event. Consider the following when examining rendering facilities:

- Rendering plants typically have service contracts with other entities and, if operating contractually at full capacity, may be unable to accept waste material associated with an animal health emergency
- A rendering facility may not be able to handle certain items such as whole carcasses or feathers
- A facility may be able to retrofit to handle whole carcasses
 - Additional time and costs may be required
- A facility may require the pre-processing of carcasses before acceptance; such processing may produce contaminated aerosols and increase the risk of disease spread
- A rendering facility may not be able to process the carcasses as fast as they can be delivered
 - A cold-storage option at the farm site or rendering plant may be required
 - Decomposed carcasses cannot be rendered
- Rendering plant personnel must be trained in biosecurity procedures

Facility Evaluation Questions

The following questions can help you evaluate the suitability of facilities for disposing of infected carcasses:

- How far is the carcass management facility from the infected site? Minimizing transport distance saves money and time, and reduces the risk of spreading pathogens.
- Can a vehicle cleaning and disinfection station be constructed at the site?
- Does the facility have a means of establishing the weight and/or volume of the materials being delivered? Since any carcass management effort will involve monitoring the total amount of diseased material being disposed of, it is imperative that a facility have accurate and easily accessible truck scales or some other means to determine how much material is being processed.
- What actions does the facility take to reduce odor and vermin? Ensuring that the operation is following through on their stated procedures, and that these procedures are effective, is important to avoid any negative publicity surrounding the carcass management activities.
- Does the facility have all of the permits required to dispose of this type of material?
- Are the rendering operators trained and medically cleared to wear any required personal protective equipment?

Facility Evaluation Questions (cont.)

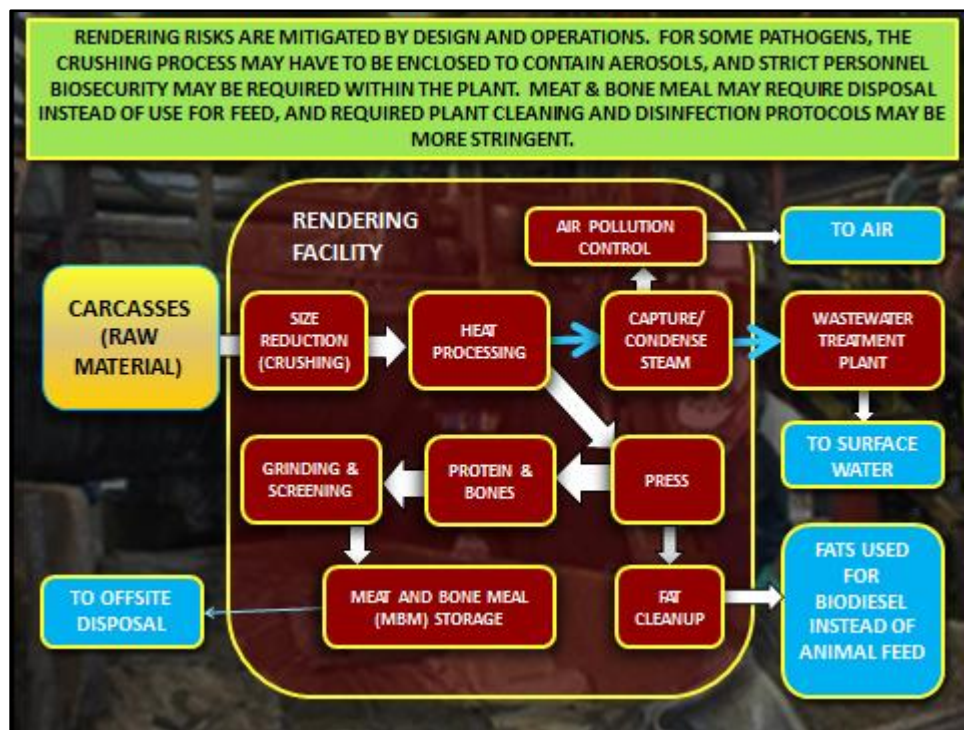
- Does the facility handle carcasses, by-products and eggs?
 - Do these materials need to be processed before the facility will or is able to accept them?
- Who owns the facility?
 - Is it part of a large poultry producing company? If so, you may be able to access resources to help with the carcass management process. For example, some larger poultry processing companies have integrated rendering operations that may be available in the event of an outbreak.
 - Is the facility being operated in accordance with its permit? Contact the state regulatory agency about any permit violations and how they were addressed.
- Is an agreement already in place that allows emergency carcass management using the method you are considering? This will help speed up implementation of the carcass management process.

