APHIS Risk Analysis on Importation of Classical Swine Fever (CSF) Virus from Nayarit, Mexico

United States Department of Agriculture
Animal and Plant Health Inspection Service
Veterinary Services
National Center for Import and Export
Regionalization Evaluation Services

April 2006

Table of Contents

Abbreviations

APHIS Animal and Plant Health Inspection Service

CPA *Comision Mexico-Estados Unidos para la prevencion y control de la fiebre aftosa y otras enfermedades exoticas* (Mexico-USA Commission for the Prevention of Foot and Mouth Disease and other Foreign Animal Diseases)

CENASA *Centro Nacional de Servicios de Diagnostico en Salud Animal* (National Veterinary Services Diagnostic Laboratory)

CENAPA *Centro Nacional de Servicios de Constatacion en Salud Animal* (National Veterinary Toxicology and Parasitology Laboratory)

CFPP *Comité Estatal Para el Fomento y Protección Pecuaria de Nayarit, S.C.* (Animal Agriculture Promotion and Protection Committee)

CSF Classical swine fever

DGICA *Direccion General de Inocuidad y Calidad Agroalimentaria* (Agrofood Safety and Quality Control General Directorate)

DGIF *Direccion General de Inspeccion Fitozoosanitaria* (Animal and Plant Health Inspection Service General Directorate)

DGSA *Direccion General de Salud Animal* (Animal Health General Directorate)

DINESA *Dispositivo Nacional de Emergencia de Sanidad Animal* (National Animal Health Emergency Operation)

GEESA *Grupos Estatales de Emergencia en Salud Animal* (State Animal Health Emergency Group)

NOM *Normas Oficiales Mexicana* (Official Standards of Mexico)

SAGARPA *Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentación* (Ministry of Agriculture, Livestock Production, Rural Development, Fishery, and Food)

SENASICA *Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria* (National Service of Health, Safety and Quality Agrofood)

TIF Federal Inspection Type Establishments

Executive Summary

The State of Nayarit, Mexico, submitted a request to the Animal and Plant Health Inspection Service (APHIS) in April 2004, seeking recognition as a region free of classical swine fever (CSF) [1]. Upon receipt of this request, APHIS initiated an evaluation of the CSF status of Nayarit. The report represents APHIS' evaluation of Nayarit with regard to the status, infrastructure, and control measures in place for CSF and includes an assessment of CSF surveillance measures, import practices, laboratory capacity, emergency response procedures, and other factors that could influence the risk of CSF introduction into the United States.

Supporting documentation for this risk analysis consists of documentation provided by the *Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentacion* (SAGARPA), the State of Nayarit, observations of a joint APHIS and Canadian Food Inspection Agency (CFIA) site visit team, peer-reviewed articles, information from the World Organization for Animal Health (OIE), and other technical sources.

This risk analysis was conducted according to OIE guidelines and therefore includes a hazard identification section, a release assessment, an exposure assessment, a consequence assessment, and a risk estimate [2]. The hazard under consideration is CSF.

Release Assessment

APHIS found no evidence that CSF virus exists in Nayarit. CSF has not been detected in Nayarit since 1989 despite ongoing surveillance.

Nayarit is relatively isolated by the mountains and oceans and has few points of entry into the state. Mexico has a National CSF Campaign to eradicate CSF from all of its territory. As a tenet of that campaign, movement of swine and swine products from regions of higher CSF risk into Nayarit is prohibited, thus reducing the greatest potential source of virus introduction into the State. To verify and enforce compliance with that provision, Nayarit is located in a region of the country protected by a quarantine lines across Mexico. It also has animal health inspection control posts along the highways entering the State. However, APHIS considers that the potential for introduction of CSF into Nayarit is greater than the current potential for introduction of CSF into the United States because Nayarit shares common land borders with regions considered affected with CSF.

In this regard, the risk profile of Nayarit resembles that of other Mexican States currently recognized as CSF free (Baja California, Baja California Sur, Campeche, Chihuahua, Quintana Roo, Sinaloa, Sonora, and Yucatan) which also share common land borders with regions considered affected with CSF.

Current U.S. regulations require certification that live swine have been kept in a region entirely free of CSF for 60 days prior to export (9 CFR § 93.505) and also require a

minimum quarantine of 15 days for all imported live swine (9 CFR § 93.510). This requirement serves to mitigate the risk of exposure by increasing the probability of CSF detection prior to contact with susceptible swine in the United States.

Additional certifications are required of live swine, pork, and pork products imported from certain regions, including the Mexican States of Baja California, Baja California Sur, Campeche, Chihuahua, Quintana Roo, Sinaloa, Sonora, and Yucatan. These additional certifications are described in 9 CFR § 94.25. [1]

Under 9 CFR §94.25, swine imported from listed regions must be accompanied by certification that the swine originated in and were exported from regions free of CSF, and furthermore, that the swine must never have commingled with swine that have been in regions affected with CSF.[2] Likewise, pork and pork products imported from listed regions must be accompanied by certification that the swine from which the pork or pork products were derived were born and raised in regions free of CSF, and that the swine were slaughtered in such a region at a federally inspected slaughter plant eligible to export to the United States. Additionally, the pork or pork products must never have been commingled with pork or pork products that have been in regions affected with CSF. These certification requirements mitigate the risk of importing CSF virus by reducing the likelihood of exposure of exported swine, pork or pork products to potentially infected swine or CSF contaminated pork or pork products from regions that are CSF affected.

