
Carcass Disposal: A Comprehensive Review

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Chapter

17

Transportation

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Section 1 – Key Content

The transportation of large numbers of diseased animals/carcasses resulting from a natural disaster or terrorism event requires significant planning and preparation in order to prevent further dissemination of the disease to susceptible animal or human populations. Defining and following critical protocols will be essential to the safe and successful transportation of such animals to an off-site disposal location following a disaster. While carcass disposal information is widely available, relatively little is currently predefined concerning the transportation of such cargo.

Specific guidelines should be developed prior to disasters that define necessary preparations, response, and recovery methods for potential animal disease outbreaks and/or significant death losses. Providing transportation equipment operators, supervisors, and drivers with the necessary guidelines and training in the use of personal protective gear, handling diseased animals/carcasses in various states of decay, responding to inquisitive public sources such as the media, and becoming familiar with all pertinent permits and other transportation documents are vital to planned preparation for a disaster. There may be significant health risks, stress variables, manpower issues, and emotional trauma associated with the handling and transportation of diseased animals in an emergency situation. Employers must be prepared to credibly explain the risks and safety precautions necessary to minimize the negative impact a potential disaster can have on the transportation workforce. In addition, workers involved in the transportation between multiple city, county, and state jurisdictions must be made aware of the regulations regarding public health, transportation, agriculture, and the environment of those jurisdictions along the selected travel route.

The logistics issues involved in the transportation of diseased animals or carcasses include the use of skilled labor and necessary equipment to dispose of the potential health threat and/or emotional impact of a visible disaster. As a result of Hurricane Floyd, North Carolina's State Animal Response Team recommends the pre-arrangement of contracts for

such resources, including plans for financial reimbursement for such contracts. Local emergency responders must be aware of the process of acquiring these resources and develop resource lists in order to expedite a successful disaster response.

Transportation issues involving off-site disposal include carefully selecting a travel route to limit human exposure, minimizing the number of stops required, and ensuring close proximity to the infected site in order to limit refueling. The load may require special permitting for hazardous waste. There may be a need for prepared public announcements regarding the transportation of diseased animals/carcasses, as well as the need for law enforcement involvement to assist with the safe, uneventful completion of the transportation and disposal process.

When biosecurity is a primary concern, disease confinement is a necessity. Planning for the possibility of disease control may be defined by conducting a vulnerability assessment which will help determine the most likely scenarios that are possible for a breakdown in the transportation process. The response to an incident involves containment and correction of the unfolding situation. Regulatory agencies must be prepared to work together in the best interests of the public in these situations. Emergency managers must assess the situation quickly and quantify information pertaining to the disaster. Completion of a preliminary or initial damage assessment will quantify disaster information necessary to determine response needs.

The physical condition of the diseased animals/carcasses will determine the required transportation equipment. Separate loads are required for live animals and carcasses. Containment within the transport is critical. The location of the selected disposal site will affect load requirements and limits for transportation. Containment of possible pathogenic organisms may require particular vehicles equipped with an absorption and/or liquid collection system. Air-filtering systems will be required for live animal transport, and may be used in carcass transport as well.

A breach in biosecurity is possible during transit. An inspection of the selected travel route may be necessary. For security measures, an escort service may be used to guard against terrorist activity. Upon arrival at the disposal site, biosecurity measures must continue until the completion of disposal. The disposal rate will depend on the method of disposal.

Once disposal is complete, the recovery phase will include the disinfection of transportation workers and equipment prior to returning to the highways. In addition, payment for transportation services must be handled in the recovery phase. An estimate of the cost of animal disposal can be difficult to determine. A unit price contract is commonly used, where costs are assigned to an agreed unit then counted to determine cost. While it is impossible to predetermine an exact transportation cost of a disaster, the development of some pre-established contracts is possible, and can improve the disaster response time. The transportation of diseased animals/carcasses is a part of debris management. In order to improve emergency response time nationwide, cities, counties, and states are developing preestablished debris management contracts. Final

recovery phase considerations involve the health and well-being of those involved in the disaster. Post-incident health monitoring and/or counseling should be considered for all who came in contact with the diseased animals.

Finally, the resolution of any incident requires a review of the outcome and the identification of any lessons learned. The transportation of diseased animals/carcasses as a result of a terrorist incident should be carefully reviewed. More documentation of the transportation experience may improve the success of combating a large-scale carcass disposal event. Suggested courses of action include developing an emergency action plan and exercising it, participating in educational training for emergency responders, and maintaining a list of resources and subject matter experts to be consulted upon incident.