Environmental Impact

Livestock mortality is a significant source of organic matter. A typical fresh carcass contains approximately 32% dry matter, of which 52% is protein, 41% is fat, and 6% is ash. Rendering offers several benefits to food animal and poultry production operations, including providing a source of protein for use in animal feed, and providing a hygienic means of disposing of animal carcasses.

- To reduce the moisture content of carcasses and save energy in the cooker, receiving bins are generally perforated to allow water to drain off
 - Increases the microbial and chemical load of wastewater
- Wastewater is often nutrient rich in nitrogen, phosphorus, and often potassium
- Treatment of wastewater, specifically phosphorus, is very important and continued use of wastewater for irrigation results in the accumulation of nitrogen and phosphorus in the soil
- A significant environmental issue is controlling various odors generated during pre-rendering, rendering, and post-rendering processes
 - Carcasses begin to putrefy because they are not typically refrigerated for preservation prior to rendering
 - Rendering is often perceived as an unpleasant or “smelly” industry

Figure 5. Rendering Potential Risks (Click on Image to Enlarge It)



Environmental Impact Questions

- Does record keeping by the rendering facility meet the regulatory requirements?
 - This is important to identify who may be legally liable, in case there is an environmental release from the rendering facility in the future
- What measures are taken by the rendering plant to control odor emissions?
 - All emitted odors should be treated in condensing units followed by chemical scrubbers, incinerators (afterburners) and/or bio filters for non-condensable odors
 - Procedures for monitoring odors, as well as investigating and resolving odor-related complaints, should be implemented
- Does the rendering operation treat their wastewater?
 - Leaching of excessive amounts of nitrogen and sulfur compounds to ground water can cause serious environmental problems
- Does the rendering operation have an active pest management program?
 - Attracted insects and pests can serve as potential vectors of harmful diseases for public and animal health
- Is the facility in compliance with all permit regulations?

Figure 6. Rendering Facility



Biosecurity

Biosecurity is a series of management practices designed to prevent the introduction and spread of disease agents on an animal production facility. During an animal disease emergency, biosecurity measures are necessary to keep disease agents out of healthy livestock and poultry populations and prevent the spread of disease agents from infected groups to uninfected groups within the same population.

Below are some biosecurity considerations that apply to rendering facilities. For more comprehensive biosecurity information, refer to the Biosecurity Module.

- Rendering plants are regulated by various governmental agencies and generally have good sanitation programs
- There is a lower risk of disease spreading or groundwater pollution from rendering plants compared to using landfill and burial
- Many livestock producers and governmental agencies prefer rendering as an alternative to on-farm carcass management methods to protect the environment, to protect human and animal health, and sustains animal agriculture
- Written plans must be in place to prevent disease spread during transportation. For more information see the Secure Transport Module.
- Workers who handle infectious carcasses need to take proper precautions and should be equipped with appropriate protective equipment in accordance with site-specific plans. Refer to the Health, Safety, & PPE Module.
- In cooperation with appropriate public health agencies, personnel should be monitored afterward for signs of illness if pathogen of interest is zoonotic

NOTE

The agent causing the disease may not be the only agent that poses a risk to personnel. Other potential risks may occur from *Salmonella*, *Campylobacter*, Q fever and coliforms.

- A certain degree of site security would likely be inherent to a rendering facility (e.g., fencing, central entrance, vermin/pest control, etc.)
- Once the carcasses have been rendered, the end product is generally considered biosecure
- Carcasses that are infected with pathogens or contaminated with endotoxins, pesticides, or chemicals not killed or inactivated by rendering, cannot be rendered into feed ingredients

Public Health Considerations

Although rendering processes can eliminate many microorganisms from finished products, byproducts of the rendering process, such as odors, sludge, and wastewater, may present health and environmental problems if not treated properly. The potential for rapidly spreading diseases among livestock and people, and for contaminating the environment, increases if carcasses are not disposed of promptly and properly.

