

Development and Delivery of a Carcass Disposal Expert Decision Support System

The Handbook on Best Practices and Guidelines for Disposal Technologies for Contaminated Plant and Animal Material TSWG Task# IN-2496 was conducted in two phases. In Phase I, an exhaustive literature review was completed and experts in the field were consulted in an effort to catalog the most up-to-date information available for disposal of contaminated plant and animal materials in an easy to use digital and hard copy handbook. In phase II, a carcass disposal Expert Decision Support System (EDSS) was created from the initial data collected for the handbook in an effort to provide a more user-friendly format for field use.

The goal of this project was to develop a clear, concise and easy to use Handbook for use by leaders, emergency planners, and regulators in the federal, state, and local governments and industry. The Handbook would provide guidance on the safe, effective, environmentally suitable and economical disposal of contaminated plant and animal material and be based on strategic engineering, economic, and regulatory analysis of options, building on experience and lessons learned from responses to foreign and domestic natural outbreaks. Based on local priorities, circumstances and resources, leaders would be able to use the Handbook to identify disposal methods which met their needs and criteria for low cost, minimal environmental impact, speed, throughput and logistics burden. The EDSS was a natural extension of the Handbook that would enable users in the field to have access to this information in a much concise, user-friendly format.

Software Development

The EDSS was built using commercial expert decision system software from [EXSYS](#). This software provides an automated knowledge system that calculates a decision given a set of “If...Then” rules within a decision tree. The software provides highly customizable features including weighted multi-option results and automatic backward-chaining so a user may return to a previous question at any time in the decision process.

EXSYS provides for an easily updateable system where only the decision tree needs to be maintained, and not any complex coding. EXSYS also provides customer support and regular product updates to ensure the quality of the system over time. The software can be delivered over the Web or copied to a standalone system for offline use, where its only requirement is to have the freely available Java Runtime Environment installed.

Methodology

Information from the Phase I handbook was used to construct a decision tree for each of the recommended disposal options. Five key factors were considered to be highly important in the development of the handbook and subsequently, the decision trees. These included biosecurity

and safety, environmental, regulatory and legal, logistical and infrastructure, and economic and cost factors.

A small set of questions were developed to eliminate as many disposal options as possible early in the EDSS process. These fundamental questions dealt with all of the major factors outlined in the handbook except economics and cost and were formatted as simple multiple choice or yes or no questions.

It was determined that information concerning pathogen type, the amount of material for disposal, and transportation availability were extremely important to all disposal methods. For instance, if the pathogen were a prion or spore-forming bacteria, 13 disposal options could be eliminated without further investigation. Because the intent of this software was to assist the user in choosing a disposal option in the most efficient manner, these questions were presented first. Next, three questions concerning trench burial and open-air burning options were added to further eliminate methods.

Once the fundamental disposal questions were complete, a more detailed decision tree was developed for each disposal method. Questions concerning logistical and infrastructure, environmental, and regulatory and legal factors were considered when addressing each disposal option.

Finally, the program was constructed in such a way that as disposal options were eliminated they would no longer be factored in to the remaining questions.

Case Study

The following is a case study in which there has been an outbreak of Exotic Newcastle Disease in chickens with approximately one million chicken carcasses needing disposal.

An outbreak of Exotic Newcastle Disease (END) has been verified and a quarantine zone has been set up. An estimated one million chickens will be euthanized, and disposal methods need to be determined. Based on the assumption that the average weight of a chicken is 3 lbs, 1,500 tons need to be properly disposed of. The decision tree in Figure 1 depicts the logical process that is the basis for the EDSS.

Scenario 1 – Red arrows – Assumption: Onsite disposal is possible.

Scenario 2 – Blue arrows – Assumption: Offsite disposal is required and site has been selected.

Figure 1. Carcass disposal decision tree.

