

Carcass Management Course On-site Burial Module



United States
Department of
Agriculture



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Overview

Welcome to the On-site Burial Module of the online Carcass Management Course. 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 on-site burial as the preferred carcass management option.

Effective management of carcasses and associated contaminated 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
- Planning
- Evaluation
- Operations

Upon completing this module, you should be able to:

- Describe on-site burial, including lined and unlined trench or pit methods
- Identify the advantages and disadvantages of on-site burial
- Identify personnel health risks associated with on-site burial
- Consider environmental risks associated with on-site burial
- Obtain regulations governing on-site burial by consulting with state officials
- Identify factors used to evaluate on-site burial as a carcass management option
- List critical elements when planning on-site burial
- Recognize key components of on-site burial operations

Introduction Lesson Overview

Definition: Unlined burial of carcasses involves placing them in a trench or large, earthen hole or pit. This method can be used for daily mortality and large-scale carcass management needs if site conditions are suitable and regulatory approval is obtained. However, these sites are typically not pre-existing, and must be constructed at the time of the emergency

Unlined trenches or burial pits:

- Involve excavating a trench or pit into the earth, then
- Placing carcasses in the excavation, and covering the carcasses with the excavated material

In contrast, lined burial sites:

- Are excavations which have been lined with an impermeable material, and
- Incorporate systems to collect, treat, and/or dispose of leachate and landfill gas and require regulatory approval and permits
- Lined burial also known as engineered landfills or permitted landfills, see Off-site Permitted Landfill Module for more information on lined burial

The remainder of this module will focus primarily on unlined burial.

Introduction Lesson Contents

This lesson is divided into the following sections:

- Description – Presents the key features of on-site burial
- Design – Discusses the basic design of an on-site burial site and its various components and systems
- Advantages – Describes the benefits of using on-site burial as an option
- Disadvantages – Covers the difficulties and possible drawbacks associated with use of on-site burial

Description

Trench burial and pits are the two most commonly used on-site burial methods. Trenches are much longer than they are wide, whereas pits have a length which is more proportional to width. Both methods can be used for daily mortality needs if allowed by regulatory authorities; however trench burial is more commonly used for emergency carcass management because of speed.

- Burial involves the use of an excavator or backhoe to remove soil from the ground, piling the soil nearby for later use, depositing the carcasses in the excavated area, and then covering the carcasses with the soil that had been previously removed
- Once buried, carcasses undergo anaerobic decomposition and break down into minerals and organic material. This is a slow process and may take decades in many cases.
- The anaerobic decomposition process generates body fluids (leachate) which will slowly penetrate into the native soil. Depending on the soil type and water table depth there may be some risks associated with contaminating groundwater.
- A variety of physical, chemical or biological processes may, under favorable conditions, reduce the mass, toxicity, mobility, volume or concentration of contaminants in soil or groundwater over time

Figure 1. Carcasses Deposited in an Unlined Burial Site



Description (cont.)

- Carcass decomposition also generates methane, an explosive gas which can migrate through the soil to enclosed spaces such as utility vaults and basements where it can replace the air and create an asphyxiation hazard or accumulate to explosive concentrations in the presence of a spark or flame
- Methane is also a greenhouse gas which may contribute to global climate change
- Unlined burial techniques were utilized during Foot and Mouth Disease (FMD) outbreaks in the United Kingdom, Japan and South Korea between 2001 and 2011
- Burial has been historically used for mortality management and is familiar to most people

Figure 2. Illustration of Trench Configuration with Side Slopes



Advantages

On-Site burial can be rapidly implemented in the event of an animal health emergency if the excavation equipment, space, and regulatory support is available. Burial may provide the following advantages:

- Burial can take place on or adjacent to premises where depopulation occurs, eliminating the need for off-site transport
- Carcasses can be covered with the material excavated from the trenches and additional materials are usually not required
- Buried carcasses and animal by-products are eventually degraded and broken down into minerals and organic material
- Trench burial may be able to accommodate a large number of carcasses if the space is available
- Equipment for burial is generally widely available

Disadvantages

Potential disadvantages of using on-site burial of animal carcasses and material include:

