CLASSICAL SWINE FEVER STANDARD OPERATING PROCEDURES:
3. SURVEILLANCE

FAD PReP
Foreign Animal Disease Preparedness & Response Plan

USDA

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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 **November 2013.** Please send questions or comments to:

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Contents

3.1 Introduction

Surveillance is a critical activity during an outbreak of classical swine fever (CSF). Surveillance helps to control and contain the spread of the disease and assists with eradication. The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) will coordinate national surveillance activities. This standard operating procedure (SOP) provides the Disease Surveillance Branch, Situation Unit, and other associated Incident Command (IC) personnel with guidance on developing a surveillance plan and conducting surveillance activities in the field.

Several APHIS Foreign Animal Disease Preparedness and Response Plan (FAD PReP) documents complement this SOP and provide further detail when necessary. This SOP references the following APHIS documents.

- FAD Investigation Manual (FAD PReP Manual 4-0)
- SOPs:
    - Cleaning and Disinfection
    - Health and Safety/Personal Protective Equipment (PPE)

Additionally, the FAD PReP/National Animal Health Emergency Management System (NAHEMS) Guidelines: Surveillance, Epidemiology, and Tracing will discuss surveillance activities. Surveillance guidance for a CSF outbreak is also found in the CSF Response Plan: The Red Book.

For those who have access to the APHIS intranet, many of these documents are available on the internal APHIS FAD PReP website: http://inside.aphis.usda.gov/vs/em/fadprep.shtml. These documents are also available publicly here: http://www.aphis.usda.gov/animal_health/emergency_management/.

CSF surveillance is proactively conducted in the United States through the CSF Surveillance Program. This program, USDA collaboration with the National Animal Health Laboratory Network (also known as NAHLN), conducts passive and active surveillance in five swine populations (listed below) through tissue and serology samples:

- Sick pigs submitted to diagnostic laboratories,
- Pigs condemned at slaughter by USDA Food Safety Inspection Service,
- High-risk swine populations, including waste-feeding operations and high-risk swine herds,
- Feral swine, and
- Swine foreign animal disease investigations submitted to the Foreign Animal Disease Diagnostic Laboratory as suspicious for CSF.

In the event of a CSF outbreak, additional, targeted surveillance would occur with the objective of not only detecting CSF-infected swine, but to determine the extent of the outbreak. This SOP discusses outbreak surveillance. The CSF Surveillance Plan, for routine passive and active

surveillance, can be found here:
http://www.aphis.usda.gov/vs/nahss/swine/csf/CSF_PM_2007_AppendB_SurvPlan.pdf .

3.1.1 Goals

3.1.1.1 Preparedness Goals

In an outbreak of CSF, the preparedness goals of the IC are the following:

- Develop capabilities and relationships to produce surveillance plans within 24-48 hours of a confirmed outbreak.

- Develop effective surveillance plans that can achieve desired outcomes by leveraging available resources, satisfying jurisdictional requirements, and implementing continuity of business plans.

3.1.1.2 Response Goals

In an outbreak of CSF, the surveillance goals of the IC are the following:

- Implement surveillance plans within 48 hours of the confirmation of an outbreak.

- Implement a surveillance plan that will (1) define the present extent of CSF and (2) detect unknown Infected Premises (IP) quickly.

- Have the surveillance plan consider the susceptible wildlife population in the area, and coordinate with APHIS Wildlife Services, the U.S. Department of Interior, State wildlife agencies, and State agriculture departments to perform appropriate CSF surveillance in these populations.

- Provide complete surveillance data summaries and data analysis at intervals as specified by IC.

3.1.2 Guidelines

In the first hours following the detection of CSF, there will be multiple requests for surveillance activities. Observe the following guidelines for appropriate surveillance activities in a CSF outbreak.

Surveillance plans are required to (1) establish priorities for observational surveillance and diagnostic testing based surveillance within the Control Area (CA) (which includes an Infected Zone [IZ] and Buffer Zone [BZ]) and Surveillance Zone (SZ), (2) establish priorities for Contact Premises (CP) or Suspect Premises (SP), and (3) to establish priorities for premises located within the CA seeking to demonstrate freedom from infection CSF infection. The following are example objectives of surveillance activities:

- Detect CSF IP during an outbreak.

- Determine the size and extent of a CSF outbreak.

- Supply information to evaluate outbreak control activities.

- Provide information for animal and product movement within the CA.

- Provide information for animal and product movement out of the CA.

- Prove disease freedom (DF) and regain CSF-free status after eradication of the outbreak.

3.1.3 Coordination

The following activities need to be coordinated by these entities in the event of a CSF outbreak.

- *Preparation of current maps of the Infected, Buffer, and SZ*: Coordination between the Animal Movement and Permits Group in the Disease Support Branch (Operations Section), and the Epidemiology Cell and Geographic Information Systems (GIS) Cell of the Situation Unit (Planning Section).

- *Development of specific surveillance plans for premises and zones*: Disease Surveillance Branch (Operations Section) and Situation Unit (Planning Section).

- *Biosecurity and safety measures*: Coordinate with the Animal Biosecurity and Disease Prevention Group in the Disease Support Branch (Operations Section) and the Medical Unit (Logistics Section).

- *Reporting of accurate disease information*: Disease Surveillance Branch (Operations Section) and Situation Unit (Planning Section), particularly the Disease Reporting Cell.

- *Responding to diagnostic laboratory results through surveillance*: Disease Surveillance Branch (Operations Section) and Situation Unit (Planning Section).

3.1.4 Assumed Ongoing or Completed Response Activities

These procedures assume the following outbreak response activities are in progress or have been completed before surveillance measures are in place:

- Disease confirmation—completed/ongoing

- Quarantine—ongoing

- Biosecurity procedures—ongoing

- Security measures and crowd control—completed/ongoing

- Health and safety procedures—ongoing.

3.2 Purpose

This SOP provides USDA APHIS Veterinary Services (VS), IC personnel, and other official response personnel with guidance on technical and logistical surveillance procedures. The guidance in this SOP is relevant in CSF outbreaks of varying sizes, whether the outbreak is isolated to a single premises or spans across a region to numerous premises because the Incident Command System (ICS) from which this SOP is based is both flexible and scalable.

The procedures serve as guidance for the Disease Surveillance Branch (Operations Section), Situation Unit (Planning Section), and other associated IC personnel involved in surveillance activities.

These are sample guidelines. This SOP provides recommendations regarding sampling sizes and sampling frequencies for premises located in the IZ, BZ, and SZ and for providing evidence of DF for premises that do not require daily animal or product movement (for example, weaned pigs) for business continuity.

Surveillance will be conducted at intervals as specified by the IC using the most current scientific information and best practice guidance available.

This SOP provides recommendations regarding sampling sizes and sampling frequencies for (1) premises located in the IZ, BZ, SZ, (2) proof of DF that do not require daily animal or product movement (for example, weaned pigs) for business continuity, and (3) guidance for surveillance activities from the IC.

3.3   Responsibilities

At the APHIS level, Science, Technology, and Analysis Services (STAS) and Surveillance, Preparedness, and Response Services (SPRS) design and implement surveillance plans, respectively. In the ICS, the Disease Surveillance Branch (Operations Section) in conjunction with the Situation Unit (Planning Section) are responsible for collecting, tabulating, and reporting surveillance information. Figure 3-1 provides an example ICS organizational structure. Surveillance is designed to define the extent of the disease, detect new outbreaks, and establish disease-free zones. It is necessary to help control and contain the spread of the disease.

The number of personnel and the organizational structure may vary depending on the size and complexity of the incident. The roles and responsibilities of personnel may also change throughout the incident. Large scale incidents may involve more than one premises, and may affect large geographic areas. Personnel requirements may evolve as the response progresses. All responsibilities will be designated to available and qualified personnel. The ICS structure presented here, and the responsibilities, are presented as guidance.

3.3.1 Disease Surveillance Branch (Operations Section) and Situation Unit (Planning Section)

Collaboratively, the cells within the Disease Surveillance Branch (Operations Section) and the Situation Unit (Planning Section) will monitor the location and boundaries of the infected livestock to detect new outbreaks and prevent the dissemination of the infectious agent. Together, these entities work in a coordinated manner to ensure adequate surveillance to support information-based decisions and to regain "CSF-free" status as soon as possible. These entities have the responsibility to

- establish case definitions and classifications (such as suspect or confirmed);
- identify disease control zones (Infected, Buffer, or Surveillance);
- determine premises classifications (such as Infected, Contact, or Free);
- collect surveillance data;
- assess information;

- support requests for movement permits; and

- report on findings.

3.3.2 Disease Reporting Officer

The Disease Reporting Officer, in the Situation Unit (Planning Section), is responsible for coordinating surveillance activities with the cooperation of the Disease Surveillance Branch Leader (Operations Section). This individual

- directs the activities of the Disease Reporting Cell, including veterinarians, Emergency Management Response System (EMRS) data entry specialists, and other data entry personnel as well as laboratory specialists;

- supervises the preparation, review, and entry of field investigation data, movement data, and contiguous premises data;

- supervises and organizes the orderly, efficient retrieval of routine and specialized reports from EMRS;

- coordinates all reports of animal disease investigations and results of laboratory tests, to assure the completeness and accuracy of data entry into EMRS; and

- cooperates with the Epidemiology Cell to summarize epidemiological information.

3.3.3 Disease Surveillance Branch Leader

The Disease Surveillance Branch Leader (Operations Section) supervises the activities of the Disease Surveillance Branch and works in collaboration with the Disease Reporting Officer in the Situation Unit (Planning Section). This individual

- supervises the activities of the branch (Mortality Surveillance Group, Diagnosis and Inspection Group, Disease Survey Group, Vaccination Group, and Tactical Epidemiology Group), ensuring that the surveillance objectives are being achieved through the appropriate use of resources and personnel;

- assists in ensuring data entry into EMRS is coordinated, efficient, and accurate;

- assists in ensuring that samples are collected according to a surveillance plan, and in a biosecure and appropriate manner; and

- supervises the implementation of surveillance plans, particularly as they are revised throughout an outbreak, in conjunction with the Situation Unit (Planning Section).

The command structure and positions below are provided as guidance. Figure 3-1 shows an example ICS structure.