A comprehensive understanding of the type and strain of pathogen associated with the decision to depopulate and dispose of animals is essential to prevent further spread of infection and to safeguard human, animal, and environmental safety and security.

- Care must be taken to conduct operations in such a manner that public health is protected

Disease agent considerations also weigh heavily in transportation planning as well as human safety both during and after carcass management activities. Cleaning and disinfection protocols will be largely based on the type and strain of pathogen. It is a best practice to consult the State Animal Feed Regulators or State Feed Control Officials and state EPA representatives responsible for enforcing applicable regulations, and ask them about suitability of specific rendering facilities for accepting carcasses, as discussed in more detail in the next section.

Public Health Questions

- Are there event and site-specific health and safety plans for the rendering operators that are approved by a credentialed Safety Officer?
- Are rendering operators trained in proper handling of potentially infectious material and the requirements of the health and safety plan?
 - If not, will specialized operators be available for temporary service?
- What are the plant operator's perceptions of the disease?
 - Will the plant accept infected carcasses?
 - The rendering industry may be very wary of public perception about a link between rendering and animal disease
 - The association between rendering and the spread of BSE, also known as mad cow disease, has caused a substantial decline in demand for rendering products
- Is employee health and safety monitored and are health and safety rules enforced?
 - If the contaminant poses an increased health risk to employees, it is important that personnel use required protection and are monitored regularly by healthcare workers to ensure they are not exhibiting effects of exposure
- What surrounds the carcass management operation site?
 - Are there any surrounding farms or residential neighborhoods that would be vulnerable to potential infection?
 - Knowing this would aid in developing a transport route to the site and help limit public resistance to the process
- Is the site completely secure at all times?
 - What security measures are in place?
 - Procedures must be in place to prevent the disturbance of animal carcasses received at the carcass management facility
 - Examples could be fencing surrounding the facility or some means of encapsulating the waste to prevent scavengers from accessing the waste
- What biosecurity and cleaning and disinfection measures are employed at the operation?
 - Examples of good biosecurity measures are separate "clean" and "dirty" areas where dirty areas can be disinfected and the clean areas are protected from contamination

Planning Lesson Overview

This lesson contains information to help you plan for rendering of carcasses resulting from an animal health emergency. Planning is essential to ensure that the carcass management task is carried out efficiently and unimpeded by a lack of resources. Successful management of a large number of contaminated animal carcasses requires proper planning to protect workers, the general public, and the environment.

Important considerations include:

- Classifying and characterizing the waste material
- Identifying and contacting suitable rendering facilities
- Finding adequate carcass storage facilities
- Assessing availability of secure transportation

Planning Lesson Contents

This material in this lesson is divided into the following key sections:

- Personnel – Highlights requirements and related issues associated with personnel involved with the carcass management activities
- Waste Classification – Discusses the procedures necessary to clearly identify and describe the material being disposed
- Facility Identification – Describes planning considerations for selecting and using a rendering facility
- Storage – Provides several considerations for temporary carcass storage until carcass management can commence
- Secure Transportation – Provides a list of important questions to consider before transporting carcasses

Personnel

There are certain planning aspects that are common to all carcass management options. Those aspects include human health and safety, biosecurity, and physical security, as described below.

- Health and safety – Planning to implement rendering as a carcass management option should include measures to protect workers and the public from hazards associated with loading infected materials for transport, transporting the materials to the rendering facility, and disposing materials at the facility. Refer to the Health, Safety, & PPE Module.
- Biosecurity – Planning to use rendering must include strict biosecurity measures to minimize disease spread when handling infected materials. Refer to the Biosecurity Module.
- Physical Security – Rendering planning efforts should consider security of personnel at the infected premises, security of infected material during transport, and security at the rendering facility. Below are some ideas for minimizing physical security risks:
 - Providing a single entry point to the infected premises
 - Providing badges to all authorized personnel entering the infected premises
 - Signing in and out of the premises
 - Sealing truckloads at the origin and ensuring the seals are unbroken at the destination
 - Separating routine rendering operations from emergency operations for infected materials, if possible

Figure 7. Briefing the Carcass Management Team



Waste Classification and Characterization

Classification is a determining factor in considering whether a proposed facility is permitted to accept the waste. Because regulations may vary between states, do not assume all states' waste classification regulations are similar. This is particularly relevant if waste generated during a response is transported across state lines. Consult a certified waste management professional when classifying waste.