- Carcass degradation will generate significant quantities of leachate and groundwater contamination may result
- The burial process may not significantly inactivate pathogens or contain contaminants
- The by-products of carcass burial have no commercial value
- Certain geological conditions, such as karst topography sandy soil and a high seasonal water table, can increase the risk of contaminants reaching the groundwater
- Costs of installing and maintaining groundwater monitoring wells; collecting water samples, lab analysis of samples, environmental remediation (particularly groundwater remediation), etc. should be taken into account
- Land used for carcass management may not be available for other productive purposes for a number of years
- The property owner may be liable for all environmental remediation costs associated with unlined burial
- The presence of a burial site may reduce the property value, and must be disclosed if the property is sold
- It may be difficult to identify burial sites with suitable geological and/or hydrological properties, and wet or frozen ground may hinder burial

Evaluation Lesson Overview

This lesson contains information to help assist you in determining if on-site burial is a suitable method for disposing of carcasses following an animal health event.

Factors in the evaluation include:

- Knowing and understanding applicable regulations
- Identifying the waste stream
- Evaluating the on-site burial site
- Recognizing the environmental impact

Evaluation Lesson Contents

This lesson presents the following information:

- Regulations – Covers many of the key regulations governing burial
- Waste Stream Evaluation – Contains questions to assess the material on the infected premises to determine suitable management options
- Burial Site Evaluation –Includes factors to determine if a site is suitable for onsite burial
- Environmental Impact – Includes a discussion of potential environmental impacts, important biosecurity considerations, and public health considerations

Regulations

Depending on the circumstances, carcasses resulting from an animal disease outbreak may be considered solid waste or infectious waste. It is important to consult with experienced personnel familiar with all disposal regulations in the affected areas when determining if unlined burial is a feasible carcass management option at a particular site. Applicable laws and regulations may include:

- [Clean Air Act](#) for air emissions
- The U.S. Occupational Safety and Health Administration (OSHA) has set requirements and recommendations for those engaged in hazardous waste operations involving disease-causing organisms ([29 CFR 1910](#))
- Resource Conservation and Recovery Act ([RCRA](#)) for solid waste processing
- Use of personal protective equipment in hazardous waste operations can be found at [29 CFR 1910.134](#) and [29 CFR 1910.156](#)
- Title [40 CFR 262.11](#) requires any person generating waste must determine if that waste is hazardous and follow strict protocols if it is
- State Departments of Health issue regulations that determine which wastes are considered 'regulated' or require special handling. Check the Regulated Medical Waste [RMW State Locator](#) to find the classifications.
- Consult with the USDA-Natural Resources Conservation Service (NRCS) [Web Soil Survey](#) and appropriate State agencies to obtain soil maps

Regulations (cont.)

All waste materials slated for management and/or transport must be correctly classified by an experienced waste manager prior to assure that appropriate carcass management and transportation methods are selected. The classification of the waste will depend upon the specific type of incident and the federal agency with primary authority.

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, unless the waste is infected with highly dangerous organisms, in which case it would be an infectious waste
- 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 - When carcasses are moved in commerce (under US Department of Transportation authority), infectious material (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
 - Compliance with incident-specific state and federal requirements for biosecurity, transport method, chain of custody, and cleaning/disinfection (e.g., using VS Form 1-27)
 - Refer to the [NAHEMS Guidelines: Quarantine and Movement Control](#) for additional information

Waste Stream Evaluation

The following are issues one should consider before starting on-site burial activities:

- What types of infected 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?
- How much material needs to be buried?
 - If there is more material than on-site burial can handle, off-site carcass management may be required
 - The material from a large outbreak may have to be sent to multiple off-site locations as capacities are reached

Burial Site Evaluation

A number of important factors will affect the decision to use on-site burial as a carcass management option. These may include:

