STANDARD OPERATING PROCEDURES:
20. OVERVIEW OF MODELING AND ASSESSMENT TOOLS

FAD PReP

Foreign Animal Disease Preparedness & Response Plan

USDA

United States Department of Agriculture

United States Department of Agriculture • Animal and Plant Health Inspection Service • Veterinary Services

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The Foreign Animal Disease Preparedness and Response Plan (FAD PReP) Standard Operating Procedures (SOPs) provide operational guidance for responding to an animal health emergency in the United States.

These draft SOPs are under ongoing review. This document was last updated in **March 2014.** Please send questions or comments to:

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FAD PReP
Foreign Animal Disease
Preparedness and Response Plan

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20.1 Introduction

In animal health emergency management, modeling and risk assessment can be important tools. They provide decision makers with epidemiological, economic, and risk-management insight. This standard operating procedure (SOP) is a broad overview of modeling and risk assessments, and how they may be used in animal health emergency management before, during, and after an incident. This SOP does not go into depth on the quantitative or qualitative complexities of modeling or risk assessment; instead, it provides an applied view of when these models can be used and the types of questions they can answer.

20.1.1 Goals

The following are the goals of using modeling and assessment tools.

20.1.1.1 Preparedness Goals

- Develop, evaluate, and use quantitative tools to prepare for an animal disease incident. These tools can be used for the following:
  - Contingency planning,
  - Training and exercises,
  - Assessment of emerging disease threats,
  - Evaluating control strategies,
  - Estimating consequences of disease introduction and spread,
  - Designing surveillance and control programs,
  - Prioritizing interventions, and
  - Supporting resource management and allocation.
- Develop proactive product and commodity specific risk assessments that support continuity of business in the event of an outbreak.

20.1.1.2 Response Goals

- Provide scientifically supported modeling products and qualitative or quantitative risk assessments to address the issue of concerns within 72 hours after a request from the Incident Commander.
- Use models and assessment tools in after action reports and/or lessons learned documents to analyze incident response as needed.

20.2 Responsibilities

Within Science, Technology, and Analysis Services, the Center for Epidemiology and Animal Health (CEAH) has the lead in livestock disease modeling, risk identification, and risk assessment for the Animal and Plant Health Inspection Service (APHIS). Various industry working groups are also involved in developing product-specific risk assessments.

CEAH will be responsible for meeting the preparedness and response goals by ensuring that:

1. The results of the corresponding products are interpreted and communicated in the context of the assumptions made;
2. The customers of the products understand the limitations associated with the approach and the quality of data used; and
3. The results are presented in such as way so as to ensure that they are understood, relevant, useful, and actionable.

To meet the preparedness and response goals, CEAH also:

- Performs risk identification.
- Performs forecasting and trend analysis.
- Conducts risk analysis.
- Conducts epidemiologic modeling of disease spread and control activities.
- Performs pathways analyses for risks (hazards) that are identified.
- Estimates the economic consequences of hypothetical outbreaks related to production impacts, trade embargoes, costs of response strategies, and business continuity.
- Uses geospatial methods to enhance animal health by assessing the ecology of disease and population factors, habitat characteristics, and geographic distributions of potentially invasive species.
- Designs surveillance schemes and assists in establishing boundaries for regulatory zones.
- Prepares risk assessments before and during an outbreak.

20.3 Modeling

As a regulatory agency responsible for protecting American agriculture and contributing to public health, Veterinary Services (VS) uses a variety of models. Models can be constructed to improve our understanding of historical events, to estimate future consequences, and to inform strategic and logistical decisions based on an evaluation of the effectiveness of varying interventions. Models are important tools in helping to explain biological events and predict outcomes in settings where empirical observations may not be available. All models are simplifications and approximations of the real world. A model is defined as a *mathematical or otherwise logical approximation of a system, process, or phenomenon that is constructed to help inform decision making*.

Epidemiologic models are defined as *mathematical and/or logical representations of the epidemiology of disease transmission and its associated processes*. These models are typically known as disease spread models. Other aspects of animal health management can also be explored with a range of statistical/mathematical tools which fall into the broader definition of a ‘model’ including, for example: population dynamic models used to study changes in population structure, risk models which describe the risk of disease introduction, analytic models used to identify risk factors or disease occurrence, and economic models.[1] In this SOP, the focus is primarily on epidemiologic and economic models, although other types of models are addressed as well.

