Factors to Consider in a Potential Eradication Plan for African Swine Fever in the United States: A White Paper

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Note: The final version of this document will contain the input from stakeholders from Federal and state government and industry. The content of this White paper is the sole responsibility of the authors listed on page 1.

Executive Summary

This white paper presents background information on African swine fever (ASF) (Section 1) and factors to consider in designing an eradication plan should ASF be introduced into the United States and not be eradicated despite intensive efforts during the initial emergency response (Section 2). Section 3 focuses on proposed ASF status of production sites and states, and Section 4 covers approaches to regaining exports. All of the concepts discussed in this white paper need further discussion by USDA Officials, State Animal Health Officials (SAHOs), swine producers, industry associations and packers. **This white paper contains information and suggestions for consideration only.**

The U.S. Swine Health Improvement Plan (US SHIP), a joint industry, state, and federal plan, is in the process of being established (https://usswinehealthimprovementplan.com/). U.S. pork production operations could enroll in US SHIP (when fully implemented and codified as a USDA program) to be ASF and Classical Swine Fever (CSF) monitored certified before an outbreak occurs and during an outbreak. Through this voluntary plan, modeled after the long-standing and successful National Poultry Improvement Plan (NPIP), US SHIP will facilitate early detection of ASF or CSF and enable producers to more quickly demonstrate in an outbreak that their herds are not infected in order to resume intrastate and interstate movements.[7] **This white paper presents information to consider as the U.S. SHIP plan is developed and codified into a USDA program (target Dec 2024).**

Challenges in designing and implementing a long-term ASF eradication plan in domestic swine include:

- Animals may be infected before showing clinical signs and even before testing positive by PCR (Figures 1 and 2)
- Extensive distribution of feral swine (>6 million) that may be infected (Figure 9)
- ASFV survives a range of environmental conditions (Table 1)
- Diversity in size of domestic swine operations (~46,000 operations with less than 25 head; ~93% of the swine inventory is on operations with greater than 2,000 head in 2017)[1] (Figure 4)
- Diversity in number of domestic swine per state (from less than 2,000 market hogs/state to greater than 23 million market hogs/state) (Figure 6) and in annual inshipments of pigs and hogs per state for feeding or breeding purposes (from less than 1,000 inshipments/state to greater than 30 million) (Figure 8)
- Modern swine production is dependent on extensive interstate and intrastate movement of swine (~57 million pigs and hogs moved interstate for feeding or breeding in 2021) (Figures 6 and 7)
- Lack of uniform and effective sanitation and virus elimination of swine transport vehicles, especially market haul trailers returning to growing-pig farm sites from terminal points of concentration, is a major concern for transmission of infectious agents between premises
- Absence of implementation of a national program and modern electronic system for capturing and sharing inter-premises movement of swine in real-time
- Acceptance of pigs that may be infected with ASFV but undetected onto a production site endangers the entire production site and perhaps the production system
- A very high volume of PCR (and potentially antibody) testing may be required to demonstrate, with a high degree of confidence, ASFV freedom to the satisfaction of receiving premises, packing plants, and/or states

- Limited number of sample types approved for regulatory submission to NAHLN laboratories for ASFV PCR testing (Table 2)
- Continuing pressure of ASFV introduction from other countries in this hemisphere, especially if Canada or Mexico become affected

If the emergency response based on Control Areas and managed by a Unified Incident Command (UIC) according to the USDA ASF Red Book **succeeds in eradication of ASF from both domestic and feral swine,** ASF freedom for the U.S. can be re-established three months after the disinfection of the last infected establishment. If infection becomes established in feral swine, freedom of ASF in domestic swine in the nation, a zone, or a compartment can be achieved 12 months after the last case in domestic swine (3 years if ticks are involved in transmission). A single case in domestic swine will likely cause the continued loss of ASF free status in the country, zone, or compartment. If ASF is endemic in feral swine, establishing and maintaining freedom in domestic swine in the nation, a zone, or a compartment will be very challenging.

If ASFV becomes established in feral swine and if domestic swine in the major swine producing states continue to experience outbreaks of ASF, the recommendation discussed in this white paper is for the eradication plan to transition from an emergency response plan based on Control Areas managed by the UIC to a state-based eradication plan. However, the extensive interstate movement of swine makes some states interdependent in terms of ASF infection status.

This white paper recommends modifying the typical state-based eradication plan by proposing that swine production systems dependent on extensive intrastate and/or interstate movement of swine develop a Production System ASF plan within their system for ASF prevention, detection, and eradication to help preserve business continuity. The Production System ASF plan should include biosecurity, surveillance, animal identification, and movement tracing. In addition, it should include a plan for depopulation (which may include controlled marketing), disposal, virus elimination, and recovery of free status after a detection of ASFV in their system (Production System-ASF plan). **Putting the swine production system in charge of ensuring with a high degree of confidence and transparency that the system is protected from ASF and that all animals entering the system, moving between sites in the system, and leaving the system are negative for ASFV should facilitate business continuity for the production system and lessen the burden on states, allowing them to focus on other swine premises and movements.** An observation during the 2022 high pathogenic avian influenza (HPAI) outbreak as compared to the 2015 HPAI outbreak in the Midwest has been that surveillance testing, depopulation, carcass disposal, and virus elimination were more successful with fewer problems when production systems were prepared to manage these aspects under the supervision of federal and state authorities rather than depending on federal contractors.

Production System ASF plans should be submitted to USDA APHIS Veterinary Services and the SAHOs in each state in which they operate for their information (and perhaps approval). Developing an ASF plan before an outbreak could facilitate the outbreak response and contribute to a more rapid resumption of business continuity for the production system. Templates for Production System ASF plans could be developed as guidelines for systems and modified to fit each system's situation. As long as the production system follows the template, it may not be necessary for the USDA or SAHO to approve the plan. A proactive measure could be to routinely collect and archive blood or spleen swabs (pool 5 swabs

per tube and store for 30 (or 60) days) from all pigs that died with no definitive cause prior to an outbreak. In the event of an ASF outbreak, these archived samples could be submitted for ASFV PCR testing during the 72-hour standstill to rapidly establish evidence of freedom from ASF in the production system.

The core technical elements of the US SHIP program are surveillance, movement tracing, and biosecurity including the Secure Pork Supply Plan site biosecurity plans, thus the US SHIP program could be further developed to address the Production System ASF plans. Surveillance methods have been adopted by the US SHIP House of Delegates (but not yet accepted by USDA) to address sampling and testing procedures during an initial emergency response to an ASF introduction.

Section 3 of this document contains suggested methods to categorize the ASF status of premises and states during a long-term ASF eradication program. ASF affected states are proposed to be classified in 1 of 5 stages of ASF status as they work to eliminate ASF from domestic swine in their state (Figure 11). In order for the USDA Chief Veterinary Officer to declare the U.S. free of ASF in domestic swine, all states will need to be free for at least 12 months.

If the U.S. transitions from the emergency response phase of ASF eradication to a long-term eradication plan in domestic swine because of extensive cases of ASF in feral swine, it may take many years to establish freedom in domestic swine in the whole country or even in zones or compartments. All exports of swine and their uncooked products are expected to be lost on Day 1 of a confirmed case of ASF in the U.S. Re-establishing exports requires USDA to negotiate with each trading partner. It will be very important for international food security and for continuity of business for the U.S. swine industry to work toward regaining exports of pork to willing trading partners while continuing efforts to eradicate ASF.

Section 4 of this document discusses approaches to regaining pork exports during an ASF eradication program according to the 2022 World Organization for Animal Health (WOAH) Terrestrial Animal Health Code (TAHC). Potential approaches to regaining exports include:

- Pursuing ASF freedom in all domestic swine in the U.S.
- Establishing regions or zones free of ASF
- Establishing compartments free of ASF

Each of these approaches is likely to be very difficult to achieve and maintain. The 2022 WOAH TAHC Article 15.1.15[2] provides an option unique to ASF for export of fresh meat from a country not free of ASF (Note: “meat” means all edible parts of an animal). Under this option, a packing plant only accepting swine from herds with adequate biosecurity and surveillance to demonstrate freedom from ASF may be qualified to export meat to willing trading partners.[2, 3] The US SHIP program is well positioned to develop and document “export certified” swine packing plants and supply chains utilizing the basic tenets of biosecurity, movement tracing, and surveillance being developed as part of the US SHIP program. As with all other approaches to regaining fresh meat exports, this will require bilateral negotiations with a willing trading partner. Unlike all of the other approaches to regaining pork exports, a single case of ASF in the nation, zone, compartment, or even in the production system would not necessarily cause a loss of ability to export pork from the qualified packing plant.

Introduction

This white paper presents factors to consider and potential approaches for developing an eradication plan for African swine fever (ASF) should it become established in the United States. The white paper has been developed with input from USDA, State Animal Health Officials (SAHOs), and various stakeholders of the U.S. swine industry. The purpose of the white paper is to encourage discussion and consideration of important factors for ASF eradication amongst all regulatory officials and stakeholders. If or when needed, any national ASF eradication plan will be developed and led by the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS).

Extensive work has gone into planning for ASF in swine in the U.S. and these resources have been considered while developing this white paper (See Appendix A). Most current ASF preparedness and response information focuses on prevention of disease introduction, and on initial detection and response. This is appropriate because early detection in domestic and feral swine and an aggressive response provides the best opportunity to eliminate ASF in the U.S.[4]

This white paper assumes ASF has been detected in the U.S. and has not been eradicated despite intensive efforts. If ASF is not rapidly detected and eliminated, eradication in domestic or feral swine, or both, is likely to be a long-term effort which may not be successful, as has been the case in many countries in Europe and Asia. Major differences between states' commercial swine industries and feral swine populations will require state specific plans and responses. The focus of this white paper is on eradication in domestic swine. Eradication in feral swine will require a different approach and is beyond the scope of this white paper. A national commercial swine ASF eradication plan should serve as an umbrella that accommodates different state situations while providing consistent guidance to states to facilitate eradication and a return to disease free status. **Given the difficulty and likely long-term effort needed to eradicate ASF, plans should be developed to regain some exports of pork according to the 2022 World Organization of Animal Health (WOAH) Terrestrial Animal Health Code (TAHC) while the eradication plan proceeds.**

Role of the US Swine Health Improvement Plan (US SHIP) in Establishing Standards Applicable in a Long-Term ASF Eradication Plan

The **Swine Health Improvement Plan project (US SHIP),** funded by USDA APHIS, is working to develop and implement ASF and classical swine fever (CSF) monitored certifications for the pork industry.[7] An objective of the US SHIP project is to enhance ASF-CSF prevention, response and recovery through adoption of a voluntary health monitoring and certification structure derived through the input of industry, state and federal partners. U.S. pork production operations could enroll in US SHIP (when officially codified as a USDA program) to be ASF and CSF monitored certified before an outbreak occurs and during an outbreak. Through this voluntary plan, modeled after the long-standing and successful National Poultry Improvement Plan (NPIP), US SHIP will facilitate early detection of ASF or CSF and enable producers to more quickly demonstrate in an outbreak that their herds are not infected in order to resume intrastate and interstate movements.[7] US SHIP has had two successful House of Delegates meetings during which several program standards have been approved. USDA is continuing to fund the US SHIP project and it is expected to become a codified program involving USDA, states, and various components of the pork industry in late 2024. The US SHIP has a process involving the General

Conference Committee and the House of Delegates for modifying standards and accepting new standards as new information or technologies become available. The USDA will need to review and accept the standards voted on by the House of Delegates. **It is anticipated that US SHIP will play a major role in facilitating detection, response, recovery, and business continuity in future ASF outbreaks in the U.S. after it becomes a USDA Codified Program. However, the structure of the US SHIP is still being formulated. This white paper is intended to present potential approaches to a long-term ASF eradication plan in case ASF is introduced to the U.S. before the US SHIP is fully implemented. It may also stimulate discussion that could be useful as the standards for US SHIP are being developed and codified as a USDA program.**

Section 1: Background Information and Literature Review on African Swine Fever and Experiences with Control of ASF

Background Information and Literature Review on African Swine Fever

Summary of Existing ASF Plans and Resources

Many organizations, including individual states and production systems, have devoted significant time and effort in developing plans and guidance for use in the event ASF is found in the U.S. A national ASF eradication plan should build upon significant efforts already underway including:

The **USDA ASF Red Book** provides strategic guidance for responding to an animal health emergency caused by ASF in the U.S. The Red Book emphasizes initial response actions and critical response activities and tools. This is essential for rapid detection, response and elimination of ASF. There is less guidance on managing a long-term eradication effort which will be necessary if ASF becomes established in feral swine, or if the initial outbreak in commercial and small holder pig premises becomes extensive before effective detection and control measures can be implemented. "The USDA APHIS acknowledges that significant work remains to respond effectively to ASF. Preparing for and responding to an ASF outbreak is and will be a complex effort that requires collaboration and cooperation from all stakeholders." [5]

The **Appendix** contains a list of additional documents related to ASF produced by USDA APHIS and others.

The **Secure Pork Supply Plan** **(SPS)** is a voluntary plan intended to facilitate the intrastate and interstate movement of pigs from uninfected premises located in a control area to further stages of production or harvest during an FAD outbreak.[6]

The **National Pork Board** (NPB) and State Pork Producer Associations are involved in ASF preparedness and response helping pork producers be prepared for and respond to an outbreak of ASF in the U.S. Additional information can be found in the Appendix. AgView is a free, opt-in technology solution from the National Pork Board that helps producers of all sizes and types provide disease status updates and pig movement data to USDA and SAHOs. This promotes business continuity for America's swine producers by making disease traceback and pig movement data available to the USDA and SAHOs in the event of a foreign animal disease outbreak.

The **National Pork Producers Council** **(NPPC)** works with many federal agencies, including USDA, the National Pork Board, American Association of Swine Veterinarians and the Swine Health Information Center on disease preparedness issues. The NPPC advocacy mission would be important in establishing rules and identifying sources of funding for indemnity.

The **Swine Health Information Center (SHIC)** has a mission to protect and enhance the health of the United States swine herd through coordinated global disease monitoring, targeted research investments that minimize the impact of future disease threats, and analysis of swine health data. There is extensive information regarding ASF on the SHIC website.

The **Certified Swine Sample Collector (CSSC) Program**, which is being implemented on a state-by-state basis was funded by USDA APHIS National Animal Disease and Preparedness Program (NADPRP) and the National Pork Board. The purpose is to train and certify individuals working under the authority of a Category 2 Accredited Veterinarian to collect and submit approved samples to a National Animal Health Laboratory Network (NAHLN) laboratory during a foreign animal disease outbreak affecting swine.

The **World Organization for Animal Health (WOAH)** also has extensive information on ASF. The Terrestrial Animal Health Code (TAHC) and the Manual of Diagnostic Tests and Vaccines for Terrestrial Animals are especially important when considering exports of swine and pork.

In summary, a National ASF Eradication Plan can be constructed on the foundation provided by existing federal, state, and industry information and plans for ASF. An ASF eradication program will be managed by USDA and SAHOs and must be mandatory to be successful.

Overview of ASF Characteristics Important in Designing an Eradication Plan

This section reviews important characteristics of ASF and the ASF virus (ASFV) that should be considered when designing an eradication plan. This information may change as more is learned about this disease and virus through research and the experiences of countries currently involved in eradication efforts. To be successful, any eradication plan will need to be flexible and able to adapt to changes or new information about characteristics of the ASFV strains involved.

ASF Virus Genotypes and Virulence

More than 20 genotypes of ASFV have been identified in wildlife cycles in Africa. ASFV ranges from highly pathogenic strains with a nearly 100% case fatality rate in domestic pigs to less virulent isolates causing a milder non-specific illness that is difficult to recognize clinically as ASF.[8, 9] In the 1950s and 1960s, Genotype I ASFV caused outbreaks in various countries in Europe and the Americas (Brazil, Haiti, Dominican Republic). These outbreaks were eventually eradicated, except on the island of Sardinia, where ASF has been endemic since the 1960s.

Genotype II ASFV (Georgia 2007 strain) was introduced into the Caucuses region of Europe in 2007 and has since spread widely across eastern Europe and into central and western Europe and Asia. Recently, it has been found in the Dominican Republic and Haiti. This genotype II virus is typically highly virulent with a very high case fatality rate when initially introduced into a country. However, due to natural mutations, less virulent strains of genotype II ASFV emerged in Europe[10-12] and similarly in China in 2020.[13] This naturally occurring mutation of the highly virulent genotype II ASFV to lower virulence strains may cause non-lethal, sub-acute or chronic disease, and persistent infection. The presence of lower virulence strains will greatly complicate eradication plans.