Response personnel should perform the following:

- Identify all waste materials designated for management (in accordance with the site-specific carcass management plan, if available). For more information, refer to the Emergency Management Tools Module.
- Mark waste materials and verify with the Disposal Group Supervisor that all designated materials are to be disposed of
- Sort materials by type (recyclables, putrescible waste, debris, and potentially hazardous waste)
- Stage the various waste materials in suitable areas and containerize or enclose in secondary containment putrescible or wet materials to avoid leaching to the environment. Waste materials may require tarp or shelter covering.
- Estimate the quantities of each waste type and record the information
- Characterize each waste type in accordance with all applicable local, state, and federal regulations
 - Improper waste management can result in penalties (fines or imprisonment)
 - Improperly disposed waste creates environmental contamination, and clean-up liabilities may also be incurred
 - Document the characteristics of each waste type and label all waste types in accordance with applicable regulatory requirements

Identifying Facilities

For help in locating rendering facilities, you may access the Incident Waste Decision Support Tool ([I-WASTE DST](#)) to search for carcass management facilities in each state and/or U.S. Environmental Protection Agency (EPA) region. The National Renderers Association represents 90% of overall rendering capacity and maintains an up-to-date list of member rendering companies. There are a number of smaller, non-member rendering facilities around the country.

Rendering Facility Evaluation – The facility must be constructed and operated in accordance with applicable regulations and the conditions of its operating permit. It is important for planners to realize that not all rendering plants have the capacity or capability to accept infected carcasses.

Figure 8. Delivery to a Rendering Facility



Material, Supplies, and Equipment

The Disposal Group must identify all necessary materials, supplies, and equipment to carry out the chosen site-specific carcass management method(s).

The list is provided as an example of the types of materials, supplies, and equipment which might be needed for rendering:

- Health, Safety, PPE and associated personnel decontamination equipment
- Secure transport equipment (driven by trained drivers)
- Vehicle cleaning and disinfection equipment
- Vehicle liners, such as plastic sheeting or specialized bags
 - Large volumes of plastics are a problem in rendering cookers and in final products
 - Some starch-based or protein based films are more “renderable”
- Loading equipment
- Absorbent material to prevent leakage
- Regulatory authority approved containers, including sharps containers

Figure 9. Example Supplies Needed for Cleaning and Disinfection



Material, Supplies, and Equipment (cont.)

- Bio hazardous waste bags and containers, if applicable Note: use biohazard bags only for identified biohazard waste. Putting non-biohazard waste into biohazard bags results in excess expenses for carcass management.

Biohazard Waste

Includes plastic ware such as pipettes or pipette tips, culture plates, specimen vials, etc. that are contaminated with biological specimens, bacterial and cell culture material, or nucleic acids. It also includes towels and bench paper that are biologically contaminated (i.e., used where samples or cultures are opened and manipulated). It may also include culture or sample containers (e.g. plastic tubes of blood) that are contaminated with biological materials. The categories are based on the UN assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods ([UNECE](#)).

Temporary Carcass Storage

When the Euthanasia Group generates mortalities at a faster rate than the Disposal Group can process them, some means of temporary carcass storage must be provided. It is important to identify where carcasses can be collected and stored until carcass management can commence. For related guidance, refer to EPA regulations regarding storage and collection of solid waste [40 CFR 243.200-1\(a\)](#).