Economic models consist of logical and/or quantitative relationships between a set of variables that represent an economic process in reality. There are a wide variety of economic models used for various reasons, but this SOP will focus on highlighting those used at CEAH to answer questions related to estimating the economic consequences of livestock disease outbreaks.

20.3.1 Use of Models before an Outbreak

It is important to understand that models are not a definitive representation of the future. They can provide accurate, quantitative predictions of how likely it is for a given set of outcomes to occur or what the range and distribution of possible outcomes may be for a given set of input parameters. Models are not designed to provide an absolute answer but rather to generate a broad range of outcomes which can allow for the systematic comparison of alternative control strategies by identifying differences in likely outcomes. Models can provide useful insight into a variety of issues associated with the management of animal diseases; however, model output cannot stand alone and should be considered in conjunction with other information, including field observations, professional experience, and judgment. Models do not replace but rather assist the decision-making process.

Models are particularly well suited for use before an outbreak in order to:

- *Study disease processes*: Models can be used to better understand infectious disease dynamics and examine factors that may influence the distribution and/or persistence of disease within populations.
- *Evaluate the effectiveness of various early disease detection strategies:* Models serve to illustrate the consequences with differing probabilities of detection and reporting and help substantiate the importance of surveillance for early detection.
- *Identify areas to target preparedness and prioritize surveillance activities:* Models help identify areas, production systems, or other factors that might be at greater risk of infection and therefore crucial areas to target surveillance efforts.
- *Develop and evaluate contingency plans:* Models are used to develop and evaluate proposed disease control strategies and estimate resources needed in the event of an outbreak. Models also help test the relative merits of different control strategies and help identify appropriate decision criteria for selecting a response strategy.
- *Provide realistic scenarios for training and disease simulation exercises:* Models are used to simulate a range of scenarios that allow participants to practice their response and refine contingency plans. Models are also used to communicate principles of epidemiology and disease control.

[1] MG Garner, SA Hamilton. 2011. "Principles of Epidemiologic Modeling." *Rev. sci. tech.off. Int. Epiz.* 30(2): 407-416.

- *Assess the potential impacts of disease introduction and associated control measures:* Using epidemiologic model output in economic models allows for the estimation of economic impacts of disease and alternative control strategies.

20.3.2 Use of Models during an Outbreak

Models may be used during an outbreak for short term planning and resource management. Due to the variable nature of outbreaks, the lack of suitable data, particularly early in an outbreak, and the resulting inability to validate key model assumptions, the use of models as predictive tools to guide policy should be approached with caution. Using model outputs alone to direct policy should be avoided.

Some of the areas where epidemiological models may be useful during an outbreak include:

- *Identification of areas to target surveillance and control activities:* In conjunction with information gathered in the field, models can be used to identify areas where the presence of risk factors might suggest a potential high risk area for disease spread.
- *Assist in resource planning by refining estimates of future needs:* Models can provide short- and medium-term projections that can be used to more efficiently target resources and reduce risk.
- *Investigate alternative control strategies:* Models might be useful in long outbreaks to assist the disease control program by comparing the relative expected effectiveness of alternative control measures, and estimate their associated economic impacts as well as implementation costs. This would include the use of indemnity calculators for response strategies that include depopulation.

20.3.3 Use of Models after an Outbreak

Models are useful immediately after an outbreak to conduct retrospective studies to increase our understanding of the outbreak. This information is extremely valuable in assessing the effectiveness of the response and evaluating alternative approaches, refining model inputs, and optimizing disease preparedness plans.

Areas where models may be useful after an outbreak include:

- *Define the most appropriate course of actions after an outbreak:* Models can be used to support decisions to manage future risk, including the timing for lifting restrictions and the need for on-going measures, such as continuing or suspending vaccination, repopulation, adjusting surveillance, etc.
- *Assess alternative control strategies:* Models can be used to simulate past outbreaks and evaluate the range of possibilities that could have resulted given a different combination of disease management decisions made during an outbreak and the timing, effectiveness, and cost of their implementation.
- *Assess data gathering and information management:* The use of models to recreate the outbreak allows the identification of data gaps in understanding disease dynamics and the effect of intervention strategies and may also capture important information only available immediately after an outbreak.

20.3.4 Simulation Systems and Quantitative Tools

Models can be of great value in helping us prepare for and respond to highly contagious disease outbreaks, provided that their strengths and weaknesses are clearly understood.