Figure 3-1. Example ICS Structure
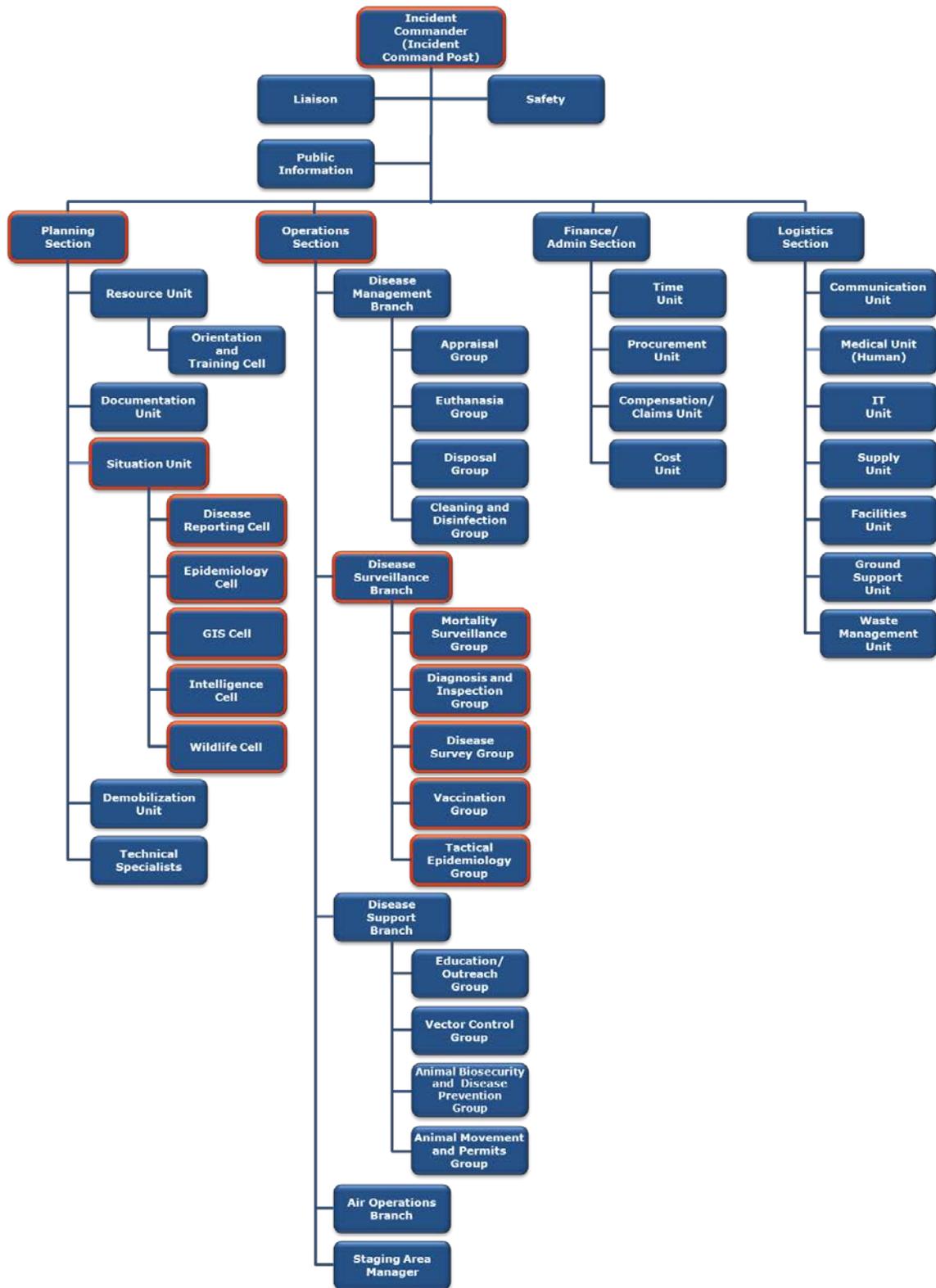
Note: GIS = Geographical Information Systems, IT = Information Technology.

3.4   Surveillance Planning at the Incident Command Post (ICP)

3.4.1 Surveillance Parameters

The Disease Surveillance Branch (Operations Section) in collaboration with the Situation Unit (Planning Section) is responsible, with input from other personnel as required, for developing a surveillance plan for a CSF outbreak. A surveillance plan indicates the frequency, number, and distribution of animals and premises to be sampled. Surveillance plans are developed by selecting combinations and levels of the six tools listed below. Developing a CSF surveillance plan requires tradeoffs to be made among these six surveillance parameters, employing initial information collected, ongoing evaluation of outbreak conditions, and best estimates to many questions listed below. More specific guidance on a surveillance plan for a CSF outbreak is found in Attachment 3.A. The six surveillance parameters are:

1. *Design (threshold) prevalence*: The goal is to determine the lowest feasible prevalence that can be used to detect infected swine on premises. The chosen proportion of animals or premises infected that if exceeded will indicate the disease has been detected for a given confidence level and population size (1 percent vs. 5 percent vs. 15 percent). Factors that influence the design prevalence choice are:

    a. Available tests (such as visual inspection and laboratory)

        i.   The test sensitivity and specificity, and

        ii.   The turn-around time for the test results.

    b. If clinical observation is the selected detection method, at what herd prevalence can the clinical signs be observed?

    c. How severe are the clinical signs?

    d. What is the prevalence of detectable infected swine on the premises given the test selection?

    e. How quickly will there be enough detectably infected swine (such as clinical) so that the chosen test can detect the infected swine?

        i.   Has the disease spread throughout the premises?

        ii.   How many swine herds are detectably ill?

        iii. How long has the disease been on the premises?

2. *Confidence level*: The selected level (for example, 90 percent confident vs. 95 percent confident) that the disease can be detected for the chosen design prevalence, given the population size. Questions to consider are:

    a. At a chosen confidence level, how many samples are required to be taken, given the number of animals or premises?

    b. Does sampling more premises less intensively supply more usable outbreak information than a higher confidence level sampling, where more animals are sampled on fewer premises?

c. Can the same level of overall sampling confidence be achieved by more frequent sampling using a sampling scheme with lower confidence level? For example, does sampling every third day with an 85 percent confident sampling scheme equal sampling once a week with a 95 percent confident sampling scheme?

d. If an infected animal is easily detected early, will choosing a sampling scheme with a lower confidence level achieve acceptable detection results?

3. *Types of tests*: Test choices—clinical inspection, polymerase chain reaction (PCR) testing, serology testing, etc.—and the test cutoff values can influence the design prevalence choice. Each test has a sensitivity and specificity that varies with the cutoff values. Following are questions to consider when selecting tests:

a. What tests are available?

b. What are the test sensitivities (assume that this is a screening test)?

c. Can the test detect infection early in the disease process?

d. Is the test reliable and test results repeatable?

e. Is the test rapid and easy to administer?

f. How much labor is required to take samples of the animals or premises?

g. How many trained personnel are available to administer the test or sample the animals?

h. Is the disease easily transmitted by the sample taker?

i. What is the optimum frequency interval at which the test can be applied?

j. Does the sampling/testing activity seriously disrupt the normal premises work flow?

k. Costs of the tests?

4. *Sample frequency*: Previous negative test results can augment information gained from test day's negative test results if the time period between sampling is short—ideally daily, but definitely less than the incubation period. The value of the previous negative test results decreases as the interval between sampling increases (daily vs. every other day). Below are questions to consider when determining the frequency of sampling:

a. How frequently should the premises in each zone (IZ, BZ, SZ and Free Area [FA]) area be inspected?

b. How long is the disease incubation period?

c. How long is the latent period?

d. How long is the infectious period?

e. How rapidly is the disease spreading through the premises?

f. How likely is the disease to spread to other premises?

5. *Risk-based sampling (target a sub-set of the population with factors that increase the likelihood of infection, e.g., recently introduced animals):* Selecting populations with a higher proportion of infected animals (1 percent vs. 10 percent) reduces the number of

samples needed for a given confidence and population size. Below are several questions to consider:

> a. How many animals are on the farm?
>
> b. Is there a high risk population (assumed higher prevalence rate) that can be sampled to reduce the sample numbers required or is a census or random sample of the premises entire population required?

6. *Sampling scheme*: Within the selected population (risk-based or total population), a random, convenience, or other scheme may be used, and the choice will influence the number of animals/premises sampled. Questions to consider when developing a sampling scheme include:

> a. Is it possible to target a high risk population that should have a higher CSF prevalence rate, for example, sick or dead animals?
>
> b. Will convenience sampling supply the same confidence level as random sampling?
>
> c. Is random sampling possible?

3.4.2 Surveillance Plan

The surveillance plan, created based on the six criteria above, will change as new information becomes available by adjusting the combination of these six surveillance tools. It is expected that the surveillance plan will continue to evolve as new information is incorporated by IC personnel.

In an outbreak, the actions and information needed for outbreak management changes throughout the course of the outbreak. Surveillance will be ongoing during the CSF outbreak (a continuous activity) until last the area/zone is proven disease free. The emphasis of surveillance will change during the response, from finding infected swine herds to demonstrating that there aren't infected animals/premises in an area/zone.

Ideally, every At-Risk Premises (ARP) would be tested/sampled every day, but this is impossible, given the limited resources at hand in any outbreak. The surveillance plan that is to be developed must ensure the information needed to control the outbreak is collected despite restrictions on the availability of resources. This is accomplished by choosing realistic combinations of the six surveillance parameters.

To optimize the available resources, surveillance during an outbreak will be coordinated by the Unified Command within the affected areas with support and additional guidance as needed from APHIS and other State, Tribal, and Federal officials or the multi-agency coordination groups as needed. STAS and SPRS design and implement surveillance plans, respectively.

The intervals between inspections or surveys will depend on the maximum observed incubation period of CSF, the resources available, and the risk of exposure to susceptible animals. Operationally, the epidemiology, tracing, and surveillance teams in the ICP will work together to accomplish the expected outcomes.

Every effort must be made to educate producers about the clinical signs of CSF and to encourage them to report any suspicious symptoms. A case definition for "suspect" herds/animals will provide information about clinical signs that private practitioners and people in daily contact

with herds might see. Information will be widely disseminated by the Joint Information Center explaining how producers should report suspicious findings.

It is likely that a surveillance plan for wildlife will be implemented to determine if CSF is in that population. A veterinarian or wildlife biologist trained to recognize clinical and pathological signs of CSF will investigate suspect cases in wildlife within 24 hours.

For additional information to develop a specific disease response surveillance plan, see the Outbreak Surveillance Toolbox, from the USDA APHIS-VS Centers for Epidemiology and Animal Health (CEAH), available to APHIS employees at http://inside.aphis.usda.gov/vs/ceah/nsu/toolbox/.

3.4.3 Surveillance Objectives by Time Period

There are three key segments of surveillance activity in a CSF outbreak. These segments have distinct objectives and goals to aid in the control and eradication of CSF from domestic swine.

