Traditional Outbreak Management Practices in the U.S.

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Tools for Control of Foreign Animal Disease Outbreaks

- Stop Movement
- Biosecurity
- Stamping Out
  - Slaughter of all clinically affected and in-contact susceptible animals (within 24 hours or as soon as possible)
- Trace-back/Trace-forward
  - 2 incubation periods prior to outbreak
- Surveillance - Rapid Diagnostics
- Vaccination
  - Vaccinate to kill or slaughter; Vaccinate to live
FMD: The MOST Contagious Disease of Animals

FMD is the major animal disease preventing world trade of animals and animal products

Adults: Mortality is low but morbidity is high

Young animals: High mortality associated with some strains

Not a public health or food safety concern
FMD Causes lesions on Mouth, Feet, and Teats
FMD: The MOST Contagious Disease of Animals

- 96 countries in the world are endemic for FMD

- The U.S. has had 9 outbreaks of FMD 1870 to 1929
  - All outbreaks controlled by stop movement and stamping out

- Can no longer count on stop movement and stamping out to control FMD
  - Very large herds
  - Extensive movement of animals
  - Areas with very high livestock density
  - Public resistance to stamping out
  - Carcass disposal issues
  - Large feral swine and deer populations
Day 1 of an FMD Outbreak

- Notification of World Organization for Animal Health (OIE) and member countries
  - All exports of cattle, swine, sheep, goats and their uncooked products will be STOPPED
- Control Area(s) established to manage movements
- Prices will drop
- Consumer confidence at risk
Beef Exports 2015 = $6.3 billion

Pork Exports 2015 = $5.6 billion

Total Dairy Exports 2015 = $5.4 billion

Source: http://www.qtagonline.com/ginzel-weekly-hog-pork-report-4-8-2016/
Time to Regain FMD-Freedom

Country, Year of Outbreak

Economic Impacts of FMD

- Center for Agricultural and Rural Development Food and Agricultural Policy Research Institute (CARD FAPRI) model (Dr. Dermot Hayes)
  - Cumulative losses over 10 years = $199.8 Billion
    - Pork – 57 Billion
    - Beef – 71 Billion
    - Poultry - 1 Billion
    - Corn - 44 Billion
    - Soybeans – 25 Billion
    - Wheat – 1.8 Billion
Iowa has More at Stake than any Other State

- Most livestock dense state (24 million FMD susceptible animals)
- Number 1 in corn and (often) soybean production
- Many Iowans employed in production and processing industries
- State tax revenues dependent on agriculture
Secure Food Supply Plans
Movement from Premises with No Evidence of Infection

HPAI
- Secure Egg Supply
- Secure Turkey Supply
- Secure Broiler Supply

FMD
- Secure Milk Supply
- Secure Beef Supply

FMD, CSF & ASF
- Secure Pork Supply
Secure Food Supply Plans During an FAD Outbreak

• Overall goals include:
  – Detect, control, and contain FAD as quickly as possible;
  – Avoid interruptions in animal/animal product movement to commercial processing from farms with no evidence of infection during a foreign animal disease outbreak;
  – Provide a continuous supply of safe and wholesome food to consumers; and
  – **Maintain business continuity** for producers, transporters, and food processors through response planning.

Control Area Established Around Each Infected Premises

- Minimum size of Control Area is 6.2 mile radius around each infected premises (120 Sq. Mi.)
- Movement by permit only in Control Area
Secure Food Supply Plan Development

• Industry-State-Federal-Academia Partnership
• Academic partners draft documents
  – Iowa State University
  – University of Minnesota
  – Kansas State University
  – University of California at Davis
• Circulate drafts to Working Group members
  – Review, suggest improvements
• Revise, pilot test, lessons learned
Common Components of Secure Food Supply Plans

- **Voluntary** pre-outbreak preparedness
- Biosecurity
- Surveillance
- Epidemiology questionnaires
- Movement permit guidance
- Risk assessments
  - Completed and in process
- Pre and Post-outbreak training
Revisions to Secure Food Supply Plans Based on Experience with HPAI
What Went Well During 2014-2015 HPAI Outbreak?

Movement permitting for poultry and poultry products in a Control Area

- Approximately 8,000 movement permits were issued during the HPAI outbreak enabling more than 20,000 movements.

- Epidemiology report suggested that three movements may have contributed to disease spread.