A genotype II ASFV isolated from pigs in the Dominican Republic in 2021 (ASFV-DR21) caused acute disease in pigs inoculated intramuscularly (IM). However, when inoculated oronasally (ON), there was a

heterogenous pattern of disease ranging from acute infection and euthanasia at 7 days post-inoculation to a milder form of disease lasting until the end of the 28-day observation period. A group of naïve pigs housed with the IM inoculated pigs also had a heterogenous pattern of disease ranging from severe disease and euthanasia between 14 and 21 days after the IM contact group was inoculated. Other contact pigs developed mild disease and survived until the end of the 28-day observation period. A proportion of the ON inoculated animals and the contact exposed animals did develop an acute and fatal disease. Viremia was detected at some point in all infected animals. This suggests that PCR testing of blood swabs from animals that died should detect infection with the ASFV DR21 strain of ASFV in a herd. Surprisingly, no shedding of infectious virus could be detected in any of the oral swabs collected from any of the animals. Viral genome was not detected by qPCR in oral swabs from any of the contact exposed animals.[14]

In October 2021, two genotype I strains of ASFV were reported in China. The isolates share a high similarity to two genotype I ASF viruses found in Portugal in the last century. These viruses were eradicated from Portugal and Spain in the 1990s, after 30 years of effort. They had not been found again anywhere in the field until they emerged in China in 2021.[15] It has been speculated that the strains may have been illegally imported into China for use as an ASF vaccine.[16]

The genotype I strains have longer incubation periods, efficient transmissibility, and cause mild onset of infection and chronic disease[15] when compared to the genotype II strain detected earlier. Infected pigs continuously shed virus and develop low level viremia. There is concern that reassortants of the genotype II and genotype I viruses now circulating in China could emerge in the field with unknown virulence. The presence of genotype I viruses is expected to significantly complicate ASF control and eradication in China.[15]

Walczak et al.[22] demonstrated that intranasal inoculation of 22 pigs with an ASFV isolate obtained from ASFV infected pigs in Poland in 2018 produced various clinical forms of disease (acute, subacute, and chronic).[22] The pigs were divided into three groups with each group receiving a different dose of the virus isolate. In all three groups, pigs exhibited various forms of clinical disease.

ASF has been considered to be a highly contagious disease, however, analysis of outbreaks of ASF in domestic pigs in Europe and experimental studies reveal that the transmission of the highly virulent genotype II strain of ASF virus circulating in Europe is relatively slow.[17, 18] In contrast, the spread of the genotype II ASF virus through China and South East Asia has been very rapid.[19-21] The difference in speed of spread of ASF in Europe as contrasted with Asia could be due to differences including:

- The structure of the domestic swine industry – (biosecurity practices, herd size and production methods)
- Wild and/or feral swine populations – number, proximity to domestic pigs
- Industry and governmental response to the ASF outbreak
- Pork producer compliance with governmental animal health guidance/regulations

Based on the information on strain variation cited above, an ASF eradication plan in the U.S. must be prepared to detect and eradicate diverse clinical forms of ASF disease and ASFV strains such as the highly virulent genotype II viruses introduced in Eurasia and Hispaniola, reduced virulence genotype II viruses derived from the highly virulent viruses circulating in Eurasia and Hispaniola, reduced

virulence genotype I viruses now circulating in China, and any of the ASFV genotypes currently found only in Africa. If an ASF eradication plan for the U.S. is developed, it should be modified as the outbreak unfolds and be focused on the characteristics of the virus strain(s) found in the U.S. and the various clinical forms of disease that may occur.

Kinetics of ASFV Infection, Onset of Clinical Signs, and Diagnostic Detection

As with all viral infections, there is a period of time between infection, onset of clinical signs, and ability to detect infection through diagnostic testing. This period of time is likely to depend on the route of infection, infectious dose, strain of the virus, and immune competency of the pig. Lee et al. (2021) infected pigs by intramuscular injection of a strain of the ASF virus from Viet Nam.[23] They observed that the mean time until onset of clinical signs was 3.7 (+/- 0.5) days (Figure 1). Sampling individual pigs or pen-based oral fluid samples could usually detect infection by the time clinical signs appeared (Figure 2). However, pigs could be infected for at least 3 days before clinical signs or most tests would detect infection. Therefore, **even with clinical observation and testing before movement, there is still potential for moving infected but undetected animals**. The importance of effective biosecurity, epidemiologic tracing, and quarantine of pigs for two incubation periods (30 days) after arrival at their destination for further production is critical.

Figure 1: Daily clinical scores of pigs after intramuscular inoculation of an ASFV strain from Viet Nam (* P<.05).[23]

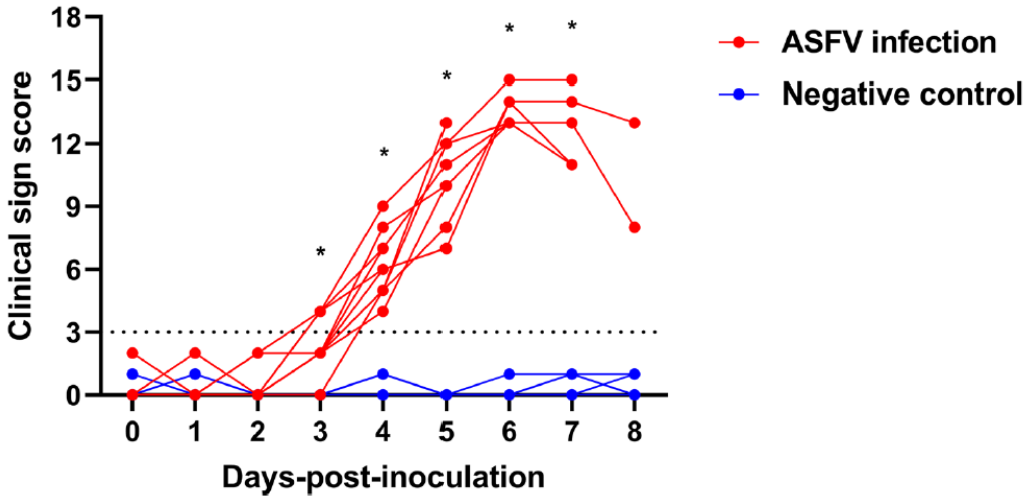
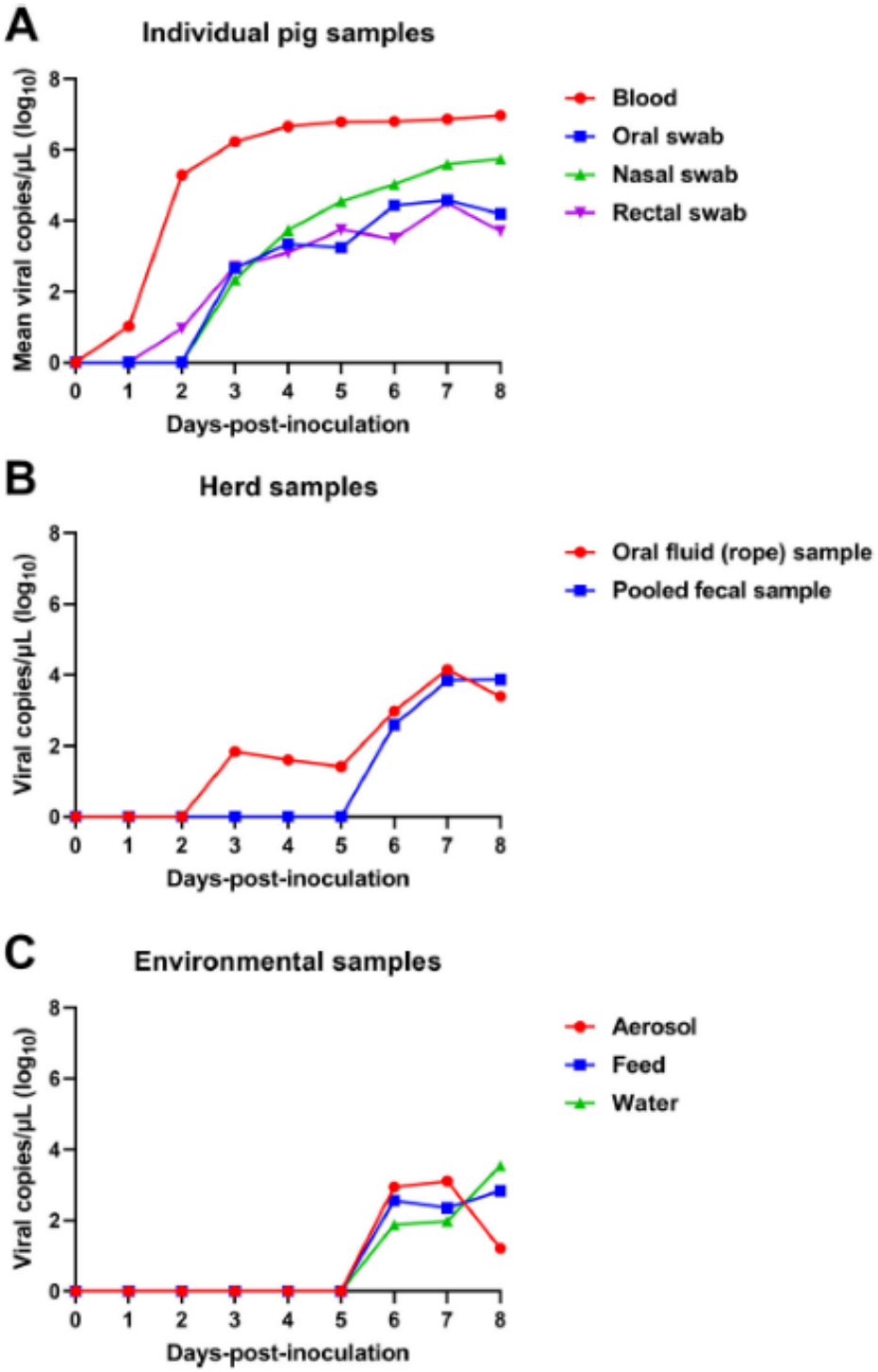


Figure 2: Patterns of ASFV detection observed in pigs after intramuscular inoculation of an ASFV strain from Viet Nam.[23]



ASFV Transmission and Persistence in the Environment

Transmission

- ASFV may be found in all tissues and body fluids of infected swine[24]
- Very high levels can occur in blood[24-26]
- Average time from infection with the highly virulent genotype II ASFV to death is approximately 10 days[27]
- In the absence of the *Ornithodoros spp.* soft tick vector, the most efficient route of virus transmission is via direct contact with blood from infected animals[18, 19]
- Transmission through contact with infected animals mainly happens once clinical disease is evident[18]
- ASF is adapted to low animal densities and does not need high densities of susceptible animals to spread and survive. In contrast, foot and mouth disease (FMD) virus in domestic animals is adapted to high densities of susceptible animals and is typically transmitted directly from animal to animal leading to rapid large outbreaks in susceptible herds. (Figure 3)
- ASFV might spread slowly within a large farm depending mainly on direct contacts between pigs and the level of internal biosecurity.[27] Transmission of ASFV from pigs that die or shed blood in confinement will be reduced if the dead or sick animal is quickly removed and the area is cleaned and disinfected.
- Complete depopulation of an infected herd within 24 hours of detection may be less important for stopping the spread of ASFV than for rapidly transmitted diseases such as FMD or highly pathogenic avian influenza (HPAI)
- Jumps of ASFV over long distances are usually the result of human activities and are therefore unpredictable[19]
- A study in South Korea found that vehicle movements from infected premises were associated with a higher probability of ASFV incursion into a farm than geographic proximity to ASFV-infected wild boar populations[28]

Figure 3: Comparison of FMD, ASF and CSF

Hypothetical disease scenario of three major pig diseases over a period of 2-4 weeks (copied from Busch, 2021[29], citing Depner, et al. 2016[30]), highlighting the differences between ASF, CSF, and FMD. In comparison to FMD and CSF, contagiousness of ASF during the initial phase of an incursion (with highly virulent genotype II) is low to moderate while the case fatality rate is above 90%.

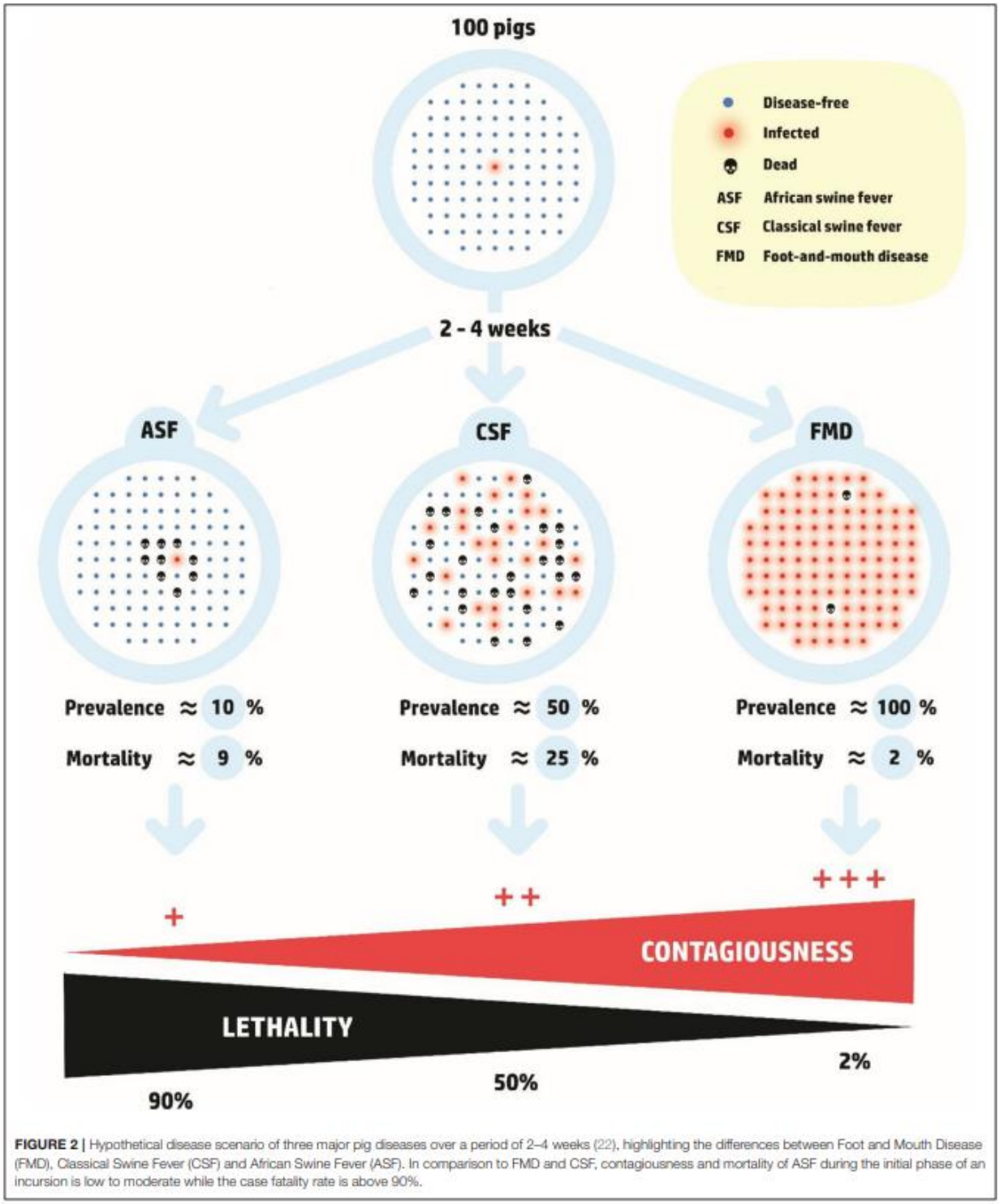


FIGURE 2 | Hypothetical disease scenario of three major pig diseases over a period of 2–4 weeks (22), highlighting the differences between Foot and Mouth Disease (FMD), Classical Swine Fever (CSF) and African Swine Fever (ASF). In comparison to FMD and CSF, contagiousness and mortality of ASF during the initial phase of an incursion is low to moderate while the case fatality rate is above 90%.

ASFV Persistence in the Environment

- Massive environmental contamination can result if blood is shed into soil during necropsies, if pigs develop bloody diarrhea or if carcasses are not properly disposed of
- ASF virus can persist in the environment where blood has been shed or a carcass has decomposed. When a domestic or feral pig investigates the site of bloodshed or a decomposing carcass, it can become infected[18]
- The ASF virus is relatively stable in the environment and resistant to many environmental conditions (Table 1).

Table 1: ASFV Virus Survival in Various Situations[24]

Resilience of ASFV across a variety of environmental conditions

Item	ASFV survival time
Meat with and without bone and ground meat	105 days
Salted meat	182 days
Cooked meat (minimum of 30 minutes at 70 °C)	0
Dried meat	300 days
Smoked and deboned meat	30 days
Frozen meat	1 000 days
Chilled meat	110 days
Offal	105 days
Skin/Fat (even dried)	300 days
Blood stored at 4 °C	18 months
Faeces at room temperature	11 days
Putrefied blood	15 weeks
Contaminated pig pens	1 month

Source: adapted from Scientific Opinion on African swine fever, *EFSA Journal*, 2010; 8(3):1556.
The times given reflect the known or estimated maximum duration and will depend strongly on environmental temperature and humidity.