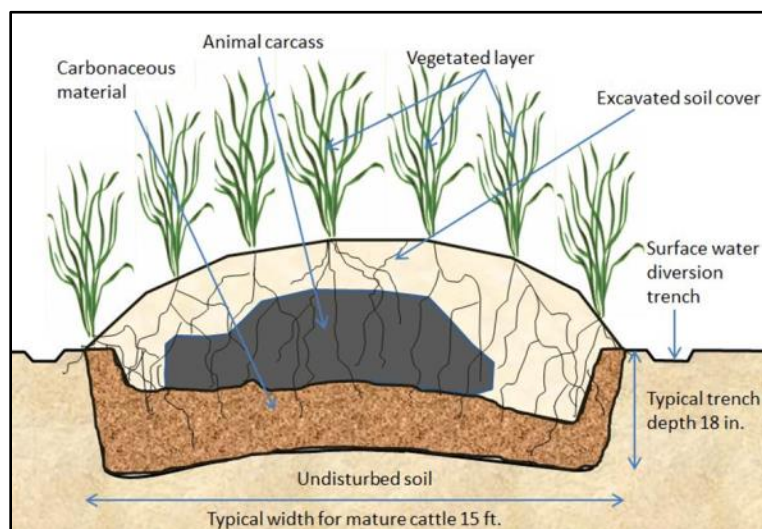
- Is an agreement with the state or regulations already in place that allows on-site burial?
- Does the applicable permitting authority allow on-site burial?
- Can the permit conditions be met?
- Who owns the land or facility? Will the owner allow burial on their property?
- Do state regulations require deed recordation of the burial pit or trench?
- Does the owner have labor and equipment to assist with burial?
- 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 prior to management (e.g., fencing surrounding the facility).
- What actions will be taken to reduce odor and vermin? Ensuring that the operation is following regulations and procedures effectively is important to avoid any negative publicity surrounding the carcass management activities.

Evaluation Questions

Below are some additional considerations that should be weighed in selecting a burial site.

- Are climatic and weather factors suitable? (e.g., is the soil too wet or frozen to be worked, or will the prevailing winds and odors disturb neighbors?)
- Is the proposed site near water bodies, wells, roadways, public areas, dwellings, residences, municipalities, or property lines? If so, consider another site.
- Are measures taken to ensure no underground lines or other hazards are present where digging is proposed? Contact local utility location service before digging if applicable.
- Will additional backfill be required to prevent pooling of water at the burial site due to site settlement? If so, be sure it is readily available.
- Are there suitable soil conditions and depth to the seasonal high water table? Refer to NRCS [Web Soil Survey](#).
- Consider using an Above-Ground Burial method ([G. Flory, et al, Virginia DEQ](#)) to minimize impacts to groundwater. Aboveground Burial offers benefits over traditional burial methods because carcasses decompose more rapidly in a shallow, biologically active zone and the practice provides greater separation from groundwater resources.

Figure 3. Cross Section of Aboveground Burial System



Environmental Impact

Burial of carcasses results in decomposition processes that can take many years to occur depending on temperature, moisture, burial depth, soil type and permeability, humidity, and rainfall.

- The decomposition process releases gases and leachate which may contain biological and chemical contaminants
 - Leachate can migrate to groundwater and surface water contaminating it with pathogens and chemical compounds which can cause illness
 - Contaminated groundwater can discharge to surface water, spreading the pathogen and disease
- The leachate contains high levels of nitrogen and phosphorus which can pose a risk to human and environmental health
 - EPA standard for nitrates in drinking water is 10.0 mg/L. Carcass burial sites can generate over 1000 times the standard.
 - Nitrate contaminated drinking water used to prepare infant formula is a risk factor for infant methemoglobinemia (develop a blue-gray skin color) which can be fatal
 - Nitrogen is toxic to aquatic life. It depletes dissolved oxygen in receiving waters and stimulates aquatic plant growth (eutrophication).

Environmental Impact (cont.)

- Air pollution is another potential environmental impact resulting from the anaerobic decomposition of carcasses
 - Methane is an explosive gas; methane and carbon dioxide are greenhouse gases which may contribute to climate change. Hydrogen sulfide is very malodorous, and some states also have air quality standards for hydrogen sulfide concentrations. Additionally, the decomposition of carcasses can lead to creation and emission of volatile organic compounds, many of which are also odorous.
 - Gases must be monitored on a routine basis for potential health hazards to workers and the public living around the sites

Figure 4. On-site Burial Potential Risks (Click on Image to Enlarge It)