- HPAI was not spread to other regions of the U.S. by permitted movements

- Testing for permits contributed to early detection and control of infected flocks
## Highly Pathogenic H5N2 Avian Influenza in Iowa

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Poultry Affected (6/8/2015)</td>
<td>31,502,052</td>
</tr>
<tr>
<td>Layers</td>
<td>24,725,086</td>
</tr>
<tr>
<td>Pullets</td>
<td>5,624,336</td>
</tr>
<tr>
<td>Turkeys</td>
<td>1,128,729</td>
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<tr>
<td>Hatchery</td>
<td>18,791</td>
</tr>
<tr>
<td>Backyard Flocks</td>
<td>5,110</td>
</tr>
</tbody>
</table>

April 13 to June 16, 2015

77 infected sites
- 6 “Backyard” sites
- 71 Commercial sites

Estimated $1.2 billion impact on Iowa economy

http://www.iowaagriculture.gov/AvianInfluenza.asp
Porcine Epidemic Diarrhea Virus (PEDV) Positive Biological Accessions

First case April, 2013
4,458 Positive Biological Accessions by March 12, 2014

Source: AASV website www.aasv.org
Biosecurity is expensive and inconvenient

- Livestock and poultry producers implement level of biosecurity needed to protect from endemic diseases
  - There is herd or flock immunity to most endemic diseases
  - Low levels of pathogen shedding and high levels of resistance

- Routine level of biosecurity is not sufficient to protect from a newly introduced highly contagious disease (e.g., SECVD, HPAI, FMD, CSF, ASF)
  - No herd or flock immunity
  - High levels of pathogen shedding and low levels of resistance
Reduced Confidence in Biosecurity

Very difficult to have effective biosecurity to prevent FMD infection in a livestock dense area for animals not totally confined indoors (beef and dairy)
Consequence of Delayed Stamping Out

• Delayed stamping out of HPAI infected flocks allowed amount of virus in environment to become very high
  – Challenged biosecurity and made it less effective

• USDA, State and Industry agree that stamping out HPAI should be accomplished within 24 hours of diagnosis to prevent high virus loads

• In a large FMD outbreak, stamping out in 24 to 48 hours will become impossible
  – Herds will be allowed to recover
  – Virus loads will be very high
Surveillance to Establish Lack of Evidence of Infection

• Cannot prove a flock/herd or animal is free of a disease
• Can only establish lack of evidence of infection
  – For HPAI sampling 5 of every 50 dead birds daily by PCR provides 95% confidence the flock is negative (USDA CEAH)
    • HPAI is usually rapidly fatal, sampling dead birds increases chance of finding infection
    • NASAHO requested sampling 11 out of every 50 dead birds to increase confidence above 95%
Surveillance to Demonstrate Lack of Evidence of Infection

PCR testing

• PCR testing of suspect (clinical) animals is valuable to detect the presence of infection.
• PCR testing is less valuable for providing a high degree of confidence that a herd is not infected.

There is no sampling scheme which would prove with 95% confidence that a cattle or swine herd is negative for FMD

The potential for moving infected, but undetected animals is higher for FMD than for HPAI
Revisions to the Secure Food Supply Plans
Based on the Experience with HPAI

All Secure Food Supply Plans
• Encourage all producers to have validated premises ID
• Make plans more concise for ease of use during an emergency
• New approach to biosecurity
• Coordinated input from SAHOs during plan development

Secure Milk, Pork, and Beef Supply Plans
• Optimal surveillance to give confidence of negative disease status
• Plan for potential extended period with restricted animal movement
• Emphasize rapid vaccine availability for FMD and CSF
Options for Control

• HPAI must be stamped out
  – High fatality rate
  – Potential to be zoonotic
  – Continual mutation makes vaccination very difficult

• Allowing animals to recover from FMD and CSF is an option when it is not possible or desirable to stamp out all infected herds
  – **FMD, CSF, and ASF are not food safety or public health concerns**
  – Vaccine will be an essential tool for FMD and CSF control
Phases and Types of FMD Response

Strategies for the response to, and management of, an FMD outbreak will change as the outbreak progresses and will depend upon the magnitude, location and other characteristics of the outbreak.

www.cfsph.iastate.edu/pdf/phases-and-types-of-an-fmd-outbreak
Potential Phases of an FMD Response

- FMD response and management strategies
  - Change as the outbreak progresses
  - "Phases"