1. *The initial 72 hours post-CSF outbreak declaration*: The objective is to detect existing infected animals and premises as quickly as possible. The goals of IC are to:

    a. Create the initial BZ designation and the boundary of the CA.

    b. Create a list of premises with susceptible herds located in the CA.

    c. Determine the boundary of the SZ and start developing a surveillance plan to be used in the SZ.

2. *The control and eradication period (from initial 72-hour period until the last case is detected and eradicated):* There are four key objectives during this period that must be accomplished simultaneously.

    a. Detect IP, new or existing, so that control measures can be put in place.

    b. Provide evidence that premises are free of CSF, thereby permitting animal and animal product movements in the CA.

    c. Evaluate the outbreak management control activities.

    d. Prove that the FA is free of disease, thereby enabling unrestricted animal and animal product movement.

To attain these four key objectives, the goals of IC are the following:

    a. Evaluate control measures by determining the outbreak's epidemiological curve, numbers of newly IP, and the location of the newly detected IP.

    b. Provide evidence of DF on Monitored Premises (MP) with frequent testing of populations on the premises, ideally targeting populations based on risk disease factors.

    c. Provide evidence of DF on Free Premises (FP) in the SZ and FA by sampling.

      i. Select FP to sample, either randomly or with a risk-based selection process during the quarantine. Sample livestock from the selected premises randomly or sample a targeted population on the premises (sick animals).

      ii. Reduce the size of the BZ by sampling regions that can be separated from the BZ if test results are negative.

3. *Post eradication (quarantine).* The objective is to prove that the CA and FA are free of disease (using World Organization for Animal Health [OIE] recommendations and requirements). To achieve this objective, the goals of IC are the following:

    a. Prove DF on depopulated premises.

    b. Prove DF on ARP in CA by random sampling or targeted sampling (choosing populations based on risk) on selected premises and selected herds.

    c. Prove DF in the FA, following OIE guidelines, using multiple methods including serological slaughter sampling and passive surveillance by veterinarians and the public.

3.5   Activities by Surveillance Personnel

3.5.1 Surveillance Team Field Protocol

The following protocols are provided as guidance for IC Personnel in a CSF outbreak that are performing surveillance activities.

3.5.1.1 Before Leaving the ICP

1. Collect all equipment and supplies needed for the day. Attachment 3.B contains a sample equipment list.

2. Obtain maps and decide on route to the designated survey area.

3. Check Global Positioning System (GPS) unit at designated location.

3.5.1.2 At the Time of Arrival at the Premises

1. Wear the response team identification.

2. Park the vehicle safely on the roadside in the area to be surveyed.

3. Put on your rubber boots as you exit the vehicle. Rubber boots or foot covers (booties) should be worn.

4. Gather supplies (such as quarantine book, clipboard, quarantine signs, duct tape, cable ties, survey forms, and disinfectant spray).

5. Begin to survey the assigned area.

6. Approach the residence and knock on the door or ring the bell to contact the residents. If there is no response, do not walk around the premises in an attempt to locate the residents.

7. Use caution and common sense when entering premises. Avoid any confrontations with residents.

8. Respect any "Beware of Dog" and "No Trespassing" signs.

9. Make a note on the survey sheet if the owner was uncooperative.

3.5.1.3 Objectives to Accomplish While at Each Premises

1. Introduce yourself as members of the response team.

2. Use an interpreter if needed to communicate with the residents.

3. Explain the program and the reason for being at the premises. Make sure the residents understand the need for correct information for the survey.

4. Complete the survey questionnaire as fully as possible. Add additional comments as necessary. Too much information is better than none.

5. Use neat handwriting on your forms. Someone else will be entering this information into the database.

6. Give information fact sheets to the residents and point out the telephone number that they can call if they have any questions or "hot tips."

7. Thank the residents for their cooperation and participation.

8. If you notice animals of any kind and no one is home, complete the survey. Leave information brochures and a copy of the quarantine together and leave them in the door or gate.

9. If sick and/or dying animals are present, call this information in to the ICP.

10. Complete the quarantine for premises that have sick animals and leave a copy with the residents. Note any refusal to sign the quarantine.

11. Hang quarantine signs in a conspicuous spot in appropriate languages, either with cable ties or duct tape.

3.5.1.4 When Departing from the Premises

1. Walk off the premises to the Personnel Decontamination Site.

2. Stop and spray rubber boots or remove foot covers (booties) and dispose of them properly. Spray shoes with disinfectant after leaving each premises.

3. Continue to the next premises and proceed as above, or return to vehicle.

3.5.1.5 When Returning to the Vehicle

1. Upon returning to the vehicle, wash your hands with an alcohol-based hand sanitizer.

2. Sit inside the car with your feet out. Spray your shoes with disinfectant before placing your feet in the car.

3.5.1.6 Before Returning to the ICP at the End of the Day

1. Call the team leader to report that you have completed your task and are returning to the ICP.

2. Run your vehicle through a car wash that cleans the undercarriage. Vacuum the inside of the vehicle, and throw garbage away.

3.5.1.7 Upon Return to the ICP

1. Detach the white and pink copies of the quarantine forms (if applicable), and staple the survey form on top of the white and pink copies of the quarantine form.

2. Turn surveys in to the Group Leader upon completion of the assigned task.

3. The Group Leader is responsible for ensuring that surveys are collected from each team and for seeing that the Situation Unit in the Planning Section receives the completed surveys for data entry.

3.5.1.8 The Surveillance Sample Team Procedures

1. DO NOT enter premises with dead or sick animals. If you observe dead or sick animals, leave the premises and call the Tactical Epidemiology Group.

2. A biosecurity line must be established between the premises and the vehicle. Use the biosecurity procedures and PPE outlined in the CSF Biosecurity and CSF Health and Safety/PPE SOP.

3. Two members of the three-person surveillance team will enter the premises. Using large animal handling equipment, one crew member will hold and handle the animal(s). The other crewmember will collect tissue or serum samples (tonsils are priority tissue sample), and handle tris-buffered tryptose broth (TBTB) tubes.

4. Tissue and serum samples must be collected according to procedures outlined during training and the appropriate section in the Diagnostics SOP.

5. The third crew member is the clean person who remains at the biosecurity line established between the premises and the vehicle. This crew member calls for the premises identification information and takes the decontaminated samples at the biosecurity line and stores them in the ice chest that will be used to transport them. This crew member also processes the trash when the other two crew members return to decontaminate at the biosecurity line prior to returning to the vehicle at the end of the collection.

6. The two crew members who collect the samples should complete the following procedures before transferring the samples across the biosecurity line to the third team member:

    a. Complete the Premises Exam form with owner prior to taking samples.

    b. Confirm the Premises Exam form with owner prior to taking samples.

    c. Complete the Laboratory Submission form.

    d. Attach a label to each of the Laboratory Submission forms.

    e. Label the TBTB tubes with the premises identification number, date, species (if there are multiple species on same premises), and premises owner's name.

    f. Complete a yellow tag. Each yellow tag should include the premises identification number, and the name of the animal owner. Insert the yellow tag into the bags with the TBTB tubes.

    g. Triple bag the TBTB tubes.

7. Photocopy the Laboratory Submission form.

8. Summarize and turn in daily totals the on Sample Summary form to the Team Leader.

3.5.1.9 Waiting Period

It is important to follow appropriate biosecurity procedures while undertaking surveillance activities. Personnel should not travel directly between IP and unknown or uninfected premises. It is important to wait the allotted time between visits. Typically, in addition to following appropriate cleaning and disinfection protocols, personnel wait between 24 – 72 hours between premises visits during a CSF outbreak. *The actual waiting period can be dictated by IC based on particular circumstances in the outbreak.* Team members should not travel from an IP or SP to an unknown or uninfected premises. However, personnel may travel between IP, if proper mitigating procedures are followed.

3.5.2 Training

Having the appropriate training is an important part of responding to a CSF outbreak. There are many options for surveillance training, including AgLearn and APHIS, VS, Professional Development Staff (PDS) Training Courses. In addition, there is substantial information on surveillance, and guidance for developing a surveillance plan in the VS Outbreak Surveillance Toolbox, available to APHIS employees at
http://inside.aphis.usda.gov/vs/ceah/nsu/toolbox/index.html.

All of the following courses are both AgLearn and PDS Training Courses, and have surveillance components:

- *Federal and State Epidemiology Officer Course:* This course is appropriate for Federal and State Epidemiology Officers, and provides them with the tools to effectively manage and direct surveillance programs. At the end of this training, participants should know how to oversee and develop field surveillance strategies and properly evaluate field surveillance activities.

- *Field Epidemiology Training for High Priority and Program Diseases Course*: This course provides problem solving skills related to those diseases for which VS has a control, eradication, or surveillance program. At the end of this training, participants should be familiar with gathering surveillance data and applying epidemiological principles in the field, and developing and implementing herd plans.

- *Program Disease Field Skills Course*: This course provides State and Federal Veterinary Medical Officers (VMOs) and Animal Health Technicians (AHTs) with the skills to effectively perform basic regulatory veterinary field skills, such as surveillance programs. At the end of training, participants will be familiar with sample submission, collection, and basic herd plans.

- *Veterinary Services Careers Program (VSCP): Basic Epidemiology (AHT):* This course is for those accepted to the VSCP curriculum, and specifically designed for AHTs to ensure they can assist VMOs in conducting epidemiological investigations and analyses of animal disease outbreaks.

- *Veterinary Services Careers Program (VSCP): Basic Epidemiology (VMO)*: This course is for those accepted to the VSCP curriculum, and is specifically designed for VMOs to

ensure that newly hired VMOs possess the skill set necessary to conduct epidemiological investigations and analyze animal disease outbreaks.

Attachment 3.A CSF Outbreak Surveillance Guidance and Rationale[1]

These are updated recommendations for classical swine fever (CSF) outbreak surveillance, prepared by the Centers for Epidemiology and Animal Health (CEAH), Science, Technology, and Analysis Services (STAS), Veterinary Services (VS), Animal and Plant Health Inspection Service (APHIS). These guidelines may be updated periodically.

Purpose

The purpose of these guidelines is to provide recommendations for surveillance activities in domestic swine. These are sample guidelines.

These are strategies regarding sampling sizes and sampling frequencies for premises located in the Infected Zone (IZ), Buffer Zone (BZ), Surveillance Zone (SZ), and proof of disease freedom (DF) that do not require daily product movement. Surveillance will be conducted at intervals as specified by the Incident Command (IC) using the most current scientific information and best practice guidance available.

Definitions

There are two key definitions that are important in outbreak surveillance.