Cleaning and Disinfection

- A summary of the resistance of ASFV to physical and chemical action is found in the WOAH Technical Disease Card on ASF[31]
- Decontamination of soil contaminated by blood or a decomposing carcass is essential, especially if feral swine may be present

Refer to the WOAH Technical Disease Card on African Swine Fever for additional information on ASFV characteristics.[31]

Feed, Bedding and Forages as a Potential Source of ASFV Transmission

In recent years, the potential for feed and feed ingredients to serve as fomites for virus transmission has been an active area of research. A special issue of Transboundary and Emerging Diseases[32] is dedicated to this topic. Contaminated feed is a concern due to both the potential for transboundary spread of ASFV from positive to negative countries and the potential for spread of ASFV within an already infected country. An ASF eradication plan will need to identify and mitigate the risk of transmission of ASFV in feed from infected domestic and feral swine to ASF negative herds. Research on contamination, detection and mitigation of ASFV in feed is progressing.[33] If an outbreak of ASF occurs in the U.S., a group of leading experts on ASFV contamination, transmission, and mitigation in feed should be convened to apply the latest research findings to mitigate the potential for ASFV transmission in feed.

The European Food Safety Authority (EFSA) convened a panel of experts to provide an opinion on the ability of different matrices to transmit ASFV.[34] The group identified some types of feed which may present a risk for transferring ASFV to a farm, particularly in regions where wild boar contamination is present. They conclude that in areas where ASFV is present in the wild boar population, locally produced hay, straw or grain, farm equipment, and fresh forage provided to pigs may serve as potential sources of ASFV for domestic pigs; notably on backyard farms.[34]

Arthropods as a Potential Source of ASFV Transmission

Soft ticks (*Ornithodoros spp*.) are known to play an important role in the sylvatic cycle of ASFV in warthogs in East Africa. However, soft ticks are not considered to play a role in the epidemiology of ASF in the current epidemic in Central and Eastern Europe.[17]

According to the USDA ASF Red Book (section 4.5.3): "Evidence from recent outbreaks in previously ASF-free countries suggest that ticks may not play an epidemiologically significant role (if any role) in sustained transmission; other modes of direct and indirect transmission pathways should be the focus of control and containment activities."[5] This raises the question of whether insects may be capable of mechanically transmitting ASFV.

Stable flies (*Stomoxys calcitrans*) have been shown experimentally to be capable of transmitting ASFV to pigs after feeding on infected material.[35] Pools of stable flies (62.96%) and biting midges (*Culicoides spp.)* (42.02%) collected from 30 ASFV positive farms in Romania were positive for ASFV DNA.[35] House flies (*Musca domestica)*, blowflies *(Calliphoridae)* and stable flies collected at ASF positive farms in Lithuania were also found to be positive for ASFV DNA.[36] Pig farms in Europe with high biosecurity levels sometimes become infected with ASFV. In Lithuania, 79% to 100% of the ASF outbreaks in 2014 to 2019 occurred between June and August, coinciding with the period of highest insect activity.[36] These observations raise the possibility that insects may serve as mechanical vectors of ASFV and may need to be considered when designing controls and an eradication plan for ASFV. However, there is apparently no direct evidence that flying insects are capable of transmitting ASFV under field conditions.

Characteristics of the Swine Industry and Feral Swine in the U.S.

U.S. Swine Industry

The commercial and smallholder swine industries in the U.S. and feral swine in the U.S. are quite different from those of both Europe and Asia. Therefore, although important lessons can be derived from the experience with ASF in other parts of the world, an ASF eradication plan for the U.S. will need to be tailored to U.S. production systems.

According to the USDA National Agriculture Statistical Service (NASS) in 2017, 70% of the hog operations in the U.S. had fewer than 25 head of swine. However, 93.4% of the US inventory of swine were on hog operations with more than 2,000 head of swine (Figure 4). Eradication in domestic pigs in the U.S. will require that ASFV is eliminated from swine operations of all sizes.[1]

There is extensive interstate movement of swine in the U.S. Estimates are that approximately one million swine are in trucks being moved every weekday. Many are being moved to harvest and others are being moved to other production sites. The modern intensive swine industry depends on extensive

movement for business continuity and to provide sufficient pork for U.S. and international consumers. There is also extreme diversity in the number of market hogs per state (Figure 6) and in the inshipments of pigs and hogs per state (Figure 8).

Figure 4: Number and size of herds (USDA-NASS, 2017)[1]

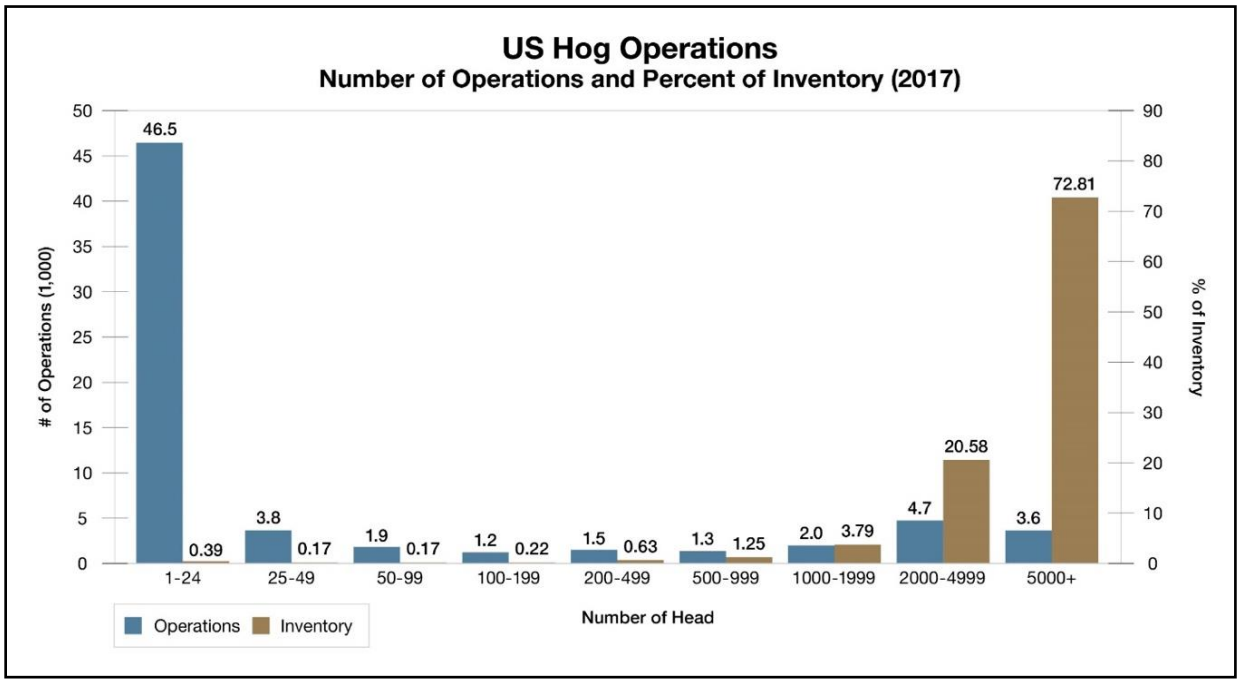


Figure 5: Distribution of swine in the U.S.
(Hogs and pigs inventory and distribution; USDA-NASS, 2017)[1]

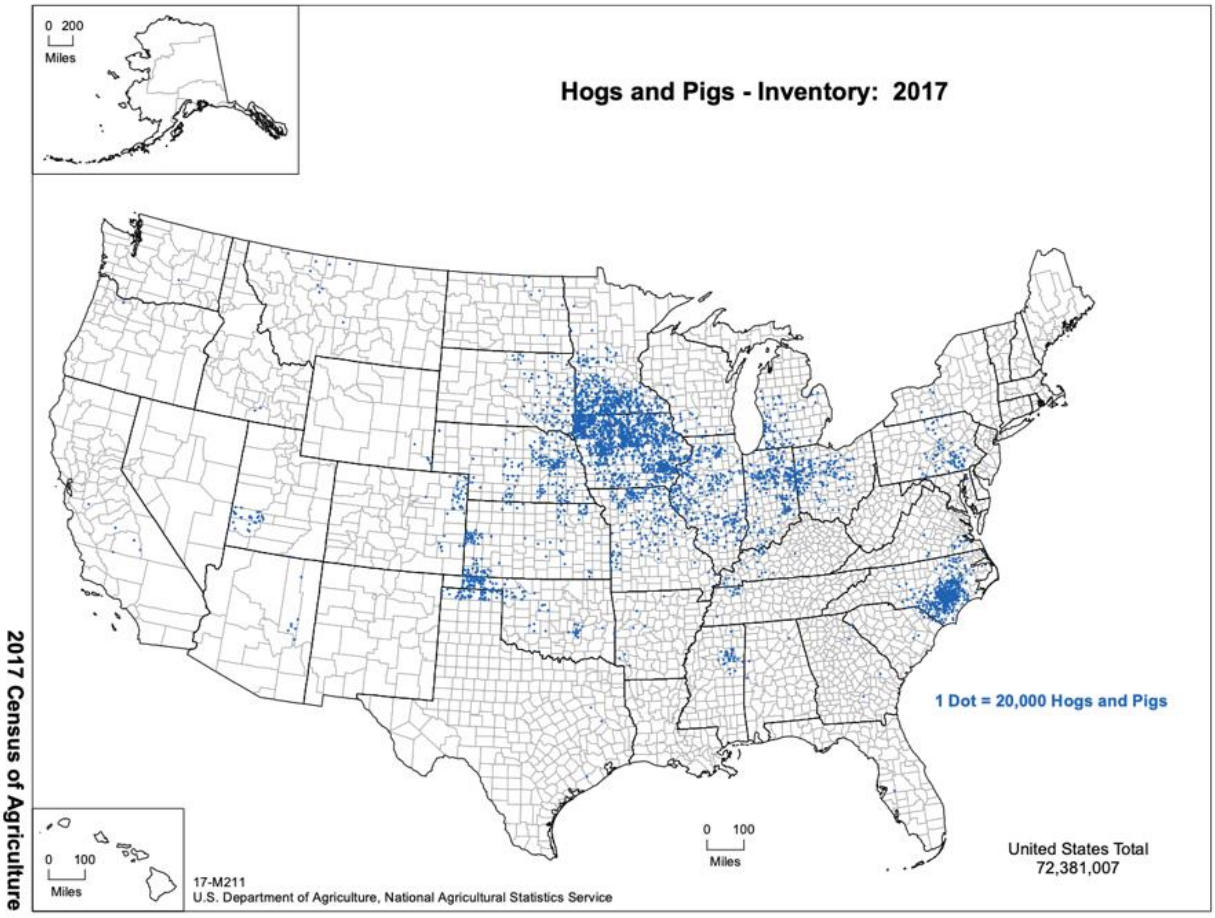
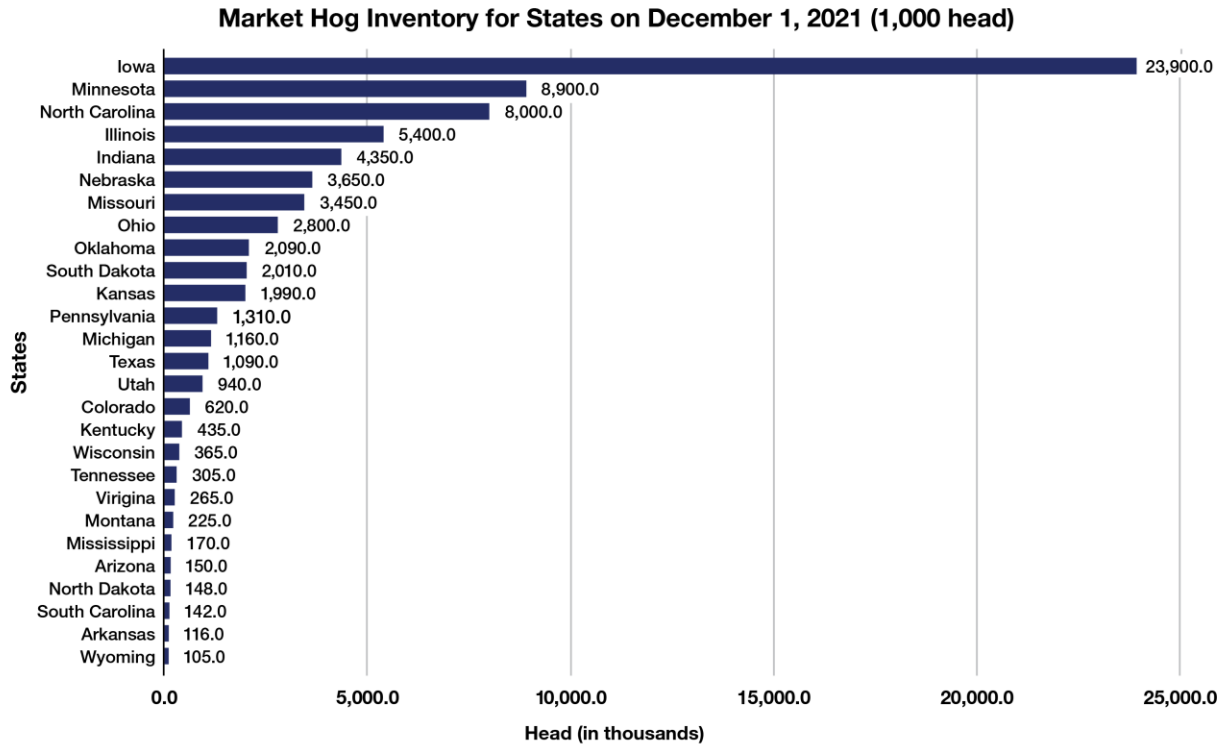


Figure 6: Market Hog Inventory for States on December 1, 2021 (USDA NASS)[74].



States with Fewer than 100,000 Market Hogs on December 1, 2021 (in thousands)

California	82.0	Hawaii	9.0	Maine	4.7	Rhode Island	2.0
New York	61.0	Oregon	8.5	Delaware	3.9	New Mexico	1.9
Georgia	45.0	Massachusetts	8.5	New Hampshire	3.7	Alaska	1.9
Idaho	27.0	New Jersey	6.5	West Virginia	3.5	Florida	NA
Washington	24.0	Louisiana	6.0	Connecticut	3.5	Alabama	NA
Maryland	22.0	Vermont	5.0	Nevada	2.5		

Figure 7: Volume of interstate movement of swine in the U.S. for feeding or breeding. (Adapted from; Haley 2004[37] and USDA-NASS[1, 74])

