

REPORT OF THE USAHA/AAVLD COMMITTEE ON ANIMAL EMERGENCY MANAGEMENT

Co-Chairs: Marilyn M. Simunich, ID

Nick J. Striegel, CO

John B. Adams, VA; Bruce L. Akey, NY; Gary A. Anderson, KS; Joan M. Arnoldi, IL; Marianne Ash, IN; Tammy R. Beckham, TX; Lisa Becton, IA; Patricia D. Bedford, MN; Patricia C. Blanchard, CA; Gary L. Brickler, WA; Peggy K. Brinkman, IA; Shane A. Brookshire, GA; Suzanne L. Burnham, TX; Heather C. F. Case, IL; Tony A. Caver, SC; Gregory S. Christy, FL; Neville P. Clarke, TX; Matt H. Cochran, TX; Leslie E. Cole, OK; Thomas L. Cropper, TX; S. Peder Cuneo, AZ; Debbie Cunningham, OK; Glenda S. Davis, AZ; Leah C. Dorman, OH; Brandon Doss, AR; Bob Ehart, DC; Brigid N. Elchos, MS; Dee B. Ellis, TX; Francois C. Elvinger, VA; Mac Farnham, MN; Dave E. Fly, NM; Rose Foster, MO; W. Kent Fowler, CA; Tam Garland, TX; Cyril G. Gay, MD; Lelve G. Gayle, TX; Robert F. Gerlach, AK; Timothy J. Hanosh, NM; Greg N. Hawkins, TX; Burke L. Healey, CO; Jan E. Hershenhouse, CA; Donald E. Hoenig, ME; Floyd P. Horn, MD; Dudley Hoskins, DC; Pamela J. Hullinger, CA; Carla L. Huston, MS; Gregory P. Jillson, NM; Thomas R. Kasari, CO; Patrice N. Klein, MD; Anthony P. Knight, CO; Paul Kohrs, WA; Charlotte A. Krugler, SC; Michael Langford, MD; Elizabeth A. Lautner, IA; Randall L. Levings, IA; Tsang Long Lin, IN; Mary J. Lis, CT; Martha A. Littlefield, LA; Frank Liu, MN; Amy W. Mann, VA; Barbara M. Martin, IA; Sarah J. Mason, NC; John Maulsby, CO; Thomas J. McGinn, III, DC; David L. Meeker, VA; Gay Y. Miller, IL; Alfred W. Montgomery, MD; Lee M. Myers, GA; Gene Nemechek, AR; Sandra K. Norman, IN; Kenneth E. Olson, IL; Kristy L. Pabilonia, CO; Boyd H. Parr, SC; Jeanne M. Rankin, MT; Tom Ray, NC; Paul E. Rodgers, WV; Keith Roehr, CO; James A. Roth, IA; John Rowden, CA; Mo D. Salman, CO; A. David Scarfe, IL; Gary B. Sherman, DC; Brian T. Smith, DC; Julia M. Smith, VT; Harry Snelson, NC; R. Flint Taylor, NM; George A. Teagarden, KS; Kerry Thompson, DC; Jimmy L. Tickel, NC; Peter J. Timoney, KY; Dave B. Tomkins, TX; Alfonso Torres, NY; Jesse L. Vollmer, ND; Patrick Webb, IA; Stephen E. Weber, CO; Annette M. Whiteford, CA; Brad L. Williams, TX; John L. Williams, MD; Ellen M. Wilson, CA.

The Committee met on November 13, 2010 at the Minneapolis Hilton Hotel in Minneapolis, Minn., from 8:00 a.m. - 1:00 p.m. There were 57 members and 88 guests present. Dr. Nick Striegel was introduced as the co-chair of the committee. USDA, EPA and ARS responses to 2009 CAEM Resolution on Animal Mortality Disposal and Decontamination were confirmed to be favorable.

Dr. Gay Y. Miller, Professor, Department of Veterinary Clinical Medicine, University of Illinois presented a time-specific paper on Triggers for FMD (Foot-and-Mouth Disease) Vaccination. An abstract of the presentation is included in the body of this report, and the paper in its entirety is included at the end of this report.

USDA-APHIS-VS Emergency Management and Diagnostics Update -

Dr. Jose' R. Diez, Associate Deputy Administrator, USDA-APHIS-Veterinary Services (VS), National Center for Animal Health Emergency Management

The National Center for Animal Health Emergency Management (NCAHEM) consists of Preparedness and Incident Coordination, Interagency Coordination and National Veterinary Stockpile.

FAD PReP Documents-Dr. Jon Zack leads Preparedness and Incident Coordination (PIC) and this year PIC created and updated many materials in the Foreign Animal Disease Preparation and Response Plan (FAD PReP) library. PIC issued FAD PReP SOPs, Guidelines, Response Plans and Industry Manuals. More SOPs, both HPAI and Foot and Mouth Disease, and NAHEMS Guidelines will be issued later in 2010. All will be on line at fadprep.lmi.org.

In 2010, APHIS and the Egg Sector Working Group released the Secure Egg Supply Plan which plans for Continuity of Business during an HPAI outbreak and is available at the FAD PReP web site. A Secure Milk Supply Plan is at the workgroup and risk assessment stage.

VS Memo 580.4 Flow Charts-VS Memo 580.4 outlines the procedures for investigating a suspected foreign animal disease incident. It was revised in 2008 to include testing by NAHLN laboratories in some investigations. Due to the complicated nature of the communications in the memo, PIC developed flow charts in 2010 that were distributed to NAHLN laboratories, State Animal Health Officials and others. The flow charts are available at the FAD PReP web site.

National Animal Health Emergency Response Corps (NAHERC)-NAHERC was formed in 2001 to provide an emergency reserve of veterinary professionals to assist State and Federal responders during an animal health emergency. NAHERC volunteers become temporary Federal employees when activated by USDA. In 2010, NAHERC increased enrollment and name recognition among the animal health community. To date, 1,211 applicants have qualified for NAHERC through the USAJOBS web site: these include 504 veterinary medical officers and 702 animal health technicians. In 2010, NAHERC

- Developed online training portal at Iowa State University
- Developed quarterly NAHERC newsletter
- Developed Memorandum of Understanding (MOU) for incorporation of CARTs and

SARTs into incident responses-

NCAHEM-Interagency Coordination-Dr. Mark Teachman is Director of the Interagency Coordination (IC) group which coordinates APHIS' interaction with other agencies inside and outside the federal government. IC staff identifies resources and clarifies roles in an animal emergency through participation in interagency and international working groups and permanent assignments at other Federal agencies. The staff develops methods to obtain and analyze surveillance information within USDA and APHIS. They lead the implementation of the joint USDA/Department of Homeland Security foreign animal disease modeling analysis center, and contribute funding to additional modeling efforts through cooperative agreements.

IC coordinates development and deployment of emergency disposal and decontamination tools through international, Federal, State, industry and academic working groups and partnerships.

3-D Planning-Within NCAHEM three staff members concentrate on specialized areas of emergency response: Depopulation, Disposal and Decontamination. 3-D response capability gaps have been identified for study:

Depopulation-There are ongoing studies for firearms for cattle, CO2 for swine, foam for poultry and captive bolt for cattle.

Disposal-There are studies evaluating composting to inactivate pathogens; evaluating spread of pathogens during rendering; developing protocols to return facilities to previous use after processing infectious material; developing standards for moving beef products, carcasses and live animals into and out of quarantine zones; analyzing economic, social, environmental and industry costs and benefits of different response strategies and developing new carcass disposal techniques

Decontamination-Research projects with APHIS participation include a generic disinfectant efficacy study at Plum Island (with EPA); studying effectiveness of cleaning technologies (EPA); Return-to-normal operations SOPs (EPA/rendering industry) and cold weather decon SOPs (Canada)

Online Emergency Management Tools-APHIS has developed an emergency management tools web site that includes training modules on composting, onsite burial and treatment, secure transport, offsite burial and treatment, and cleaning and disinfection. It has a database identifying disposal sites which was expanded to include rendering facilities in 2010. Find it at

http://www.aphis.usda.gov/emergency_response/tools/aphis_role_emergency_tools_disposal_training.shtml

The National Veterinary Stockpile (NVS)- NVS is available within 24 hours of a request by state or federal animal health officials. Trucks loaded with supplies, personal protective equipment, vaccines and anti-virals will arrive at warehouses near the outbreak site. A typical shipment would involve six semi-trucks. The National Veterinary Stockpile has contracts with commercial firms to provide emergency services and for transportation of high priority samples more quickly than the usual overnight service used for FAD investigation samples.

NVS exercises-Annually, the NVS exercises with the states, testing ordering, receiving, storage, distribution and return of stockpile materials. During 2011 NVS will be working with the Navaho nation in such an exercise. Contact Dr. Lee Myers, the NVS outreach coordinator, for information at lee.m.myers@aphis.usda.gov or (301-910-7336).