Future research should be done on special purpose designs for mass animal transportation. This may include a combination of disposal methods. Issues such as disease containment, processing, and cargo disposal methods regarding transportation are essential to improving emergency response.

Section 2 – Introduction

As a result of a natural disaster or terrorism event, large numbers of diseased and/or dead animals will need to be transported to a disposal site when they cannot be disposed of on site. A bioterrorism event directed at US agriculture could result in entire large-animal feedlots and poultry facilities being infected, requiring disposal of diseased and decaying animal carcasses to protect against further dissemination of the disease and/or etiologic agents throughout the industry.

This chapter focuses on critical issues related to established protocols during the transport of diseased animals/carcasses from the property of infection/mortality to an off-site disposal location. Research efforts consisted of internet searches for information related to the disposal/transportation of diseased animals/carcasses, open interviews with people who held leadership positions for the transportation of animal carcasses resulting from

disaster and/or disease, open interviews with people who are experienced and trained in responding to weapons of mass destruction and biohazard emergencies, and review of research papers on the subject of animal carcass disposal.

The information search was limited to English-speaking people and publications in English. While a significant amount of information was available regarding the disposal of infected animals/carcasses, comparatively little was available regarding the transportation of animals/carcasses. The majority of available information was comprised of regulatory documents and supporting guidelines that did not include details of results achieved or potential applications. The protocols for managing an agricultural disaster seemed to be consistent across all sources: human health and welfare, agriculture industry, and animal health.

Section 3 – Preparation

3.1 – Preparing Operators/Drivers/Supervisors

Transporting diseased animals and carcasses en masse is not a part of daily life for most American transportation and construction workers. Prior to engagement in such a project, supervisors, equipment operators, and drivers should be provided training and guidelines in (1) using personal protective equipment, (2) handling diseased animals and carcasses in various states of decay, (3) completing/maintaining required written transportation documentation, and (4) responding to media personnel seeking information for public broadcast.

As discovered by Waste Management, Department of Riverside County, California, during a recent Newcastle disease outbreak in Southern California, workers fear for their health and that of their families when confronted with transporting and handling diseased animals (Midwest Regional Carcass Disposal Conference, 2003). In order to maintain the workforce, employers must be prepared to credibly explain health risks and precautions to be taken by workers in order to ensure their safety and protection (Mummert, 2001). Ronnie Philips, of Philips and Jordan, Inc., cited that workers become very stressed when working with mass quantities of animal carcasses for long periods of time (Midwest Regional Carcass Disposal Conference, 2003). According to Philips, workers must be rotated away from direct contact with the carcasses periodically. In order to avoid short- and long-term worker health problems, preparations must be made to deal with the emotional impact of working with mass volumes of carcasses continuously for extended periods of time.

Transporting diseased animals and carcasses is well regulated through agencies with federal, state, county, and city jurisdictions. Examples include:

- Department of Agriculture and Food of Ireland
- Florida Statutes 2003

- Florida Department of Agriculture and Consumer Services – Animal Movement
- Idaho Department of Agriculture, Division of Animal Industries
- City of Rolla, Missouri – Municipal code of ordinances, Chapter 5 animals and fowl.
- Nevada Revised Statutes 2003
- City Codes for St. James, Missouri
- US Department of Agriculture – US State and Territory Animal Import Regulations

Since a mass outbreak may require employees from wide regions, and transporting animals and carcasses may cross jurisdictional lines, workers will need to be briefed on all pertinent regulations including environmental, transportation, public health, and agriculture.

3.2 – Preparing Logistics

A primary logistic concern is the resources, skilled workers, and equipment required to dispose of the diseased animals and carcasses expediently (Mummert, 2001). The disposal of thousands of animal carcasses in North Carolina in the wake of Hurricane Floyd resulted in additional provisions regarding carcass handling. In the County Plan recommended by the North Carolina State Animal Response Team, the Mortality Management Section coordinators, Drs. Jim Kittrell and Dan Wilson, identify the need to “prearrange contracts for resources to handle dead animal removal, burial and disposal.” Under the State Plan, it is recommended to “work out financing so counties can arrange local contracts with understanding of reimbursement” (Kittrell and Wilson, 2002). An important consideration in any contract is how the contracted work is to be measured and compensated. In developing such contracts, consideration should be given to how the animal will be handled and the condition of the carcass. Both parties of the designated contract, the payee and payer, must be able to accurately and consistently measure and

count the unit (Ellis, 2001; Department of Agriculture and Food of Ireland; Kittrell and Wilson, 2002).