- *Clinically ill animals.* Animals with clinical signs of illness compatible with CSF.

- *Detection probability.* Likelihood that the sampling scheme will detect at least one infected animal in each premises or epidemiological unit with 95 percent confidence at the selected design prevalence, population size, and sensitivity of the chosen validated test.

Rationale for Selecting a Design Prevalence

It is difficult to recommend a single surveillance sampling scheme for a CSF outbreak because many factors impact the nature and characteristics of the outbreak. Each outbreak is different; surveillance plans will need to be tailored to individual outbreaks.

General Considerations for Selecting a Design Prevalence

There are a number of general factors that impact the selection of a design prevalence to be used in a CSF surveillance plan. Some of these factors are related to the nature of the CSF outbreak itself, while others are related to the surveillance plan.

- Outbreak or disease related factors:
  - *Prevalence.* (1) proportion of infected animals on the premises, or (2) proportion of Infected Premises (IP) in the area at a specific time period.

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[1] This guidance is also found in the appendices of the CSF Response Plan: The Red Book.

- *Incubation Period*. Length of the period that elapses between the introduction of the pathogen into the animal and the occurrence of the first clinical signs.
- *Transmission and Generation*. Length of time between when one animal is infected, becomes infectious, and infects another animal.
- *Ease of Recognition*. The ease of recognition of clinical signs of CSF in affected species.
- *Time*. The length of time which has passed since the disease was introduced to the premises or area.
- *Herd Size*. Number of animals on a given premises.
- *Density of Premises*. Number of IP in a given area.
- Surveillance plan factors:
  - *Resources*. Resources that are available for sample collection or visual observation, including personnel.
  - *Diagnostics*. Tests that are available, including how many animals must be tested, and what type of sample (tissue, serum) is needed.
  - *Detection Time*. How long it takes before a test can detect the presence of classical swine fever virus (CSFV) in an animal. For example, does the test require the animal to be clinically ill or can it detect prior to visual signs.
  - *Test Sensitivity*. The estimated proportion of true diseased or infected animals that will test positive.
  - *Test Specificity*. The estimated proportion of true non-diseased or non-infected animals that will test negative.
  - *Frequency*. How often samples must be collected and diagnostic tests must be conducted for effective surveillance.
  - *Goal of Surveillance*. A surveillance scheme will depend on whether the goal is to prove DF or detect disease in a vaccinated or unvaccinated population.
  - *Confidence Level*. The probability of accepting the null hypothesis when it is true; choosing a confidence level (e.g., 90 percent, 95 percent, or 99 percent) for the surveillance plan.

All of the factors listed above are interrelated. Table 3A-1 lists the factors and general surveillance design in an outbreak response effort. It is important to consider all factors together, rather than independently, when developing a surveillance plan.

**Table 3A-1. Interaction of Disease/Outbreak and Surveillance Factors,
with Suggested Adaptations in Surveillance Scheme**

Disease/Outbreak Factor	Surveillance Factors						
	Design Prevalence	Sampling Frequency	Visual/ Observational Exam (lower sensitivity test)	Animal Handling	Test Sensitivity	Early Detection	Tissue Testing (higher sensitivity test)
Shorter incubation period	Increase	Increase	Use, depending on strength of clinical signs	Decrease	Less important	Increased likelihood	Less important
Strong clinical signs	Increase	Depends	Use	Decrease	Less important	Increased likelihood	Less important
Size of epidemiological unit	Decrease	Frequent	Depends	Depends	More important	Depends	More important
Increased prevalence	Decrease	Less frequent	Depends	Depends	Less important	Depends	Less important

Reasons to Select a Low Design Prevalence

It is impossible to select one disease factor and one surveillance factor from Table 3A-1 and to understand how the surveillance factor should change based on that one disease factor independently of the other factors. However, if possible, it is always desired to (1) select the test that detects CSFV as early as possible, and (2) use the lowest design prevalence. A low design prevalence is consistent with surveillance schemes used for disease detection, business continuity, and proof of DF.

The reasons for selecting the low design prevalence are as follows.

- CSFV is highly contagious. In a naïve population, the virus multiplies rapidly in multiple animals and spreads quickly throughout the population via direct contact, indirect contact (fomites), and possible aerosol transmission.

- Animals infected with CSFV may become infectious and transmit the virus early in the infectious process (1 to 14 days after exposure, depending on the specific virus and susceptibility of the infected pigs); this may be before clinical signs are apparent.

  - Clinical infection varies from very mild to severe; animals with mild clinical signs may not be detected.

- Low design prevalence will be exceeded rapidly, as CSF spreads quickly through an epidemiological unit, which fosters early disease detection in comparison to a high design prevalence.

- Early detection reduces the time that premises are infectious.

- The CSFV is detectable in lymphoidal and reticuloendothelial tissues (e.g., spleen, lymph nodes, and tonsils [preferred]) before animals display clinical signs.

- Collection of samples required for approved and validated diagnostic tests—such as tissue, whole blood, or serum—requires direct contact with the animal.

- There are no approved and validated mass population or pooled sampling procedures.

- Monitoring feed intake in large swine herds may require more than a few infected animals before signs trigger additional diagnostics.

- It is not likely that the index premises is the first IP; CSFV may be widely dispersed.

  - All IP may be a source for transmission of CSFV.

  - More undetected IP (without movement controls) increases the probability that the CSF outbreak will be widespread.

  - Personnel may unknowingly transmit CSF from clinically normal but infected animals to uninfected animals.

- Following appropriate biosecurity and cleaning and disinfection requirements, surveillance teams can sample approximately 2 premises per day if taking individual animal samples.

Surveillance Scheme Sampling Considerations

Surveillance on susceptible premises should detect the presence of CSFV at the earliest possible moment after viral introduction. This occurs when the virus is detectable, using the lowest possible design prevalence, in tissues or serum.

The choice of the design prevalence depends on (1) the surveillance methodology, (2) the diagnostic test sensitivity, and (3) the chosen confidence level.

At present, there are no validated mass population sampling techniques. It is a priority to validate mass population or pooled sample testing.

The following diagnostic tests will be used in a CSF outbreak to detect and characterize CSFV. Please see the CSF Response Plan: The Red Book for more information.

- Virus isolation

- Avidin-Biotin Complex stain (known as ABC stain)

- Immunoperoxidase

- Ab enzyme-linked immunosorbent assay (ELISA)

- Virus neutralization

- Real-time reverse transcriptase polymerase chain reaction (rRT-PCR)

- Nested PCR.

The rRT-PCR test will be used in an outbreak to detect infected, unvaccinated animals because of its rapid turnaround time (approximately 3 hours).

Given that no mass population sampling techniques are available at this time, the following questions provide guidance to develop a surveillance sampling scheme after declaration of a CSF outbreak in a location or area.

Acute Form (Clinically Ill Animals on Premises)

1. Are resources available to intensively survey premises (for example, collect tissue and whole blood samples from the needed number of clinically ill animals)?

If "yes," then

2. Does evidence suggest the introduction of the virus (the start of the outbreak) on the premises or in the zone began at least 5 days ago but less than 21 days ago?

3. Is there evidence that the CSF serotype is highly pathogenic (a high proportion of the infected animals will show clinical signs and/or severe clinical signs)?

If "yes" to Questions 2 and 3, then

4. Is it likely that the outbreak can be contained locally (for example, on a farm or within a small geographic area)?

5. Are there limited movements of animals, vehicles, products, and personnel on and off premises (in other words, it is unlikely that the virus will be introduced to, or spread from, this premises or zone)?

6. Are the swine operations in the zone managed for low-risks of exposure (for example, biosecurity practices in place, little opportunity for fomite transmission)?

7. Are there few noncommercial swine operations or feral swine in the zone?

8. Are there large swine operations in the zone?

If all or most of the answers to Questions 4–8 are "yes," the minimum surveillance sampling to detect CSFV is observational surveillance with routine visual inspection of swine for clinical signs, and targeted tissue sampling of individual animals with clinical signs.

If all or most of the answers to Questions 4–8 are "no," both animals with clinical signs and those appearing healthy should be sampled.

If the answer to Question 1 is "no," then visual surveillance should be conducted. Laboratory sampling/testing should be initiated upon positive visual exam for verification. Premises must be sampled based on the probability of transmitting CSF (the highest probability premises will be sampled first), whether rRT-PCR or serologic tests are used.

Please see these questions illustrated in Figure 3A-1.

Non-Acute Forms (Convalescent, Asymptomatic, or Pigs with Mild Clinical Signs)

1. Are resources available to intensively survey premises (for example, collect tissue, serum, or whole blood samples from the needed number of clinically ill animals)?

If "yes," then

2. Does evidence suggest that the introduction of virus (the start of the outbreak) on the premises or in the zone began at least 21 days ago?

3. Is there evidence that the CSF serotype is not highly pathogenic (a high proportion of infected animals will show clinical signs and/or severe clinical signs)?

If the answer is "yes" to either Question 2 or 3, then sampling and serological testing of both ill and healthy animals on the premises is necessary.

If the answer to Questions 2 and 3 is "no," then please see the Acute Form flowchart.

Questions 4–8 in the previous section will help design the specific surveillance scheme, but do not influence the test choice or sampling targets.

If the answer to Question 1 is "no," then visual surveillance should be conducted. Laboratory sampling/testing should be initiated upon positive visual exam for verification. Because there may be few or no clinical signs, premises must be sampled based on the probability of transmitting CSF (the highest probability premises will be sampled first), whether rRT-PCR or serologic tests are used.

Please see these questions illustrated in Figure 3A-2.