2010 Foot-and-Mouth Disease (FMD) Outbreak in Japan -

Dr. Shiro Yoshimura of Japan Ministry of Agriculture, Forestry & Fisheries (MAFF)

Dr. Yoshimura provided information on location, of premises and numbers of cattle and hogs affected and depopulated because of the occurrence of FMD in the Miyazaki Province of Japan which cost US \$600 million dollars in compensation to producers. There were day-to-day eradication costs in addition to the indemnity costs. The outbreak began in April 2010 in Tsuno municipality and spread to 10 additional

municipalities in Miyazaki into the month of July. Clinical signs in hogs consisted primarily of salivation without much evidence of vesicular disease. Cattle exhibited lameness primarily without much evidence of vesicular disease. Numbers of animals affected were: 37,412 cattle, 42 water buffalo, 174,132 hogs, 14 goats, and 8 sheep for a total of 211,608 animals. Forty-six thousand (46,000) head of cattle and 80,000 hogs within a 10-mile radius of infected areas were vaccinated with a Type O, oil-adjuvanted, killed vaccine. All known affected and vaccinated animals were destroyed totaling 211,608.

FMD O-type was last found in Japan in 2000. O/JPN/2010 was sequenced by WRLFMD and identified as Southeast Asia topotype (Mya-98 lineage), which is most closely related to viruses from Thailand and Malaysia in 2009.

The source of the infection is not known, but suspected to be by rice trade from the mainland. Water buffalo were not suspected to be the cause of the outbreak. More than 4300 personnel were dispatched in the response.

NAHLN FMD Diagnostics – Current Capabilities and Surge Capacity -

Dr. Beth Lautner, Director, National Veterinary Services Laboratories, USDA-APHIS-VS

Presented by Sarah Tomlinson, Assistant Coordinator of the National Animal Health Laboratory Network (NAHLN)

A series of NAHLN FMD tabletop exercises were undertaken to assess capacity in the NAHLN lab system. This was a collaborative effort with CAN and Kansas State University to develop and test the pilot exercise. Representatives from NCAHEM, NVSL FADDL and NAHLN, NAHPP, and NSU attended the exercise. The primary goal was to identify and discuss the roles and responsibilities of decision-makers, and solutions to policy questions related to NAHLN laboratory response during an FMD outbreak. The Kansas State tabletop exercise was hosted by National Agriculture Biosecurity Center at Kansas State University. The objectives were to examine early, mid, and late-response activities regarding the decision-making process for NAHLN activation and de-activation. Testing capacity for the Kansas and Iowa NAHLN labs, surveillance sample collection protocols and testing algorithms during different phases of the outbreak, communication and coordination processes were also examined.

There were 15 separate follow-up exercises in single or multiple states across country. Exercises were focused on actions, decisions and communication by NAHLN laboratories, State Animal Health Officials, and VS Area officials and field staff.

In the area of Laboratory Preparedness, an increased understanding of function and benefits of NAHLN was gained. It was decided that a NAHLN Disease Outbreak guidelines was needed to provide more information and decision points on use of BSL 2 vs. BSL 3 space, compliance with select agent rule, use of proficiency tested personnel, timelines for reagents and support by other labs, process for financial reimbursement. It was decided that NAHLN Laboratory and State Emergency Notification Plans were needed.

In the area of communication, it was found that there was generally great communication among labs, State and AVIC offices. Early and frequent coordinated communication of outbreak events throughout the network is vital. NAHLN labs, State and APHIS field officials need more education and information from VS on VS Memo 580.4, National Veterinary Stockpile support, indemnity decision-making, surveillance and movement testing guidelines, and wildlife testing.

In the area of capacity, NAHLN labs seemed well prepared for early outbreak testing capacity, although sustainability during outbreak recovery will be a challenge. Information on long term supply of probe, primer and laboratory supplies and on testing algorithms when vaccination is used and during recovery is needed. A real-time estimate of network capacity is needed.

In the area of diagnostic development and validation, several NAHLN labs were interested in assisting with efforts to identify assays deployable to NAHLN labs including a validated test for FMD in milk, an antibody ELISA, validation of pooled sample techniques, DIVA antibody test capability, and validation of tests in wildlife.

In the area of decision-making, VS Memo 580.4 is used as guidance for the variety of decisions made by SAHOs and AVICs such as splitting samples, as outbreak surveillance greatly effects NAHLN lab testing volume and surge needs. A decision on when NAHLN lab becomes involved or notified affects lead time for the lab to prepare for onset of outbreak.

As a result of the exercises, an Emergency Response Support System (ERSS) is in development by APHIS & FAZD to serve as a multi-purpose system for emergency managers, which will provide an integrative display system and visual analytical system. The project objectives are to integrate data into a

user-defined system, improve communication among responders, enrich incident command capabilities, and utilization as a tabletop or field operational training tool. ERSS will support the overall emergency response cycle, manage a large amount of data and real-time communication channels, coordinate collaborative responses among agencies and decision makers, enable operating picture for incident commanders at varying levels of scale, display complex information from multiple related data sets through a customizable user interface.

To estimate diagnostic capacity in NAHLN Laboratories, a Capacity Estimation Program is underway by NAHLN, FAZD, and AAVLD to develop a software tool for evaluating and monitoring NAHLN capacity (daily testing and surge). The project objectives are to Improve knowledge in individual and overall NAHLN diagnostic testing, enhance the NAHLN activation plan, prioritize resources, and serve as a critical tool for managing a large number of diagnostic tests simultaneously. An implementation plan to assess diagnostic capacity in NAHLN labs will have three steps which are: 1) assess NAHLN processes, equipment, capabilities, and staff resources by assessing time/ effort of key laboratory tasks and analyzing existing laboratory capacity models, and 2) develop a capacity calculator to test and verify the database using sample data and determine user acceptance through testing NAHLN laboratories, and 3) implement the capacity calculator by conduct training with NAHLN laboratory personnel, and expanding to other members of the Integrated Consortium of Laboratory Networks (ICLN).

National Bio and Agro-Defense Facility (NBAF) Project Update -

Dr. Cyril Gay, Senior National Program Leader, USDA, Agricultural Research Service (ARS)

Dr. Gay listed the seventeen diseases that DHS and USDA consider to be the most significant threats to U.S. agriculture which are: Highly Pathogenic AI *, Foot-and-Mouth Disease, Rift Valley Fever *, Exotic Newcastle Disease, Nipah and Hendra virus *, Classical Swine Fever, African Swine Fever, Bovine Spongiform Encephalopathy, Rinderpest, Japanese encephalitis*, African Horse Sickness, Venezuelan Equine Encephalitis*, Contagious Bovine Pleuropneumonia, Ehrlichia ruminantium (Heartwater), Eastern Equine Encephalitis *, Coxiella burnetii *, and Akabane virus. Asterisked names are zoonotic. A list of emerging diseases was also presented. Homeland Security Presidential Directive Nine (HSPD-9) of January 30, 2004, Section 18(a) calls for the development of a "National Veterinary Stockpile (NVS) that shall contain sufficient amounts of animal vaccine, antiviral, or therapeutic products to appropriately respond to the most damaging animal diseases affecting human health and the economy and that will be capable of deployment within 24 hours of an outbreak. Homeland Security Presidential Directive Nine (HSPD-9) of January 30, 2004, Section 23 calls for the Secretaries of DHS, USDA, HHS, the Administrator of the EPA, and the heads of other appropriate Federal departments and agencies, in consultation with the Director of OSTP, to accelerate and expand development of current and new countermeasures against the intentional introduction or natural occurrence of catastrophic animal, plant, and zoonotic diseases. Homeland Security Presidential Directive Nine (HSPD-9) of January 30, 2004, Section 24 calls for the Secretaries of Agriculture and Homeland Security to develop a plan to provide safe, secure, and state-of-the-art agriculture biocontainment laboratories that research and develop diagnostic capabilities for foreign animal and zoonotic diseases.

The DHS-USDA "Joint Strategy" identifies the following gap: "Modern, safe, and secure biocontainment laboratories of sufficient capacity to work on high-consequence foreign animal diseases in livestock are a gap in our national strategy. A further gap is the capability to work on high consequence zoonotic pathogens in host livestock animals, to include emerging zoonotic BSL-4 pathogens."

With a notation that the design and program data is under development, the National Bio and Agrodefense Facility will be the first BSL-4 facility in the U.S. for large animal research, and will have shared research space to provide optimum utilization of space and facility resources and space for vaccine development.

Physical facility components consist of an Entry Control Center, Central Utility Plant, transshipping and storage facilities.