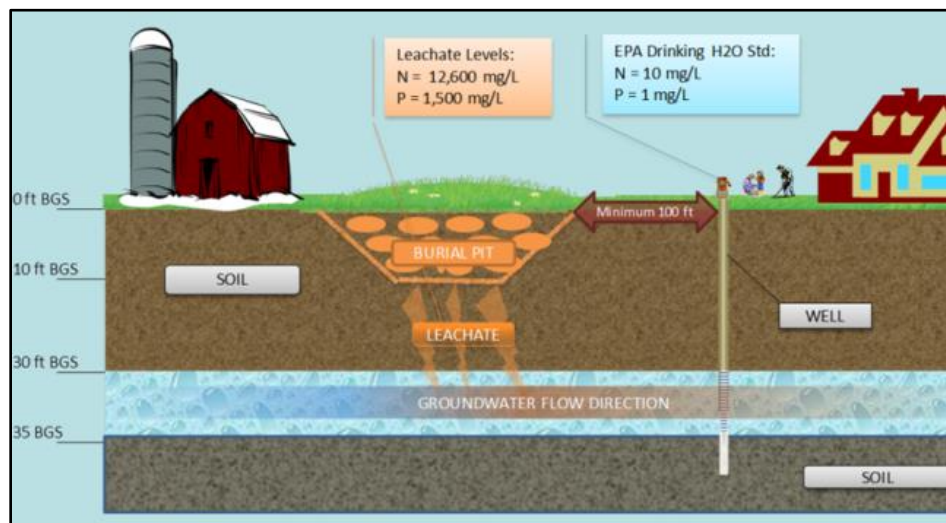


Environmental Impact Questions

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

- Is the burial site the required distance from sensitive areas? Is there sufficient distance from the burial site to groundwater wells and surface waters to prevent environmental harm?
- Does the distance to surface and groundwater take into account site-specific soil characteristics? Contact the local Natural Resources Conservation Service office for assistance.
- Will practices ensure groundwater is not contaminated by conventional pollutants, such as total dissolved solids and ammonia?
- Will use of a liner system be considered where site-specific conditions do not protect the environment?
- Will carcasses rise to the surface after burial, due to fluctuating groundwater levels? How will this be prevented?
- Is the premises in compliance with all permit requirements?
- Does record keeping meet the regulatory requirements?
- Who will keep the records?
 - This is important to identify who may be legally liable, in case there is an environmental release in the future

Figure 5. Example Burial Site Location



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. For more comprehensive biosecurity information, refer to the Biosecurity Module.

- Plans must be in place to prevent disease spread during transportation of carcasses, even if the transport occurs from one part of the farm to another. For more information see the Secure Transport Module.
- Workers who handle infectious carcasses need to take proper precautions and should be equipped with appropriate PPE in accordance with site-specific plans. Refer to the Health, Safety, and Personal Protective Equipment (PPE) Module.
- In cooperation with appropriate public health agencies, personnel should be monitored afterward for signs of illness if the pathogen of concern is potentially 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.

- Proper storage for carcasses should prevent scavenging by wildlife and access by other vectors
- Proper storage should prevent release of leachate to the environment

Public Health Considerations

A comprehensive understanding of the type and strain of pathogen associated with the animal disease event is essential to prevent further spread of infection and to safeguard human, animal, and environmental safety and security. Biosecurity measures along with cleaning and disinfection protocols will be governed by the type and strain of pathogen present.

- Care must be taken to conduct operations in such a manner that public health is protected
- On-site burial will also require transportation of potentially contaminated biomass from the barn or pasture to the burial site. If public roads are used, there may be additional public questions which will need to be answered.
- Heightened public health concerns will exist and must be addressed when dealing with a zoonotic disease agent
- Carcasses infected with spore forming bacteria (such as the *Bacillus anthracis*, the bacteria which cause anthrax) may not be candidates for burial and incineration should be strongly considered as an option
- Burial may not be a suitable option, depending on the soil types, for animals infected with or exposed to a disease agents responsible for Transmissible Spongiform Encephalopathy (TSE) (E.g., Scrapie, Bovine Spongiform Encephalopathy, & Chronic Wasting Disease)

Public Health Questions

The following questions will help evaluate the public health concerns associated with on-site burial activities:

- Are there event and site-specific health and safety plans for the operators that are approved by a credentialed Safety Officer?
- Are on-site burial 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 at the on-site burial site?
- 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.
- Do the carcasses, by-products, and/or eggs need to be processed in any fashion before management? For example, with trench burial operations, preprocessing or venting of carcasses may be necessary prior to burial.
- Is the pathogen of concern likely to survive in the on-site burial leachate?
- Will groundwater monitoring be required?