When using models to help inform decisions, there are a number of important factors to consider:

- The value in multiple models and different approaches to modeling.
- An understanding of the information that was used to construct the model.
- The validity of any model depends on the accuracy and completeness of the data used to develop and parameterize the model.
- The selection of the appropriate model to answer the questions related to the specific situation.
- The predictions resulting from a model are most accurate when there is adequate knowledge of the system they are intended to represent and sufficient data to estimate parameters.
- The benefit in running multiple scenarios in order to better understand which factors contribute to the spread of disease and therefore what animal health officials can do to alter the course of the outbreak and their associated costs.
- Occasionally, models may be used to address questions for which they have not been validated; as such, direct inferences should be made with caution.

There are a wide variety of modeling tools which have been developed for or by U.S. Department of Agriculture (USDA) APHIS VS to support animal health emergency management. All of the modeling tools currently available periodically undergo revisions in order to include enhancements or additional capabilities in order to best reflect the "state" of emergency preparedness and response. Data are also continually updated to reflect the current environment in the livestock industry. Examples of the types of models available for use in high consequence animal disease outbreak planning and preparedness include:

- *Epidemiologic models*: These models focus on simulating the spread and control a highly contagious animal disease within a population.
- *Logistic/supply chain models*: These models can be used to determine throughput or maximize resource allocation.
- *Network models*: Network models simulate movements or contacts between different premises or individuals in order to better understand connectivity.
- *Economic models*: Used in the estimation of response strategy cost, indemnity values for depopulated animals, and other economic consequences related to livestock disease outbreaks.

The nature of the studies conducted by the modeler depends on the objectives of the project. However, in all cases, the findings of the model should be interpreted within the context of the assumptions made about the behavior of the system the model is intended to represent and any limitations of the modeling approach and quality of the data used.

20.3.5 Data for Models

The data and information needed to properly estimate parameters are often sparse, dated, and not readily available. Researchers typically address these shortcomings with expert opinion and informed assumptions. The following table is intended to provide an overview of data sources commonly used to construct epidemiologic models.

Table 20.1. Data for Models

Data Source	Description	Frequency of updates	Data confidentiality
Farm Location and Animal Population Simulator (FLAPS)	FLAPS is a data-driven model that predicts the geography and demography of individual livestock farms throughout the conterminous U.S. The FLAPS model uses a suite of spatial, statistical, and simulation sub-models to disaggregate county-level Census of Agriculture data collected by the USDA, National Agricultural Statistics Service (NASS) and simulate the distribution and populations on individual livestock facilities.	Every five years	Open, Web-based
National Agricultural Statistics Service (NASS)	NASS conducts hundreds of surveys every year and prepares reports covering virtually every aspect of U.S. agriculture. Included in these surveys and reports is a Census of Agriculture which provides information on the number of farms and animals for every county in America.	The Census of Agriculture is updated every five years	Open, Web-based
National Animal Health Monitoring System (NAHMS) Surveys	NAHMS collects, analyzes, and disseminates data on animal health, management, and productivity across the U.S. by conducting national studies on the health and health management of U.S. domestic livestock populations. These studies are designed to meet the information needs of the industries associated with these commodities, as identified by people within those industries.	Swine, dairy, beef, and poultry commodities are studied every five years	Summarized information is available on-line
State governments	State and Federal animal health officials routinely share animal health information to administer animal health programs and activities. In the case of an animal disease event, relevant information maintained by State animal health officials can be shared with those who administer the disease response and investigation.	Varies	Varies
Public and private information systems	The information utilized to prepare for, respond to, and recover from an animal disease event is quite extensive and is likely to require data from a variety of government and non-government sources, including but not limited to state and federal, public and private animal health information systems. Examples of information systems include but are not limited to surveillance, laboratory, emergency, and herd information management systems.	Varies	Varies
Industry	Industry representatives and their relevant data are tremendous resources for developing an accurate understanding of industry practices (e.g., management, movement, biosecurity, etc.). USDA and industry continue to work towards finding suitable strategies to access relevant data.	Varies	Varies

20.3.6 Requesting Modeling Support

Due to the complexity of many modeling tools, their use is often limited to a small group of trained professionals; requests for modeling support can be made to CEAH. The timeframe and outputs of any modeling project will depend on the complexity of the questions being asked and the intended purpose of the results. Projects should be developed collaboratively in order to ensure that the objectives of the study are met and timelines for deliverables are clearly understood. For VS modeling projects, other units should be involved as appropriate.