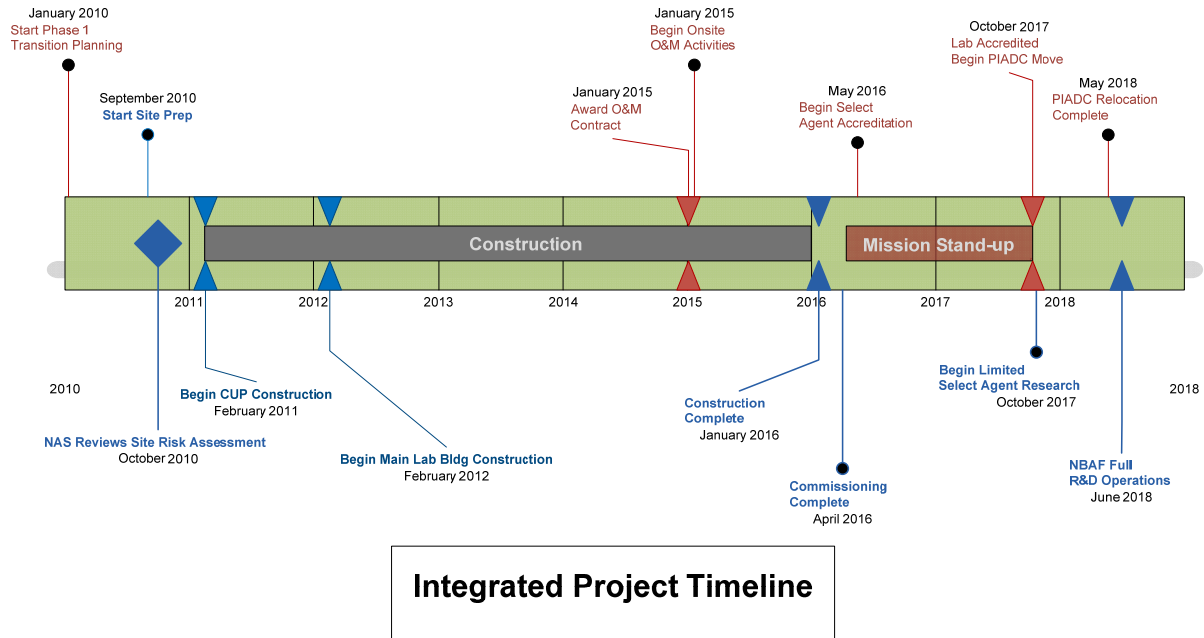
The NBAF will fulfill the critical national mission of protecting the nation's animal agriculture, food supply and public health from natural or intentional outbreaks of foreign, emerging and zoonotic (animal to human) diseases. It will also counter new and emerging biological threats to protect our nation's animal agriculture and public health, which continue to be a priority of this Administration.

NBAF will meet these goals by providing enhanced research capabilities to diagnose foreign animal, emerging and zoonotic diseases in large livestock, replacing and expanding research currently done at the

Plum Island Animal Disease Center (PIADC), and providing expanded vaccine development capabilities for large livestock.

The BSL-4 suite will provide unique capability to test and evaluate biological countermeasures against highly transmittable and potentially deadly BSL-4 zoonotic diseases. NBAF will host coordinated and integrated research and diagnostic program with USDA-ARS, USDA-APHIS, and DHS with accelerated development of countermeasures against priority BSL-4 zoonotic agents.

The pilot manufacturing plant will produce quality controlled biological reagents and reference reagents for use in research, countermeasure development, and diagnostic assays, as well as master seeds for transfer to private sector collaborators for scale-up biologics production. NBAF might provide rapid response small scale biologics production against emerging high consequence zoonotic agent if needed.



Time Specific Paper: FMD Vaccination Trigger Study

Dr. Gay Miller, Professor, Department of Veterinary Clinical Medicine, University of Illinois
USDA, APHIS, National Veterinary Stockpile

Abstract

Objective: Vaccine is a means of control of a Foot and Mouth Disease (FMD) outbreak in the United States. A clear national policy regarding vaccination is lacking. Our goal was to better understand what potential incident commanders see as important “triggers” for vaccinating as an outbreak control strategy.

Design: An FMD outbreak scenario was developed. The outbreak started in Northwestern Illinois (four Illinois premises affected at the end of week one; thirteen by the end of week two) and spread across state lines into Minnesota by the end of the fifth week (sixty premises affected). This scenario was used to query potential incident commanders regarding the factors that would most determine their likelihood to recommend vaccination in the given situation.

Sample Population: Seven potential incident commanders participated in individual phone discussions regarding FMD vaccination given the outbreak scenario.

Results: Two individuals favored vaccination the first week of the outbreak, with six wanting vaccination before the end of week five; one did not want to vaccinate during the scenario. Respondents ranked nine specific determinates for deciding to vaccinate. Ranked from most important to least important were: 1) the capability to manage the outbreak by stamping out; 2) rate of spread; 3) size of outbreak; 4) density of animal populations; 5) number/type of affected industries; 6) national security/economic impact; 7) outbreak duration; 8) type of index case; 9) infection in wildlife.

Conclusions: Most (4/7) incident commanders wanted to vaccinate on or before the end of week two of the outbreak scenario.

FMD-responsive Vaccination Planning for the California Dairy Industry & Incorporation into CAHEMS (California Animal Health Emergency Management System) “Tool Kits”

Dr. Annette Whiteford, State Veterinarian, California Department of Food and Agriculture

Why are we thinking about vaccination in the face of a foot and mouth disease (FMD) outbreak?

The nature of the robust dairy industry in California suggests that in certain scenarios an outbreak of a highly contagious disease like FMD could instantaneously wipe out food security and the largest agricultural economic driver in California, IF creative control solutions are not developed now.

How vaccination fits in the big picture

– Vaccination is one tool in an enormous disease control effort. There are a myriad of federal (primarily USDA), state agency, university and agricultural business driven efforts that are moving preparedness forward. The National Veterinary Stockpile, USDA and FEMA resource typing, vaccination decision criteria (i.e. Tool for Assessment of Intervention Options), continuity of business plans, USDA Foreign Animal Disease Preparedness and Response Plan, California Animal Health Emergency Management System “tool kit”, the “Dashboard,” and the Bioportal are just a few. The California Department of Food and Agriculture (CDFA), like other organizations, is working with USDA to leverage these efforts and fill gaps.

Current California approach:

–Tactical: The focus is on ensuring that we can receive, distribute, vaccinate and verify vaccination quickly. To that end, field veterinarians and animal technicians are developing “real world” standard operating procedures with the goal of “getting needles in target animals fast.” These efforts will help determine how much vaccine may be needed in what time frames given worst case scenarios.

– Strategic: Once determined that rapid vaccination can tactically be accomplished, the urgency for strategic issue resolution increases: when, where and what should be vaccinated given various scenarios. These issues are more complex, but if leaders do not enter a disease crisis ready to use ALL disease control tools, it will quickly be too late to use some of them effectively. Uruguay offers some excellent perspective.

Secure Milk Supply Plan - Continuity of Business Planning for the Dairy Industry

*Center for Food Security and Public Health (CFSPH), Iowa State University;

*University of California, Davis; and

*Center for Animal Health and Food Safety (CAHFS), University of Minnesota

Dr. Pam Hullinger, Professor, UC Davis

Introduction

In the event foot-and-mouth disease (FMD) is diagnosed in the United States, an animal health emergency will be declared and livestock and allied industries will feel the immediate impacts of animal quarantines, increased testing, and product movement restrictions. Foot-and-mouth disease (FMD) is a highly contagious viral disease of cattle and other cloven-hooved animals such as pigs, sheep, and goats. FMD does not affect humans. Movement restrictions are designed to contain the disease and minimize virus spread. Export markets for all cloven-hooved animals and animal products will likely be closed until FMD is eliminated.

Most dairy operations and processing plants do not have the capacity to store milk for more than 48 hours; some have less than 24 hours storage capacity. The just-in-time supply practices of milk movement in the U.S. could result in significant interruptions of milk and milk products to consumers, as well as create significant milk disposal and animal welfare issues on dairies. Appreciating the challenges of controlling and eliminating FMD, while at the same time maintaining the viability of the dairy industry and thus, a secure supply of milk to the consumer, represents an important first step in addressing this complex and multifaceted problem.

Goals of the SMS Plan

- Avoid interruptions in raw milk movement from dairy farms (with no evidence of infection) in a FMD Control Area to commercial processing;
- Provide a continuous supply of wholesome milk and milk products to consumers; and
- Maintain business continuity for dairy producers, haulers, and processors through response planning.

Initial Steps

Develop agreed upon processes and procedures to pick up, transport, and pasteurize milk from uninfected farms in a FMD Control Area.

Intended Audience

- Dairy producers, milk haulers, milk processors, and any allied industries interacting with dairy operations;
- Local, state, and national level officials involved in developing policy and/or managing a FMD outbreak (Incident Command);
- Public health officials involved in regulating milk movement and delivering messages to consumers;
- Veterinarians and animal health technicians who are members of veterinary response teams carrying out FMD surveillance or control efforts on dairy operations.