Considerations for temporary storage include:

- Can the storage area be secured to prevent unauthorized access, scavengers, odors, rapid decomposition, and potential disease spread to susceptible species?
- Will the carcasses be stored using refrigeration or some other stabilization method such as grinding and preserving them in containers?
 - If so, are the equipment, supplies and materials available?
- Will the storage capacity be sufficient to accommodate the difference between the maximum expected euthanasia rate and the maximum carcass management rate?
 - If not, avoid euthanizing animals at a rate that exceeds carcass management and storage capacity
 - When maximum carcass management and storage capacities are reached, curtail euthanasia until adequate capacity is available
 - Consult with Incident Coordination Group leadership for strategies to minimize the number of animals to be euthanized and managed
- Can wastewater and storm water runoff be controlled from the storage facilities?
- Outline a recordkeeping system for identifying and tracking all carcasses and other materials entering and exiting the storage facilities
- Can the storage facility be adequately cleaned and disinfected during and/or after the response?
- Can storage containers be made leak-proof?
- Is there sufficient space for heavy equipment which may be needed to move large loads?
- What safeguards will be used to protect soil and groundwater from a release of leachate?
- Do safeguards meet all applicable local, state, and federal regulations?
- Ensure the storage method will contain leachate, address pressure buildup, and avoid uncontrolled release of gases and pathogens
 - Consult a certified waste management professional for assistance

Secure Transportation

Transport vehicles will be needed to move carcasses and other materials to the carcass management site. If the waste must travel on public roads, it should be transported in closed, leak-proof trucks or dumpsters. Secondary containment may be needed, depending on the type of waste being transported. Consult a qualified waste management professional when developing this section of the carcass management plan. Some transport planning considerations are listed below:

- Does the facility have the needed equipment to unload the material?
- Does receiving facility have the capability to clean and disinfect vehicles after delivering loads?
- Do the carcass management facilities selected for these premises have any special requirements?
- Have the carcass management facilities agreed to accept the type and amount of waste you plan to send them and are they permitted appropriately?
- Are all permit, agreement, and/or contract conditions delineated and will the shipments meet the conditions? If not, what corrective actions would be needed?
- Are haulers to be used for the response properly equipped to haul carcasses in accordance with all applicable laws?
- Are transport vehicles designed to handle the materials to be transported?
- Are the drivers adequately trained in biosecurity?
- Can two-way communications be maintained with the hauler during transport?
- Do shipments require law enforcement escorts?
- Will travel routes from the premises to the carcass management site avoid uninfected farms, road construction, neighborhoods, and densely populated areas?
- Has an alternate travel route been identified?
- What procedures will be followed if the vehicle is damaged during transit?
- How is the waste classified for transport? What DOT packaging standards apply? Are all standards consistently met, including labeling, placarding, and manifesting?
- How will transport vehicle traffic be minimized into the Control Area?

For more information, refer to the Secure Transport Module.

Facility Suitability

Members of the carcass management team must contact or visit the rendering facility to ensure it is operated in accordance with all applicable laws and regulations. It is important to contact renderers in advance to discuss waste acceptance policies, conditions, and cost.

The carcass management team should ask the following questions when considering the suitability of a rendering facility:

- Are rendering personnel trained, equipped, and certified to handle the infectious waste in a biosecure manner?
- Does the rendering facility offer a pickup service?
- Does the receiving facility have sufficient space for incoming vehicles to avoid causing traffic disruptions on access roads?
- How will vehicle unloading be performed in order to avoid releasing biological agent(s) to the environment?
- How will vehicles be cleaned and disinfected after materials have been unloaded at the carcass management site?
- Is wastewater managed in a way that will prevent pathogen spread?
- Is there an existing contract or agreement in place with the rendering facility?

Facility Suitability (cont.)

Only rendering facilities that have minimum standards for elimination of the disease agent should be approved for use. Rendering processes are computer controlled in order to best achieve cooking time and temperature conditions for optimal microorganism thermal kill values. Criteria for disease elimination include:

- Material particle size - smaller pieces may result in more efficient cooking
- Temperature – the temperature of the material must be monitored continuously in the rendering vessel to ensure a minimum temperature is achieved (e.g., 260°F (127°C))
 - An alarm system must be in place to notify personnel if the operating temperature falls below the set point
 - The material must be reprocessed if the material temperature falls short
 - The final temperature of the cooker destroys harmful pathogens and produces usable end products
- Time - the material must remain at the required temperature for the appropriate time (e.g., at least 15 minutes for 260°F (127°C))
 - The input rate, relative to the size of the rendering vessel, must be monitored to ensure that the material is not processed too quickly
 - Monitoring information should be recorded for documentation purposes

Under-processing conditions will reduce the efficiency of the fat extraction and may generate contaminated products and byproducts that can spread diseases to soil, plants, animals, and people. The temperatures required for efficient fat removal are normally higher and for longer times than needed to kill common pathogens.