Figure 3A-1. Surveillance Scheme Sampling Considerations: Acute Form
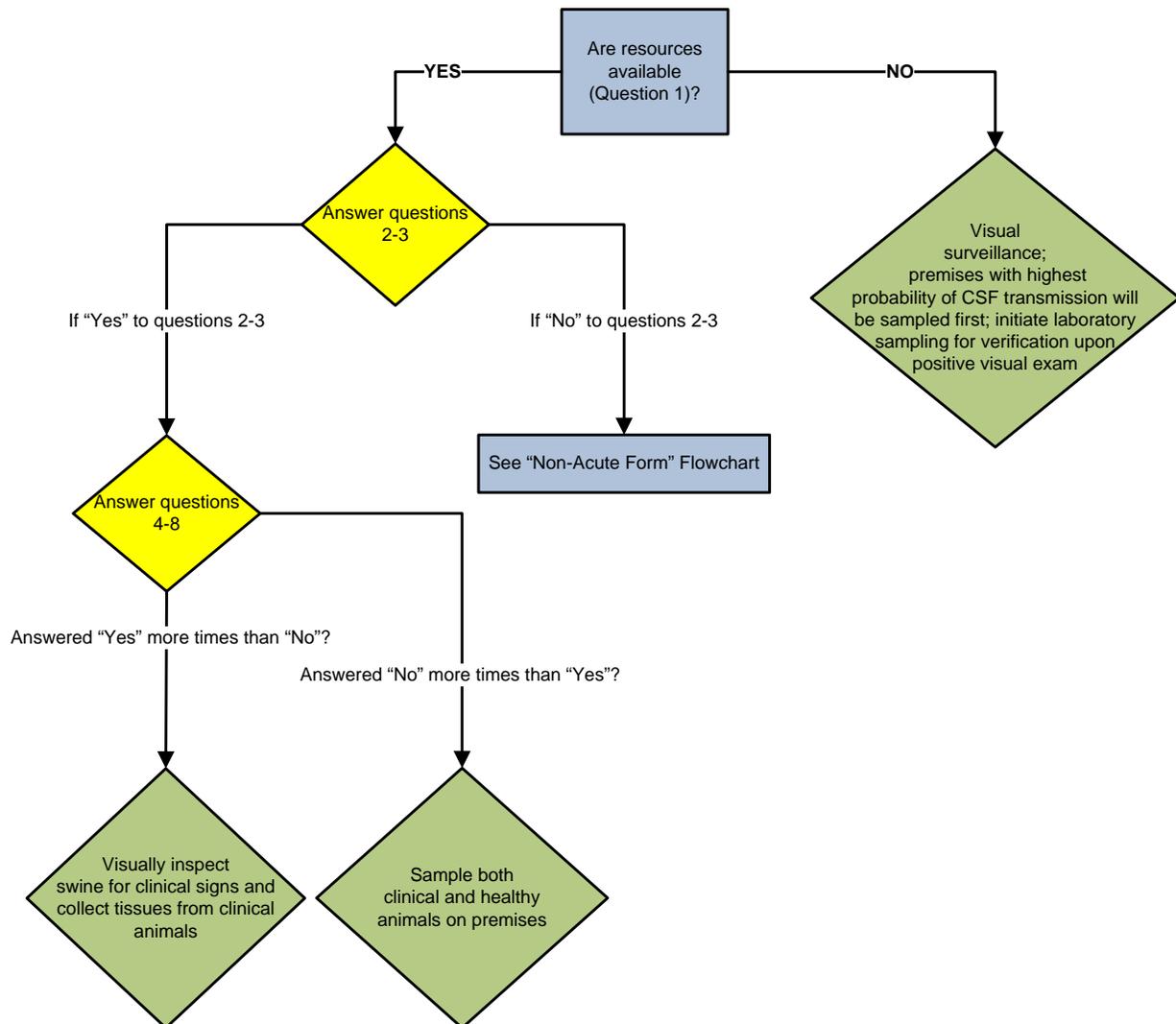
Figure 3A-2. Surveillance Scheme Sampling Considerations: Non-Acute Form
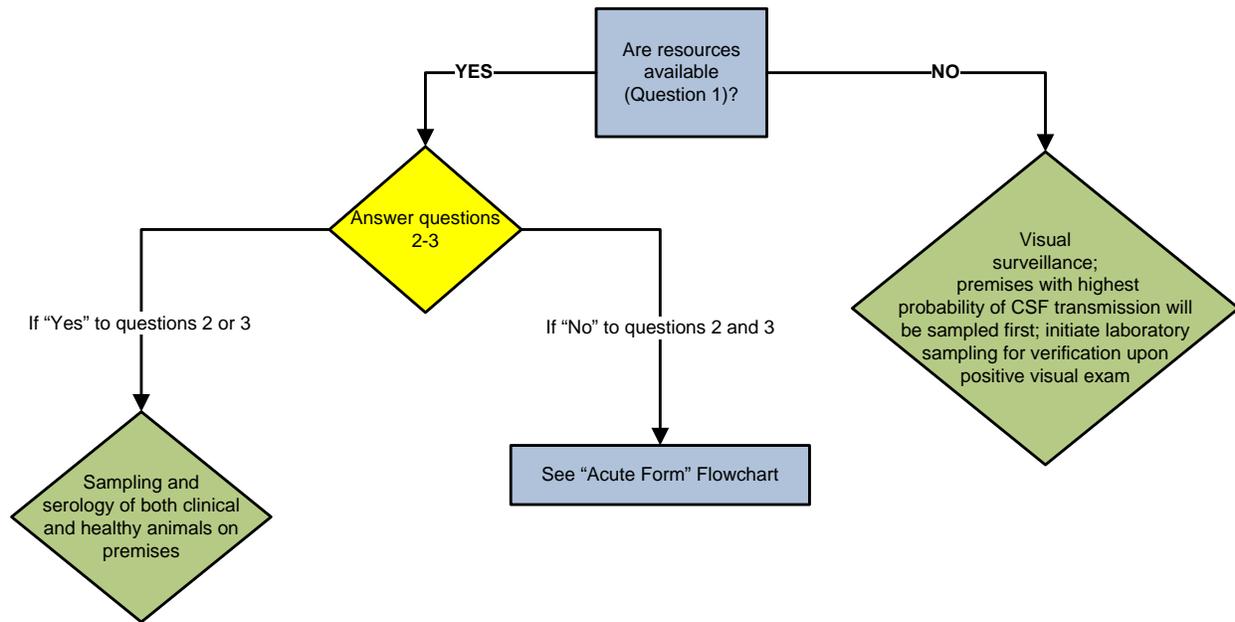
Surveillance Test Choices

The positive predictive value (PPV) of a diagnostic test depends, foremost, on the disease prevalence in the population. The PPV also depends on test specificity and sensitivity. The PPV of any test is poor if the prevalence in the population is less than 5 percent. Early in the disease outbreak, it can be difficult to estimate the prevalence of IP in a given area, or the prevalence of infected animals on a given premises. The goal is always to detect viral presence with the least number of infectious animals. Subsequently, it is important to use the lowest design prevalence possible.

The negative predictive value of a test is best used when the disease is not prevalent (less than 1 percent), the specificity of the test is high, and there is little disease clustering. These conditions, coupled with low design prevalence and negative diagnostic test results, facilitate proving DF in a given population.

As CSF viral prevalence increases, the PPV increases and the specificity of the test plays a minor role in disease detection. With CSF, the rRT-PCR has the ability to detect viral presence earlier than visual examination.

Factors That Influence Diagnostic Test Choice

The choice of a diagnostic test or tests is influenced by a number of choices, including the following:

- *Resources available.*

- *CSF prevalence in the population.* The following factors increase prevalence:

- Highly contagious animals.

- Short incubation period (2 days vs. 2 weeks).

- Number of contacts between infectious and susceptible animals.

- Animals infected with CSFV may become infectious and transmit the virus early in the infectious process (1 to 14 days after exposure, depending on viral virulence and pig susceptibility); this is before clinical signs are apparent.

- Pathogenicity of the virus.

- *Test characteristics.*

  - Prevalence at which the test can detect disease.

    o For example, visual inspection may require approximately 50–75 percent of the herd to be infected before morbidity is likely to appear abnormally high.

  - Speed of test results.

  - Sensitivity.

  - Sampling frequency.

  - Level of animal contact required.

Sampling Alternatives

If resources are not significantly limited, (1) use the lowest intra-premises and inter-premises design threshold, and (2) sample at least three times per incubation period.

If mass population sampling tests become available, substitute these tests for individual animal sampling, and sample frequently.

The following are sampling scheme alternatives to individual sampling using a 1 percent design prevalence.

- Increase the design intra-premises prevalence from 1 to 2 percent, or 5 to 10 percent. With each percent increase, fewer animals will be sampled.

- With a highly contagious CSF viral strain, there will be less time lost between infection and detection when using higher design prevalence. This is because the number of ill animals increases exponentially (for example, if an animal infects 10 other animals vs. only infecting 2 other animals).[2]

  - Visual detection of CSF infected animals will become easier.

- If the CSFV strain has a short incubation period, there will be less time lost between infection and detection using a higher design prevalence because the animals become infectious and display clinical signs rapidly.

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[2] For example, if R_0=2, each animal infects two other animals, so the number of infected animals will increase in the exposed group from 1, 2, 4, 8, etc. But if R_0=5, every animal infects five other animals, so the number of infected animals will increase from 1, 5, 25, 125, etc. (R_0 is the basic reproduction number, or the expected number of cases produced by a single case in a susceptible population.)

- The reverse is true with a CSFV that has a longer incubation period.

Sampling Examples

1. *rRT-PCR*. The rRT-PCR test would be used to sample all clinically ill swine. The remainder of the samples (from the calculated total needed) would be from swine selected from the population without clinical signs. In this population of swine that do not have clinical signs, the prevalence of infected swine is expected to be *less than* in the sub-population of animals with clinical signs.

2. *Visual examination*. Visual examination will occur in the sub-population of animals with clinical signs.

For example, 5 pyretic pigs may be expected each day in a group of 250 pigs (pneumonia, etc.). Visual observation would detect the 5 additional CSF clinically ill pigs, (the prevalence of CSF in the group may vary from 10 to 80 percent). The prevalence of CSF infected animals would be 50 percent in the group of 10 clinically ill animals.

Minimum Sample Sizes

Tissue or whole blood collection from apparently healthy animals/herds is performed to detect subclinical animals as quickly as possible, reducing the risk of virus spread. The selection of an appropriate prevalence level in a CSF outbreak should be based on known or estimated epidemiological findings. Table 3A-2 presents sample sizes based on prevalence levels. Five percent and 10 percent prevalence rates are also provided.

Table 3A-2. Minimum Sample Sizes with Various Design Prevalence Levels Needed to Detect CSF in Apparently Healthy Herds/Animals

Herd Size or Number of Premises	Design Prevalence			
	1%	2%	5%	10%
<=50	ALL	ALL	37	23
51–100	ALL	82	47	27
101–200	164	111	54	28
201–300	199	124	56	29
301–400	222	131	58	29
401–500	237	136	59	30
501–600	248	139	62	30
601–700	256	141	62	30
701–800	262	143	62	30
801–900	268	144	62	30
901–1,000	272	146	62	30
1,001–2,000	292	157	62	30
>2,000	314	157	62	30

Note: These sample sizes are based on an rRT-PCR sensitivity of 95 percent for detecting CSFV in appropriately collected samples from infected pigs. The sizes provide 95 percent confidence that the premises or area has a CSF prevalence less than the design prevalence given that the virus is there and all animals test negative.