Working Groups (WG)

Four different Working Groups (WG) have been established to draft guidance on the processes and procedures. Requirements of WG members include an interest and desire to contribute to pre-event policy development, time to read emails, review documents and provide input, and periodic participation in conference calls. The Chairperson(s) and their contact information are provided below if you are interested in becoming involved.

1. Premises Biosecurity WG – Danelle Bickett-Weddle, Iowa State University dbweddle@iastate.edu
2. Milk Hauler/Transport Biosecurity WG – Danelle Bickett-Weddle, Iowa State University dbweddle@iastate.edu or Tim Goldsmith, University of Minnesota gold0188@umn.edu
3. Milk Processing Biosecurity WG – Pam Hullinger, University of California-Davis phullinger@ucdavis.edu
4. Milk Movement Matrix WG – Jim Roth or Chris Mondak, Iowa State University jaro@iastate.edu or cmondak@iastate.edu, Pam Hullinger, University of California-Davis phullinger@ucdavis.edu

Funding for this project has been provided by USDA-APHIS.

Outbreak Surveillance Toolbox -

Dr. Aaron Scott, Director, National Surveillance Unit, Centers for Epidemiology and Animal Health, USDA APHIS VS

Success in containing a rapidly developing infectious disease outbreak depends greatly on the expertise and training of animal health professionals responding to the outbreak as well as how well they are equipped in their response effort. Veterinary epidemiologists often are responsible for assessing the initial disease situation and developing a surveillance plan to control the disease outbreak, but they may have varying levels of experience with developing and writing a surveillance plan. The Outbreak Surveillance Toolbox, created by the Centers for Epidemiology and Animal Health-National Surveillance Unit (CEAH-NSU), is designed specifically to provide these professionals with the resources to quickly develop a consistent and complete surveillance plan in the event of a disease outbreak. Additionally, the Toolbox will standardize the surveillance planning associated with outbreaks.

The Toolbox is a webpage-based collection of resources that is available online via the intranet site: <http://inside.aphis.usda.gov/vs/nsu/toolbox/> or by CD-ROM. The centerpiece 'tool' in the Toolbox is the Outbreak Surveillance Template. This template, in MS Word® format, provides a standardized framework wherein the veterinary epidemiologist is prompted to supply specific information to populate each section of the surveillance plan. Each section of the surveillance plan template has a corresponding webpage that walks the user through the completion of the section. The other resources or 'tools' in the Toolbox have been assembled as sources of information that are readily available to populate the various sections of this template. Upon populating all sections of the template with the needed information, the template is transformed into a finished written document that can then be printed.

Additional Toolbox resources include:

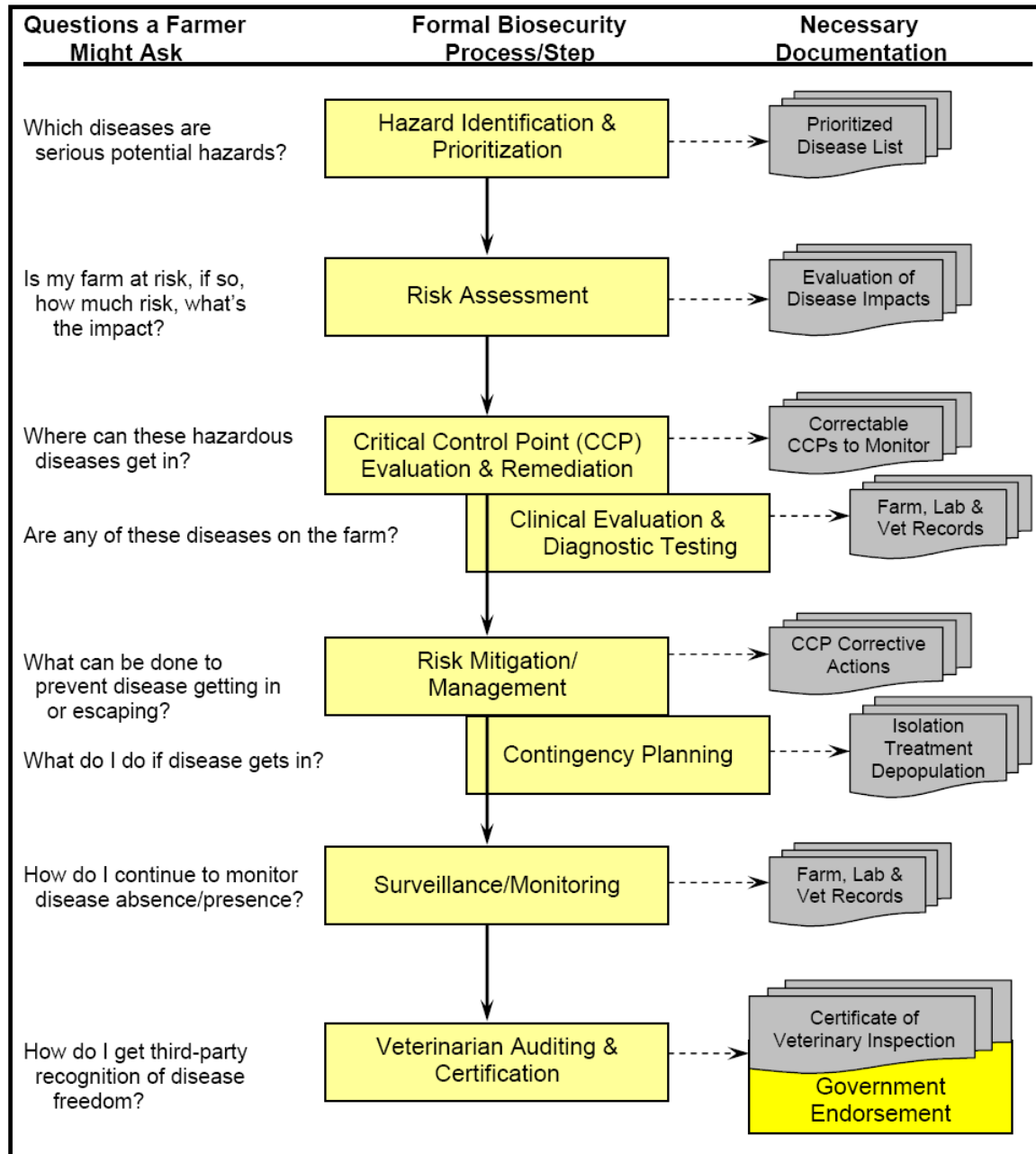
- Sampling plan: information on target population, and how to determine sample size, sampling priority and sampling frequency
- Case definitions: 60+ drafted case definitions to cut and paste into the document
- Premises classifications and disease control zones: definitions, instructions for defining zone boundaries during an outbreak, permitted activities, and holding periods for each zone
- Glossary of outbreak terminology
- Document library
- Contact list
- Calculators: premises sample size calculator, animal sample size calculator, random sampling calculator, interval sample size calculator, probability of failure to detect disease calculator

The calculators provided in the Toolbox are easy to use tools that are provided in Excel spreadsheets. For example, for the sampling plan section of the toolbox, Excel®-based electronic spreadsheets have been developed to enable veterinary epidemiologists to determine and communicate to field personnel the appropriate number of premises to sample in each zone, and the number of animals to be sampled per premises. One spreadsheet automatically estimates the number of animals to sample, given values provided by the epidemiologist for the expected prevalence of disease within the herd or flock to be sampled, the sensitivity of the test being used, and the level of confidence (e.g., 95 percent,) that infected individuals will be found in the sample if the disease is present at the expected prevalence in the sampled population. Help is given to determine the correct prevalence and confidence levels to enter in the calculators. Sometimes resource limitations (e.g. money, personnel) or other factors may dictate a need to alter sample size estimates obtained from the animal sample size calculator or premise sample size calculator. In these situations, another calculator is provided to evaluate what the change in sample size means in terms of what the probability is of *failing to detect* diseased premises and/or animals if they are present in the population from which the sample was taken.

Biosecurity Model & Decision Tree for Livestock Production Units -

Dr. David Scarfe, Assistant Director, Scientific Activities, American Veterinary Medical Association

Ideal process of integrated steps for developing, implementing, auditing and certifying a biosecurity program intended to prevent, control and possibly eradicate disease in any epidemiological unit (a tank/pond, farm, state/province, zone, region or country) is illustrated by the following schematic. Epidemiologic Unit— a defined population of animals, separated to some degree from other populations, in which infectious and contagious diseases can be transmitted



EDEN Animal Health Network Alert System (to reach “Backyard Producers”) -

Shannon H. Degenhart, Shavahn Loux, and Andy Vestal

Texas AgriLife Extension Service;

The National Center for Foreign Animal and Zoonotic Disease Defense; Texas A&M System:

The Animal Health Network is a state-adaptable, local emergency communication network which delivers vital animal disease-related alerts and information from the State Veterinarian to local feed retailers via the established Extension system in each state to reach NLPO. It provides State Veterinarians and State Departments of Agriculture one more tool to communicate with this hard to reach population in the event of an animal disease incident.