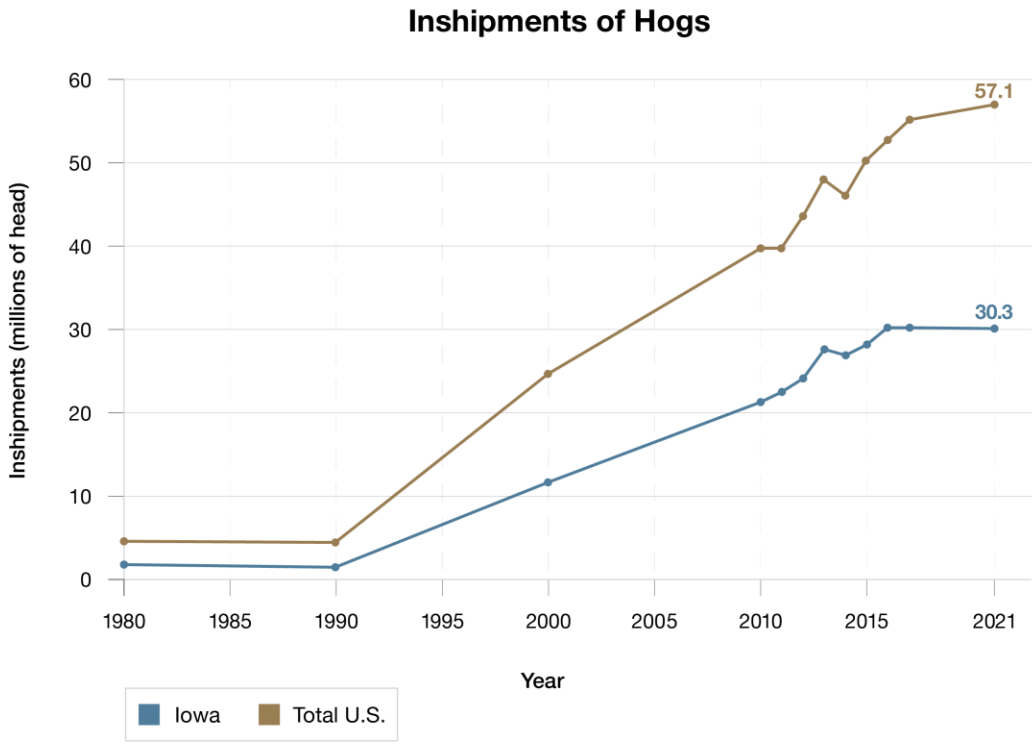
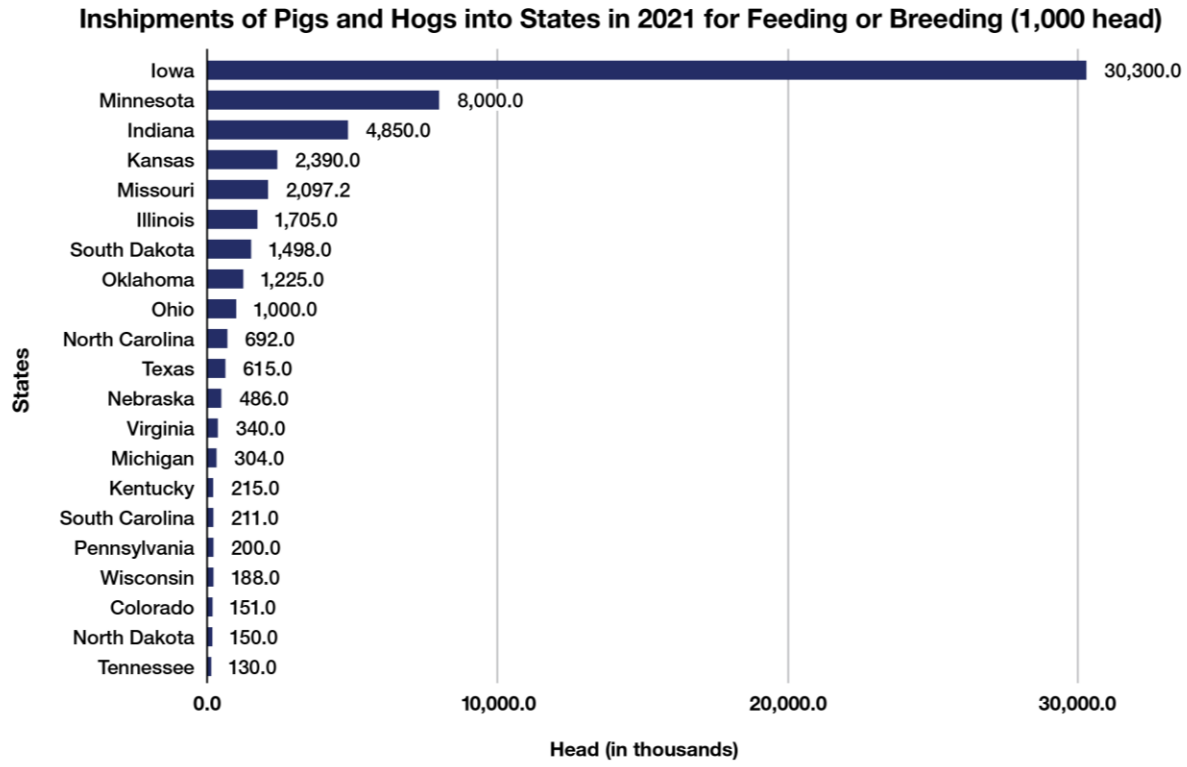


Figure 8: Inshipments of pigs and hogs into states in 2021 for feeding or breeding. Excludes animals brought in for immediate slaughter (USDA NASS 2022)[75].



States with Fewer than 100,000 Head Inshipments of Pigs and Hogs in 2021 for Feeding or Breeding (in thousands)

California	73.0	Alabama & Florida	21.0	Maine	3.4	Delaware	1.1
Georgia	51.2	Maryland	13.5	Massachusetts	3.0	Hawaii	1.0
New York	34.5	Arizona	9.0	Washington	3.0	Wyoming	1.0
Idaho	34.3	Mississippi	6.0	Nevada	2.8	West Virginia	0.5
Montana	29.0	New Jersey	6.0	New Hampshire	2.0	Connecticut	0.4
Utah	24.0	Louisiana	3.5	Vermont	2.0	Alaska	0.2
Arkansas	21.0	New Mexico	3.5	Oregon	1.3	Rhode Island	0.1

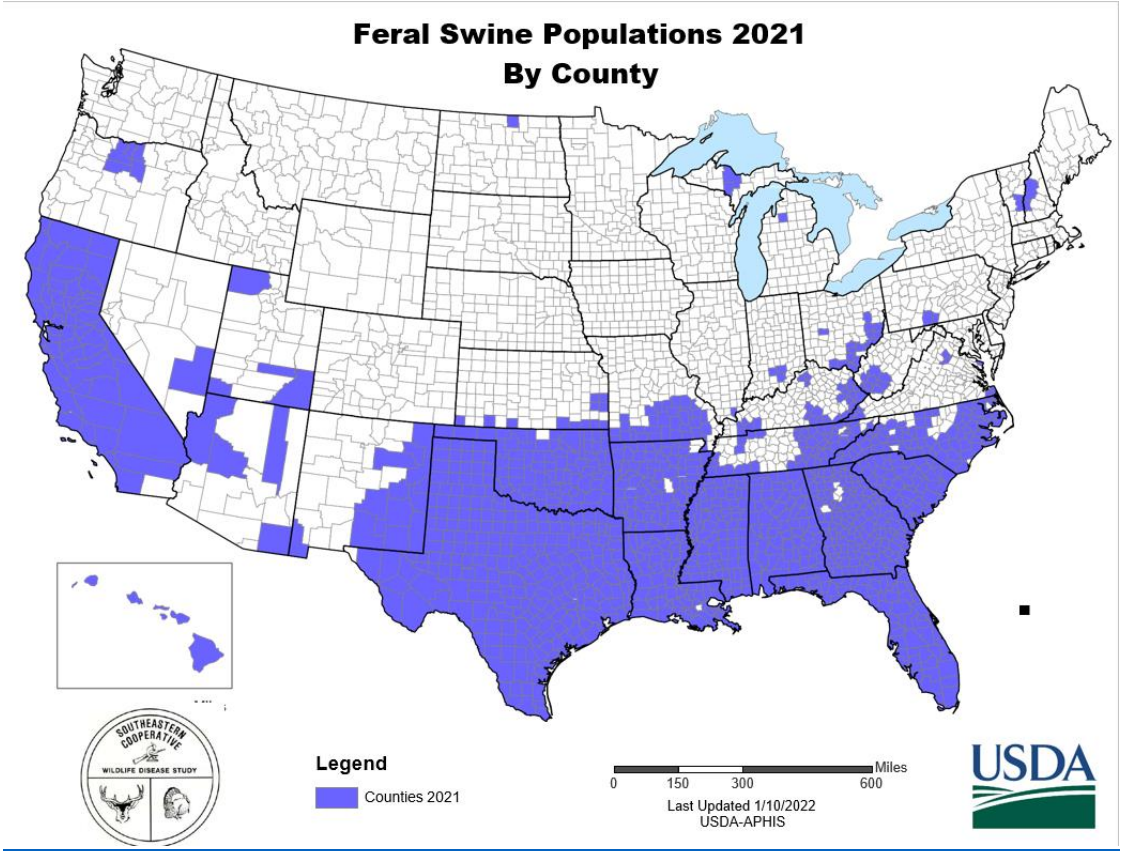
Feral Swine, Wild Boar, and ASF Eradication

In Europe ASF-infected wild boars have posed a significant challenge to disease control and eradication efforts. Many U.S. states have significant populations of feral swine which would likewise pose a challenge to ASF eradication efforts. The USDA ASF Red Book states on page 2-3: "…measures must be taken to keep these potential reservoirs (wildlife and feral animals) separate from domestic animals…"[5]

U.S. Feral Swine Population and Control Efforts

There are an estimated 6 million feral swine in the U.S. with numbers rapidly increasing. Feral swine are currently found in 35 states and across many habitats.[38] In 2012, 36.5% of farms in the U.S. with domestic swine were located in counties with feral swine.[41] Eradication of ASF in feral swine is beyond the scope of this manuscript. A recent publication provides a tool for determining optimal control plans for ASF in feral swine in different areas and planning resources needed for rapid elimination.[39]

Figure 9: Feral Swine Population by County, 2021
(Source: USDA APHIS National Feral Swine Damage Management Program)[40]



USDA APHIS Wildlife Services is engaged in efforts to manage and control feral swine across the U.S. The APHIS National Feral Swine Damage Management Program is a collaborative national program. Program goals include stabilization and eventual reduction in the size of the feral swine population and the territory they inhabit and surveillance of feral swine for pathogens that may pose a health risk to domestic swine, other livestock, and humans.[38, 41]

The distribution of feral swine across the U.S. varies from state to state and county to county. In developing an eradication plan, each state will need to consider whether feral swine are present and in what concentration, whether the feral swine are infected with ASFV, and measures available to mitigate potential transmission between feral and domestic swine.

ASF Transmission Pathways and Outdoor Pigs: EU Findings

In the EU, ASF is self-sustaining in the wild boar population; wild boar movement is believed to only be responsible for local transmission of ASFV. Other pathways involving human activities are more important in medium and long-distance transmission.[42] Examples include transport of ASFV contaminated meat, failure to report suspected cases, and selling infected animals.[18] The European Food Safety Authority (EFSA) Panel on Animal Health and Welfare published a summary of scientific opinion on ASF and outdoor farming of pigs.[43] The publication describes outdoor farming of pigs in the EU,

assesses the risk of ASF introduction and spread associated with outdoor pig farms, and proposes biosecurity and control measures for outdoor pig farms in ASFV-affected areas of the EU.

In the EU, pigs are raised outdoors in a variety of settings ranging from free range systems to outdoor farms with access to fenced yards.[43, 44] The number of farms raising pigs outdoors varies between EU Member States with most states having some outdoor pig farms. Some Member States have banned outdoor pig raising due to ASF.

The panel notes that "according to EU and national legislation, all pig farms must be registered in national pig databases with a unique identification number, irrespective of their size, category and commercial activity."[43] In addition, "in most member states, there is a legal requirement to implement biosecurity measures on all pig farms, and there is an official control system to verify implementation and assess the level of compliance." However, "[n]on-compliance with required on-farm biosecurity measures on outdoor pig farms is a common challenge across member states, with frequent areas of non-compliance relating to fencing, biosecurity relating to clothes and shoes, record keeping, disinfection at the farm entrance and movement and disinfection of vehicles."[43] Swill feeding also occurs despite an EU ban on the practice.[18] The panel reviewed and evaluated a number of biosecurity measures to determine which would be most effective in reducing the risk of ASF introduction into outdoor pig farms. Wild boar proof fences were determined to be the most effective measure against the introduction of ASF.[43]

The panel recommended either single solid fences or double row fences. Double row fences should be at least 1.5m high and made of metal net or wire with a minimum distance between rows of 1.5m. Recommendations for single solid fences include a minimum height of 1.5m, constructed of a solid material with measures to prevent rooting under the fence.[44] USDA APHIS has an Information Sheet providing advice on fencing out feral swine.[45]

Current Eradication and Mitigation Efforts

Vaccines for ASF

Important and promising advances are being made towards the development of safe and effective ASF vaccines.[16, 46-52] However, an ASF vaccine is not anticipated to be available as a tool to assist with eradication in the U.S. in the next few years. When vaccine becomes readily available, the eradication plan should be modified to incorporate vaccination. When a vaccine is available, it will be very important to understand the ability of the vaccine to prevent or reduce infection and virus shedding of various strains of ASFV, induce immunity in the presence of maternal antibody, enable detection of infection in vaccinated animals/herds, prevent carrier state, and induce long term immunity in order to effectively use the vaccine as part of an eradication plan.

Examples of Successful ASF Eradication

A manuscript by Danzetta et al[4] (2020) reviews the lessons learned from past successful ASF eradication programs. Between 1954 and 1999 nine countries were able to successfully eradicate ASF. Eradication required anywhere from a few months up to 35 years to complete. Each successful approach to eradication was designed based on the following:

- Epidemiology of the outbreak
- Characteristics of the ASF strain involved
- Laboratory diagnostic capacity
- Structure of the national swine industry and
- Characteristics of any feral swine or wild boar populations

The approaches used and the lessons learned from each eradication effort are interesting and informative, but cannot be directly adopted for a potential ASF eradication plan in the U.S. These will not be summarized here because it is not possible to summarize them more succinctly than Danzetta et al[4] without leaving out important information. Information from the manuscript relevant to an ASF eradication plan in the U.S. is incorporated in this white paper.

Total Depopulation – Malta and Hispaniola

Two islands (Hispaniola and Malta) eliminated ASF in the 1970s by depopulating all swine on the island.[4] This approach resulted in obvious food security and business continuity issues.

Aggressive Control Measures – Brazil

ASF genotype I virus was introduced into Brazil in 1978. A very aggressive response included the Ministry of Agriculture, the Ministry of the Army, and the Military Police. Actions taken to control the disease included:

- banning the sale of animals and pork products
- banning the feeding of food waste
- controlling pig movements
- banning exhibitions, fairs, and other events where pigs are aggregated
- culling and immediate cremation of pigs within the affected areas
- establishing check points and
- repopulating with sentinel pigs after 6 months

These and other actions led to Brazil regaining ASF free status in 1984. Brazil had the advantages of not having soft tick vectors playing a role in transmission and not having feral swine or wild boars in the infected region.[4]

Incursion Limited to a Defined Area – Belgium and the Czech Republic

The Czech Republic and Belgium are the only two European countries so far that have been successful in eliminating ASFV from their territories during this current disease incursion.[53] Each country had cases clustered into a single defined area where they were able to take strict control and eradication measures. After the initial detection of ASF in 2020, Germany implemented control measures resembling the successful measures used in the Czech Republic and Belgium. However, Germany's control efforts faced significant challenges including several independent introductions caused by continuous infection pressure along the border with Poland.[53]

U.S. Disease Eradication Programs – The Pseudorabies Program

The most recent successful eradication program of a disease from U.S. domestic swine has been the Pseudorabies virus (PRV) eradication program. In 1989, USDA APHIS and the pork industry embarked on

a program to eliminate pseudorabies from domestic swine.[54] At the time the eradication program began, PRV was widespread in the US. By 2004, all U.S. states were declared free of pseudorabies virus (PRV) in the domestic swine population, marking the successful eradication of the disease. However, PRV remains present in the feral swine population.

Busch et al. (2020) emphasized the importance of considering the characteristics of the biologic agent and the host's response to infection when designing a disease control and eradication program.[29] Due to major differences between ASFV and PRV, and changes in the U.S. swine industry in recent years, measures used in the PRV eradication program have limited relevance to the design of an ASFV eradication program. For example,

- PRV was widespread in the U.S., but an extensive vaccination and testing program controlled the disease and set the stage for the implementation of the eradication program
- PRV is a herpesvirus which establishes latency in nervous tissue in apparently healthy animals and can recrudesce and spread infection
- Marker vaccines and differential ELISAs played a critical role in the PRV eradication program, allowing for the detection and elimination of carrier animals with no clinical signs
- The swine industry has become more diverse in size of operations and extent of intrastate and interstate movement

Surveillance

Surveillance and Traceability in Domestic Swine for ASF Virus

Early detection of ASFV infection through extensive testing for ASFV and antibody will be needed for any ASF eradication plan. Even a small outbreak will require extensive testing by the National Animal Health Laboratory Network (NAHLN) laboratories to demonstrate that U.S. domestic and/or feral swine populations are free of ASFV. The USDA ASF Red Book states: “Currently there are 46 laboratories approved for ASF testing. Collectively, they have the ability to run at least 40,000 PCRs every 24 hours.”[5] Recent information from the NAHLN labs indicated that 49 laboratories have the capacity to conduct 80,000 ASF PCR tests in 24 hours. However, it is not certain how long NAHLN labs can sustain that level of testing due to concerns regarding access to sufficient PCR reagents and supplies. The testing capacity also depends on quality and type of sample submissions and the amount of individual data entry needed. The diagnostic capacity needed for a rapid initial ASF response and a long-term plan to eventually demonstrate ASFV freedom should be estimated, and sufficient funding requested to build capacity before an ASF outbreak occurs. Sample types, including pros and cons for each, should be discussed. Accurate, rapid, pen-side tests for ASFV[55] and antibody would facilitate rapid detection and eradication of ASFV in both domestic and feral swine. Currently, only a limited number of sample types are approved for regulatory submission to NAHLN laboratories for ASFV PCR testing (Table 2). ASFV antibody testing is not currently approved. There are no approved pen-side tests for ASFV antigen or antibody in the U.S.