20.4 Risk Analysis

Risk analysis consists of various methods and tools for informing and assisting decision makers. Figure 20.1 illustrates the components of the World Organization for Animal Health's (OIE) risk analysis process. The scientific process starts with identification of the hazard and then continues with three additional interrelated steps: risk assessment, risk management, and risk communication.

Figure 20.1. OIE's Risk Analysis Process

Hazard identification, the first of the four steps, is the process for identifying pathogenic agents (hazard), susceptible hosts, and environmental conditions in which a pathogen can survive.

Risk assessment establishes how likely the hazard is to occur and the consequences of the entry or spread of the agent. The risk assessment must be transparent, unbiased, repeatable, and scientifically defensible. It may be qualitative or quantitative, depending on the quality and availability of relevant data and the time available for the assessment.

- Quantitative assessment can be defined as an assessment where the outputs of risk are expressed numerically. Typically, it is considered objective and the number can represent the probability of an event occurring during a specific time frame.

- Qualitative assessment is defined as an assessment where the outputs of risk or likelihood of an outcome (or the magnitude of the consequences) are expressed in qualitative terms such as ‘high’, ‘medium’, ‘low’, or ‘negligible’. Typically, it is considered subjective in nature. It is often not possible to quantify risks, as there may not be sufficient data to make reliable calculations.

Risk assessment consists of four components:

1. Entry (release) assessment consists of describing the biological pathways necessary for the release (introduction) of a hazard or agent into a particular environment, and estimating the likelihood of that complete process occurring.
2. Exposure assessment describes the biological pathways for exposing the population at risk to the hazard within the environment. Exposure assessment may include host susceptibility, demographic information, duration of exposure, and route of exposure.
3. Consequence assessment identifies potential biological, environmental, and socio-economic consequences of exposing the population at risk to the hazard.
4. Risk estimation combines all of the above results to give risk managers an overall description of risk (in either qualitative or quantitative terms), from disease introduction and spread to their consequences.

Risk communication is an interactive process that conveys the results of the risk assessment to risk managers, the public, and other stakeholders. Risk communication also seeks the input of these stakeholders during risk assessment.

Risk management is typically conducted by the decision maker. The decision maker uses information received from the risk assessment to assist with the final decisions or actions. However, additional input may be needed from laboratory staff, field staff, economists, or others to determine an acceptable risk reduction strategy for the hazard in question given one or more mitigation actions.

20.5 Risk Assessments before an Outbreak

20.5.1 Permits

Proactive risk assessments support animal disease response efforts during an outbreak. A permitting system controls the movements of animals or animal products within an animal disease Control Area. In order to assist emergency responders in conducting these assessments and issuing permits, APHIS CEAH, the University of Minnesota Center for Animal Health and Food Safety, and industry representatives are working together to proactively assess the risks of moving various commodities of concern during an outbreak. These assessments incorporate current scientific and best practice industry knowledge available to evaluate risks so that less information will need to be gathered under emergency conditions, such as during an outbreak.

20.5.2 Methods

These assessments use qualitative and quantitative methods as applicable. Data on risks associated with moving the various products are typically (or usually) sparse and may not be directly applicable to the specific situation. Due to this scarcity of data, abstract models, laboratory studies, and expert opinions are used extensively. The staff at the Center for Animal Health and Food Safety at the University of Minnesota functions as a bridge between the staff at CEAH and industry, as well as serving as a resource to help obtain the most accurate information in the most efficient way possible.

20.5.3 Current Uses of Risk Assessments

Currently foot-and-mouth disease (FMD) and highly pathogenic avian influenza (HPAI) risk assessments are underway in support of industry specific continuity of business plans, such as the Secure Milk Supply Plan, Secure Egg Supply Plan, Secure Pork Supply Plan, Secure Turkey Supply Plan, and Secure Broiler Supply Plan. The initial FMD assessment is likely to focus on the risk of moving cooked pork products, and additional assessments to be determined by how industry experts prioritize issues.

20.5.4 Deliverables

Proactive risk assessments follow OIE guidance for risk assessments[2] and have sections on hazard identification, entry (release) assessment, exposure assessment, and risk estimation. In addition, the assessments typically include:

- Descriptions of the product.
- A summary of applicable regulations.
- A review of available scientific, epidemiological, and historical information that may pertain to the commodity/situation.
- A summary/checklist for Incident Command staff to use during the outbreak.