Phases of FMD Response

- Heightened Alert Phase: FMD outbreak in either Canada or Mexico, but not U.S.
- Phase 1: From confirmation of the first case of FMD in the U.S. until reasonable evidence to estimate outbreak extent.
- Phase 2: Surveillance and epidemiology provides timely evidence of outbreak extent to support decisions by Incident Command.
- Phase 3: Recovery: surveillance and epidemiology indicates FMD is under control; plan implemented to recover disease-free status.
- Phase 4: U.S. declared free of FMD, possibly with vaccination.
This title says 'Potential Phases' - now that it has been incorporated as a FAD PReP document, could you remove the 'Potential'
Zaabel, Pamela K [CFSPH], 3/29/2016
Phases and Types of an FMD Response

Strategies for the response to, and management of, an FMD outbreak will change as the outbreak progresses and will depend upon the magnitude, location and other characteristics of the outbreak.

Six Types of FMD Outbreaks

Size of FMD Outbreak (in terms of animals, premises, and jurisdictions affected)

Type 1: Focal
Type 2: Moderate Regional
Type 3: Large Regional
Type 4: Widespread or National
Type 5: Catastrophic U.S.
Type 6: Catastrophic North American

Response Shifts from Emphasis on Stamping-Out to Emphasis on Alternate Strategies (duration of FMD response)

www.cfsph.iastate.edu/pdf/phases-and-types-of-an-fmd-outbreak
If the title on the previous slide only includes ‘Phases’, should this title only include ‘Types of an FMD Response’?

Zaabel, Pamela K [CFSPH], 3/29/2016
### Table 2: Current Capability of the United States to Effectively Implement Vaccination Strategy or Strategies

<table>
<thead>
<tr>
<th>Type of Outbreak</th>
<th>Vaccinate-to-Kill</th>
<th>Vaccinate-to-Slaughter and Vaccinate-to-Live</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1: Focal FMD Outbreak</td>
<td>+</td>
<td>+/- (depends on regulatory infrastructure)</td>
</tr>
<tr>
<td>Type 2: Moderate Regional FMD Outbreak</td>
<td>+/- (depends on animal density)</td>
<td>+/- (depends on regulatory infrastructure and animal density)</td>
</tr>
<tr>
<td>Type 3: Large Regional FMD Outbreak</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Type 4: Widespread or National FMD Outbreak</td>
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</tr>
<tr>
<td>Type 5: Catastrophic U.S. FMD Outbreak</td>
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<td>--</td>
</tr>
<tr>
<td>Type 6: Catastrophic North American FMD Outbreak</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

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4 Includes, but is not limited to, vaccine quantities, time to delivery, and regulatory infrastructure (regulatory issues such as procurement, licensing, permitting, distribution, use, and traceability).
Need for FMD Vaccine

Working with industry to emphasize the need for adequate FMD vaccine stockpile

- FMD Vaccine Surge Capacity White Paper

- Letter from commodity groups to Senate Ag Committee

- Commodity groups requested House Ag Subcommittee hearing on FMD preparedness
  - Held on Feb 11, 2016

- March 14, 2016: USDA Seeking Information from Foot and Mouth Disease Vaccine Manufacturers
  - APHIS would like to have a minimum of 25 million doses for each of the 10 high-risk strains available.
Vaccine Availability

- FMD and CSF
  - Vaccine will not be immediately available, and will be in short supply when available

- ASF
  - No vaccine

- Vaccination is not currently a viable option for initial rapid control of these FADs in a large FAD outbreak
I assume this slide remains to emphasize ASF and CSF Vaccine- so one option would be to change the title to “CSF and ASF Vaccine Availability” and remove FMD from the slide as I assume you will emphasize the concerns over FMD vaccine availability in the previous 2 slides...
Zaabel, Pamela K [CFSPH], 3/29/2016
Classical Swine Fever (CSF) (Hog Cholera)

• The disease was eradicated from the U.S. in 1978

• Outbreaks have occurred in Asia, South America, Africa, and Central America, including Mexico and parts of the Caribbean
African Swine Fever (ASF)

2005
• 20 countries reported cases

Last reporting period
• 30 countries with reported cases

Source: National Pork Board’s handout titled: AFRICAN SWINE FEVER (ASF) A THREAT TO THE U.S. PORK INDUSTRY
Phases and Types of CSF and ASF Responses

DRAFT
GUIDELINES FOR CLASSIFICATION OF PHASES AND TYPES OF A CLASSICAL SWINE FEVER OUTBREAK AND RESPONSE
March 22, 2015
Version 2.3

The following guidelines are being developed as an aid to support decision making to facilitate response planning and development of business continuity plans in the event of a classical swine fever (CSF) outbreak in domestic or feral swine in the United States. These guidelines are intended to supplement information and recommendations contained in the FAO FAQ Classical Swine Fever Response Plan (Red Book, May 2013).