Operations Lesson Overview

This lesson contains general procedures in preparing for and disposing of carcasses by utilizing a rendering facility. The following topics will be addressed:

- Rendering procedures
- Secure transport
- Health and safety
- Biosecurity

Critical steps used during recent U.S. animal disease outbreaks are also included.

Figure 10. Vehicle Cleaning and Disinfection Operations



Operations Lesson Contents

This material in this lesson is presented in a step-wise manner that provides detailed instructions and key steps based on the criteria and measures instituted during recent U.S. animal disease outbreak responses.

- Incident Management – General guidelines to the Disposal Group personnel when dealing with an animal emergency situation
- Rendering Plant Preparation – General guidelines for assessing facility readiness and need for operational modifications to accept infected biomass
- Infected Premises Preparation – Lists steps for assessing facility readiness to begin operations
- At the Rendering Facility – General guidelines for safe and proper management of infected carcasses once delivered to an off-site rendering facility

Incident Management

All Disposal Group personnel should familiarize themselves with each approved site-specific carcass management plan. The Disposal Group Supervisor will review the plan with the Disposal Group and brief them on all relevant aspects of the carcass management effort. For further guidance, refer to the [FAD PReP APHIS Foreign Animal Disease Framework: Roles and Coordination](#).

1. The Incident Coordination Group (ICG) / Incident Management Team (IMT) will ensure that there is a system in place to identify carcass management team members with the required expertise.
2. The Disposal Group Supervisor, Disposal Coordinator, or other assigned official will verify credentials, training, and security clearances and arrange just-in-time training as needed for carcass management team members.
3. The Disposal Group Supervisor will prepare briefings and reports for the Operations Section Chief.
4. The Safety Officer will brief all responders on safety precautions and will provide a briefing on the nature of the disease and other circumstances affecting the response.
5. The Safety Officer or Biosecurity Officer will brief all responders on biosecurity protocols.
6. Plans should be developed to be sure that all onsite carcass management related personnel are briefed on safety requirements, site conditions, and tasks.
7. The Public Information personnel will develop material, such as Frequently Asked Questions, to address public concerns.

Rendering Plant Preparation

1. Because it can take time to get the first load accepted by a rendering facility, it is critical to negotiate agreements with rendering facilities in advance; note however that the federal government cannot issue a contract until there is a bona fide need so any work in advance with rendering facilities can include general guidelines, but will not be an actual contract for services.
2. Based on the list of suitable rendering facilities identified in the planning stage, contact each rendering facility to ensure they have agreed to accept infected material.
3. Ensure the State has provided any required permits and permit conditions to the rendering facility – prior to awarding contracts.
4. Ensure contracting personnel are prepared to award contracts to rendering facilities and pay contractors and rendering facility operators after their invoices are approved.
5. Visit the rendering facility to assess site conditions and determine if any temporary improvements are needed.
6. Coordinate with the rendering facility operator to
 - o Plan traffic routing for trucks and other vehicles
 - o Select a suitable location for vehicle C&D
 - o Identify and select C&D wash water management option(s)