20.5.5 Risk Communication and Collaboration

Construction of risk assessments involve participation by the commodity-specific industry through their working groups. Their development, progress, and final products are of considerable interest to senior APHIS/USDA officials, State governments, and collaborating industries. Ensuring that the risks are correctly characterized and effectively communicated to interested parties is a significant aspect of risk communication.

Due to the high degree of public concern about HPAI (and possibly FMD), all risk assessments and other analyses undergo an extensive review process. The expectation is that all factual statements will be traceable and the sources documented in the assessment. Any analysis for the assessment will be transparent and verifiable; this includes showing source code or copies of any models used. Team opinions and judgments are explicitly stated and identified as such.

[2] OIE. 2013. *Terrestrial Animal Health Code*. Volume 1, Section 2, Chapter 2.1 http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_1.2.1.htm.

Reviews use a number of reviewers from various parts of APHIS and other agencies. The process consists of

- review of drafts by team members (assigned APHIS staff, industry collaborators, and University of Minnesota staff),
- review by the Risk Assessment Team,
- review by CEAH staff (this also includes assistance from a technical writer/editor),
- review by APHIS National Preparedness and Incident Coordination staff
- review by other Federal and State agencies as appropriate.

Reviews may be sequential or concurrent.

20.6 Risk Assessments during an Outbreak[3]

Risk assessments during an outbreak can help decision makers determine whether products or animals can be moved, identify the most effective mitigation measures, or examine other issues that improve emergency response.

20.6.1 Deliverables

Because these risk assessments are needed during an outbreak, they typically consist of a more rapid qualitative assessment. The results of a rapid assessment during an outbreak may come in the form of a decision memo, which provides only a summary of information and options to decision makers (see Attachment 20.A). This enables decision makers to review documents that look familiar and can speed the acceptance of recommended protocols. The scientific information used to produce such memos would still follow the OIE's risk assessment guidelines and would be maintained by the analysts. This information can be the starting point for subsequent assessments during the outbreak, allowing for more rapid turnaround time.

20.6.2 Resources Required

- A group of subject matter experts should be gathered.
- Expertise may be needed in the ecology of the disease, the industry, risk assessment, economics, the incident, or others as needed.
- Because individuals in VS will be pulled for the incident, experts may need to come from sources outside VS, such as retirees or university faculty.
- A contract and/or memorandum of understanding may include funding for overtime, travel, and equipment (computers and software).

20.6.3 Information Needed

References for the disease in question should be gathered and stored so all experts and analysts have access to this information (for example etiology, disease spread, effective mitigations, and

[3] Experiences gained from Newcastle disease outbreak (2002-2003).

viral/bacterial lifespan). The expert group should agree on the primary references used. Students can assist with this work, with some direction of what to look for.

20.6.4 Communication Channels

- Establish communication channels between the risk assessment team and risk managers early in the management of the incident
- Establish information flow from the outbreak in real-time back to the assessment team to ensure that its members are using the most up-to-date information.
- Establish communication within the risk assessment team, since experts may be in multiple locations.
- Use teleconferencing, video conferencing, and document editing done via collaborative web technology such as WebEx.
  - Establish a standard call-in time every day for the group.
  - Plan travel for site visits if necessary.

As an example of communication in action during a real outbreak, the risk assessment team for Newcastle disease (2003) used the following process:

- The group called in every morning.
- Discussion of the subject risk assessment went on all day.
- One person was appointed to write the document, with the others editing (all done via WebEx).
- If further references were needed, those were gathered and read at night for discussion and inclusion the next morning.
- Once everyone was comfortable with the document, the team sent it to the decision maker.

20.7 Risk Assessments after an Outbreak

20.7.1 Development

A risk assessment after an outbreak has occurred can help develop a complete picture of the outbreak and identify risk factors. This assessment may lead to policy changes, prevent further disease introduction, and improve emergency response.

20.7.2 Deliverables

A thorough risk assessment after an outbreak may be qualitative or quantitative, depending on the available information. It should be a transparent, scientifically defensible document structured consistently with OIE’s risk assessment guidelines.

20.7.3 Time Frame

A risk assessment should begin as soon as is feasible after the outbreak, while information and appropriate personnel are still readily available. Because this is not an emergency request, adequate time can be given to conduct a thorough assessment.

20.7.4 Resources Needed

- For reference, an Incident Commander or equivalent.
- For the incident, an epidemiologist or other individuals intimately familiar with the outbreak.
- For work, one or more risk analysts or epidemiologists (number determined by expertise and speed required for assessment).