INTRODUCTION

Having pre-defined phases and potential types of an outbreak will aid in the development of an efficient and effective CSF response strategy and provide a standard for incident management. The guidelines are intended to provide a framework for the development of a national strategy for CSF response and to serve as a reference for different regions of the United States or segments of the industry to be adapted to local situations. The guidelines are intended to be used in conjunction with individual phases or types of a CSF outbreak as necessary.

Goals for Response to a CSF Outbreak

The goals for response to a CSF outbreak are:

1. To control the spread of disease
2. To prevent further outbreaks
3. To protect human and animal health
4. To facilitate trade

The guidelines are intended to support the development of a national strategy for CSF response and to serve as a reference for different regions of the United States or segments of the industry to be adapted to local situations. The guidelines are intended to be used in conjunction with individual phases or types of a CSF outbreak as necessary.

www.cfsph.iastate.edu/pdf/phases-and-types-of-a-csf-outbreak
www.cfsph.iastate.edu/pdf/phases-and-types-of-an-ASF-outbreak
Phases and Types of CSF and ASF Responses

<table>
<thead>
<tr>
<th></th>
<th>Classical Swine Fever</th>
<th>African Swine Fever</th>
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</thead>
<tbody>
<tr>
<td><strong>Foot and Mouth Disease</strong></td>
<td>4 Phases</td>
<td>4 Phases</td>
</tr>
<tr>
<td>4 Phases</td>
<td>4 Phases</td>
<td>4 Phases</td>
</tr>
<tr>
<td>6 Types</td>
<td>4 Types</td>
<td>2 Types</td>
</tr>
</tbody>
</table>

**Why the differences?**

- ASF and CSF only infect swine whereas FMD infects cloven hooved animals
- Lack of ASF vaccine availability increases the importance of rapid detection and aggressive measures to stamp out infected herds
- Virulence of the strains and ability to detect them
- Stability in the environment
- OIE rules on regaining disease freedom
FMD Vaccination

• Killed virus vaccines
• 7 distinct serotypes
  – Not cross protective
  – Approximately 65 Subtypes
    • Cross-protection varies between strains within a serotype
    • 23 strains are recommended for FMD vaccine banks
  – **Essential** to isolate virus and identify serotype to select correct vaccine
North American FMD Vaccine Bank

• Vaccine antigen concentrate (VAC) currently held by NAFMDVB is intended to be shared by U.S., Canada, Mexico

• Vaccine manufacturers can produce 2.5 million doses in 21 days upon receiving VAC from NAFMDVB
  – Iowa: 3.9 million cattle, 20.8 million hogs

• Additional vaccine* production can take as long as 14 weeks
  *Created from a master seed and not currently stored as VAC

Source: USDA Foot-and-Mouth Disease Vaccination Policy in the United States, September 2014
R & D Innovations Needed

• Surveillance to achieve 95% confidence a herd is negative for FMD, CSF and ASF
• Novel FMD vaccines that can be safely manufactured in FMD free countries
  – DIVA vaccines and companion diagnostic tests for FMD and CSF
• ASF vaccines
Novel FMD Vaccines Under Development

- Human Adenovirus 5 Vectored FMD Vaccines
- Inactivated Leaderless LL3B3D FMD Vaccines
- Alphavirus-vectored FMD Vaccines
- Plasmid DNA Vaccines
R & D Innovations Needed

• Data management and sharing
  – Herd specific information on biosecurity, surveillance, health status needed for movement permits
  – Tracking all vaccinated animals and diagnostic testing results.

• Develop interferon or other antiviral biotherapeutic products for inducing rapid and medium term resistance (1 day to 14 days) to FMD infection (a long term goal).

http://www.cfsph.iastate.edu/Secure-Food-Supply/index.php
R & D Innovations Needed

• Develop and adopt available technologies and scalable information technologies for identifying and tracking all vaccinated animals and diagnostic testing results.

• Develop interferon or other antiviral biotherapeutic products for inducing rapid and medium term resistance (1 day to 14 days) to FMD infection (a long term goal).

http://www.cfsph.iastate.edu/Secure-Food-Supply/index.php
R & D Innovations Needed

Economic incentives for biologics companies to license and produce vaccines for transboundary livestock and poultry diseases