Early detection of the high virulence ASFV genotype II in Europe has been most effective by PCR testing of sick and dead domestic swine.[27, 29, 56] The low contagiousness of ASF virus in well-managed herds (effective biosecurity, sick and dead animals quickly removed, animals housed on impervious surfaces, surfaces

cleaned after sick or dead animals are removed) and the high case fatality rate make testing dead animals the most effective method for early detection of highly virulent ASF virus in a herd.[56] This approach can pick up an infection of high virulence ASF genotype II virus in a herd even before the mortality rate is noticeably increased in the herd. ASFV might circulate in a herd for nearly a month before it causes a marked increase in mortality. Since the onset of severe disease in acute cases is rapid and the case fatality rate is high, nearly all of the animals die before seroconverting, although there are exceptions. A similar approach was successfully used for the high pathogenic avian influenza (HPAI) outbreak in the U.S. in 2015.[57] HPAI also has a very rapid onset and high case fatality rate. Testing dead poultry from each poultry house each day could detect early infection with HPAI in the building. Daily negative tests of pooled samples from dead laying hens provided assurance that the birds in the building were not infected with HPAI, so the eggs were safe to enter commerce for human consumption.[57, 58] However, the highly virulent ASF genotype II virus tends to mutate over time into a reduced virulence strain, and there is also the possibility of new reduced virulence ASFV strains being introduced. In this situation, testing of sick pigs by ASFV PCR and for the presence of antibodies to ASFV can provide valuable information. **Because high virulence ASFV may cause rapid death with few clinical signs and reduced virulence ASFV may cause clinical signs similar to other swine diseases without high death loss, it is essential to conduct surveillance on both dead pigs and clinically ill pigs. Pen-based oral fluids are considered an environmental sample. Not all sick (or dead) pigs in a pen need to chew on ropes in order for the oral fluids sample to test positive for ASFV by PCR. Therefore, pen-based oral fluid samples should be considered to sample both sick and dead pigs in a pen. However, pen-based oral fluids are not currently an approved sample for regulatory submission for ASFV PCR testing (Table 2).**

The USDA Swine Hemorrhagic Fevers: African and Classical Swine Fevers Integrated Surveillance Plan (July 2022)[64] outlines an active integrated surveillance plan that builds upon current diagnostic and surveillance methodologies for both diseases. The surveillance objectives for this plan are to:

- Strengthen detection capabilities and enhance outbreak preparedness for ASF and CSF, and
- Support claims of disease freedom for ASF and CSF

One of the active surveillance components of this plan is to test case-compatible sick pig Veterinary Diagnostic Laboratory (VDL) submissions. As stated in the plan: “Since the specimens come from clinically ill swine, these samples represent the highest surveillance value for improving ASF/CSF detection capability. Laboratory personnel reviewing the case make the decision to test VDL submissions for ASF and CSF.” The plan document also presents the selection criteria to identify eligible cases for ASF and CSF surveillance testing.

Active surveillance based on random testing is no longer recommended for early detection of ASFV in Europe.[29, 56] The EFSA Panel on Animal Health and Welfare concluded: “In case of both highly and low virulent strains, sampling of dead and clinical animals would lead to an earlier detection”.[56] They recommend the weekly sampling of at least 2 dead post weaning pigs or pigs older than 2 months in all establishments in the surveillance zone. **Epidemiological tracing of contact farms is extremely important to identify sources of infection as early as possible and to interrupt the spread of disease.[29]**

The role that recovered pigs can play in transmitting ASFV is still debated, various studies have failed to demonstrate that recovered pigs play a significant role in spreading ASF virus.[60-62] However, this may

vary with the strain of the ASFV. Domestic swine that have recovered from ASF should be depopulated and safely disposed of.

Surveillance of Feral Swine for ASFV

The EFSA Panel on Animal Health and Welfare recommended: "Enhanced passive surveillance (wild boar carcass search) in the area surrounding the (ASF affected) establishment should be implemented. All wild boar found dead should be tested for virus and antibodies. If hunting is ongoing in the surrounding areas, the shot animals should also be tested".[56]

The USDA Swine Hemorrhagic Fevers: ASF and CSF Integrated Surveillance Plan (July 2022) states: "Wildlife Services (WS) will monitor feral swine for CSF and/or ASF by testing serum and whole blood samples collected as part of its activities to reduce crop damage. When feral pigs are found sick or dead due to non-traumatic events (disease, starvation, old age, etc.), VS will test for ASF and CSF by viral antigen testing through FAD investigations. WS will collaborate with the USDA Area Veterinarian in Charge (AVIC) or State animal health official to initiate FAD investigations."[64]

Isolation of Domestic Swine from Feral Swine

The minimum biosecurity recommendation for farms engaged in raising pigs outdoors in wild boar areas of the EU is to prohibit the practice.[65] A few countries (the Baltics) prohibit the raising of any pigs outdoors, however, some member states have proposed exceptions to the ban and set biosecurity criteria to allow for certain exceptions.[43]

The Expert Review Panel[43] evaluated the effectiveness of various biosecurity measures in reducing the risk of introduction of ASFV on outdoor pig farms in the EU and found wild boar proof fences to be the most effective. Effective fences could be either single solid or double fences at least 1.5m high and fixed to the ground to prevent pigs from burrowing under them. Double fences should be placed at least 1.5m apart.[43] USDA APHIS has published an information sheet on using fences as a feral swine control method.[45] Recommendations include:

- multiple fences (one around the property perimeter and another around crops or animals) at least 5 feet high, strands no more than 4 inches apart
- barb wire on the top and reinforced fencing on the bottom to keep hogs from going over or under the fence
- electrified wires associated with the non-electric fencing

Section 2: Factors to Consider in Designing an Eradication Plan Should ASF Become Established in the U.S.

Introduction

A long-term ASF eradication plan for the U.S. will be expensive and labor intensive for state and federal governments, producers, and processors and will affect business continuity. The components of an ASF eradication plan on a production premises and in a state or region must be adequate to detect, control, and eliminate ASF and to maintain the ASF-free status. In order to conserve resources and limit the impact of an outbreak on business continuity, only the controls needed for a specific situation and location should be implemented and only for the duration of time required.

Ideally, an ASF eradication plan in the U.S. would result in the complete eradication of ASF from both domestic and feral swine populations. If eradication in feral swine will require a prolonged effort, or proves to be impossible, the WOAH Terrestrial Animal Health Code provides guidance for a country to declare freedom of ASF in domestic and captive wild pigs without eradication in feral swine.[2]

This section describes potential approaches to surveillance of swine, biosecurity (including feed biosecurity), isolation of domestic swine from feral swine, disposition of infected animals and herds, and considerations for packing plants and swine aggregation events. All of these aspects of ASF control are critical to a long-term ASF eradication plan. A single case of ASF in domestic swine when a state or the U.S. are close to successfully eradicating ASF can set the eradication effort back by many months.

Testing of Swine to Establish that a Premises is Highly Likely to be Negative for ASFV and Potential Testing Before Movement

Periodic testing for ASFV will be essential to provide a high degree of assurance that a swine production site is not infected with ASFV (See Section 3). Swine premises may need a permit issued by the SAHO of the receiving state to move pigs interstate to another production site or to slaughter. Premises may need to demonstrate through testing before movement that they are unlikely to have swine that are infected with ASFV. The requirements may differ depending on whether the premises of origin is within or outside of a control area.

- The USDA may recommend or require minimum sampling and testing standards for swine in an ASF control area
- SAHOs may require additional sampling and testing for swine within their state and entering their state
- Premises of destination (e.g. production sites, packing plants, or swine aggregation points) may also require additional sampling and testing for swine they will receive. The North American Meat Institute (NAMI) Industry Guidance document: Pork Packer African Swine Fever Response Strategy (September 13, 2021) states that “establishments outside of the Control Area should continue normal operations, with enhanced biosecurity features that focus upon prevention of

the disease in their facilities. Such measures can include requiring a negative on-farm test for the relevant FAD before receiving hogs…"

The feasibility of testing, the capacity of NAHLN labs to conduct the testing, and the sensitivity for detecting infected premises should be evaluated and discussed. Even with testing before shipping, there is still a small risk of moving infected but undetected pigs because pigs may be infected for 3 or more days before showing clinical signs or testing positive for ASFV. This risk can be mitigated through effective biosecurity and quarantine (two incubation periods = 30 days) of newly arrived swine at a production site until it is clear that they were not infected, but undetected, when moved.

An optimal approach to sampling and testing could include:

- The US SHIP Program Standard for sampling and testing once it becomes an official USDA program
- Sampling and testing for surveillance using NAHLN approved sample types and assays (Table 2).[66] It is anticipated that additional sample types such as oral fluids and testing for antibody to ASFV may be approved early in an outbreak
- The sampling and testing described in the USDA Swine Hemorrhagic Fevers: African and Classical Swine Fevers Integrated Surveillance Plan (July 2022)[64]
- Testing of pooled blood or spleen swabs from pigs which died of unknown cause. Perhaps focusing on pigs in buildings with swine to be moved within 30 days
- Using pooled samples as approved and appropriate to reduce the burden on NAHLN labs

Table 2: NAHLN Sample Chart for Regulatory Submitters[66]

<table>
<tr><th>Disease</th><th>Species</th><th colspan="2">NAHLN Approved Sample Type</th></tr>
<tr><td rowspan="2">African Swine Fever (ASF)</td><td rowspan="2">Pigs</td><td>Live sick animal: whole blood**</td><td>Dead animal: tonsil**, spleen**, lymph node (gastrohepatic and renal)</td></tr>
<tr><td colspan="2">Following confirmation of ASF in the U.S., blood swabs, spleen swabs, and blood cards may be used for outbreak response/surveillance testing.</td></tr>
</table>

**Labs may pool up to 5 equal amounts of blood, tonsil, or spleen samples. Blood swab, spleen swab or blood card may be pooled up to samples of 5. One sample type per pool. Samples should be pooled by the smallest epidemiological unit (pen>room>barn>premise). Samples can only be pooled from one premise.

Potential sampling and testing to designate a swine premises as ASF Checked (see Section 3 for additional details on ASF Checked status):

The sampling and testing for ASFV outlined in the USDA Hemorrhagic Fevers: African and Classical Swine Fevers Integrated Surveillance Plan (July 2022)[64] is expected to be ongoing prior to an ASF outbreak and may continue during the outbreak. An ASF Checked swine premises must have a veterinarian routinely submitting tissue samples from sick pigs to a NAHLN laboratory for diagnostic workup. One of the

surveillance components for the USDA Integrated Surveillance Plan is for diagnostic laboratory pathologists to submit samples from case-compatible sick pigs for ASFV and CSFV PCR testing.

Potential enhanced sampling and testing to provide additional assurance that the pigs to be moved are not infected with ASFV

The testing required may depend on the virulence characteristics of the ASFV strain present in the U.S. and may change over time. The testing may also depend on whether the pigs are in a control area or not. The testing required before movement will also depend on any minimum requirements established by USDA and additional requirements that may be established by the SAHO in the state of destination. **The production premises or packing plant of destination may also require additional assurance that the swine to be moved are negative for ASFV considering that a production premises that accepts ASFV infected but undetected pigs (if they are not quarantined after arrival) will likely need to be depopulated and the virus eliminated. If ASFV infected pigs are found at a packing plant, the plant may need to stop accepting pigs until all pigs are processed or disposed of, the plant is cleaned and ASFV is eliminated[63].**

- Requirements may include:
    - Do not ship any animals from a building with an increased incidence of dead or clinically ill animals with unexplained cause until the animals are tested for ASFV as described here.
    - PCR testing of blood or spleen swabs for ASFV of all animals (up to five samples pooled) that died in the building of unknown causes in the 30 days prior to shipping (up to two business days before shipping). This could detect acutely infected animals that die early in the outbreak before the overall mortality rate is increased.
    - PCR testing for ASFV of blood swabs from all animals (up to five samples pooled) in the building that have clinical signs of unexplained cause that could be consistent with moderate to low virulence ASFV in the 30 days prior to shipping (up to two business days before shipping). Collection and testing of pen-based oral fluids is likely to be a superior sample type, if validated and approved. This could detect infection with moderate to low virulence ASFV before the incidence of illness increases. Submission of samples from clinically ill animals to a NAHLN laboratory participating in the USDA Hemorrhagic Fevers: African and Classical Swine Fevers Integrated Surveillance Plan[63] may accomplish the same thing.

Biosecurity

Implementation of effective biosecurity to protect domestic swine from ASFV infection is ultimately the producer's responsibility. The state can set the standards for biosecurity required for movement based on unique attributes of swine production in the state (climate, swine density, presence of feral swine, etc.). The Secure Pork Supply plan has extensive resources to assist producers in developing biosecurity plans.

The biosecurity recommendations in the Secure Pork Supply plan should be re-evaluated and updated considering current knowledge of ASF, including the potential for feed and bedding to be contaminated with ASFV. The SPS biosecurity plans should also specifically address the need to isolate domestic swine from feral swine.

Garbage Feeding

Feeding of garbage that may contain pork products to swine is a known risk factor for ASFV transmission. Stringent enforcement of garbage feeding regulations for swine will be essential. The EU bans feeding of swill.[67] The Swine Health Protection Act[68] and accompanying regulations[69] require that food waste containing meat products (garbage feeding) must be treated to kill disease organisms before it can be fed to swine. Under this statute, producers must be licensed in order to engage in garbage feeding. States determine whether the practice will be allowed and can enact more stringent requirements or prohibit the practice. Garbage feeding is allowed in 27 states, the Virgin Islands, and Puerto Rico: it is prohibited in 23 states.[70]

- "Waste from ordinary household operations which is fed directly to swine on the same premises where the household is located" is not considered to be "garbage" under the requirements of the Swine Health Protection Act" (9 CFR 166.1)[69]

Many states allow household garbage to be fed to swine on the same premises. The risks associated with this practice in the event of an ASF outbreak should be considered and the regulations regarding garbage feeding should be re-evaluated.

Feed, Bedding and Forage as a Potential Source of ASFV Transmission

In recent years, the potential for feed and feed ingredients to serve as fomites for virus transmission has been an active area of research[32]. A special issue of Transboundary and Emerging Diseases is dedicated to this topic. Contaminated feed is a concern due to both the potential for transboundary spread of ASFV from ASF affected to ASF negative countries and the potential for spread of ASFV within an already affected country. An ASF eradication plan will need to identify and mitigate the risk of transmission of ASFV in feed from infected domestic and feral swine to ASF negative herds. Research on contamination, detection and mitigation of ASFV in feed is progressing.[33] If an outbreak of ASF occurs in the U.S., a group of leading experts on ASFV contamination and transmission in feed, bedding, and forage should be convened to apply the latest research findings to mitigate the potential of ASFV transmission.

Isolation of Domestic Swine from Feral Swine in an ASF Affected Area

The presence or absence of feral swine in an area is a critical factor for designing an ASF eradication plan for a state or region. Eradication will be much more difficult in states that have infected feral swine. States with feral swine will need to take this into consideration when developing their eradication plans. The USDA APHIS Wildlife Services has identified the counties in the U.S. that are known to have feral swine (Figure 9); this can assist in plan development.

Feral swine are very difficult to control and eliminate. In areas with feral swine, if either domestic or feral swine are positive for ASFV, domestic swine must be isolated from feral swine. It is almost always more feasible to isolate domestic swine than to eliminate feral swine from an area. All domestic swine (including backyard pigs) should be confined in a biosecure building if either the domestic swine or feral swine in a region are ASFV positive. Confinement in a biosecure building will also greatly reduce the potential exposure to *Ornithodoros sp.* ticks which may carry the ASF virus. Swine premises should implement the biosecurity described in the Secure Pork Supply plan. In addition, barriers (fences)

capable of excluding feral swine should be constructed so that feral swine cannot cross the perimeter buffer area[6] around swine buildings.[43, 45, 71] Experience has shown that fences for excluding feral swine must be carefully constructed and monitored to be effective.[72]

If feral swine in the area are believed to be free of ASFV, backyard pigs that continue to have access to the outdoors should be protected by a double fence (at least 1.5 m high with 1.5 m between fences) capable of excluding feral swine from contact with backyard swine.[43-45] This will provide some assurance that the backyard pigs are protected in case feral swine become ASFV positive.

Disposition of Swine on an ASFV Infected Premises or in an ASFV Infected Network

Initial Response

The initial response to a confirmed diagnosis of ASF by USDA APHIS Foreign Animal Disease Diagnostic Laboratory (FADDL) will include the Secretary of Agriculture authorizing "…depopulation of Infected Premises in conjunction with APHIS, State, and Tribal animal health officials according to the depopulation methods approved by the American Veterinary Medical Association…".[5] Therefore, if pigs positive for ASFV are detected on a premises early in an outbreak, it is likely that the entire premises will be depopulated, carcasses disposed of in a biosecure manner and a thorough cleaning and disinfection process will be implemented for virus elimination.

Long Term Response

During a long-term eradication plan, if ASFV positive swine are found on a production premises, the goal is likely to be depopulation of the site and virus elimination. Infected pigs must be depopulated and carcasses disposed of in a biosecure manner. A decision must be made regarding the disposition of pigs on the same premises and perhaps in the same production system network that do not have evidence of infection.