20.7.5 Information Needed

Information about the outbreak is necessary to explore the risk factors. Data sources that may contain information include the Emergency Management Response System (EMRS) 2.0, State reports, animal movement data, and laboratory data. Analysts will need to pull information from multiple sources to build an understanding of the disease's introduction and spread, and communication with the field personnel is essential. Site visits are often helpful to understand biocontainment procedures of Infected Premises, biosecurity of premises used to prevent infection, and other factors that play a role in spread.

20.8 Current Modeling Efforts

This table provides a list of current modeling resources that are being used by USDA APHIS VS for national preparedness and response planning for animal disease incidents. This list is provided for information only; specific models used over time are likely to change to reflect changing needs and priorities. Additionally, many models may have concurrent versions which remain under development and are not considered operational.

This list does not imply that the models listed have been validated for use in the event of an outbreak.

Table 20.2. Current Modeling Efforts

Simulation System/ Quantitative Tool	Purpose
Farm Location and Animal Population Simulator (FLAPS)	FLAPS is a data-driven model that predicts the geography and demography of individual livestock farms throughout the conterminous U.S. The FLAPS model uses a suite of spatial, statistical, and simulation sub-models to disaggregate county-level Census of Agriculture data collected by the USDA, NASS and simulate the distribution and populations on individual livestock facilities.

Interspread Plus (IS+)	IS+ is similar to the North American Animal Disease Spread Model (NAADSM). It is a spatial, stochastic, state-transition simulation model of infectious disease in domestic animal populations. Users set parameters to define the spread of infectious agents from one farm location to another. Control measures such as depopulation, vaccination, and movement restrictions, in addition to varying disease surveillance intensity, can be simulated, with the ability to carry out each of these activities subject to user defined resource constraints.
Laboratory Capacity Estimation Model (LCEM)	LCEM is a web-based software program that enables local laboratories to determine throughput under various scenarios; identify rate limiting processes; and maximize their efficiency. LCEM also provides the ability for the National Animal Health Laboratory Network coordinator to view an individual laboratory's current and maximum throughput and guide decision-making for appropriate direction of samples in an outbreak situation.
North American Animal Disease Spread Model (NAADSM)	NAADSM is similar to IS+. It is a herd-based, state-transition, stochastic simulation model that simulates spatial and temporal aspects of disease spread and includes cost accounting components. It is designed to simulate the spread and control of highly contagious foreign animal diseases in order to estimate future consequences of disease introduction and inform strategic and logistical decisions based on an evaluation of the effectiveness of varying interventions.
United States Animal Movement Model (USAMM)	USAMM provides a quantitative, national scale understanding of cattle movement in the U.S. which has been achieved using Bayesian techniques to scale up a national scale database of cattle movement based on a 10% sample of interstate movement in order to predict U.S. cattle movement networks and associated uncertainty.
United States Disease Outbreak Simulation (USDOS)	USDOS is an FMD simulation model built around the generated cattle movement networks, to assess the potential for epidemic spread and associated uncertainty while keeping the number of parameters low.

20.9 Other Assessment Techniques

20.9.1 Technique for Assessment of Intervention Options (TAIO)

TAIO is used in comparing different intervention options for an animal health incident, such as an foreign animal disease or emerging disease outbreak. TAIO uses the best available economic and epidemiologic data to support the decision making process by contrasting multiple interventions. Leveraging a decision support framework, TAIO incorporates factors such as costs, benefits, logistic feasibility, pathway control and host response. The results of TAIO are not a decision; they are intended to provide information for officials in making a decision.

TAIO does not consider all factors that may impact decisions, such as political or social factors or fiscal constraints. However, it is a structured process that evaluates available data and information systematically. Sensitivity levels to different inputs can be assessed. TAIO can be used iteratively; results may change as more data is available or as information changes during an outbreak. TAIO is designed to promote a collaborative and multidisciplinary approach; TAIO outputs may suggest the need for further evaluation of other options.

20.10 Training

There are currently no AgLearn training modules specifically on the models listed in Section 20.9. However, if a potential user is interested in using or learning about one of the models discussed, CEAH may be able to provide further information on available opportunities; please call 1-970-494-7200.