Based on this evaluation, APHIS considers the export risk from Nayarit to be equivalent to that of the Mexican States listed in 9 CFR §94.25. Applying the provisions of 9 CFR §94.25 to Nayarit would address the risk from sharing common land borders with regions affected by CSF.

If CSF virus were reintroduced into the State, it would likely be detected and contained before spreading. This would be accomplished through the cooperation of Federal, State and municipal government officials and industry representatives serving in the State animal health committee. The swine population in Nayarit is relatively small and swine density is low. Wild boar are not known to exist in the State, so no apparent wildlife reservoir for CSF exists. Domestic swine are naïve to CSF since vaccination has been prohibited for 10 years. Clinical signs should appear soon after infection. Although

[1] Regions listed under 9 CFR §94.25 are in a special category because, even though APHIS has determined that the region is free of CSF, one or more of the following conditions occur: (1) the region supplements its pork supplies with fresh (chilled or frozen) pork imported from regions designated in §§ 94.9 and 94.10 as being affected by CSF; (2) it supplements its pork supplies with pork from CSF-affected regions that is not processed in accordance with the requirements of part 94; (3) it shares a common land border with CSF-affected regions; or (4) it imports live swine from CSF-affected regions under conditions less restrictive than would be acceptable for importation into the United States [3].

[2] APHIS considers all of Mexico to be affected with blue-eye disease of pigs, a disease which is not known to exist in the United States [4, 5]. APHIS has not evaluated Mexico, including the State of Nayarit, for blue-eye disease. As a result, APHIS denies permits for the importation of live swine and semen from all of Mexico, including Nayarit (9 CFR § 93.504(a)(3)). CSF is the hazard being evaluated in this analysis. The analysis does not address the status of blue-eye disease in Nayarit.

clinical suspicion of CSF must be reported to veterinary authorities and epidemiological investigations conducted, there have been no suspicious cases of CSF reported since Nayarit was declared CSF free in May 1999. Also since this time, an active CSF surveillance program has been conducted annually in both commercial and backyard herds, and all samples have tested negative for CSF.

CSF virus is not likely to be exported from Nayarit to the United States through trade of swine, pork and pork products. The strength of Mexico's National CSF Campaign is based mainly on active serological surveillance and strict movement controls. Under the national program, Nayarit, as well as 12 other States, eradicated CSF to achieve free status and have continued to maintain that status. APHIS considers the level of surveillance to be adequate and movement controls to be strong. However, since Nayarit shares a common land border with regions considered affected with CSF, a risk of exporting CSF exists. This risk is low. If the mitigation measures described above for Nayarit are implemented the risk would be reduced even further.

Exposure Assessment

APHIS assessed the probability of exposure of susceptible swine populations in the United States to CSF virus carried by live swine, pork, or pork products imported from Nayarit. The assessment concluded that the likelihood of exposure of susceptible swine to CSF via waste feeding was low. This conclusion was based on studies of waste-feeding in the U.S., which showed a substantial reduction in number of waste-feeding operations in recent years and a very small proportion of food waste is inadequately processed prior to feeding to swine. Although the unmitigated potential for exposure to the CSF virus via live swine imports would be comparatively high, considering that SAGARPA veterinary officials are required to provide certification that appropriate mitigations are applied to reduce that risk (9 CFR 93.505) and that live animals are subject to 15 day quarantine upon entry into the United States (9 CFR 93.510), APHIS concluded the probability of exposure of susceptible U.S. swine to CSF virus via infected swine from Nayarit to be low.

Consequence Assessment

APHIS also assessed the biological and economic consequences of introducing CSF virus into the United States. This assessment concluded that CSF virus has the potential to cause significant distress and suffering in affected animals. The economic costs of control and eradication would be substantial if CSF was established in the United States, and export losses due to restrictions imposed by trade partners on swine, pork, and pork products could run into billions of dollars. An extensive foreign animal disease outbreak could also result in severe psychosocial effects on farmers and farming communities.

Risk Estimate

In summary, although an extensive CSF outbreak in the United States would likely have severe animal health and economic consequences, APHIS considers the risk of infected

live swine, pork, or pork products entering the United States from Nayarit and exposing U.S. swine to be low. This risk is further mitigated if Nayarit is subject to the mitigation measures discussed in this document.

Introduction

The State of Nayarit, Mexico, submitted a request to the Animal and Plant Health Inspection Service (APHIS), in April 2004, seeking recognition as a region free of classical swine fever (CSF) [1]. Upon receipt of this request, APHIS initiated an evaluation of the CSF status of Nayarit. The results will provide the basis for APHIS to decide whether to recognize the State of Nayarit as free from CSF.