Underserved communities of non-commercial livestock and poultry owners (NLPO) are a difficult but vital audience to reach for the protection of our food and agricultural infrastructure. Unlike commercial livestock and poultry operators who stay well informed and have emergency contingency plans,

underserved owners may pose a threat from unintentional spread of disease either through live bird markets with small producers or through practices less than adequate for disease prevention and suppression. Also, underserved owners may not be associated with commodity organizations or veterinary practitioners, and may not sustain continuing education opportunities that equate to good stewardship.

Timely notification of NLPO could significantly mitigate the negative effects to the animal agriculture industry from disease incursions, such as the 2002 Exotic Newcastle outbreak in Southern California or the 2003 Bovine Tuberculosis in El Paso, TX. A pilot test of the Animal Health Network in 2007 funded by the National Center for Foreign Animal and Zoonotic Disease Defense, a Department of Homeland Security University Center of Excellence (FAZD Center), indicated that through utilizing the state's Extension System, the Animal Health Network has the potential to reach feed retailers with alerts from the State Veterinarian within 49.8 hours and 797 NLPO per county through local feed retailers within 7 days of message initiation.

The support of Extension is vital to the successful adoption and implementation of the Animal Health Network in each state. Based on lessons learned from the 2007 Pilot Test and adoption in other states, recruitment of an Extension Specialist is vital to the successful adoption of the Animal Health Network in each state. Extension Veterinarians are uniquely positioned to either provide this leadership or identify and support the appropriate Extension Specialist to lead the adoption and implementation of the Animal Health Network in their state.

Guided by the activities and results of the 2007 Animal Health Network Pilot Test, in 2009 a prototype multimedia, web-based Animal Health Network Start-Up Resource was created for use by states in their efforts to adopt and expand the Animal Health Network concept. The Prototype Resource Kit contained procedural guidelines for implementing the Animal Health Network and background concerning animal-disease outbreaks and the usefulness of such a network. The Prototype Resource Kit also contained educational materials such as: Power Point presentations, video clips, interactive educational activities, and downloadable print material.

The Prototype Resource Kit was reviewed by a national advisory council consisting of Extension Specialists, State Veterinarians, county Extension educators/agents, targeted state agency representatives, and feed retailers; and pilot tested during Michigan's state-wide adoption of the Animal Health Network in January - March 2010. Recommendations of the advisory council and results of the prototype pilot test were used to redesign the Resource Kit into a final Animal Health Network Resource Website.

The Animal Health Network Resource Website <http://animalhealthnetwork.org> was officially launched in July 2010, at the 2010 Ag Media Summit in St. Paul, MN, to facilitate national awareness and aid Extension, State Veterinarians, and Departments of Agriculture with the adoption of the Animal Health Network nationwide. Currently the FAZD Center is seeking Extension Specialists, especially Extension Veterinarians, to serve as the Point of Contact to lead the adoption and implementation of the Animal Health Network in his or her state. If adopted nationally, the Animal Health Network will be poised to address key animal diseases and prioritized agro-terrorism animal disease related issues.

APHIS, Animal Care Emergency Management Projects and Update

Dr. Kevin Dennison, Western Region Emergency Programs Manager, USDA-APHIS-Animal Care

Dr. Dennison provided an update on a variety of APHIS Animal Care emergency management activities, including:

The 3rd Summit on Household Pet Emergency Management will be held December 7-9 in Las Vegas, NV, hosted by the National Alliance of State Animal and Agricultural Emergency Programs (NASAAEP). The first two Summits were funded by APHIS and FEMA is funding this year's meeting. APHIS is funding the meeting of 8 Best Practice Working Groups (BPWG) on Monday, December 6 in Las Vegas through a cooperative agreement with Iowa State University.

BPWGs include Planning and Resource Management, Training, Preparedness and Outreach, Evacuation and Transportation, Animal Sheltering, Animal Search and Rescue, Veterinary Medical Response, and Animal Decontamination.

APHIS and FEMA are meeting with the NASAAEP BPWGs to discuss improvements to the FEMA Authorized Equipment List (<https://www.rkb.us/FEMAGrants/DisplayFEMAGrants.cfm>) to make it more applicable to grant proposals pertaining to animals and agriculture. The group will also discuss the BPWG's *Animal Emergency Management Roadmap* and *Resource List* documents.

Update on the AC-ISU Cooperative Agreement to produce the course *Introduction to Animal Emergency Management*.

APHIS AC has sponsored six exercises with States in the last three years and is looking to collaborate on four more in FY 2011 if funding can be secured. If funded, at least one exercise will address animal transportation issues and one will provide a table top exercise for a zoological facility during a foreign animal disease outbreak.

An update on APHIS AC's statutory and ESF #11 based role in disasters.

Statutory: Support and coordination pertaining to facilities regulated under the Animal Welfare Act (research, exhibitors/zoos, kennels, dealers, carriers)

ESF #11: Subject matter experts for coordination with FEMA and States. Household Pet Support Task Force leadership and staffing. Technical assistance and direct Federal assistance missions.

A brief update on progress in the management of animals after a radiological or nuclear incident.

http://hps.org/hsc/documents/Planning_Guidance_for_Response_to_a_Nuclear_Detonation-2nd_Edition_FINAL.pdf

Dr. Dennison contact information:

2150 Centre Ave, Bldg B, MS 3W11

Fort Collins, CO 80525

Office: 970-494-7433, Mobile: 970-231-3477

Kevin.M.Dennison@aphis.usda.gov

Committee Business

Three Resolutions were discussed and accepted for submission to AAVLD and USAHA Committee on Nominations and Resolutions for consideration.

The CAEM meeting schedule for 2010 - 2011 is:

Monthly conference calls will remain the LAST Thursday of each month

No call in the same month as the AAVLD/ USAHA meeting

NO Dec 2010 conference call; we'll resume calls the LAST Thursday of January

Triggers for vaccination as a response strategy during a Foot and Mouth Disease outbreak

Katie B. Parent, BS, Gay Y. Miller, DVM, PhD, Pamela J. Hullinger, DVM, MPVM, Dip
ACVPM

From the Department of Pathobiology, Division of Preventive Medicine and Epidemiology,
College of Veterinary Medicine (Parent, Miller), and the Department of Agricultural and
Consumer Economics, College of Agriculture, Consumer and Environmental Sciences,
University of Illinois, Urbana, IL 61802 (Miller); and the Department of Veterinary Medicine
and Epidemiology, School of Veterinary Medicine, University of California, Davis, CA 95616
(Hullinger)

Supported in part by a cooperative agreements between the University of Illinois and USDA,
APHIS, Veterinary Services, the National Veterinary Stockpile.

Address correspondence to Katie Parent (kgammon2@illinois.edu).

| | |
|------|-----------------------------------------|
| FMD | Foot and Mouth Disease |
| FAD | Foreign animal disease |
| UK | United Kingdom |
| USDA | United States Department of Agriculture |
| VS | Veterinary Services |

Abstract

Objective Vaccine is a means of control of a Foot and Mouth Disease (FMD) outbreak in the United States. A clear national policy regarding vaccination is lacking. Our goal was to better understand what potential incident commanders see as important “triggers” for vaccinating as an outbreak control strategy.

Design An FMD outbreak scenario was developed. The outbreak started in Northwestern Illinois (four Illinois premises affected at the end of week one; thirteen by the end of week two) and spread across state lines into Minnesota by the end of the fifth week (sixty premises affected). This scenario was used to query potential incident commanders regarding the factors that would most determine their likelihood to recommend vaccination in the given situation.

Sample Population Seven potential incident commanders participated in individual phone discussions regarding FMD vaccination given the outbreak scenario.

Results Two individuals favored vaccination the first week of the outbreak, with six wanting vaccination before the end of week five; one did not want to vaccinate during the scenario. Respondents ranked nine specific determinates for deciding to vaccinate. Ranked from most important to least important were: 1) the capability to manage the outbreak by stamping out; 2) rate of spread; 3) size of outbreak; 4) density of animal populations; 5) number/type of affected industries; 6) national security/economic impact; 7) outbreak duration; 8) type of index case; 9) infection in wildlife.

Conclusions Most (4/7) incident commanders wanted to vaccinate on or before the end of week two of the outbreak scenario.