20.11 References and Resources

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Attachment 20.A Example Decision Memo—END Outbreak

USDA

United States Department of Agriculture

Marketing and Regulatory Programs

Animal and Plant Health Inspection Service

Veterinary Services

Centers for Epidemiology and Animal Health
2150 Centre Ave.
Mail Stop 2W4

DECISION MEMORANDUM FOR THE DEPUTY ADMINISTRATOR

FROM: Randall Crom, Deputy National Incident Coordinator

DATE: February 19, 2003

SUBJECT: END and the Movement of Hatching (fertile) Eggs from Non-infected Flocks Within the Quarantine Zone to Areas Outside of the Quarantine Zone.

ISSUE:

Define policies and protocols for issuing permits for the movement of hatching eggs from inside the Federal Quarantine Zone moving to areas outside the quarantine zone using a clear, transparent, science-based decision making process.

Hatching eggs may spread END virus by mechanical means and may harbor virus within the egg. Therefore, hatching eggs can play a role in the distribution of END virus to other birds and poultry. It is therefore critical that producers who ship hatching eggs outside of the quarantine zone are subject to an ongoing, routine, laboratory-supported, active surveillance program and appropriate biosecurity measures.

This plan seeks to minimize the risk of END virus spread through the incorporation of simple, straightforward policies that address both surveillance and biosecurity.

RECOMMENDATIONS:

1. Whenever possible, it is highly recommended that hatching eggs produced within the quarantine zone should be sent only to hatcheries within the quarantine zone and the progeny reared in the quarantine zone.

2. Only hatching eggs from non-infected flocks should be considered for shipment out of the quarantine zone. Ongoing surveillance (see Item III) must provide no evidence that the source flock is infected and must also show that no infected domestic birds or poultry are within ½ mile of the source flock for the hatching eggs.

3. Surveillance requirements:

    - Hatching eggs shipped out of the quarantine zone must come from a flock subjected to ongoing, routine, laboratory-supported, active surveillance based on weekly dead bird testing by an approved laboratory methodology for virus detection. Ongoing surveillance must be in place for at least 21 days prior to any egg shipment.

- Spread of the END virus has often been associated with movement of people, equipment, and materials (e.g., agriculture workers and service personnel). Also, agricultural workers often reside in proximity to their place of employment, and many backyard flocks exist in the quarantine zone. Therefore, it is recommended that additional surveillance be conducted in the proximity of the source flock. In order to decrease the likelihood that the source flock is unknowingly exposed to END virus, known contact premises and all domestic birds and poultry within a ½ mile radius of the source flocks considered for shipping hatching eggs out of the quarantine zone must be subjected to ongoing, routine, laboratory-supported, active surveillance for END. Surveillance preferably needs to be focused on dead bird testing and most current laboratory methodology for virus detection. If no dead birds are available, then other approved methods can be applied.
- The requirements of 9 CFR 82.9, "Interstate movement of hatching eggs from a quarantined area," and 9 CFR Part 93 "Importation of certain animals, birds, and poultry, and certain animal products; requirements for means of conveyance and shipping containers" must be followed. Hatching eggs must move under permit, with appropriate certification from a government veterinarian, and must go into quarantine for 30 days post-hatch. During this quarantine, they are tested for END. Part 93 lists some basic certification requirements. The flock must be free of evidence of communicable disease, no Newcastle disease has occurred on the premises of origin or adjoining premises during past 90 days, and the flocks have been free from exposure to disease during the preceding 90 days. In addition to the requirements of 9 CFR 82.9, written approval from the animal health authority in the receiving State must be obtained prior to the shipment of the hatching eggs; the approval should specify that a 30-day post-hatch quarantine and END testing will be required after arrival of the shipment. In the event that the source flock is found to be infected with END virus after the shipment of the hatching eggs, the source flock management must notify the State Veterinarian and AVIC and the recipients of their eggs that have been shipped in the last 30 days.

4. On-farm washing and sanitation of hatching eggs must conform to the highest industry standards. Hatching eggs must be washed and treated with an appropriate sanitizing agent prior to movement off the breeding farm. National Poultry Improvement Plan protocols for hatching egg sanitation should be followed (paragraphs 147.22, and 147.25).
5. Only clean nest eggs can be adequately sanitized for movement. Dirty, fecal-stained eggs do not qualify for movement off the farm because they cannot be adequately disinfected.
6. Sanitized eggs must be packed in new disposable single-use paper flats and boxes for shipment. These flats and boxes must be destroyed at the destination.

Premises sanitation: Each source flock considered for shipment of hatching eggs out of the quarantine zone must have a specific plan that addresses egg equipment and facility sanitation.