Planning Lesson Overview

This lesson contains information to help you plan for on-site burial of carcasses resulting from an animal health emergency. Planning is essential to ensure that the 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, susceptible animals, and the environment.

Important considerations include:

- Classifying and characterizing the waste material
- Identifying suitable on-site burial sites
- Finding adequate carcass storage facilities
- Assessing availability of secure transportation

Planning Lesson Contents

The material in this lesson is divided into the following 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
- Materials, Supplies, and Equipment– Provides a list of equipment and supplies which might be needed for on-site burial
- Secure Transportation – Presents important questions to consider before transporting carcasses
- Site Suitability – Describes planning considerations for selecting and using an on-site burial site

Figure 6. Briefing the Carcass Management Team



Personnel

There are certain personnel 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 on-site burial 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, and disposing materials at the on-site burial site. Refer to the Health, Safety, & PPE Module.
- Biosecurity – Use of on-site burial must include strict biosecurity measures to minimize disease spread when transporting and handling infected materials. Refer to the Biosecurity Module and Secure Transport Module.
- Physical Security – Planning efforts should consider security of personnel at the infected premises, security of infected material during transport, and security at the burial site. 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

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 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

Materials, Supplies, and Equipment

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

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

- Personal protective equipment
- Personnel, supply, and equipment decontamination equipment
- Secure transport equipment (driven by trained drivers) to deliver carcasses from the pens/pastures/barns to the burial location
- Vehicle cleaning and disinfection equipment
- Vehicle liners, such as plastic sheeting or specialized bags
- Loading equipment
- Absorbent material to prevent leakage from transport equipment
- Regulatory authority approved containers, such as sharps containers that are puncture-resistant and leak-proof
- 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](#)).

Material, Supplies, and Equipment (cont.)

Equipment requirements may include:

- Excavators which are:
 - Typically used to dig and/or fill burial trenches
 - Self-propelled, large, mounted on tracks with a boom (arm) and bucket; sometimes called a trackhoe
 - Can (a) construct a long, deep, vertical-walled trench efficiently; (b) store topsoil separately from subsoil; (c) fill a pit with carcasses or other materials and close it without disturbing the carcasses; and (d) cause comparatively little site disturbance
- Loaders, bulldozers, road graders, and backhoes
 - These tend to be less efficient and involve continual movement over the site, causing relatively greater damage to the site
- Holding pen(s) for confining animals prior to euthanasia should be available near the burial site
- Global Positioning System (GPS) coordinates should be used to record the location of each burial site

Figure 7. Example Supplies Needed for Cleaning and Disinfection



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. Guidance related to storage and collection of solid waste which may have some relevance to carcass collection and staging, refer to [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?
 - Can the equipment be cleaned and disinfected?
- 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 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

Secure Transportation

Transport vehicles will be needed to move carcasses and other materials to the burial site, even if it's on the same premises as the animals. If the waste must travel on public roads, it should be transported in closed, leak-resistant and/or lined trucks or dumpsters. Secondary containment may be needed, depending on the type of waste being transported. Consult a certified waste management professional when developing this section of the carcass management plan. Some transport planning considerations are listed below:

- 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 packaging standards apply? Are all standards consistently met, including labeling, placarding, and manifesting, if required?
- How will transport vehicle traffic be minimized into the Control Area?

For more information, refer to the Secure Transport Module.

Site Suitability

Members of the carcass management team must contact or visit the premises and/or the appropriate state regulatory authorities to ensure on-site burial is accomplished in accordance with all applicable laws and regulations.

During an animal disease outbreak, the carcass management team should consider the following:

- Soil properties (texture, permeability, surface fragments, depth to water table, and depth to bedrock)
- Slope or topography
- Hydrologic properties
- Proximity to water bodies, wells, public areas, roadways, dwellings, residences, municipalities, or property lines
- Accessibility
- Subsequent intended use of site

In states where carcass management is regulated, trench burial is frequently one of the options allowed. However, state regulations vary considerably in terms of specific criteria required for a suitable burial site.