Infected Premises Preparation

1. Consider treating carcasses at infected premises to inactivate pathogen prior to transport so waste will be more readily accepted.
2. Develop a communication plan between the farm and the rendering facility with a single point of contact to coordinate arrival times and rendering facility resources
3. If possible, use the rendering company's carcass pickup service. Regardless of the transportation provider, a certified waste management professional should be consulted prior to the transport of infected carcasses off premises.
4. Upon arrival at the farm, the truck driver should remain in the vehicle with the windows closed until the load has been picked up, transported, and emptied at the rendering facility and the vehicle cleaned and disinfected. If the driver must leave the truck before that time, proper biosecurity procedures should be followed.
5. Use leak-proof vehicles to transport carcasses.
6. Allow a minimum of one foot of headspace at the top of the trailer to allow for expansion of the material.
7. Securely fasten a tarp over the trailer/roll-off container to prevent damage to the load during highway transport. The tarp must be capable of being cleaned and disinfected.
8. Check trailers/roll-off containers for leakage before leaving the farm.
9. Before leaving the farm, clean vehicles - including tires, wheel wells and undercarriages – to remove organic material. Thoroughly spray the vehicle with a disinfectant registered by the EPA and labeled for the pathogen of concern.
10. Give the truck driver all appropriate paperwork and transport the load to the rendering facility.
11. Contact staff at the rendering facility with the time the truck left the farm and an estimated time of arrival at the rendering facility.
12. Trucks must travel to the rendering facility under permit by USDA on a route specified by the State Veterinarian, USDA, or other designated official.
13. When trucks arrive at the rendering facility, check in and obtain a receipt
14. Proceed to unloading area.
15. Any problems or deviations in these procedures are to be reported to the government site manager immediately.

At the Rendering Facility

1. All employees in the carcass management area will wear PPE, if required, in accordance with the Centers for Disease Control and Prevention (CDC), the Occupational Safety and Health Administration (OSHA), the incident-specific Health and Safety Plan (HASP) or other established guidelines. APHIS employees should refer to the APHIS Emergency Management, Safety and Security Division [EMSSD](#) website for more information.
 - The USDA contractor will establish a cleaning and disinfection station; location of this disinfection station will be coordinated between parties
 - Operations staff will monitor and prevent scavenging animals from gaining access to the carcass waste
2. Once arriving at the rendering facility, direct trucks to the unloading area to dump their loads onto the designated area.
3. Once emptied, trucks will pull forward for cleaning and disinfection
 - All vehicles will be pressure washed with a detergent solution, and then will have disinfectant applied that has been approved by the USDA
 - The entire vehicle (excluding the interior of the vehicle cab) will be cleaned and disinfected, including tires, wheel wells, undercarriages, and both the internal and external surfaces of truck/trailer beds, sidewalls, tailgates, and tarps
4. Perform the rendering process within 24 to 48 hours of an animal's death.
 - Delays are acceptable only if carcasses can be stored at temperatures of less than 40°F (5°C)
5. Control and record the input rate, relative to the size of the rendering vessel, and verify that all locations in the vessel reach the minimum temperature and cooking time to inactivate pathogens.
6. Properly maintain the carcass-receiving and finished-product sections as “dirty” and “clean” areas of the rendering plant to keep them separated.
7. Workers cannot move between the “dirty” and “clean” areas without personnel decontamination.
8. Routinely sanitize the equipment and maintain the tools used on the processing lines and in the facilities.
9. Prevent the drainage of liquids from dirty to clean areas to avoid contaminating the finished products and their transportation system.
10. Implement procedures to monitor odors and investigate/ resolve odor-related complaints.

At the Rendering Facility (cont.)

11. Monitor the cooking process.
12. Plan for proper disposal of the rendered products, unless specifically authorized to use for animal feed. Disposal options for rendered product include composting, landfilling, or recycling at a cement kiln. Fats could be used for biofuel or burned in plant boilers.
13. All cleaning and disinfection spray and overspray will be collected for on-site management.
 - No runoff from the cleaning and disinfection will occur to the rendering site
14. Any equipment or personal protective equipment used to manage the carcasses or related material must be cleaned and disinfected or disposed of at the end of the day or as appropriate.
 - No material used to manage carcasses shall leave the premises or the carcass management area without cleaning and disinfection

Summary

Congratulations! You have completed the Rendering Module. In this module, you have learned to:

- Describe rendering as a method for carcass management
- Understand the advantages and disadvantages of rendering
- Identify personnel health risks associated with rendering
- Consider environmental risks associated with rendering
- Obtain regulations governing rendering by consulting with state officials
- Identify factors used to evaluate rendering as an option
- List critical elements when planning use of rendering
- Recognize key components of rendering operations

Please click [here](#) to download the certificate of completion for this module. You can enter your name on the certificate and save or print it for your records.