FMD is likely to be the most economically devastating FAD of modern times.¹ The United Kingdom outbreak of FMD in 2001 resulted in the destruction of an estimated 6 to 10 million animals to eradicate the disease.² Total direct cost to industry and government were estimated to be £7.947 billion to £8.787 billion (US\$15.388 billion to US\$16.748 billion in 2009\$).³

The North American FMD Vaccine Bank, a tripartite bank shared by Canada, the U.S., and Mexico stocks many of the most common strains/serotypes of FMD antigens.⁴ In addition, conventional vaccines are available worldwide, which may be useful to the U.S. during an FMD outbreak response. Strategic use of vaccination can reduce FMD transmission and help to create barriers of immune animals between infected and uninfected populations. Although vaccination has, in recent years, been a realistic countermeasure for responding to FMD, there are no specific national policy guidelines for when vaccination may be used or what strategic strategies might be utilized for various situations. Such a policy strategy needs to consider that vaccination may require a longer waiting period and additional serological data to regain FMD free status compared to countries that did not vaccinate or destroyed vaccinates to control an outbreak.⁵

For certain outbreaks, FMD eradication without vaccination may produce problems separate from the impact on international trade. First, not vaccinating rapidly and effectively in large outbreaks makes it more likely that a traditional stamping out approach will slaughter more animals because of disease or animal welfare considerations. Second, with more animals depopulated for welfare purposes (i.e. otherwise healthy animals are depopulated because animal movement is prohibited and the animal's welfare deteriorates), animal protein is wasted that could otherwise enter the food chain. Third, the depopulation of large numbers of animals will

potentially produce significant environmental issues related to disposal of large numbers of carcasses and the potential for contamination of ground water. The UK FMD outbreak in 2001, for instance, did not use vaccination and more than 6 million animals were slaughtered over the course of the outbreak:⁶ 1.3 million from infected premises, 1.2 million from dangerous contact or contiguous premises, 1.5 million from dangerous contacts but non-contiguous premises, 125,000 from suspicion of FMD, and the largest number, 2.3 million for welfare reasons. An additional unknown number of newborn lambs and calves were slaughtered that were not accounted for in the official total of 6 million.

Additionally, there are no assurances, even after the required post-vaccination period has passed and serological screening has been completed, that our foreign trading partners would accept U.S. exports, regardless of OIE (Office International des Epizooties) rules.³ At least 44 countries shut off exports from the U.S. poultry industry when a Highly Pathogenic Avian Influenza outbreak involving only the index farm and two live birds markets occurred in Texas in 2004.⁷ These 44 countries imposed import restrictions and banned imports until after August 2005 even though the outbreak was very short (initial diagnosis on Feb 16, 2004, and the 3 infected premises identified were depopulated within 6 days of the first confirmed case; the subsequent four week intensive surveillance program found all samples collected to be negative). Given the extremely small size and short duration of the Texas HPAI outbreak and trading partner response, it seems highly likely that world response to a U.S. outbreak of FMD would result in an extensive time when the U.S. would not be able to export to markets in countries requiring FMD free status without vaccination. Being excluded from FMD free world markets is certainly possible regardless of the use of vaccination during response. Fear of this type of response may

underlie attitudes in the agricultural production industries that the most important aspect of FMD response will be to contain the disease by eradication rapidly, while maintaining U.S. consumer (i.e. domestic market) confidence in the quality of products produced by affected industries. If vaccination allows more rapid eradication of the virus and less waste of animal protein (by lower numbers of depopulated animals), industry, American consumers and trading partners may all benefit.

This article describes some of the factors and considerations that a select group of individuals, potential Incident Commanders during an FMD outbreak response, might use in deciding to implement vaccination during an FMD outbreak response. The individuals were queried using a structured approach to probe their attitudes about using FMD vaccination and identify what they thought were important factors that would prompt them to recommend it for a specific FMD outbreak scenario. The authors hope that this study will enhance the dialogue among the various parties that would be involved in responding to an FMD outbreak including USDA, VS, the National Center for Animal Health Emergency Management (NCAHEM), the National Veterinary Stockpile, state animal health officials, and industry regarding FMD vaccination strategies. The authors hope that the article will encourage state animal health officials and producer groups to improve their understanding of strategic vaccination options at local and regional levels, so the NCAHEM can better define the logistical support and incident coordination planning to support state and local response efforts.

Materials and Methods

Seven individuals were chosen based on input from Dr. Glen Garris (Director, National Veterinary Stockpile). While seven individuals may not seem like a reasonable sample size from whom to garner knowledge and attitudes about vaccination, the realistic pool of potential incident commanders during an FMD outbreak is fairly small, perhaps in the range of 25-30 individuals within the U.S. Thus, seven was deemed to be a reasonable number from whom to gather information. Approval was obtained through the chain of command within VS to enlist the cooperation of the individuals (hereafter referred to as respondents). The seven respondents were contacted by email to enlist their cooperation and a time and date was set to talk with them over the phone. The developed scenario was shared with the respondents by email within 48 hours of the phone call.

A plausible outbreak scenario (Table 1 and Figures 1 and 2) was developed with the intended purpose of evoking a mixed response regarding the use of vaccination, with some individuals potentially wanting to vaccinate early in the course of the event and others potentially not wanting to vaccinate at all. A transcript (available upon request) was developed to ensure that each respondent was handled in a standard fashion and that the questions asked would be the same. Two individuals served to beta test the transcript and were handled in the same fashion as respondents; small changes were subsequently made in the questions and the scenario. None of the beta test data are included in this report.

Respondents were contacted over a two week period in January, 2010. Conversations were recorded and a written transcript sent to each respondent. Respondents concurred with the transcription or edited it to better reflect what they tried to communicate.

The results are summarized using basic descriptive statistics. For the one question where respondents were asked to rank potential FMD vaccination triggers, the results were ranked using the Baldwin Ranking method.⁸

Results

General attitudes about FMD vaccination - Respondents fell into three general categories: two had a favorable view of vaccination from week one of the outbreak scenario, four would not vaccinate in the first week of the scenario but favored vaccination as the scenario progressed, and one would not vaccinate during the five-week scenario (Table 2). Reasons for supporting vaccination or not supporting vaccination at the end of the first week varied (Table 3). The two individuals who were either somewhat or very likely to vaccinate in the first week of the scenario were not opposed to stamping out. Rather both acknowledged that stamping out would be the first line of defense and the best way to manage an outbreak if possible. However, by the end of week one, the situation had progressed in their opinion to the point where they were likely or very likely to vaccinate. They similarly voiced the concern that the logistics and planning required to implement a vaccination program would be extensive and should be started at least by the end of the first week. The four participants who changed from unlikely to likely to vaccinate during the course of the scenario did so at weeks 2, 3, and 5 of the outbreak for varying

reasons (Table 4). The final individual was ambivalent about vaccination. He opposed using it during the scenario but felt it might be used in some cases.

FMD Vaccination Trigger Ranking - Respondents were asked to rank nine factors in the order of importance as triggers for vaccination. Many of the factors were related to one another. Capability to manage the outbreak with a stamping out approach was overall the most important factor when considering vaccination. All but two respondents ranked it highest (Table 5). One of the respondents who did not rank stamping out as the top factor stated that “the cleanest way is always just stamping out”. The other respondent later clarified that his interpretation of stamping out was that it was a “scorched earth” policy or “euthanizing herds and disposing of carcasses with no efforts to salvage anything.”

The effect on national security or the economic impact of the disease was ranked sixth as a trigger for vaccinating. No respondent placed it higher than 4th and one respondent ranked it last. In general, respondents did not explain the reasons for their rankings. However, one did mention that the importance of national security and that the economic impact will be large regardless and so would not be a major factor in the decision to vaccinate during an outbreak.

General Attitudes about FMD Preparedness and Response - Each respondent provided answers to direct questions regarding USDA preparedness and response.

Question: “How well prepared do you think the USDA is now for handling an outbreak of FMD?” Only one of the responders said the USDA is more prepared now than it was a year ago.

Four respondents said that USDA would be limited by resources, both financial and human, but that the financial resources could most likely be procured in an emergency situation. One respondent thought that people are better educated about the Incident Command System now, but that some aspects of an outbreak have not been fully considered, namely carcass disposal and industry's ability to maintain continuity of operations during an FMD outbreak. One respondent thought that the biggest challenge would be handling the smaller producers who may not use legal means to move and sell (income not reported) their animals and, thus would be impossible to track. Such individuals would most likely not comply with stop movement orders and would therefore contribute to the spread of FMD. Multiple respondents felt that USDA has the ability to contain an FMD outbreak if the outbreak remained geographically limited, but that spread beyond one or two geographic areas (eg: states), would make containment a challenge and be more likely to fail. One respondent was confident that USDA, states and industry could manage FMD but was much less confident that the political and public will (i.e. forthcoming with needed resources) would exist to fight the disease.