Plans must be coordinated so that all workers and agencies are moving toward the same objectives. It will be very important for local emergency responders to know the process for acquiring the necessary resources. Developing and maintaining a resource list before an incident is paramount to a successful response. When the disposal location is off site, a travel route must be carefully selected to limit exposure of humans to the bio-contaminants in the load. People may be infected with the disease or may assist in the propagation of the disease.

Socially, people are emotionally impacted by the sight of large volumes of animal carcasses. Selecting a travel route through areas with limited or no population is the best way to avoid conflict. The route should be as direct as possible with few stops to ensure an efficient transportation operation. The ideal disposal site will be as close to the infected site as possible to avoid the need to refuel. Truck trip cycles should be planned to refuel on the return trip to the loading site. The carcasses may be considered a hazardous waste and require special permitting from regulatory agencies. It may be necessary to obtain permits from regulatory agencies for the selected travel route (Ellis, 2001; Fulhage, 1994).

While there is no desire to alarm the surrounding communities, there is a duty and purpose to inform the public. Large numbers of trucks traveling on low volume roadways will attract attention. Transportation officials should work with the Public Information Officer to prepare a public notice statement informing citizens about the operation. Drivers should be briefed on responding to the media and directing them to the Public Information Officer. If the event has been identified as a terrorist incident, law enforcement security should assist in ensuring that the load is secure during transit, is not used as a weapon itself, and reaches its destination safely (Ellis, 2001; Fulhage, 1994; Department of Agriculture and Food of Ireland).

Since biosecurity is a primary concern, preparing appropriate measures to help confine the disease outbreak and planning for them is a necessity. Consideration of all the factors that can work in opposition to disease control is termed a vulnerability assessment. Conducting vulnerability assessments for various most-likely scenarios will identify areas to be addressed in order to prevent or limit enlarging the outbreak as the result of a breakdown in the transportation process (Ellis, 2001; Department of Agriculture and Food of Ireland).

Section 4 – Response

When an incident occurs, a response that attempts to contain and correct the situation must be a priority. While regulations govern daily routines, including “normal” emergencies; those same regulations may not be practical during extreme events due to conflicting values. For example, strictly following truck load weight requirements may exacerbate a public health problem during the emergency by slowing the removal of diseased carcasses. Mechanisms must be in place in order for agencies to work together for the public good in such situations.

Every emergency manager must assess the situation and quickly answer two questions: How big is big? How bad is bad? Emergency managers use a

preliminary damage assessment or initial damage assessment to evaluate situations that may require state or federal disaster assistance (Federal Emergency Management Agency, 2003). Although the forms and information required vary, the assessment will quantify information pertaining to the disaster and resulting debris (animals/carcasses) such as the physical condition of the animals/carcasses, the animal count, estimated unit weight of animals to be transported, and/or the total estimated volume.

Diseased animals/carcasses may be in various states of physical condition from appearing healthy to liquefied. Live animals and carcasses should not be

mixed in the same load. The condition of the animals/carcasses will determine the equipment required to load them and contain the diseased organism. Containers for transporting diseased animals/carcasses are dependent upon the size and the condition of the animals/carcasses. In any condition, the primary consideration should be to contain the load within the transport vehicle. Live animal transportation must additionally consider ventilation, feeding, and watering of the animals. At a minimum, vehicles should be disinfected before loading diseased animals/carcasses, and made liquid-tight from loading to unloading.

The travel route and distance to the disposal site will affect allowances and limitations on the transport vehicles. If the travel route allows the use of large off-road haulers, the quantity of animals/carcasses carried in each load will be greater, reducing the number of loads and, therefore, reducing the risk of a biosecurity breach incident. More likely, the transportation route will utilize existing public roadways and commercial vehicles. The California Department of Food and Agriculture (2003) Web site provides a partial list of commercial dead animal haulers in that state. Other states may have similar resources.

Various systems may be employed to contain the pathogenic organism, depending on the size and

condition of the animals/carcasses (Ellis, 2001; Fulhage, 1994; Department of Agriculture and Food of Ireland). Containers must be liquid tight. Typically, they will be equipped with an absorption system and/or liquid collection system. A self-contained air filtering system is a must for transporting live diseased animals, and may be advantageous for order mitigation for carcass transport. Covers must securely prevent debris from blowing out of the top and/or prevent vector pilferage.

Transport vehicles may be most vulnerable to a breach of biosecurity while in transit. The route must be thoroughly inspected and monitored during the transport operation. An escort service may be necessary to guard against a hijacking of the load for the purpose of sale, ransom, or increased disease propagation of the pathogen(s) and negative impact of the terrorist incident (Ellis, 2001; Fulhage, 1994; Department of Agriculture and Food of Ireland).