Rapid depopulation of all pigs on the site within 24 to 48 hours is probably not necessary in a long-term eradication plan for ASF since it has been found that the virus often spreads slowly within a production site.[29, 31] If ASFV DNA is found, the production site should be depopulated by a combination of stamping out with carcass disposal and perhaps controlled slaughter of pigs with no evidence of infection. Other production sites in contact with the infected premises and in the same production network should be evaluated for ASFV and, depending on the outcome, perhaps be depopulated.

Zhang estimated that in two cases in China the compulsory culling of all pigs on a premises after detection of ASFV resulted in culling of 90% (18,000 head farm) and 98% (73,000 head farm) non-infected pigs.[70] The strategy for culling pigs on the infected premises during a long-term eradication plan may depend upon:

- The effectiveness of biosecurity and biocontainment practiced on the premises in preventing spread of ASFV between pens, buildings and to other premises
- The length of time between introduction of ASFV onto the premises and the detection of ASFV which may relate to the virulence of the ASFV strain and the severity of clinical signs

- The stage of the ASF outbreak and control in the state or region
- The type of production (gestation, farrowing, nursery, grower, finisher, boar stud, backyard)
- The number of pigs involved
- How close the pigs are to being ready to harvest
- The capability and frequency for diagnostic testing to monitor infection in other pens and buildings
- Ability to safely dispose of carcasses
- Availability of funds for indemnity and other aspects of the response
- Public acceptance of depopulation
- Public acceptance of meat from healthy animals from an ASFV infected premises

Taking these factors into consideration, production system owners, managers, packing plants, and the regulatory officials should work together to develop a Production System ASF plan for managing the swine on the premises that would result in elimination of ASFV from the premises without spreading infection and with limited disruption of business continuity.

Options to consider:

- Depopulation may be through stamping out and disposal, controlled slaughter, or a combination
- Depopulate all swine in the production system network with an infected animal?
- Depopulate all swine on the premises with an infected animal?
  - And all swine on contact premises?
- Depopulate all swine in the building with an infected animal?
- Depopulate all swine in the pen with an infected animal and pens in contact with an infected animal?

A possible approach for finishing buildings in a long-term ASF eradication plan that would minimize the need to dispose of carcasses and enable salvage of high-quality protein for consumption:

- Depopulate and dispose of all swine in a pen with a PCR positive animal and all contact pens. Other pens in the same building can either be depopulated and disposed of, or with permission of the regulatory authority may be monitored for ASFV by testing all sick and dead pigs by PCR until they are ready for harvest. All pigs in any pens that test positive should be depopulated and disposed of. When ready for harvest, all healthy pigs in the building may be slaughtered and the products of all pigs that pass FSIS ante- and post-mortem inspection should be considered safe and wholesome for consumption and perhaps allowed to enter normal commerce. All dead and sick pigs in other buildings on the same site, and within the same network should be tested for ASFV by PCR

Packing Plants

Packing plants receiving swine from states that may be, or are confirmed to be, ASF affected should not allow any live swine to leave the packing plant. If they do allow live swine to leave the packing plant, the plant should meet all of the biosecurity and other requirements in the Secure Pork Supply plan for production sites. This will be very difficult for packing plants to achieve. If no live swine leave the plant and any swine that cannot be processed within 24 (48?) hours are euthanized and safely disposed of so they cannot replicate the virus, then no new infections with ASFV will occur at the plant. In that case,

the risk of ASFV transmission from the plant would be limited to fomites leaving the plant that may carry ASFV (live haul transports, rendering trucks, other vehicles, personnel, etc.). The risk of transmission of ASFV on fomites leaving the plant can be reduced by testing herds for ASFV before they arrive at the plant.

The primary control point for any fomites contaminated with ASFV is to prevent them from transmitting virus across the perimeter buffer area and line of separation at swine production premises and to feral swine.

Products from swine which pass ante-mortem and post-mortem inspection by USDA Food Safety Inspection Service (FSIS) are safe and wholesome for consumption, even if they may be in a pre-clinical stage of infection with ASFV. The ASFV does not infect people or any other species besides swine (suids). The uncooked products from a healthy pig that is pre-clinically infected with ASFV could be capable of infecting another pig that consumes it. Stringent enforcement of prohibition of garbage feeding to swine should mitigate that possibility.

The United States Animal Health Association (USAHA) Committee on Swine approved a resolution in 2022 requesting that USDA APHIS VS recognize and consider adopting Draft National Standardized Guidelines for Harvesting Establishments Prior to an ASF Outbreak. These draft guidelines were developed by the Harvesting Establishment Working Group and are for harvesting establishments that are an infected/positive meat harvest facility, a contact meat harvest facility (contact premises) in a free area, and a non-infected meat harvest facility in a control area[63].

Packing plants can provide a high degree of assurance that they will not receive pigs pre-clinically infected with ASFV if they require all producers who plan to ship hogs to the plant:

- To have implemented biosecurity and other measures outlined in the Secure Pork Supply plan (and perhaps enhanced biosecurity)
- To require all swine to be from herds participating in the USDA Swine Hemorrhagic Fevers: ASF and CSF Integrated Surveillance Plan with no cases of ASF
- To only ship swine from an “ASF Checked” building to the plant as described above

Implementing these three steps would be important for qualifying a packing plant to be certified to export pork according to 2022 WOAH TAHC Article 15.1.15.[2] Only accepting swine from premises participating in the US SHIP when it is fully developed and approved by USDA may also qualify a packing plant to be export certified.

Swine Buying Stations, Fairs, Exhibitions, or Other Swine Aggregation Events

Swine buying stations (live animal marketing channels), fairs, exhibitions, and other events where swine are aggregated, present a risk for transmission of ASFV. The risk could be reduced if swine have been tested for ASFV DNA before leaving the farm of origin (as described above) and if they proceed immediately to slaughter within 24? (48?) hours after arriving. An alternative is to ban swine at all fairs, exhibitions, etc. and to require that swine ready for harvest move directly from the production premises to the packing plant.

Section 3: Designation of ASF Status of Production Sites and States

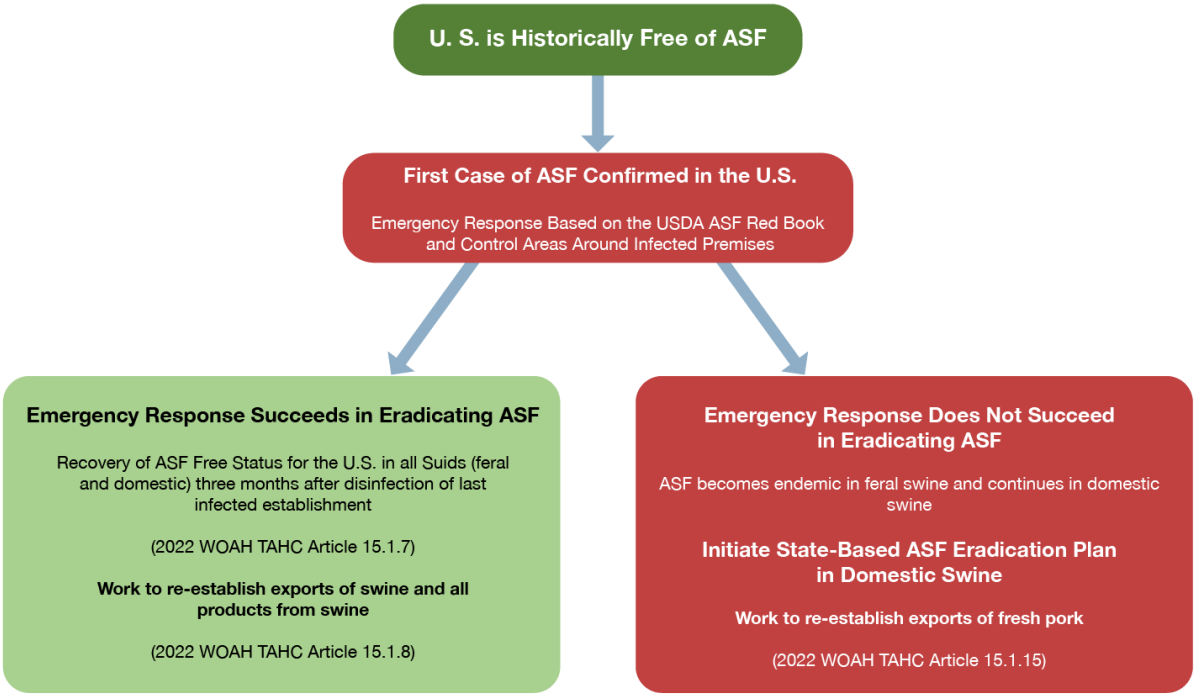
All states are currently considered to have historical freedom from ASF. This status may be lost upon the first case of ASF in the mainland U.S. This section proposes for discussion potential ASF status designations for production sites and states, and stages of ASF eradication in domestic swine in ASF affected states.

Management of an ASF Eradication Plan using Control Areas, State Status and/or Production System Status

Control Areas for management of an ASF Eradication Plan

The initial response to a detection of ASF in the U.S. is likely to trigger an emergency response and to be managed by a Unified Incident Command as described in the USDA ASF Red Book. This will include establishment of control areas around each infected premises. Control areas are based on the expectation that the disease agent may spread to other premises due to their proximity to the infected premises. Long distance spread of ASFV in other countries has been attributed to human activities. The extensive movement of swine and associated inputs/outputs required for business continuity in the U.S. makes establishing control areas around infected premises more difficult and perhaps less effective for managing a long-term eradication plan.

Figure 10: Proposed Emergency Response Phase of ASF Eradication



National ASF Eradication Plan Based on ASF Status of a State

If the emergency response does not succeed in eliminating ASFV from both domestic and feral swine, the ASF eradication response may shift to a long-term ASF eradication plan (Figure 10). Basing a long-term national ASF eradication plan on the disease status of a state is consistent with the responsibility of SAHOs to manage animal health within their state and with previous approaches to animal disease eradication programs. However, the great variation in numbers of domestic (Figure 6) and feral swine (Figure 9) in a state and shipments of swine into a state (Figure 8) will likely require different approaches to ASF control and eradication in states. The resources required will vary greatly between states.

- The number of market hogs per state, ranged from approximately 23.9 million head to 1,900 head on December 1, 2021 (see Figure 6).[74] Fourteen states reported more than 1 million head while 15 states reported less than 10,000 head.
- Modern swine production is dependent on extensive swine movement, including inshipments into states (see Figure 8). Inshipments is defined as livestock moved into states for feeding or breeding. Animals brought in for immediate slaughter are excluded from this definition. In 2021 there were inshipments of 57.1 million pigs and hogs into a new state, with extensive variation between states, ranging from Iowa with 30.3 million inshipments of pigs and hogs to Rhode Island with 100 inshipments of pigs and hogs. Nine states had more than 1 million and 19 states had less than 10,000 inshipments.[75]

Extensive interstate movement makes designation of state ASF status problematic. Many swine production systems are responsible for managing swine premises in multiple states with frequent movement between states. If different states have different requirements related to swine movement and ASF elimination, it will add complexity to the ability of swine production systems to operate in multiple states. **ASF eradication based on state status will be very difficult for states with large numbers of swine (>1,000,000) and with extensive inshipments of swine (>1,000,000). A national ASF eradication plan must be feasible for all states to implement.**

States have limited resources to manage disease eradication programs. An additional factor to consider is that state and federal animal health officials may already be fully occupied managing detection and eradication of Highly Pathogenic Avian Influenza in poultry and wild birds when an outbreak of ASF occurs.

National ASF Eradication Plan Based on ASF Status of States and Production Systems

As with all production animal diseases, it is the producer's responsibility to protect their animals from disease and to rapidly detect and manage the disease in their animals. Swine production systems which operate within states or in multiple states should develop a plan for ASF prevention, detection, and eradication within their system (**Production System ASF plan**). This plan may be included as part of participation in the US SHIP. The plan should include biosecurity, quarantine of newly arrived animals, surveillance, animal identification, and movement tracing. In addition, they should have a plan for depopulation (which may include controlled marketing), disposal, virus elimination, and recovery of free status after a detection of ASFV in their system. This plan could be based on the Secure Pork Supply Plan with additions specific to ASF eradication, such as:

- Quarantine of newly arrived swine for 30 days (two incubation periods) to ensure they are negative before mixing with the herd (all in, all out management). If they become ASFV positive, only the quarantined swine may need to be depopulated if there is adequate biosecurity between buildings
- A plan for ASF surveillance that is satisfactory to USDA APHIS, SAHOs in the states they operate in, and premises and packing plants of destination. This could include participation in the USDA Swine Hemorrhagic Fevers: ASF and CSF Integrated Surveillance Plan. **A potential tool to assist the production system in managing the risk of ASF within their system could be to allow them to utilize private laboratories for ASF PCR testing after ASF is confirmed in their state. Any regulatory testing, such as for interstate movement, demonstration of freedom, or for export purposes, would need to be conducted by an approved NAHLN laboratory.**
- Proactively collect and archive (for up to 60 days) pooled (up to 5) blood or spleen swabs from all animals that died of unexplained causes. In the event of an ASF outbreak in the U.S. archived samples from the last 30 to 60 days could be submitted to an approved NAHLN lab for ASFV PCR testing to generate rapid results demonstrating the presence or absence of ASFV.

Putting the swine production system in charge of ensuring with a high degree of confidence and transparency that their system is protected from ASFV and that all animals entering the system, moving between sites in the system, and leaving the system are negative for ASFV should facilitate business continuity for the production system and remove some burden from states so they can focus on other swine premises and movements. If ASFV positive animals are found within the system, the production system has a plan for quick detection, depopulation, disposal, and implementation of virus elimination. An observation made during the 2022 HPAI outbreak as compared to the 2015 HPAI outbreak in the Midwest has been that testing, depopulation, carcass disposal, and virus elimination were more successful with fewer problems when production systems were prepared to manage and conduct these aspects under the supervision of federal and state authorities rather than depending on outside contractors.

The Production System ASF plan should be submitted to USDA APHIS Veterinary Services and to the SAHOs in each state in which they operate for their information. The federal and/or state authorities may decide to review and approve the plans. Alternatively, templates for Production System ASF plans could be developed as guidelines for systems and modified to fit each system's situation. As long as the production system follows the template, it may not be necessary for the USDA or SAHO to approve the plan. Developing a Production System ASF plan before an outbreak could facilitate the outbreak response and more rapid resumption of business continuity for the production system.

The Production System ASF plan could incorporate components of the USDA ASF Red Book and other FAD PReP documents, the Secure Pork Supply plan, the Swine Health Improvement Plan and the Certified Swine Sample Collector program. It could take advantage of existing swine production system record keeping programs such as AgView. A production system with a Production System ASF plan, including surveillance with no positive tests for ASFV in the past 60 days could be considered an **ASF Checked Production System** for the purposes of interstate movement.

ASF Checked Production Systems should be able to move pigs between production sites within their system and to slaughter, regardless of the ASF Status of the state of origin or destination. SAHOs would

still have authority over swine movement within and into their state and may implement additional requirements based on the characteristics of the outbreak.

Placing responsibility for developing and implementing a Production System ASF plan with swine production systems will allow SAHOs to focus on swine producers who may not have an ASF plan, including smaller producers**. Small swine producers should be encouraged to modify their production practices if necessary to retain pigs on their premises until they are ready for harvest.** Swine producers that do not need to move animals off-site, except for slaughter, should implement biosecurity and other aspects of the Secure Pork Supply plan, ensure that sick and dead pigs are examined by a veterinarian, and deliver swine ready for harvest directly to a packing plant with truck and driver biosecurity. At the processing plant, the swine will be examined by state or federal inspectors to ensure they are healthy and the meat is safe and wholesome for consumption.

Designation of ASF Status of Production Sites

This section assumes that the long-term ASF eradication plan has transitioned to a state-based plan including perhaps the status of production systems, rather than on control areas set up during the emergency response phase of the outbreak by Unified Incident Command. Some states may decide to continue using control areas to manage ASF in their state. All swine production sites are likely to need an official Premises Identification Number (PIN) to move any swine off site or to receive swine.

ASFV Infected Production Site

- Production site has confirmed case(s) of ASF and is designated as an ASFV infected site
- Site is depopulated (as described above) and virus eliminated under SAHO's authority

Swine Production Site with No Positive ASFV Tests

- No ASFV PCR, antigen, or antibody tests from the site have been positive for ASFV
- The conditions necessary to be considered an ASF Checked Swine Production Site as described below have not yet been met

ASF Checked Swine Production Site

- Implemented all aspects of the Secure Pork Supply plan including isolation of domestic swine from feral swine
- Surveillance and movement data available to share with the SAHO and USDA (through AgView or a program with similar capabilities)
- Only receives swine from other production sites that have implemented the Secure Pork Supply plan and are ASF Checked, including testing the pigs before movement as described in Section 2 of this whitepaper
- Has conducted ASFV testing of pigs that have died or are clinically ill of unknown cause (see Section 2) for at least 60 days prior to movement and has had no positive ASFV tests. Testing could be on samples archived before the outbreak

ASF Checked Swine Production System

- All swine production sites in the swine production system are ASF Checked as described above.
- Production System ASF plan in place, filed with the USDA and the SAHOs in the states they operate in.