Operations Lesson Overview

This lesson contains general procedures in preparing for and managing carcasses by utilizing on-site burial. The following topics will be addressed:

- On-site burial preparation
- Health and safety
- On-site burial operations

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

Figure 8. Carcass Management Team Wearing PPE



Operations Lesson Contents

The 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 – Provides general guidelines to the Disposal Group personnel when dealing with an animal emergency situation
- Infected Premises Preparation – Lists steps for assessing facility readiness to begin operations
- On-site Burial Operations – Describes procedures for safe and proper carcass management using on-site burial

Incident Management

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

1. The Incident Coordination Group (ICG) / Incident Management Team (IMT) should ensure 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 should verify credentials, training, and security clearances and arrange just-in-time training for carcass management team members.
3. The Disposal Group Supervisor should prepare briefings and reports for the Operations Section Chief.
4. The Safety Officer should 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 should 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 should develop material, such as Frequently Asked Questions, to address public concerns.

Infected Premises Preparation

1. Consult with local, county, state, and federal environmental officials to obtain specific information for the region or community in order to minimize any negative environmental effects associated with the management of contaminated material.
2. Determine all applicable public health or environmental protection laws, including fire codes and other regulations.
3. Consider regional climate and seasonal trends (e.g., general direction of prevailing winds, precipitation, thermal factors).
4. Verify the availability of adequate carcass storage facilities such as refrigerated rooms, transport vehicles, freezers or other means of carcass preservation if needed.
5. Identify haulers who:
 - Are equipped to haul carcasses in accordance with State and Federal laws
 - Can provide secure, leak resistant, transport for the infected carcasses and contaminated materials
 - Possess vehicles in good mechanical condition and capable of carrying the load without difficulty
 - Have vehicles which can be covered with a tarpaulin if they do not have closed tops
 - Employ licensed drivers adequately trained (see [49 CFR 172](#) and [49 CFR 173](#) for further guidance)
 - Have an emergency plan which addresses spills/excess leakage; vehicle break-downs; traffic accidents; adverse weather conditions; terrorist attacks
6. Review State and local regulations regarding burial. Individual States regulate the parameters for burial (e.g., quantity of carcasses, depth to water table, and distance to wells, surface water, and property lines).
7. Obtain information from the USDA NRCS [Web Soil Survey](#) such as soil maps, and seasonal water table data.
8. If the WSS data indicates the site is suitable for carcass burial, consider obtaining the services of an environmental professional, such as a Professional Geologist or Professional Engineer to collect at least three soil borings at the site to confirm the site is suitable. Soil boring depths shall extend the water table. Extend soil boring depths to the water table or a minimum of 10 feet below the trench bottom.

Infected Premises Preparation (cont.)

9. Trench burial has the potential to impact groundwater and generate offensive odors, requiring the water table to be deep and the soil impermeable. Using the soil logs, perform hydrogeological and contaminant transport modeling to assess the likelihood of the burial site contaminating drinking water aquifers.
10. Consult with appropriate State regulatory agencies about permits for potential sites before initiating operations.
11. Excavation should not be performed near existing structures such as buildings and roads, because it can undermine structural stability and cause structures to collapse.
12. Have underground utilities located and marked prior to beginning any excavation.
13. Verify the site is large enough for on-site burial of the carcasses based on calculations
 - For mass burial, select a cross-sectional geometry (rectangular or trapezoidal)
 - When excavating to more than 5 feet (about 1.5 meters) deep, prepare the side slopes with a minimum ratio of 1.5 (horizontal) to 1 (vertical)
 - Care must be taken to slope the sides of the trench or shore them up to avoid cave-ins
 - Place the carcasses in the trenches or pits
 - Cover the carcasses with a minimum of 2.5-3 feet of soil, depending on local requirements
 - Be sure to mound the soil above the ground level to account for future settling of the material
 - Determine the length of the trench from the cross-sectional area of the trench geometry. The ratio of trench volume to carcass volume should be 4:1 for burying one to two layers of large carcasses (1,000 pounds [about 450 kilograms] or more) and 2:1 for burial of two to three layers of medium-sized or small carcasses.

Infected Premises Preparation (cont.)