Prevalence in this table indicates:

1. If determining the number of animals in a herd, then the within-herd prevalence is the level chosen.

2. If determining the number of herds in a zone to test, then the herd-level prevalence is the level chosen.

Table 3A-3 presents sample sizes, based on prevalence level expected in the group of clinically ill swine on premises. This shows fewer samples are required to detect CSF with clinically ill animals because of the high prevalence of CSF infected animals in the clinically ill animal population. The provided sample sizes in the table are based on within-herd prevalence of CSF infection by the time pigs develop clinical illness.

Table 3A-3. Minimum Sample Sizes with Various Prevalence Levels Needed to Detect CSFV Using Visual Observation with Clinically Ill Animals

Herd Size or Number of Premises	Prevalence		
	40%	60%	80%
<=15	6	4	3
16–75	7	4	3
>75	8	4	3

Note: These sample sizes are based on an rRT-PCR sensitivity of 95 percent for detecting CSFV in appropriately collected samples from infected pigs with clinical signs of infection. The sizes provide 95 percent confidence of detecting infection in a herd or zone, given that it is there at the given prevalence.

Prevalence in this table indicates:

1. If determining the number of animals to test in a herd, then the within-herd prevalence is the level chosen. Thus using rRT-PCR for detection, we have 95 percent confidence of detecting an infected animal in the herd if the prevalence in the herd is 40 to 80 percent.

2. If determining the number of herds in a zone to test, then the herd-level prevalence is the level chosen. Thus using rRT-PCR for detection, we have 95 percent confidence of detecting an infected herd in the zone if the prevalence in the herd is 40 to 80 percent.

Sampling Schemes for Commercial and Noncommercial Premises

The following definitions apply to both commercial and noncommercial premises.

1. *Sampling Unit.* Premises or epidemiological units on premises (pens, barns, or air management units in swine operations, etc.)

2. *Sample.* (1) Visual observation of sick or dead animals followed by rRT-PCR confirmation if suspicion of CSF, (2) Collection of individual animal tissue or whole blood from calculated number of animals or premises and then test with rRT-PCR.

Frequency recommendations are based on the following:

- Short incubation period of CSF (2–14 days).

- Sufficient personnel available for surveillance activities.

- High probability of spreading CSF with frequent inspection/sampling.

- Recommendations for changing frequency of premises inspection/sampling are listed in Table 3A-4 (later in this Attachment).

To calculate sample sizes, the Outbreak Toolbox can be used.[3]

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[3]For the Outbreak Surveillance Toolbox, mentioned throughout this document, please go to http://inside.aphis.usda.gov/vs/ceah/nsu/, or e-mail National.Surveillance.Unit@aphis.usda.gov.

This information is summarized in Tables 3A-5a, b, and c.

CSF Sampling Schemes for Both Commercial and Noncommercial Premises

CSF surveillance sampling recommendations are based on virus/host behavior during the outbreak and the approved tests available. The virus/host behavior is divided into three classes and each viral/host class has general surveillance scheme recommendations.

1. Outbreak where the virus is highly pathogenic and transmissible, with acutely ill pigs.

2. Outbreak where the virus is mildly or slightly pathogenic, with ill pigs that have few or mild clinical signs.

3. Established disease with convalescent, asymptomatic or mildly ill pigs.

Box 3A-1. Important Note on Observational Sampling for Commercial and Noncommercial Premises

> Individual animal sampling is recommended for commercial and noncommercial premises. However, if resources are limited, and in the event it is an acute clinical signs outbreak, observational surveillance may be used in noncommercial premises.

Acute Highly Pathogenic Virus

Infected Zone and Buffer Zone

1. Number of premises to be sampled:

   - Census of premises within zone; sample premises as prioritized by results of epidemiological investigation and continuity of business requirements.

2. Contact Premises (CP), Suspect Premises (SP), and Monitored Premises (MP):

   - Number of animals to be sampled:

     - Observe the herd for CSF compatible signs.

     - If CSF compatible signs are observed, collect samples from the calculated number of animals (Tables 3A-2 and 3A-3) or calculated using the Outbreak Toolbox using a 15 percent design prevalence.

     - A PCR or other acceptable rapid test will be used.

   - Sampling frequency:

     - Collect samples on each premises every 5th day for the duration of the area quarantine or a minimum of 28 days.

     - MP may be sampled more frequently depending on the need to move products, but must be sampled at the minimum listed above. For example, a swine operation needing to ship pigs daily will be evaluated daily. For a finishing pig premises, the premises will be evaluated on each of the 3 days prior to shipping the animals.

3. At-Risk Premises (ARP):

- Number of animals to be sampled:
    - Observe/collect samples from the calculated number of animals (Tables 3A-2 and 3A-3), or calculate using the Outbreak Toolbox, using a 10 percent design prevalence.
        - Add randomly selected animals to pool if necessary to achieve calculated sample size.
        - A PCR or other acceptable rapid test will be used.
- Sampling frequency:
    - Collect samples on each premises every 5th day for the duration of the area quarantine.

Surveillance Zone

1. Number of premises to be sampled:

- Calculate using the Outbreak Toolbox or Cannon formulae.
- Premises to be sampled is based on detecting at least one IP with 95 percent confidence, where
    - IP prevalence equals or exceeds 1 percent of all premises with susceptible animals, or
    - a census, if the number of premises in the zone is small, and
    - in order as prioritized by results of epidemiological investigation and continuity of business requirements.

2. Number of animals to be sampled:

- Collect samples on the premises using a 5 percent design prevalence.
    - Add randomly selected animals to pool if necessary to achieve calculated sample size.
    - A PCR or other acceptable rapid test will be used on clinical animals; an Ab ELISA will be used on blood samples.

3. Sampling frequency:

- Randomly select the calculated number of premises to be sampled (as determined above, such as 60), and collect the appropriate samples on each of the selected premises once during the first 21 day period of the area quarantine. Then,
- Randomly select (include in the sampling list frame the premises sampled in the first 21 day period) and sample an equal number of premises (as calculated above) once during each additional 21 day period of the area quarantine.
    - For example, select and sample 60 premises once during the first 21 day period, then reselect (with replacement) another 60 premises to be sampled in the second 21 day period.

Mildly Pathogenic Virus

Infected Zone and Buffer Zone

1. Number of premises to be sampled:

   - Census of premises within zone; sample premises as prioritized by results of epidemiological investigation and continuity of business requirements.

2. CP, SP, and MP:

   - Number of animals to be sampled:
     - Collect samples from the calculated number of animals (Tables 3A-2 and 3A-3), or calculate using the Outbreak Toolbox, using a 5 percent design prevalence.
       - Add randomly selected animals to pool if necessary to achieve calculated sample size.
       - A PCR or other acceptable rapid test will be used on clinical animals; an Ab ELISA will be used on blood samples.

   - Sampling frequency:
     - Collect samples on each premises every 5th day for the duration of area quarantine or a minimum of 28 days.
     - MP may be sampled more frequently depending on the need to move products, but must be sampled at the minimum listed above. For example, a swine operation needing to ship pigs daily will be evaluated daily. For a finishing pig premises, the premises will be evaluated on each of the 3 days prior to shipping the animals.

3. ARP:

   - Number of animals to be sampled:
     - Collect samples from the calculated number of animals (Tables 3A-2 and 3A-3), or calculate using the Outbreak Toolbox, using a 5 percent design prevalence.
       - Add randomly selected animals to pool if necessary to achieve calculated sample size.
       - A PCR or other acceptable rapid test will be used on clinical animals; an Ab ELISA will be used on blood samples.

   - Sampling frequency:
     - Collect samples on premises every 5th day for duration of area quarantine.

Surveillance Zone

1. Number of premises to be sampled:

   - Calculate using the Outbreak Toolbox or Cannon formulae.

   - Premises to be sampled is based on detecting at least one IP with 95 percent confidence, where

- IP prevalence equals or exceeds 1 percent of all premises with susceptible animals, or

- a census, if the number of premises in the zone is small, and

- in order as prioritized by results of epidemiological investigation and continuity of business requirements.

2. Number of animals to be sampled:

- Collect samples on the premises using a 1 percent design prevalence.

  - Add randomly selected animals to pool if necessary to achieve calculated sample size.

  - A PCR or other acceptable rapid test will be used on clinical animals; an Ab ELISA will be used on blood samples.

3. Sampling frequency:

- Randomly select the calculated number of premises to be sampled (as determined above, such as 60), and collect the appropriate samples on each of the selected premises once during the first 21 day period of the area quarantine. Then,

- Randomly select (include in the sampling list frame the premises sampled in the first 21 day period) and sample an equal number of premises (as calculated above) once during each additional 21 day period of the area quarantine.

  - For example, select and sample 60 premises once during the first 21 day period, then reselect (with replacement) another 60 premises to be sampled in the second 21 day period.

Established Mildly Pathogenic Virus

Infected Zone

1. Number of premises to be sampled:

- Census of premises within zone; sample premises as prioritized by results of epidemiological investigation and continuity of business requirements.

2. CP, SP, and MP:

- Number of animals to be sampled:

  - Collect samples from the calculated number of animals (Tables 3A-2 and 3A-3), or calculated using the Outbreak Toolbox, using a census of animals within the zone.

    o Add randomly selected animals to pool if necessary to achieve calculated sample size.

    o A PCR or other acceptable rapid test will be used on clinical animals; an Ab ELISA will be used on blood samples.

- Sampling frequency:

  - Collect samples on each premises every 7th day for the duration of area quarantine or a minimum of 28 days.

3. ARP:

- Number of animals to be sampled:
  - Collect samples from the calculated number of animals (Tables 3A-2 and 3A-3), or calculate using the Outbreak Toolbox, using a census of animals within the zone.
    - Add randomly selected animals to pool if necessary to achieve calculated sample size.
    - A PCR or other acceptable rapid test will be used on clinical animals; an Ab ELISA will be used on blood samples.
- Sampling frequency:
  - Collect samples on each premises every 14th day for the duration of area quarantine.

Buffer Zone

1. Number of premises to be sampled:

   - Calculate using the Outbreak Toolbox or Cannon formulae.
   - Premises to be sampled is based on detecting at least one IP with 95 percent confidence, where
     - IP prevalence equals or exceeds 2 percent of all premises with susceptible animals, or
     - a census, if the number of premises in the zone is small, and
     - in order as prioritized by results of epidemiological investigation and continuity of business requirements.