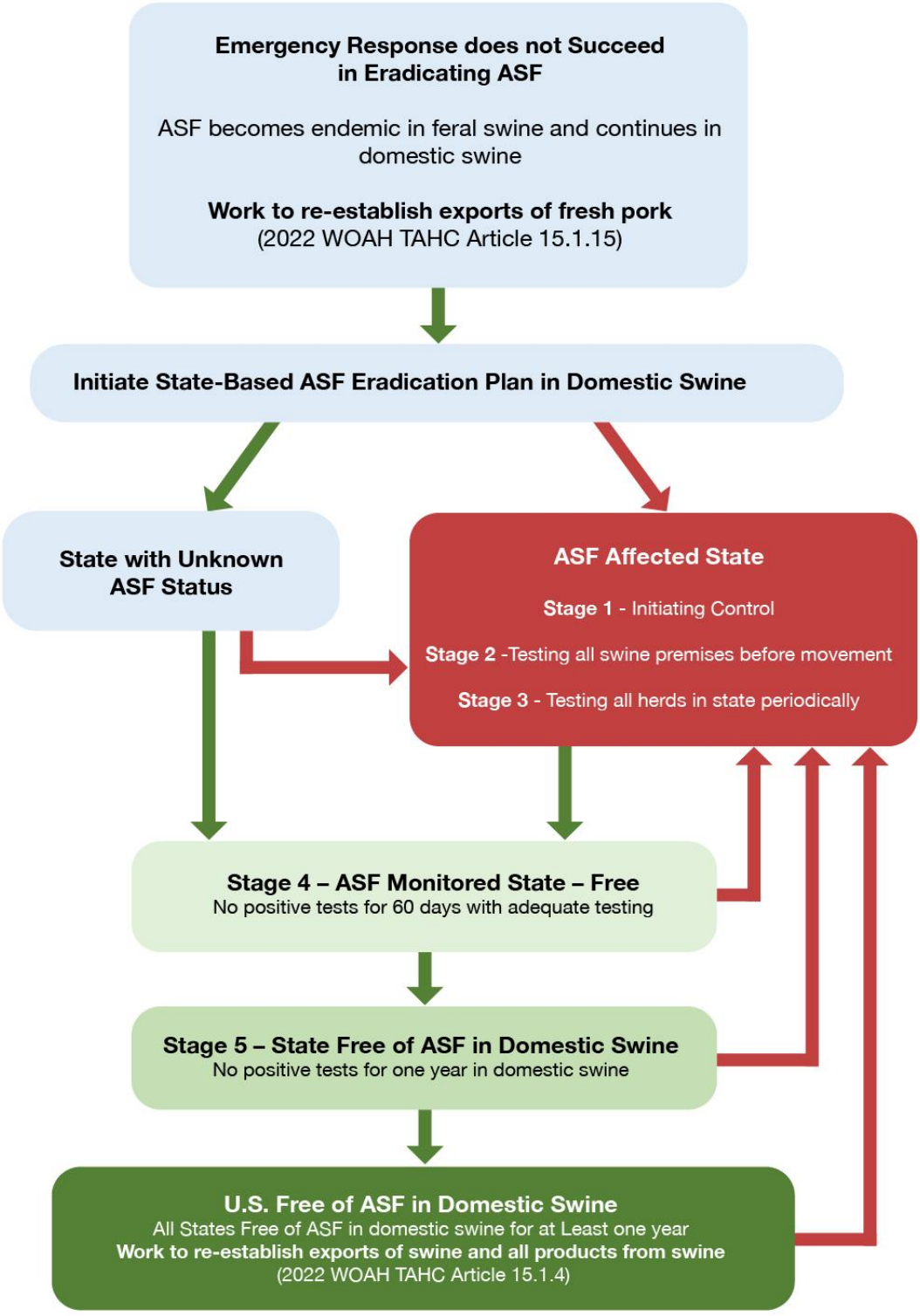
Designation of ASF Status by State

Long-term disease eradication efforts in the U.S. are typically organized by state. When planning for ASF eradication, a state needs to consider the unique aspects of its domestic swine industry and the presence, density, or absence of feral swine in the state. The considerable diversity in the number of domestic swine in states and the number of swine shipped into states will require flexibility in the approach to eradication. The resources required for managing an ASF eradication program will vary greatly between states.

For the U.S. to achieve freedom from ASF in domestic swine according to the 2022 WOAH TAHC, all states will need to demonstrate that the domestic swine in their state are free of ASF for at least a year.[2] Few states are self-sufficient in all phases of swine production. States depend on importing swine from, or exporting swine to, other states at different stages of production and also for harvest and processing. Interstate movement of swine is essential for continuity of the swine industry, provision of pork for U.S. and international consumers, and overall food security (See Figure 8). Important characteristics for a state to consider include:

- Total number of swine
- Number of swine shipped into a state for feeding or breeding
- Gestation and farrowing capacity
- Capacity for growing nursery pigs
- Capacity for finishing hogs
- Extent of farrow-to-finish on the same premises
- Number and distribution of smallholder and commercial swine operations
- Presence of feral swine
- State regulations related to garbage feeding
- Slaughter capacity
- Rendering capacity
- Options for carcass disposal within the state

Figure 11: Proposed Designation of State Status during a Long-Term Phase of ASF Eradication



Possible ASF Classification of States During an ASF Eradication Plan (Figure 11)

(Consensus on the major points needs to be achieved before adding more detail):

State with Unknown ASF Status

A state in which domestic swine have not tested positive for ASFV. Sufficient surveillance has not yet been conducted to demonstrate that the state is an ASF Monitored State - Free.

ASF Monitored State-Free (Stage 4):

States with no cases of ASF in domestic swine for 60 days since the beginning of the ASF outbreak may move directly from "State with Unknown ASF status" to "Stage 4 - ASF Monitored State-Free" if:

- They conduct tracing of all swine that moved into the state for further production from an ASF control area(s) during the emergency response phase, **OR** from an ASF Affected State beginning at least two incubation periods (30 days) before that control area or state became positive.
- All premises that received pigs from an ASF control area or an ASF Affected State test all pigs that died of unknown cause or have clinical signs of unknown cause for ASFV by PCR (and antibody?) for at least 30 days
- Swine allowed into the state for feeding or breeding purposes (or processing?) come from premises meeting one of the following; requirements:
    - Are ASF Checked (free), OR
    - Are from states in Stage 4 or 5 of ASF eradication, OR
    - Are part of a production system with a Production System ASF plan and no positive ASF tests in the last 30(?) days, OR
    - Are from premises in an ASF Affected State, or from a State with Unknown ASF Status AND that have been tested for ASFV by PCR before shipment (as described in Section 2)

ASF Affected State

A state with domestic and/or feral swine infected with ASFV. ASF Affected States could be designated as being in one of five stages of ASF elimination **in domestic swine.** Note: According to the 2022 WOAH TAHC a country or zone may be considered to be free from ASF in domestic swine when there are cases of ASF in feral swine if they meet the requirements of 2022 WOAH TAHC articles 15.1.3 and 15.1.4.[2]

Stages for ASFV Elimination in Domestic Swine in ASF Affected States

(Note: the capacity for ASFV PCR and antibody testing may limit the ability to conduct the testing recommended here. This includes limitations in availability of reagents, equipment, labware and efficient data entry.)

Stage 1 ASF Affected State: (Initiating State-Based ASF Control)

- ASF has been confirmed in domestic and/or feral swine in the state and the ASF eradication plan has switched from emergency response based on the USDA ASF Red Book and on control areas managed by the Unified Incident Command to a state-based plan which may include control areas
- State is setting up tracing and surveillance to detect infected herds within the state
- Plans are being put in place for ASFV control and elimination for each infected site and perhaps Network Based Controls for other premises in the network[5]
- USDA Wildlife Services is working to control feral swine in known ASFV positive feral swine areas
- All swine producers are encouraged to implement biosecurity according to the SPS plan
- Depopulation of ASFV infected premises is being implemented (perhaps including controlled marketing), carcass disposal underway, and a plan for ASFV elimination in a biosecure manner on premises that have ASFV positive animals is being developed
- Swine production systems operating in the state have a Production System ASF Plan in place, or are in the process of developing and implementing one
- In a state with feral swine, domestic swine are in the process of being isolated from feral swine. Biosecurity according to the Secure Pork Supply plan plus:
    - Domestic swine are all confined in a biosecure building if feral swine in the area may be ASFV positive
    - Barriers are being set up so feral swine cannot cross the perimeter buffer area around swine buildings

Stage 2 ASF Affected State: (Testing all swine premises before movement)

- All of the efforts from Stage 1 have been accomplished and are on-going
- Swine premises in the state are conducting sampling and testing for ASFV to the satisfaction of the USDA, SAHOs, and premises of destination (e.g. production site or packing plant) before swine are moved. The testing should include both sick pigs and dead pigs. This testing will depend on the characteristics of the ASFV strain(s) affecting the U.S. and may include:
    - The sampling and testing for ASFV outlined in the USDA Hemorrhagic Fevers: ASF and CSF Integrated Surveillance Plan[64] is expected to be ongoing prior to an ASF outbreak and may continue during the outbreak.
    - PCR testing for ASFV of all animals that died of unknown causes in the building swine are to be shipped from for 30 days prior to shipping (up to two business days before shipping). This could detect acutely infected animals that die early in the outbreak before the overall mortality rate increases.
    - PCR testing of all animals in the building that have clinical signs of unexplained cause that could be consistent with infection with ASFV for two incubation periods (30 days) prior to

shipping (up to two business days before shipping). This could be accomplished through participation in the USDA Swine Hemorrhagic Fevers: ASF and CSF Integrated Surveillance Plan.

- If ASFV PCR testing is positive, the site is depopulated by a combination of stamping out with carcass disposal and perhaps controlled marketing. The producer and regulatory officials work together to develop a plan for depopulation, carcass disposal, virus elimination, and repopulation. The role for indemnity must be clearly defined.

Stage 3 ASF Affected State: (Testing all swine herds in the state periodically)

- All aspects described in Stage 2 are implemented
    - All swine premises in the affected state that have not conducted Stage 2 testing for movement of pigs in the last 30 days are checked for ASFV by testing a pooled sample of blood or spleen swabs from up to five dead or clinically ill pigs for a one-week period at least monthly.

Stage 4 ASF Monitored State– Free: (No positive results for ASFV in domestic swine in the state for at least 60 days)

- No cases of ASF have been found in domestic swine in the state for at least 60 (?) days.
- All domestic swine premises in the state have been checked for ASFV as described for Stage 3 for at least 60 days with no positive results.
- Swine allowed into the state for further production come from premises:
    - That are ASF Checked (free), OR
    - Are from states in Stage 4 or 5 of ASF eradication, OR
    - Are part of a production system with a Production System ASF Plan with no positive ASF PCR tests in the last 30 days, OR
    - Come from premises in an ASF Affected State, or from a State with unknown ASF Status AND have been tested for ASFV by PCR before shipment (as previously described for Stage 2)
- States that have met the requirements for Stage 4 may reduce required testing:
    - To the sampling and testing for ASFV outlined in the USDA Hemorrhagic Fevers: ASF and CSF Integrated Surveillance Plan, AND
    - To any additional testing required by the SAHO or the premises or packing plant receiving the pigs

Stage 5 State Free of ASFV in Domestic Swine

- All domestic and captive wild swine herds have been monitored for ASFV as described in Stage 4 for at least 12 months with no positive ASFV detections.
- If no cases of ASF have been found in domestic swine in the state for one year, the state should qualify as being free of ASF in domestic and captive wild pigs according to 2022 WOAH TAHC Article 15.1.4, assuming surveillance has demonstrated no evidence of presence or involvement of *Ornithodoros sp.* ticks.[2] If there have also been no cases of ASF in feral pigs, then the state should qualify as free of ASF in all suids. All states would need to achieve this status for the U.S. to be considered ASF Free in domestic swine and perhaps all suids. The state would continue to

participate in sampling and testing for ASFV as outlined in the USDA Hemorrhagic Fevers: ASF and CSF Integrated Surveillance Plan and any additional testing required by the SAHO.

Movement of swine between states depending on ASF Status of the state

A long-term U.S. ASF eradication plan will likely be organized by state. Criteria for designation of the ASF status of a state (e.g. presence of feral swine, surveillance, biosecurity, movement controls, etc.) need to be established (as described above). The extensive daily movement of swine between states makes many states interdependent for ASF Status. Requiring production systems that operate swine premises in multiple states to file a Production System ASF plan with USDA and all states in which they operate could expedite designation of state ASF status and would also facilitate movement of swine between sites within the production system (interstate and intrastate). States with small numbers of swine (Figure 6) should be able to relatively quickly become an ASF Monitored State-Free. States with large inshipments of pigs (Figure 8) could accept pigs from small states that are ASF Monitored State-Free, and from swine production systems with a Production System ASF Plan, with confidence that they will not be bringing ASFV infected but undetected pigs into their state. As more states become ASF Monitored State-Free and more production systems have a Production System ASF Plan, the states with high numbers of inshipments of pigs for feeding or breeding have a more realistic chance of becoming ASF Monitored State-Free.

Designating ASF eradication efforts in states into different stages (1-5) and using these stages to designate a state's progress toward eradicating ASF may provide opportunities for simplified agreements for movements between states. For example, perhaps states could agree to accept pigs from other states in Stage 4 or 5 of eradication.

Section 4: Approaches to Regaining Pork Exports During an ASF Eradication Program

An outbreak of ASF in the U.S. is expected to result in the loss of export markets for U.S. pork. The immediate impact is estimated to be a reduction in live hog prices of 40% to 50%. If the outbreak is brought under control and exports are re-established in two years, the revenue losses to the pork industry are estimated at up to $15 billion. If the outbreak is not brought under control and ASF continues to affect U.S. swine for 10 years, the estimated loss of revenue is approximately $50 billion.[75]

If ASF is not eliminated from the U.S. in the first weeks or months of an outbreak and if it becomes endemic in the U.S. feral swine population, reestablishing pork exports through ASF eradication from all domestic swine will be very challenging and likely will require at least many years to accomplish. Factors that will make eradication of ASF from domestic swine in the U.S difficult include:

- Extensive intrastate and interstate movement of swine required for business continuity in the U.S.
- Swine may be infected with ASFV for 3 days or more before showing clinical signs
- There are an estimated 6 million feral swine in the U.S. If ASFV becomes established in feral swine it may occasionally cross-over into domestic swine.
- The majority of U.S. swine operations have less than 100 head and may not have adequate biosecurity, including separation from feral swine (Figure 4)
- Declaration of ASF Freedom in domestic swine requires extensive surveillance in all domestic swine with no cases for at least 12 months (36 months if tick transmission is involved)
- A single case of ASF in domestic swine will cause continued loss of ASF freedom in the U.S. for at least a year
- Zoning or Compartmentalization for ASF freedom in the U.S. would be very challenging. After an ASF free zone or compartment is defined and accepted, a single case of ASF in the Zone or Compartment will cause a loss of ASF Freedom in that zone or compartment
- There is likely to be a continued risk of ASFV introduction from other ASFV affected countries
- Lack of uniform and effective sanitation and virus elimination of swine transport vehicles, especially market haul trailers returning to growing-pig farm sites from terminal points of concentration, is a major concern for transmission of infectious agents between premises
- Absence of a national program and modern electronic system for capturing and sharing inter-premises movement of swine in real-time
- Accepting pigs that may be infected with ASFV but undetected onto a production site endangers the entire production site and perhaps the production system
- A very high volume of PCR (and potentially antibody) testing may be required to demonstrate, with a high degree of confidence, ASFV freedom to the satisfaction of receiving premises, packing plants, and/or states
- Limited number of sample types approved for regulatory submission to NAHLN laboratories for ASFV PCR testing

Requirements for Regaining Export Markets After an Outbreak of ASF

If ASF is not quickly detected and eradicated from the U.S. and becomes endemic in feral swine, it is likely to take a long time to achieve complete ASF eradication. It will be very important for both international food security and continuity of business for the U.S. swine industry to work toward regaining exports of pork to willing trading partners while continuing efforts to eradicate ASF. **This section will outline potential approaches for regulatory officials and the industry to consider.**

Chapter 15.1 of the WOAH Terrestrial Animal Health Code (TAHC) contains the internationally recognized standards related to ASF.[2] The 2022 WOAH TAHC provides mechanisms for zones or compartments within a country and for pork produced by qualifying packing plants to be considered free of ASFV for international trade purposes:

- Zone free from ASF (TAHC, article 15.1.4)
- Containment zone (TAHC, article 15.1.6)
- Compartment free of ASF (TAHC, article 15.1.5)
- Recommendations for importation of fresh pork from countries or zones not free of ASF (TAHC, article 15.1.15)

This section will summarize key details of defining free zones, containment zones, or compartments free of ASF within a country that has domestic swine infected with ASFV. An approach to exporting pork from qualifying packing plants will also be described.