Requirements described in the APHIS decision memo of February 5, 2003 regarding conveyances must be followed.

BACKGROUND INFORMATION:

Exotic Newcastle disease (END) is a contagious and fatal viral disease affecting all species of birds and poultry. In fact, END is probably one of the most infectious diseases of poultry in the world. END is so virulent that many birds and poultry die without showing any clinical signs. A death rate of almost 100 percent can occur in unvaccinated poultry flocks. However, END can infect and cause death even in vaccinated poultry.

Exotic birds and vaccinated poultry flocks are susceptible to END infection and may or may not exhibit clinical signs depending on the levels of natural or acquired immunity they possess. Inapparently infected, exotic birds and vaccinated poultry can also shed virus. These inapparent infections compromise the effectiveness of passive surveillance for END detection in exotic birds and vaccinated or previously exposed flocks.

The clinical signs of END include sneezing, nasal discharge, greenish and watery diarrhea, depression, drooping wings, circling, and twisting of the head and neck. END can also cause a partial to complete drop in egg production or the production of thin-shelled eggs.

END is spread primarily through direct contact between healthy birds and poultry and the bodily discharges of infected birds. The disease is transmitted through infected birds' droppings and secretions from the nose, mouth, and eyes. END spreads rapidly among birds kept in confinement, such as commercially raised chickens. There are high concentrations of END virus in birds' bodily discharges. Eggs produced by infected birds can be contaminated with virus on the surface or internally. Virus-bearing material can be picked up on shoes and clothing and carried from an infected flock to a healthy one. The disease may be spread by vaccination and debeaking crews, manure haulers, rendering truck drivers, feed delivery personnel, poultry buyers, egg service people, and poultry farm owners and employees.

The END virus can survive for several weeks on birds' feathers, manure, and other materials. It can survive indefinitely in frozen material. However, virus destruction is accelerated by warm and dry environment and by the ultraviolet rays in sunlight.

In addition to being a threat for the commercial poultry industry, END is a threat to the caged-bird industry. Birds illegally smuggled into the United States are not quarantined and tested by APHIS, and therefore, they may carry the END virus.

On October 1, 2002, END was confirmed in backyard poultry flocks in Southern California. On January 7, 2003, APHIS imposed a federal quarantine to regulate the interstate movement of all species of birds and poultry products from Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, Santa Barbara, and Ventura Counties in California. APHIS also established a Task Force in California. USDA declared an extraordinary emergency, which allows USDA to apply federal authority within the State of California.

The State of Nevada has also identified cases of END. On January 16, 2003, the State of Nevada had a press conference to announce that END was confirmed in backyard flock in Las Vegas, NV. Federal and State quarantines were established for all of Clark County and a portion of Nye County, Nevada. APHIS also declared an extraordinary emergency. APHIS and the State of

Nevada have begun surveillance efforts of the backyard bird population and have established a Task Force in Nevada.

On February 4, 2003, the State of Arizona confirmed END in a backyard flock in La Paz County, AZ. As of February 4, 2003, Animal and Plant Health Inspection Service (APHIS) was developing a federal quarantine for the affected area in Arizona. APHIS and the state of Arizona have begun surveillance efforts of the backyard bird population and have established a Task Force in Arizona.

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DECISION BY THE DEPUTY ADMINSTRATOR:

Approve: /s/Andrea Morgan for Ron DeHaven

Disapprove: ______________________

Discuss with me: ______________________

Date: February 20, 2003

Attachment 20.B Abbreviations

APHIS	Animal and Plant Health Inspection Service
AVIC	Area Veterinarian in Charge (now called Assistant District Director)
CEAH	Center for Epidemiology and Animal Health
CFR	Code of Federal Regulations
END	exotic Newcastle disease
EMRS	Emergency Management Response System
FAD PReP	Foreign Animal Disease Preparedness and Response Plan
FLAPS	Farm Location and Animal Population Simulator
HPAI	highly pathogenic avian influenza
FMD	foot-and-mouth disease
IS+	Interspread Plus
LCEM	Laboratory Capacity Estimation Model
NAADSM	North American Animal Disease Spread Model
NAHMS	National Animal Health Monitoring System
NASS	National Agricultural Statistics Service
OIE	World Organization for Animal Health
SOP	standard operating procedure
TAIO	Technique for Assessment of Intervention Options
USAMM	United States Animal Movement Model
USDOS	United States Disease Outbreak Simulation
USDA	U.S. Department of Agriculture
VS	Veterinary Services