Question: "What types of activities/actions should USDA undertake to improve FMD preparedness and response in advance of an outbreak?" Answers mentioned more than once included improved veterinarian reporting of suspected FADs, the need to have sufficient animal health (veterinary and non-veterinary) personnel available in the event of an outbreak, and planning for issues such as euthanasia and carcass disposal. Two respondents felt USDA needed to define the cost of establishing formal agreements with processors/slaughter facilities that would still accept animals during an outbreak. The perceived current limitations of non-veterinary animal health personnel was mentioned by three respondents, one of which suggested

that formal agreements should be established with states to use their personnel in other parts of the country during an outbreak by federalizing them or by detailing them using other methods. Reporting suspected FADs was mentioned twice; one respondent thought that veterinarians should be more accountable for reporting possible FADs. Another thought the USDA should find a way to remove the stigma of reporting a suspected FAD since it often results in a veterinarian losing a client's business. A number of other issues were mentioned: USDA needs to modify livestock market regulations and improve record keeping; there needs to be better information sharing between central Veterinary Services personnel and those VS personnel in the states; the veterinary work force should have more training in vesicular diseases; there needs to be improved VS veterinarian competency in diagnosing food animal disease generally because of the changing role of food animal veterinarians.

Question: "What do you see as the most limiting factors currently in any FMD response that we have and how could these limitations best be mitigated?" Many responses were similar to those reported with the previous question, including most commonly, the shortage of human resources, which was discussed by five respondents. One respondent thought the biggest challenge would be maintaining a sustained response, which is also directly linked to human resources. Another respondent thought a significant challenge was animal identification and record keeping, which has waned due to completion of eradication programs. A need for a mandatory and reliable system of animal record keeping and identification was also mentioned.

Discussion

Since the UK outbreak in 2001, FMD vaccination has become a more realistic FMD response option in the U.S. Mass depopulation and the challenge of disposing of large numbers of carcasses make vaccination an attractive consideration. The planning and policy development for vaccination during an FMD outbreak are in the early stages. FMD vaccination programs may be implemented with the intent to kill (vaccinates are subsequently depopulated; this approach buys additional time for depopulation while controlling the risk of spread), slaughter (vaccinates are slaughtered within a specified time period through normal meat processing channels), or allow vaccinates to live (vaccinates live their normal productive lifespan and are handled through normal channels for movements and processing). Vaccination programs may target all susceptible species or a subset of the species. Within a species, the rapidity of spread or the limited availability of vaccine may prioritize what animals are vaccinated. The desired geographical extent of the vaccination program will depend upon the epidemiology of the species involved in the outbreak as well as the disposition of vaccinates. Additionally, several options exist for acquiring the vaccines, which include the North American FMD Vaccine bank, existing conventional vaccines used in other countries and, hopefully in the future, adenovirus vectored vaccines currently under development in the U.S. Also very important in the decision to vaccinate are the short and long term impacts on foreign trade. Hence, in addition to the livestock demographics and virus serotype involved in an FMD outbreak, there are many other considerations necessary in developing a successful vaccination program for a specific outbreak.

The decision to vaccinate during an outbreak should be made with a clear understanding of the expected disease control and economic benefits of vaccination, the resources needed, and the

necessary efforts to monitor and manage vaccinated populations long term. While current vaccines provide the benefit of reducing/eliminating clinical signs and decreasing viral shedding thereby slowing disease transmission, they can also impact the number of persistently infected carriers in a herd, and thus make the serological testing of vaccinated populations more challenging and labor intensive.^{9,10} This could have significant impacts on the resources necessary to manage and eventually prove freedom from disease for a vaccinate to live strategy. Prior planning (pre-outbreak) and consideration of the pros and cons of a specific FMD vaccination campaign will likely produce a successful implementation, eradication of the disease, and overall benefits to U.S. animal agriculture. Additionally, use of vaccination influences the minimum time required to regain a specific disease status according to current OIE guidance (eg. FMD free zone where vaccination is or is not practiced).¹¹

It is apparent from this study that a lack of clarity exists on the decision process and decision criteria for when to implement an FMD vaccination campaign. Prospective incident commanders often felt that factors beyond their control (such as trade impacts) would be the primary drivers in the decision to vaccinate. State and federal animal health officials need to plan the decision process for implementing an FMD vaccination campaign. There is a need for better definition of roles and responsibilities, empowerment of individuals involved in the decision to vaccinate at the local or regional level, and enhanced development/planning for FMD vaccination strategies. Additional planning, exercising and resources need to be dedicated to the development of FMD vaccination strategies best suited for various regions throughout the U.S.

It was interesting to find that respondents felt that preparation in this area was less today than it had been historically. This could be due to several factors including focus in recent years on issues related to the initial BSE detection in the U.S., as well as the threat and significant media attention from two global influenza pandemics (H1N5 and H1N1). With those issues becoming less pressing, USDA, NCAHEM (National Center for Animal Health and Emergency Management) has a renewed focus on FMD planning and policy development. Recent work in this area includes updating many of the FADPrep (Foreign Animal Disease Preparedness) documents for FMD, beginning development of an FMD vaccination policy, improving the National Veterinary Stockpile as it relates to FMD response capability, as well as supporting and participating in recent government-industry continuity of business planning efforts across the country.

Conclusions and Recommendations

The development and communication of a clear process for implementation of specific vaccination strategies during an FMD outbreak will help assure that the best decisions are made during an actual event. Identifying who will be responsible for recommending specific vaccination strategies will help those individuals to consider different approaches for various outbreak profiles. The impacts of the approaches could then be simulated with foreign animal disease spread models to evaluate the impacts of specific strategies and estimate the resources needed to successfully implement and manage the strategies. The integration of epidemiologic model results into economic trade or regional/national economic models will produce economic estimates of the proposed impacts of various vaccination strategies. Policy makers should devote resources to defining, refining, and eventually exercising the vaccination decision making

process, including the logistics of delivering vaccines and ancillary supplies to the field and the methods of administering the vaccine to animals as well as tracking them post vaccination. A better understanding of the necessary resources and delivery mechanisms for FMD vaccination response is needed. Such understanding will be key in assuring that any FMD outbreak using vaccination for successful containment and eradication will be executed in an optimal manner.

References

1. James AD, Rushton J. The economics of foot and mouth disease. *Rev Sci Tech* 2002 21(3):637-644.
2. Foot and Mouth Disease: Lessons to be Learned Inquiry Report. Available at: http://archive.cabinetoffice.gov.uk/fmd/fmd_report/report/index.htm. Accessed March 25, 2010.
3. Miller GY. A review of the impact of six of the highest economic consequence foreign animal diseases from a U.S. perspective. Submitted to JAVMA for publication 6-8-10.
4. Foot-and-Mouth disease Vaccine. APHIS, VS Factsheet, March 2007. Available at: http://www.aphis.usda.gov/publications/animal_health/content/printable_version/fs_fmd_vaccine_07.pdf. Accessed April 9, 2010.
5. OIE Terrestrial Animal Health Code site. Foot and Mouth Disease. Available at: http://www.oie.int/eng/normes/mcode/en_chapitre_1.8.5.htm#rubrique_fievre_aphteuse. Accessed March 10, 2010.
6. The 2001 Outbreak of Foot and Mouth Disease. UK National Audit Office. Available at: http://www.nao.org.uk/publications/0102/the_2001_outbreak_of_foot_and.aspx Accessed April 12, 2010.
7. Pelzel AM, McCluskey BJ, Scott AE. Review of the highly pathogenic avian influenza outbreak in Texas, 2004. *J Am Vet Med Assoc* 2006;228:1869-1875.
8. Baldwin, JM. The technique of the Nanson preferential majority system of election 1926, *Proceedings of the Royal Society of Victoria* n.s.39; 42-52.
9. Schley D, Paton DJ, Cox SJ, Parida S, Gubbins S. The effect of vaccination on undetected persistence of foot-and-mouth disease virus in cattle herds and sheep flocks. *Epidemiol Infect* 2009;137:1494-1504.

10. Uttenthal A, Parida S, Rasmussen TB, Paton DJ, Haas B and Dundon WG. Strategies for differentiating infection in vaccinated animals (DIVA) for foot-and-mouth disease, classical swine fever and avian influenza. *Expert Rev Vaccines* 2010; 9(1):73-87.
11. OIE Terrestrial Animal Health Code Chapter 8.5. Available at:
http://www.oie.int/eng/normes/mcode/en_chapitre_1.8.5.htm. Accessed May 7, 2010.

Figure 1—Outbreak scenario in Illinois, weeks 1-5.