2. CP, SP, and MP:

   - Number of animals to be sampled:
     - Collect samples from the calculated number of animals (Tables 3A-2 and 3A-3), or calculate using the Outbreak Toolbox, using a 2 percent design prevalence.
       - Add randomly selected animals to pool if necessary to achieve calculated sample size.
       - A PCR or other acceptable rapid test will be used on clinical animals; an Ab ELISA will be used on blood samples.
   - Sampling frequency:
     - Collect samples on each premises every 14th day for the duration of area quarantine or a minimum of 28 days.

3. ARP:

   - Number of animals to be sampled:
     - Collect samples from the calculated number of animals (Tables 3A-2 and 3A-3), or calculate using the Outbreak Toolbox, using a 2 percent design prevalence.

- o Add randomly selected animals to pool if necessary to achieve calculated sample size.
- o A PCR or other acceptable rapid test will be used on clinical animals; an Ab ELISA will be used on blood samples.

- Sampling frequency:
  - Collect samples on each premises every 14th day for the duration of area quarantine.

Surveillance Zone

1. Number of premises to be sampled:

   - Calculate using the Outbreak Toolbox or Cannon formulae.

   - Premises to be sampled is based on detecting at least one IP with 95 percent confidence, where
     - IP prevalence equals or exceeds 1 percent of all premises with susceptible animals, or
     - a census, if the number of premises in the zone is small, and
     - in order as prioritized by results of epidemiological investigation and continuity of business requirements.

2. Number of animals to be sampled:

   - Collect samples on the premises using a 1 percent design prevalence.
     - Add randomly selected animals to pool if necessary to achieve calculated sample size.
     - A PCR or other acceptable rapid test will be used on clinical animals; an Ab ELISA will be used on blood samples.

3. Sampling frequency:

   - Randomly select the calculated number of premises to be sampled (as determined above, such as 60), and collect the appropriate samples on each of the selected premises once during the first 21 day period of the area quarantine. Then,

   - Randomly select (include in the sampling list frame the premises sampled in the first 21 day period) and sample an equal number of premises (as calculated above) once during each additional 21 day period of the area quarantine.
     - For example, select and sample 60 premises once during the first 21 day period, then reselect (with replacement) another 60 premises to be sampled in the second 21 day period.

Proof of Disease Freedom Surveillance

1. Surveillance samples will be tested using the Ab ELISA that demonstrates exposure to the virus, thus, adding a time element into the surveillance scheme. Additionally, there will be

enhanced passive clinical surveillance with accepted testing protocols of suspect cases, surveillance in slaughter plants, and enhanced surveillance in markets and shows. Surveillance for proof of DF starts 21 days (World Organization for Animal Health [OIE] recommendation) after depopulation of the last IP.

2. The goal is to demonstrate that all premises are disease free at the design prevalence level because diagnostic tests are negative. OIE recommends intensifying surveillance schemes in conjunction with (1) active investigation of herds with suspicious clinical signs, and (2) increased slaughter serosurveillance.

Commercial Premises (Disease Freedom)

Infected Zone, Buffer Zone, and Surveillance Zone

1. Number of premises to be sampled:

   - Calculate using the Outbreak Toolbox or Cannon formulae.

   - Premises to be sampled is based on detecting at least one IP with 95 percent confidence, where

     - the IP prevalence equals or exceeds 1 percent of all premises with susceptible animals in the IZ.

2. Number of animals to be sampled per herd:

   - Calculate using the Outbreak Toolbox or Cannon formulae.

   - Number of animals to be sampled is based on detecting at least one IP with 95 percent confidence, where

     - IP prevalence equals or exceeds 5 percent where the maximum animals sampled doesn't exceed 60 animals per herd.

3. Sampling frequency:

   - Sample the number of premises calculated above (for example, 60 premises one time each) during a 3-month period after the outbreak has been eradicated.

Noncommercial Premises (Disease Freedom)

Infected Zone, Buffer Zone, and Surveillance Zone

1. Number of premises to be sampled:

   - Calculate using the Outbreak Toolbox or Cannon formulae.

   - Premises to be sampled is based on detecting at least one IP with 95 percent confidence, where

     - the IP prevalence equals or exceeds 1 percent of all premises with susceptible animals in the IZ.

2. Number of animals to be sampled per herd:

   - Calculate using the Outbreak Toolbox or Cannon formulae.

- Number of animals to be sampled is based on detecting at least one IP with 95 percent confidence, where

  - IP prevalence equals or exceeds 1 percent where the maximum number of animals sampled doesn't exceed 60 animals per herd.

3. Sampling frequency:

- Sample the number of premises calculated above (for example, 60 premises one time each) during a 3-month period after the outbreak has been eradicated.

Further Surveillance Information

Table 3A-4 shows the incubation periods and sampling frequency.

Table 3A-4. Incubation Period and Sampling Frequency

Estimated Incubation Period Based on Field Information		
Incubation Period	Frequency of Sampling (days between sampling)	
	Minimum (Days)	Maximum (Days)
1 to 2 Days	1	1
3 to 4 Days	2	3
5 to 7 Days	4	6
8 to 14 Days	5	10
> 14 Days	10	

Table 3A-5a summarizes the outbreak surveillance scheme for disease detection in commercial and noncommercial operations for the highly pathogenic viral strain.

Table 3A-5b summarizes the outbreak surveillance scheme for disease detection in commercial and noncommercial operations for the mildly pathogenic virus.

Table 3A-5c summarizes the outbreak surveillance scheme for disease detection in commercial and noncommercial operations for the established mildly pathogenic virus.

Table 3A-5a. Outbreak Surveillance for Disease Detection – Highly Pathogenic Viral Strain

Disease Detection in Commercial and Noncommercial Operations		
CSF Outbreak Response		
14 Day Incubation Period	**Epidemic (Early; < than 1 Month Duration)**	
	Highly Pathogenic Viral Strain (Overt Clinical Signs)	
Sampling	**Infected Zone and Buffer Zone**	**Surveillance Zone[a]**
Number of Premises	Census	1% Design Prevalence*
Free Premises		
Unit	-	-	Individual Animal Sample
Target	-	-	Clinically Sick Pigs & Randomly Selected Animals^
Number of Animals	-	-	5% Design Prevalence*
Test[#]	-	-	PCR/other acceptable rapid test on ill animals (tonsil preferred) and Ab ELISA
Frequency	-	-	Reselect sampling every 21 days
Duration	-	-	
Contact, Suspect, or Monitored Premises[a]		
Unit	Observation/Individual Animal	-
Target	Clinically Sick Pigs	-
Number of Animals	15% Design Prevalence*	-
Test[#]	PCR/other acceptable rapid test	-
Frequency	5 days	-
Duration	Duration of Area Quarantine or 28 day minimum	
At-Risk Premises		
Unit	Observation/Individual Animal	-
Target	Clinically Sick Pigs & Randomly Selected Animals^	-
Number of Animals	10% Design Prevalence*	-
Test[#]	PCR/other acceptable rapid test	-
Frequency	5 days	-
Duration	Duration of Area Quarantine	
Product Movement	Daily sampling and testing is required for moving products or animals each day. For non-daily animal or product movement, sample and test 3 consecutive days prior to animal or product movement.	

Table 3A-5b. Outbreak Surveillance for Disease Detection – Mildly Pathogenic Strain

Disease Detection in Commercial and Noncommercial Operations		
CSF Outbreak Response		
14 Day Incubation Period	**Epidemic (Early; < than 1 Month Duration)**	
	Mildly Pathogenic Viral Strain (Mild Clinical Signs or Asymptomatic Animals)	
Sampling	**Infected Zone and Buffer Zone**	**Surveillance Zone[a]**
Number of Premises	Census	1% Design Prevalence*
Free Premises		
Unit	-	-	Individual Animal Sample
Target	-	-	Clinically Sick Pigs & Randomly Selected Animals^
Number of Animals	-	-	1% Design Prevalence*
Test[#]	-	-	PCR/other acceptable rapid test on ill animals (tonsil preferred) and Ab ELISA
Frequency	-	-	Reselect sampling every 21 days
Duration	-	-	
Contact, Suspect, or Monitored Premises[a]		
Unit	Individual Animal Sample	-
Target	Clinically Sick Pigs & Randomly Selected Animals^	-
Number of Animals	5% Design Prevalence*	-
Test[#]	PCR/other acceptable rapid test on ill animals and Ab ELISA on blood	-
Frequency	5 days	-
Duration	Duration of Area Quarantine or 28 day minimum	
At-Risk Premises		
Unit	Individual Animal Sample	-
Target	Clinically Sick Pigs & Randomly Selected Animals^	-
Number of Animals	5% Design Prevalence*	-
Test[#]	PCR/other acceptable rapid test on ill animals and Ab ELISA on blood	-
Frequency	5 days	-
Duration	Duration of Area Quarantine	
Product Movement	Daily sampling and testing is required for moving products or animals each day. For non-daily animal or product movement, sample and test 3 consecutive days prior to animal or product movement.	

Table 3A-5c. Outbreak Surveillance for Disease Detection – Established Mildly Pathogenic Strain

Disease Detection in Commercial and Noncommercial Operations			
CSF Outbreak Response			
14 Day Incubation Period	**Established (Duration of CSF in Control Area>1 Month Duration)**		
	Established Mildly Pathogenic Viral Strain (Convalescent, Asymptomatic, or Mildly Ill Animals)		
Sampling	**Infected Zone**	**Buffer Zone**	**Surveillance Zone**[a]
Number of Premises	Census	2% Design Prevalence*	1% Design Prevalence*
Free Premises			
Unit	-	-	Individual Animal Sample
Target	-	-	Clinically Sick Pigs & Randomly Selected Animals^
Number of Animals	-	-	1% Design Prevalence*
Test[#]	-	-	PCR/other acceptable rapid test on ill animals (tonsil preferred) and Ab ELISA
Frequency	-	-	Reselect sampling every 21 days
Duration	-	-	
Contact, Suspect, or Monitored Premises[a]			
Unit	Individual Animal Sample	Individual Animal Sample	-
Target	Clinically Sick Pigs & Randomly Selected Animals^	Clinically Sick Pigs & Randomly Selected Animals^	-
Number of Animals	Census	2% Design Prevalence*	-
Test[#]	PCR/other acceptable rapid test on ill animals and Ab ELISA on blood	PCR/other acceptable rapid test on ill animals and Ab ELISA on blood	-
Frequency	7 days	14 days	-
Duration	Duration of Area Quarantine or 28 day minimum	Duration of Area Quarantine or 28 day minimum	-
At-Risk Premises			
Unit	Individual Animal Sample	Individual Animal Sample	-
Target	Clinically Sick Pigs & Randomly Selected Animals^	Clinically Sick Pigs & Randomly Selected Animals^	-
Number of Animals	Census	2% Design Prevalence*	-
Test[#]	PCR/other acceptable rapid test on ill animals and Ab ELISA on blood	PCR/other acceptable rapid test on ill animals and Ab ELISA on blood	-
Frequency	14 days	14 days	-
Duration	Duration of Area Quarantine	Duration of Area Quarantine	-
Product Movement	Daily sampling and testing is required for moving products or animals each day. For non-daily animal or product movement, sample and test 3 consecutive days prior to animal or product movement.		