Figure 9. Length Calculation for Burial of 100 Cattle

Assumptions

- 1 - Average weight of carcass = 1,000 lb.
- 2 - Bulk density of carcass = about 62.4 lb./ft.³
- 3 - Volume ratio for a two-layer or one-layer burial trench = 4 ft.³ of trench/ft.³ of carcass
- 4 - Trench depths for one layer and two layers = 4 ft. (shallow trench) and 8 ft. (deep trench), respectively
- 5 - Trench width for both cases = 6 ft.; two carcasses lie side by side
- 6 - Length of each cattle carcass = about 5 ft.

Solutions

A. Deep trench

- 1 - Trench length in a deep trench = $\{(100 \text{ cattle}) \times (1,000 \text{ lb./cattle}) (4 \text{ volume ratio})\} \div \{(62.4 \text{ lb./ft.}^3) (8 \text{ ft. deep}) (6 \text{ ft. wide})\}$ about 130 ft.
- 2 - Number of buried cattle in two layers and two rows = $\{(130 \text{ ft.}) \times (2 \text{ layers}) \times (2 \text{ rows})\} \div (5 \text{ ft. length/carcass}) = 104 \text{ carcasses}$

B. Shallow trench

- 1 - Trench length in shallow trench = $\{(100 \text{ cattle}) \times (1,000 \text{ lb./cattle}) (4 \text{ volume ratio})\} \div (62.4 \text{ lb./ft.}^3) (4 \text{ ft. deep}) (6 \text{ ft. wide})\}$ about 260 ft.
- 2 - Number of buried cattle in one layer and two rows = $\{(260 \text{ ft.}) \times (2 \text{ rows})\} \div (5 \text{ ft. long/carcass}) = 104 \text{ carcasses}$

14. Verify the site is accessible to carcass hauling trucks and heavy equipment.
15. Design the excavation size, depth, and side slope angles to prevent cave-ins.
16. Prepare and maintain a list of names and contact information for heavy machinery operators, fire department personnel, law enforcement, public works departments, departments of transportation, and regulatory agencies. This information can be incorporated into the site specific carcass management plan, sometimes referred to as an emergency action plan.
17. Contract with local heavy equipment suppliers and operators to deliver, operate, fuel, and maintain needed heavy equipment.
18. Contract for carcass storage equipment and/or services if needed.
19. Ensure that personnel who will be operating the heavy equipment are properly certified in the use of the equipment.
20. Train carcass management personnel on safety, biosecurity, and operational procedures in accordance with the site specific carcass management plan.

On-site Burial Operations

Conducting Unlined Burial

1. Obtain all appropriate permits and approvals, including landowner's permission and acceptance of long-term environmental liability, to begin burial.
2. Don all required PPE as detailed in the Site-Specific Health and Safety Plan (HASP). APHIS employees should refer to the APHIS Emergency Management, Safety and Security Division and Veterinary Services [EMSSD](#) website for more information.
3. Flag or stake the burial site.
4. Obtain the heavy equipment and machinery (trackhoe, backhoe, scraper, bulldozer, or other equipment) required for excavating.
5. Excavate the appropriate sized trench based on the excavation design parameters.
6. Excavation should not be performed near existing structures such as buildings and roads, because it can undermine structural stability and cause structures to collapse.
7. Consider puncturing/venting the carcasses to minimize the likelihood of gas-filled carcasses emerging from the soil cover.
8. Place carcasses in the trench.
9. Cover the carcasses with the excavated earth, being sure to grade the surface soil to facilitate runoff.
10. Stabilize the surface of the excavated area in accordance with local requirements to minimize soil erosion.
11. Thoroughly clean and disinfect all of the disposal equipment. See the [FAD PReP SOP15: Cleaning and Disinfection](#) and [FAD PReP SOPs: Biosecurity](#).
12. Regularly inspect and maintain the site by adding additional backfill to prevent pooling of water if necessary.
13. Highly recommended: monitor groundwater quality down gradient of the burial site(s) to ensure the ongoing safety of ground water.

Summary

Congratulations! You have completed the On-site Burial Module. In this module, you have learned to:

- Describe on-site burial, including lined and unlined trench or pit methods
- Identify the advantages and disadvantages of on-site burial
- Identify personnel health risks associated with on-site burial
- Consider environmental risks associated with on-site burial
- Obtain regulations governing on-site burial by consulting with state officials
- Identify factors used to evaluate on-site burial as a carcass management option
- List critical elements when planning on-site burial
- Recognize key components of on-site burial 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.