The 2022 WOAH TAHC provides a mechanism for a country or zone to be considered free of ASF in domestic swine even though feral swine are known to be infected.[2] This type of designation is similar to the current situation with pseudorabies in swine in the U.S. The national pseudorabies eradication program successfully eradicated pseudorabies from domestic swine, but not from feral swine.

The WOAH does not grant official recognition of animal health status or endorsement of an official control program for ASF (or pseudorabies). The only diseases the WOAH grants official recognition of animal health status for are: African horse sickness, bovine spongiform encephalopathy, CSF, Contagious bovine pleuropneumonia, FMD, and peste de petits ruminants.[2] However, under procedures outlined in the 2022 TAHC Chapter 15.1, a Member Country may make a self-declaration of freedom from ASF for domestic and/or feral swine in a country, zone or compartment. The Member Country informs the WOAH of the claimed status and requests the WOAH publish the self-declaration to inform WOAH Member Countries. The Member Country making the self-declaration must provide documentation to support the self-declaration of freedom from ASF in domestic and/or feral swine. The WOAH will conduct an administrative and technical screening of the information. Publication of a Member Country's self-declaration of freedom from ASF in domestic swine does not imply endorsement of the claim of freedom by the WOAH and does not reflect the official opinion of the WOAH. Responsibility for the accuracy of the information contained in a self-declaration lies entirely with the WOAH Delegate of the Member Country concerned.[77] Member Countries can accept or reject the self-declaration or request additional information from the declaring country to determine whether they will accept the Member Country's self-declaration.

Using this procedure, the U.S. can self-declare the entire country, a zone, or compartment free of ASF. Trading partners will evaluate, on an individual or multilateral basis, all self-declarations from the U.S. for ASF-freedom both after an incident and for any regionalization activities that may occur during an incident. Trading partners determine whether to lift or modify trade restrictions based on information that is provided by the U.S.[5]

Approaches to Regaining Some Export Markets for Domestic Swine

The 2022 WOAH TAHC Article 15.1.9 outlines a mechanism for exporting domestic swine from a country or zone that is not free of ASF. The Veterinary Authorities should require the presentation of an international veterinary certificate attesting that the animals showed no clinical signs of ASF on the day of shipment and were kept in a quarantine station, isolated for 30 days prior to shipment, and were subjected to a virological test and a serological test performed at least 21 days after entry into the quarantine station, with negative results.

Approaches to Regaining Some or All Export Markets for Pork

An objective of an ASF eradication program is to re-establish export markets for pork. The ideal outcome is complete eradication of ASF from both domestic and feral swine. However, there are approaches to regaining some export markets while continuing to work towards complete eradication. This section summarizes various approaches to regaining export markets for pork after an outbreak of ASF, along with challenges and limitations of the approach. This brief summary is based on the information in the 2022 WOAH TAHC.[2] The WOAH TAHC is updated annually, and the most recent version should be consulted for detailed information.

Freedom of Domestic and Feral Swine from ASF

The best outcome after an ASF outbreak would be to achieve freedom from ASF in both domestic and feral swine. This can be achieved as described in 2022 TAHC Articles 15.1.3, 15.1.4, and 15.1.7. Briefly, if eradication in both domestic and feral swine can be rapidly achieved in a country that was previously free of ASF, recovery of free status can be declared three months after disinfection of the last infected establishment. Otherwise, surveillance in both domestic and feral swine needs to be conducted for three years with no detections of ASFV infection. This period can be reduced to one year when there is no evidence of involvement with *Ornithodoros* ticks.

- Rapid eradication in both domestic and feral swine would be the best outcome of an introduction of ASFV into the U.S.
- If this can be achieved, there would not be a need for a long-term ASF eradication program as addressed in this whitepaper.

Freedom of Domestic Swine but not Feral Swine from ASF

The 2022 WOAH TAHC (articles 15.1.3 and 15.1.4) allows a country to self-declare that domestic swine are free of ASFV even though feral swine may still be infected. Briefly, this requires that there has been no case of ASF in domestic swine for three years (or one year if *Ornithodoros* ticks are not involved).

- There is also a requirement that all domestic swine are separated from feral swine by "appropriate biosecurity effectively implemented and supervised"
- A single case of ASF in domestic swine in the U.S. (including in the 46,500 operations with less than 25 pigs in 2017 (See Figure 4)) would delay return to ASF free status in domestic swine for at least 12 months

Establishing a "Containment Zone" for ASF

A containment zone, which includes all outbreaks, may be established for the purposes of minimizing the impact on the entire country or zone (WOAH TAHC Article 15.1.6).[2, 78] The free status of the areas outside of the containment zone is suspended until the containment zone is established.

- One condition for the establishment of the containment zone is that there have been no new cases of ASF in the containment zone (or an outer zone of the containment zone) for at least two incubation periods (30 days) from the disposal of the last detected case.[2, 78]
- A single case of ASF in the Containment Zone will cause the loss of ASF Free status of the Containment Zone and the area outside of the Containment Zone.

Establishing a Zone Free of ASF in Domestic Swine

An ASF free zone can be established primarily on a geographic basis. There are extensive requirements for surveillance, biosecurity, animal identification, and for movement controls into the free zone which are described in the 2022 WOAH TAHC Chapters 4.4 and 15.1. [2, 78]

- The extensive intrastate and interstate movement of swine in the U.S. will make establishment of an ASF Free Zone challenging
- A single case of ASF in domestic swine in the free zone will cause the loss of ASF free status in the zone. (TAHC, Articles 15.1.3 and 15.1.4)

Establishing a Domestic Swine Compartment Free of ASF

An ASF free compartment can be established primarily by management and husbandry practices related to biosecurity. There are extensive requirements for surveillance, biosecurity, animal identification, and for movement controls into the ASF free compartment which are described in the 2022 WOAH TAHC Chapters 4.4, 4.5, and 15.1. A compartment should be clearly defined, indicating the location of all its components including establishments, as well as related functional units (such as feed mills, slaughterhouses, rendering plants, etc.) which should not interact with production units outside of the compartment. [2, 78]

- A single case of ASF in the Compartment would cause the compartment to lose its ASF Free status.

Establishing "Export Certified" Swine Packing Plants

The 2022 WOAH TAHC Article 15.1.15[2] provides an option unique to ASF for export of fresh meat of domestic pigs from a country that is not free of ASF (see below) (Note: "meat" means all edible parts of an animal). A packing plant operating as described in this Article may be qualified to export fresh

meat to willing trading partners.[2, 3] As with all other approaches to regaining fresh meat exports, this will require bilateral negotiations with a willing trading partner. **Unlike the other approaches to regaining exports, a single case of ASF in the country, zone, or compartment would not necessarily result in the loss of the ability to export fresh meat.**

2022 WOAH TAHC Article 15.1.15.
Recommendations for importation from countries or zones not free from ASF

For fresh meat of domestic and captive wild pigs

Veterinary Authorities should require the presentation of an international veterinary certificate attesting that:

> *1) the entire consignment of fresh meat comes from animals which originated from herds in which surveillance in accordance with Articles 15.1.28. to 15.1.30. demonstrates that no case of ASF has occurred in the past three years. This period can be reduced to 12 months when the surveillance demonstrates that there is no evidence of tick involvement in the epidemiology of the infection. In addition, samples from a statistically representative number of animals were tested for ASF, with negative results;*
> *2) the entire consignment of fresh meat comes from animals which have been slaughtered in an approved slaughterhouse/abattoir, have been subjected with favourable results to ante- and post-mortem inspections in accordance with Chapter 6.3.;*
> *3) necessary precautions have been taken after slaughter to avoid contact of the fresh meat with any source of ASFV.*

Testing protocols for animals under such a program will need to be designed to ensure to the degree possible that packing plants do not receive ASFV infected animals. In examining the issue, the EFSA Panel on Animal Health and Welfare[56] concluded: "the virological testing with the aim of detecting the virus at the slaughterhouse in randomly selected slaughter pigs assuming a virus prevalence of 10% with 95% confidence cannot be considered effective". They recommended "[t]he weekly sampling of at least two dead pigs (in each epidemiologic unit) if carried out in protection and surveillance zones … would lead to an early detection of the disease, and therefore is recommended as it would allow for the safe movement of animals".[56]

The testing protocol used must be sufficient to convince the USDA regulatory officials and willing trading partners that there is a high degree of confidence that ASFV infected animals will not be delivered to a participating packing plant and that if they are, the FSIS antemortem and postmortem inspection process would detect it. Regulatory testing for export will need to use validated and approved sample types submitted to a NAHLN laboratory. The currently approved sample types for ASFV after the first case in the U.S. includes blood and spleen swabs which can be pooled into 5 swabs per tube (Table 2).

The U.S. has historically been negative for ASF. In addition, USDA currently has an enhanced integrated surveillance plan for both ASF and CSF designed for early detection of either virus.[64] **To be prepared to implement this approach for the export of pork to willing trading partners, participating swine producers and production systems should have a Production System ASF Plan on file with USDA APHIS VS and the SAHO in the state with the packing plant which includes biosecurity to prevent ASFV**

introduction, surveillance to detect ASFV infection on the premises, and elimination of ASFV from the premises (as described above). The core technical elements of the US SHIP program are surveillance, movement tracing, and biosecurity including the Secure Pork Supply Plan site biosecurity plans, thus the US SHIP program could be further developed to address the Production System ASF plans.

In the E.U, the recommended approach to early detection of ASFV infection on a swine premises is to test the first two dead pigs in an epidemiologic unit each week. Weekly testing for ASFV before an outbreak in the U.S. is not expected to occur. **However, production units could collect pooled samples of up to 5 blood or spleen swabs from all pigs in swine finishing buildings which died from unknown causes and archive them (at refrigerator or freezer temperatures?) for testing in the event of an outbreak. If an outbreak occurs, archived samples from the last 30 (or 60?) days could be submitted to a NAHLN lab for PCR testing during the 72-hour standstill. If the samples are negative, there would be a high degree of confidence that the pigs in the finishing barns are negative and could be sent to slaughter. If the packing plant only accepts pigs from premises with an approved ASF prevention, detection, and eradication plan and testing of all swine that died from unknown causes in the finishing building within the last 60 days, the USDA may be willing to state to trading partners that the pork from the plant meets the requirements of TAHC article 15.1.15 and is approved for export.** Based on the United States' historical freedom from ASF before the outbreak, results from testing of the archived pre-outbreak samples and additional evidence that the swine premises sending pigs to the plant have been tested provide a high degree of confidence that the pork from the plant is ASFV negative and could satisfy the requirement that no case of ASF has occurred on this premises in the past 12 months. Bilateral agreements would need to be in place before the outbreak for trading partners to accept the pork with a minimum interruption in trade.

- Efforts to maintain fresh meat exports by meeting the WOAH standards for freedom from ASF according to WOAH TAHC Article 15.1.15 as described above may prove challenging and will likely require bilateral negotiations with each U.S. trading partner to modify the export certificates currently in use. Trading partners already affected by ASF may be more willing to accept fresh pork according to WOAH TAHC Article 15.1.15.
- A case of ASF, even in a production system supplying hogs to a packing plant, should not cause the packing plant to lose the ability to export pork as long as infected pigs were not sent to the plant and all of the premises supplying hogs to the plant have an acceptable Production System ASF plan (see above) and have submitted samples to an approved lab with negative results from all pigs that died of unknown causes in the building within the last 30 days (60 days at the beginning of the outbreak).

Appendix

USDA APHIS and others have developed extensive ASF preparedness and response information. The USDA information can be found at: http://www.aphis.usda.gov/fadprep. The USDA APHIS FAD PReP website will be updated with any new ASF response and policy guidance during an active outbreak.

FAD PReP documents and materials directly related to ASF:

- Planning & Preparing for African Swine Fever: Quick Briefing
  - https://www.aphis.usda.gov/animal_health/emergency_management/downloads/asf-briefing-plan-prepare.pdf
- African Swine Fever Response Plan: The Red Book
  - https://www.aphis.usda.gov/animal_health/emergency_management/downloads/asf-responseplan.pdf
- ASF Response: The Red Book Presentation
  - https://www.aphis.usda.gov/animal_health/emergency_management/downloads/asf-responseplan-ppt.pdf
- Overview of the ASF Response Plan: The Red Book
  - https://www.aphis.usda.gov/animal_health/downloads/animal_diseases/swine/fsc-asf-plan-overview.pdf
- ASF Response DRAFT Chronology and State Checklist
  - https://www.aphis.usda.gov/animal_health/downloads/animal_diseases/swine/asf-response-state-checklist.pdf
- USDA Swine Hemorrhagic Fevers: African and Classical Swine Fevers Integrated Surveillance Plan (July 2022)
  - https://www.aphis.usda.gov/animal_health/downloads/animal_diseases/swine/hemorrhagic-fevers-integrated-surveillance-plan.pdf
- Summary of Initial ASF Response Actions RRG
  - https://www.aphis.usda.gov/animal_health/downloads/animal_diseases/swine/fsc-asf-summary-initial-actions.pdf
- Critical Activities and Tools during an FAD Response RRG
  - https://www.aphis.usda.gov/animal_health/downloads/animal_diseases/swine/fsc-fadprep-critical-activities.pdf
- Swine Industry Manual
  - https://www.aphis.usda.gov/animal_health/emergency_management/downloads/documents_manuals/swine_industry_manual.pdf
- APHIS ASF Website
  - https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/swine-disease-information/african-swine-fever

Other websites with ASF information:

- The Secure Pork Supply Plan includes preparedness for and response to ASF:
  - https://www.securepork.org

- The Swine Health Improvement Plan is under development and includes proposed ASF Monitored status:
    - https://usswinehealthimprovementplan.com/
- African Swine Fever Fact Sheet, Center for Food Security and Public Health, 2019
    - https://www.cfsph.iastate.edu/Factsheets/pdfs/african_swine_fever.pdf
- WOAH Terrestrial Animal Health Code 2021, Chapter 15.1. Infection with African Swine Fever Virus
    - https://www.WOAH.int/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_asf.htm

Information for management of ASF in the EU:

- Strategic approach to the management of African Swine Fever for the EU
    - https://ec.europa.eu/food/system/files/2020-04/ad_control-measures_asf_wrk-doc-sante-2015-7113.pdf

Information related to ASF preparedness and response from the National Pork Board:

- National Pork Board. 2015. Disinfection of foreign animal disease viruses on surfaces relevant to the Pork Packing Industry. NPB website:
    - https://www.pork.org/research/disinfection-of-foreign-animal-disease-viruses-on-surfaces-relevant-to-the-pork-packing-industry/
- African Swine Fever Information for Producers
    - https://porkcheckoff.org/pork-production-management/hot-topics/african-swine-fever/
- Pork Checkoff Research
    - https://porkcheckoff.org/research/?_sf_s=african%20swine%20fever

Information on ASF from the Swine Health Information Center:

- https://www.swinehealth.org/african-swine-fever/

Terms/Definitions

As used in this document:

African Swine Fever (ASF) is defined as an infection of suids with ASFV[2]

ASF Positive refers to the status of an animal

ASF Infected refers to the status of a premises

ASF Affected refers to the status of a state or region

ASF Eradication refers to the status of the U.S.

ASF Elimination refers to the status of a premises or state

Abbreviations and Acronyms

AgView = A free, opt-in technology solution from the National Pork Board that helps producers of all sizes and types provide disease status updates and pig movement data to USDA and SAHOs

ASF = African swine fever

ASFV = African swine fever virus

APHIS = USDA Animal and Plant Health Inspection Service

AVIC = USDA APHIS VS Area Veterinarian in Charge

CSF = Classical swine fever

CSSC = Certified swine sample collector

EFSA = European Food Safety Authority

ELISA = Enzyme linked immunosorbent assay

EU = European Union

FAD = Foreign animal disease

FMD = Foot and mouth disease

FSIS = USDA Food Safety Inspection Service

HPAI = High pathogenic avian influenza

IM = Intramuscular route of exposure

NAMI = North American Meat Institute

NAHLN = National Animal Health Laboratory Network

NASS = USDA National Agriculture Statistical Service

NPB = National Pork Board

NPIP = National Poultry Improvement Plan

NPPC = National Pork Producers Council

ON = Oronasal route of exposure

PCR = Polymerase chain reaction

RRG = Ready reference guide

SAHO = State animal health official

SFS = Secure Food Supply

SHIC = Swine Health Information Center

SHIP = Swine Health Improvement Plan

SPS = Secure Pork Supply

TAHC = WOAH Terrestrial Animal Health Code

UIC = Unified Incident Command

USAHA = United States Animal Health Institute

USDA = United States Department of Agriculture

WOAH = World Organization for Animal Health

WS = USDA APHIS Wildlife Services

VS = USDA APHIS Veterinary Services

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