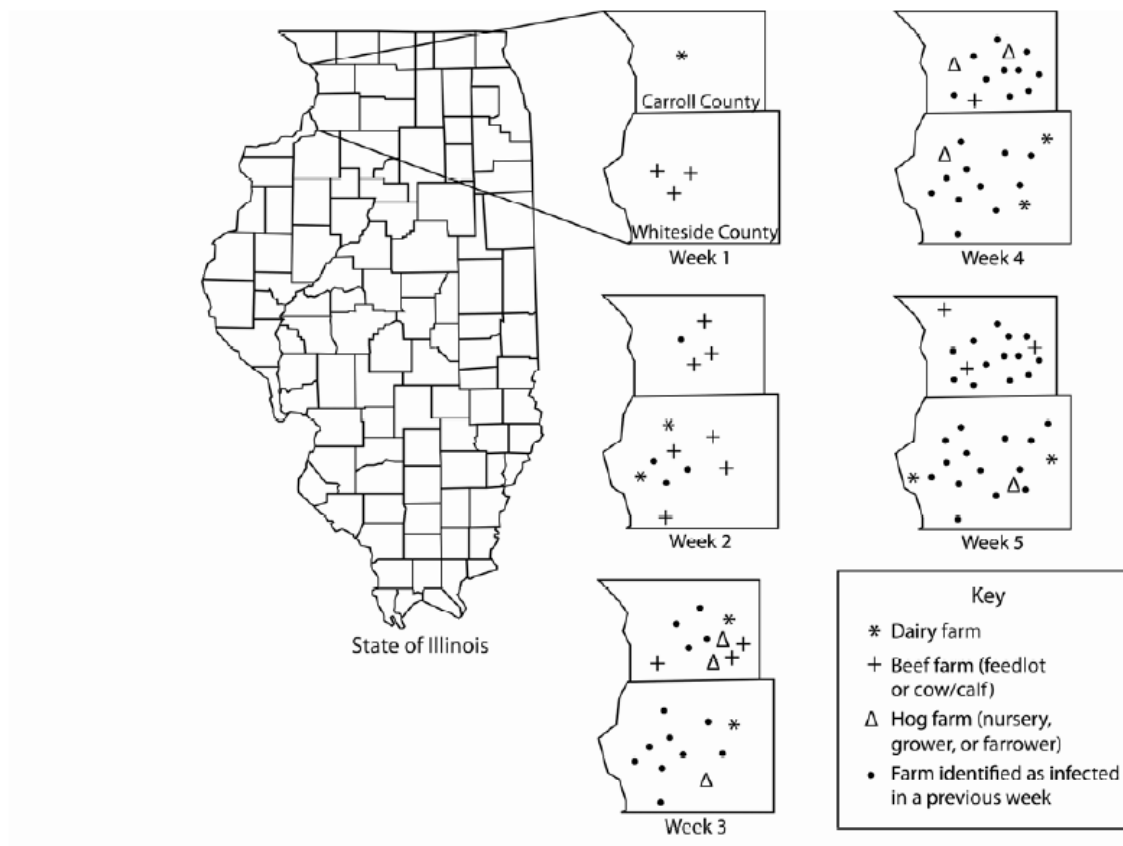


Figure 2—Outbreak scenario in Minnesota, weeks 4 and 5.

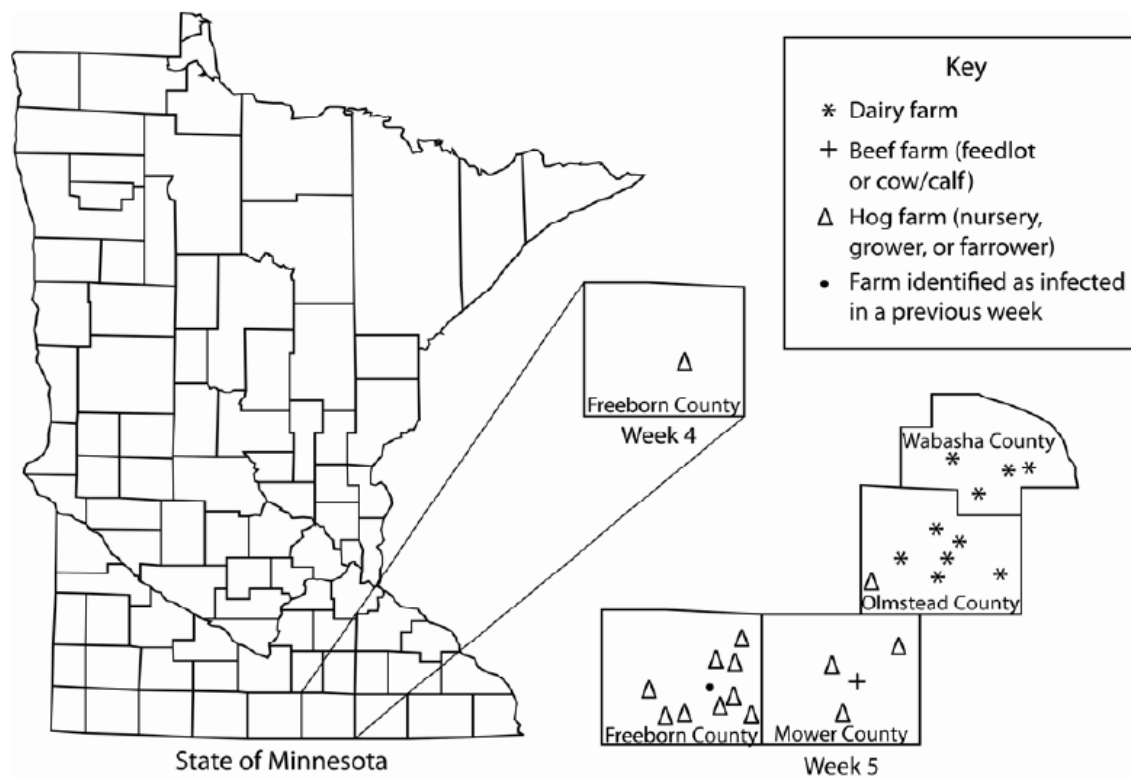


Table 1—Basic description of the scenario by week of the outbreak

| Week | Description of scenario |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Index case: 350 steer feedlot in Whiteside County (Northwestern Illinois). By the first week, three feedlots in Whiteside County and one dairy in adjacent Carroll County, Illinois are affected. There are 465 animals total on infected premises |
| 2 | Seven feedlots and two dairies infected in Whiteside and Carroll Counties. There are 4,315 total animals on newly infected premises. |
| 3 | Three dairies, one feedlot, two cow/calf farms and three hog farms are infected in Whiteside and Carroll Counties. There are 4,540 total animals on newly infected premises. |
| 4 | Three hog farms, one feedlot and three dairies are infected in Whiteside and Carroll Counties. One hog farm is infected in Freeborn, MN. There are 6,873 total animals on newly infected premises. |
| 5 | Thirty new premises are infected, twenty four of those being in four contiguous counties in Minnesota. Mostly hog and dairy farms are affected in southern Minnesota. Six new infected premises are in Whiteside and Carroll Counties. There are 18,185 total animals on newly infected premises. |

Table 2—Proportion requesting vaccination by week of the outbreak scenario

| Week | very or somewhat likely | very or somewhat unlikely |
|------|----------------------------|------------------------------|
| 1 | 2 (28%) | 5 (71%) |
| 2 | 4 (57%) | 3 (43%) |
| 3 | 5 (71%) | 2 (28%) |
| 4 | 5 (71%) | 2 (28%) |
| 5 | 6 (86%) | 1 (14%) |

Table 3—Reasons cited by respondents for being likely or unlikely to want to vaccinate in the first week

| In favor of vaccination (2 respondents) | Not in favor of vaccination (5 respondents) |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rate of spread and infected premises in adjacent county. | Stamping out should be attempted first in these circumstances. |
| Logistics of vaccination need to be planned as soon as possible. Averse to a "slash and burn" technique. Dense livestock region. | Stamping out would be better for the industry at this point. Outbreak appears to be geographically limited at this point. It hasn't spread to hogs yet so there is no aerosolized plume. Limited number of animals and premises affected at this point. Vaccination will complicate the eradication strategy since infected animals will unknowingly be vaccinated. Vaccination lengthens time to regain export markets. Incident Commander will not have time to consider vaccination due to other time constraints during an outbreak |

Table 4—Weeks at which respondents shifted from somewhat/very unlikely to somewhat/very likely to desire vaccination and their reasons for doing so

- | | |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | The disease is still spreading, and quarantine and stamping out appear to not be as effective as they need to be to control the disease. |
| 2 | The number of animals and premises involved. |
| 3 | It has now spread to swine. There was an epi link with a semen tank, so it could be more widely dispersed than known due to semen being shipped from an infected premises. |
| 5 | Geographically more widespread. Rate of spread increased. |

Table 5—Ranking of triggers for vaccination

| | |
|---|----------------------------------------------------------------|
| 1 | Capability to manage the outbreak with a stamping out approach |
| 2 | Rate of spread of outbreak |
| 3 | Size of outbreak |
| 4 | Density of animal population in outbreak area |
| 5 | Number/type of industries affected |
| 6 | National security and/or economic impact |
| 7 | Duration of outbreak |
| 8 | Type of index case |
| 9 | Infection in wildlife |