Notes to Tables 3A-5a, 3A-5b, and 3A-5c.

* Design prevalence is the predetermined proportion of IP (for example, 5 percent) used to calculate the number of premises to be sampled at a specific confidence level (for example, 95 percent) in a population of a given size (for example, 1,000 premises) based on detecting at least one IP.

^ Add randomly selected animals to pool to achieve calculated sample size.

[#] Sample types (whole blood, tissue, etc.) depends on the requirements of the available tests.

[a] Suspect Premises in a Surveillance Zone will be subject to surveillance procedures and diagnostic testing as indicated by relevant authorities.

Table 3A-6 shows surveillance requirements to prove CSF-freedom.

Table 3A-6. Surveillance for Proof of Disease Freedom

Proof of Disease Freedom[#]						
CSF Outbreak Response						
	Commercial			Noncommercial		
Sampling*	Infected Zone[$]	Buffer Zone[$]	Surveillance Zone[$]	Infected Zone[$]	Buffer Zone[$]	Surveillance Zone[$]
Number of Premises	1% Prevalence Threshold[°]	1% Prevalence Threshold[°]	1% Prevalence Threshold[°]	1% Prevalence Threshold[°]	1% Prevalence Threshold[°]	1% Prevalence Threshold[°]
Number of Animals to be Sampled per Herd	5% Prevalence Threshold[&]	5% Prevalence Threshold[&]	5% Prevalence Threshold[&]	1% Prevalence Threshold[&]	1% Prevalence Threshold[&]	1% Prevalence Threshold[&]
Frequency	Sample each premises of the Calculated Number of Premises once during a 3-month period					

[#] Serosurveillance conducted in the area to be proved disease free in addition to any other animal sampling.

[$] Infected, Buffer, and SZs combine as one unit for proof of DF.

[&] Number of animals sero-sampled based on 5 percent prevalence in herd at the 95 percent confidence level where the maximum number of animals sampled per epidemiological unit does not exceed 60 animals.

[°] Prevalence threshold is a predetermined proportion of IP (for example, 5 percent) used to calculate the number of premises to be sampled at a specific confidence level (for example, 95 percent) in a population of a given size (for example, 1,000 premises) based on detecting at least one IP. A census of the premises in a zone will be sampled if there are few premises. Sample premises in order as by epidemiological investigation and continuity of business requirements.

*Sampling Unit used in all Surveillance Schemes: individual animals observation, appropriate individual animal sample or, if available, mass population sampling techniques.

Assumptions for Surveillance Schemes

1. Production parameters will be monitored for indications of CSF intrusion.

2. The consequences of an infected but undetected premises is greater if it is located at the periphery of the BZ vs. the periphery of the IZ:

- Increased opportunity of disease spread due to less stringent movement requirements in the BZ.

- Increased difficulty of surveillance.

  - A larger number of ARP that require sampling.

  - A larger geographic area over which to sample ARP.

3. Increased size of the Control Area (CA): An IP will increase the size of the CA by the radius of the IZ. However, if the newly detected IP is located on the periphery of the BZ, the size of the CA will increase by the radius of the IZ and the BZ.

Figure 3A-3 shows that the size of the CA depends on where the new IP is located.

Figure 3A-3. Infected Premises' Effect on Size of Control Area

New Infected Premises detected in periphery of Infected Zone

New Infected Premises detected in periphery of Buffer Zone
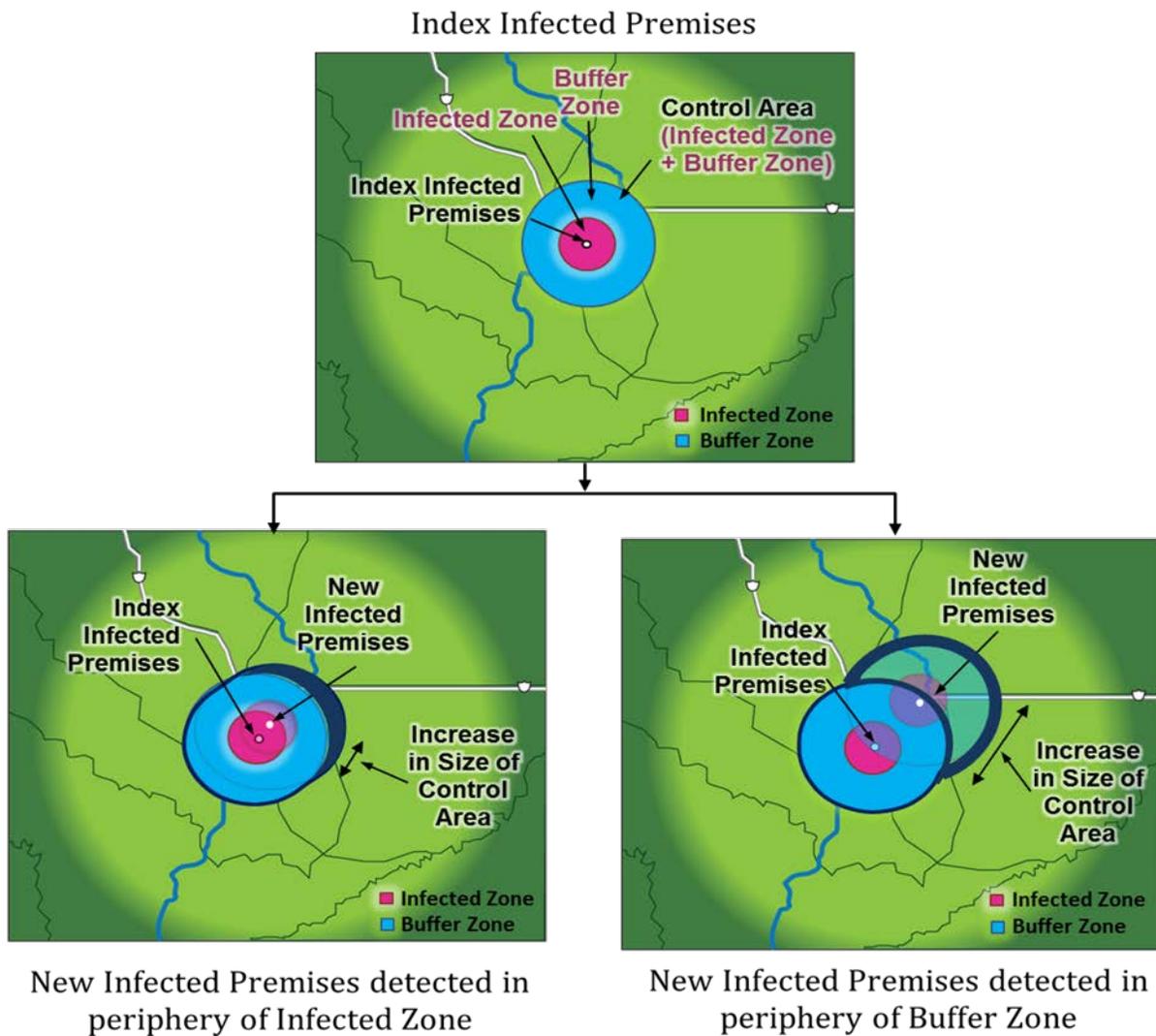
Selected References and Resources

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Attachment 3.B Site Surveillance Equipment List

The surveillance teams needs the following supplies:

- Two 5-gallon water jugs (filled with water)
- One garden sprayer
- Appropriate disinfectants (see CSF Cleaning and Disinfection SOP for list of approved CSF disinfectants)
- Disinfectant sprayer
- Plastic cooler(s)
- Large plastic bags
- Box of zip-lock bags
- Duct tape
- Sponge
- Bucket
- Safety triangles
- Plastic container for water jugs, sprayer, and bucket
- Two felt-tip markers
- Pens
- Stapler
- Scissors
- Highlighter
- Clipboard(s)
- Rubber bands or a binder clip to keep papers together
- Laboratory submission forms
- Flashlight
- Cell phone
- Drinking water or Gatorade
- Maps (county and task)
- Global Positioning System (GPS) unit
- Extra batteries for GPS unit
- CSF information brochures
- Survey forms

- Quarantine forms
- Appropriate personal protective equipment (PPE) (see CSF Health and Safety/PPE SOP)
- Rubber boots
- Waterless hand cleaner
- Paper towels
- Quarantine signs in plastic sleeves (in multiple languages if needed)
- Bag to carry quarantine signs and informational brochures, scissors, tape, etc.
- Plastic cable ties
- Response personnel phone numbers
- Garbage bags
- Official vehicle identification (to be removed at the end of the day)
- Vehicle accident report kit.

Attachment 3.C Abbreviations

AHT	Animal Health Technician
APHIS	Animal and Plant Health Inspection Service
ARP	At-Risk Premises
BZ	Buffer Zone
CA	Control Area
CEAH	Centers for Epidemiology and Animal Health
CP	Contact Premises
CSF	classical swine fever
CSFV	classical swine fever virus
DF	disease freedom
EMRS	Emergency Management Response System
ELISA	enzyme-linked immunosorbent assay
FA	Free Area
FAD PReP	Foreign Animal Disease Preparedness and Response Plan
FP	Free Premises
GIS	geographic information systems
GPS	global positioning system
IC	Incident Command
ICP	Incident Command Post
ICS	Incident Command System
IP	Infected Premises
IZ	Infected Zone
MP	Monitored Premises
NAHEMS	National Animal Health Emergency Management System
NAHLN	National Animal Health Laboratory Network
OIE	World Organization for Animal Health
PCR	polymerase chain reaction
PDS	Professional Development Staff

PPE	personal protective equipment
PPV	positive predictive value
rRT-PCR	real-time reverse transcriptase polymerase chain reaction
SOP	standard operating procedure
SP	Suspect Premises
SPRS	Surveillance, Preparedness, and Response Services
STAS	Science, Technology, and Analysis Services
SZ	Surveillance Zone
TBTB	tris-buffered tryptose broth
USDA	United States Department of Agriculture
VMO	Veterinary Medical Officer
VS	Veterinary Services
VSCP	Veterinary Services Careers Program