The unloading of vehicles should be conducted at or as close to the disposal site as practical. All of the biosecurity measures to contain the pathogenic organism must actively continue until disposal is completed. It is possible animals/carcasses may have to be stored in the transport vehicles until they are disposed. The rate of disposal is dependent upon the selected method of disposal (Fulhage, 1994).

Section 5 – Recovery

In order to maintain strict biosecurity and prevent the spread of infection, the transport vehicle and driver must be disinfected after each unloading operation. This will ensure the pathogenic organism is contained or rendered passive prior to the vehicle returning to the highways.

Ireland's Department of Agriculture and Food offers a foot and mouth disease (FMD) Operations Manual Contingency Plan on its Web site. Chapter 21 Disposal of Carcass and Chapter 22 Cleaning and Disinfection of Infected Premises (<http://www.agriculture.gov.ie/index.jsp>) provide guidance for disinfection of vehicles, persons and premises in response to FMD.

Estimating the cost of mass animal disposal is a challenge. The most common costing tool for major efforts involving large quantities is a unit price contract where costs are assigned to an agreed unit, and that unit is then simply counted to determine the amount owed the contractor. The critical elements of such a contract are the description of the unit and the description of the payment. For example, a unit might be defined as 100 individual chickens, each estimated to weigh one to six pounds (live weight). The agreed unit in this example is 100 chickens, so described. The price is then defined, and the contract includes such information as what work will be done to the unit for the contract price, and may include language about how partial units will be paid.

Operating under such a contract, the conditions of unit and services included for the cost vary greatly depending on the incident. Without building a specific scenario, it would be impossible to predetermine an exact cost for transportation of any given animal disaster. However, that should not preclude development of pre-established contracts for the transportation of diseased animals/carcasses (Kittrell and Wilson, 2002). Many conditions of the contract can and should be established in preparation for a mass emergency. By doing so, the response time for the disposal of the animals/carcasses is shortened. Animal/carcass transportation and disposal is a part of debris management. States, counties, and cities across America are developing preestablished debris management contracts to improve their response to such emergencies. When developing a unit price

contract, the primary consideration, in addition to accomplishing the desired result, is to be able to identify and count or measure the unit. For that reason, load weight, volume, and round trips are often utilized. Animal count could be used for live animals if they can be counted easily. Since carcasses vary greatly by physical state, weight or volume may be measured.

Before the records are closed on an incident, it is important for those involved to have closure. It has been determined from past experience that people will be emotionally changed as the result of their involvement in the disaster. Post-incident counseling may be necessary for some. Post-incident health monitoring should be considered for all who came in contact with the diseased animals (Ellis, 2001).

Section 6 – Research Needs

In emergency management circles, one of the final actions in any incident is to review the incident and the outcome to identify lessons learned. The transportation of mass quantities of diseased animals/carcasses in response to a terrorist incident should be carefully reviewed for lessons learned. Within the context of research for this subsection, little detail is documented relevant to the transportation of diseased animals/carcasses. Biosecurity, as related to on-site disposal and cleanup, was discussed quite extensively for diseased animal responses. More detailed attention to the transportation issue may improve the probability of successfully combating a mass animal casualty. Some suggested courses of action for assuring a successful response might be to develop emergency action plans and exercise them regularly, develop and/or participate in training and education programs for responders, develop and maintain a list of necessary and available resources, and cultivate and maintain a list of available subject matter experts to be consulted for specific disease outbreaks.

Future study should be conducted on special purpose design for transporting mass quantities of diseased animals/carcasses. In some cases, this may involve a combination of disposal methods. For example, if carcasses were allowed to decompose in sealed

containers on site, could the liquid be pumped from those sealed containers to another sealed container and transported to an incinerator that could burn the pathogenic organism? The on-site container with remaining solids and residue could be loaded onto a transport and moved to an incinerator to consume the remaining pathogenic organisms. If developed, this system could provide for rapid containment of large quantities of diseased carcasses on site, and a biosecure environment for moving the remains to a disposal site.

Could disposal and transport be combined, using a transport trailer similar to a pressure cooker? Diseased animals would be loaded into the trailer, processed in transit, and disposed when processing is complete. This would seal the diseased carcasses off from air and vectors immediately, and keep them sealed until either the pathogen is no longer a threat, or is disposed. If feasible, this option may reduce exposure and help to control the outbreak more quickly.

Moving quantities of live, large, diseased animals to a disposal/processing site is a challenge, especially for large quantities. If the equipment -- such as a sealed circulating ventilation system, waste containment system, and feed and water systems --

were available, rendering and, therefore, cost recovery could be possible in large events. This

type of process may require a transportation system on rail.

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