Supporting documentation for this risk analysis consists of documentation provided by the *Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentacion* (SAGARPA), the State of Nayarit, observations of a joint APHIS and Canadian Food Inspection Agency (CFIA) site visit team, peer-reviewed articles, information from the World Health Organization for Animals (OIE), and other technical sources.

This risk analysis was conducted according to the format recommended by OIE and, therefore, includes a hazard identification section, a release assessment, an exposure assessment, a consequence assessment, and a risk estimate [2]. The hazard under consideration is CSF.

APHIS also previously recognized Mexico, including the State of Nayarit, as a region in which other swine diseases, specifically swine vesicular disease (SVD) and foot-and-mouth disease (FMD), were not known to exist [6]. In addition, APHIS does not consider Mexico to be affected with African swine fever.[3]

[3] APHIS has not evaluated Mexico, including the State of Nayarit, for blue-eye disease, and as a result, APHIS denies permits for the importation of live swine and semen from all of Mexico (9 CFR § 93.504(a)(3)). This analysis does not address the status of blue-eye disease in Nayarit.

Hazard Identification

APHIS identifies several animal diseases listed by OIE [7] as primary hazards when considering trade in animals and animal products from foreign regions. The foreign animal diseases of primary concern are listed in APHIS regulations. One of these diseases is CSF. Since CSF virus is exotic to the United States, before opening trade in live swine, pork, and pork products with a region or country considered to have been affected with CSF, APHIS conducts an import risk analysis to support rulemaking.

CSF, also known as hog cholera, is a contagious and economically damaging viral disease of domestic swine and wild boar with worldwide distribution. It is caused by the CSF virus of the family Flaviviridae, genus Pestivirus [8]. CSF virus is quite hardy, being stable between pH 4 and 10 [9] and also stable at low temperatures [10]. The virus would likely remain viable even after carcass maturation, and is unlikely to be destroyed by transport or cold storage. Laboratory confirmation of infection, essential during an outbreak situation, is complicated by the close antigenic relationship of the CSF virus with bovine viral diarrhea virus and border disease virus [8].

The incubation period for CSF is 2–14 days [11]. The virus multiplies in the epithelial crypts of the tonsils and may be carried to local lymph nodes and into the bloodstream for distribution throughout the body [12]. Blood and all tissues, secretions, and excretions of sick and dead animals are sources of virus [11]. CSF virus has been recovered from muscle and lymph nodes of infected pigs, and high titers of virus have been isolated from bone marrow [13]. The disease may also be introduced or spread via infected semen [14].

CSF can spread in an epidemic form as well as establish enzootic infections in domestic swine and wild boar populations. Infection generally spreads directly from pig to pig, but products including fresh, frozen, or cured pork can remain infectious to other pigs via the oral route [15]. Imported pig products are frequently implicated in the introduction of CSF virus into previously disease-free regions, primarily through the practice of swill feeding [16]. Dahle and Liess [17] demonstrated that the oral infectious dose of CSF virus is very low. Indirect transmission may occur via movement of people, wild animals, and inanimate objects such as live-haul trucks [18].

The role of wild boar as a virus reservoir and possible source of infection for domestic swine is well known and epidemiological links between CSF virus infection in wild boar and domestic swine have been reported repeatedly in recent years [19, 20]. In countries that are free of CSF in domestic swine, epidemics in wild boar are typically initiated by swill feeding [21]. Abnormal mortality and sometimes obviously sick animals are the first indicators of CSF introduction into a wild boar population [21].

Four distinct clinical forms of CSF have been described, including acute, chronic, congenital, and mild manifestations [22, 23]. The acute form involves a disease progression of 2–4 weeks and is characterized by high fever, generalized illness,

hemorrhagic lesions, immunosuppression with secondary infections, and high mortality. The chronic form may last 30–90 days before death and usually involves older swine or congenitally infected piglets. Congenitally infected piglets may develop symptoms of chronic CSF within 3–6 months, or may never develop symptoms but continuously shed virus. Mild CSF is typically seen only in sows and may result from exposure to a low virulent strain. Infected sows may show no overt clinical signs but continuously shed virus to their young and to other swine they contact.

Release Assessment

A release assessment describes the biological pathway(s) necessary for an importation activity to introduce pathogenic agents into a particular environment and estimates the probability of that introduction [2]. This release assessment addresses the 11 factors described under 9 CFR 92.2 for evaluation of foreign animal disease status [24]. Risk factors and issues of concern, which may directly or indirectly affect the risk estimate, are identified during this process. APHIS evaluated the current status of Nayarit with regard to CSF to decide whether it can recognize Nayarit as CSF free.

Authority, organization, and infrastructure of the veterinary services

Federal Veterinary Authority [1, 25, 26]

The *Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentación* (SAGARPA, Ministry of Agriculture, Livestock Production, Rural Development, Fishery, and Food) is the Federal department within the government of Mexico responsible for the agriculture and livestock sectors. SAGARPA is considered equivalent to United States Department of Agriculture (USDA).

Within SAGARPA, there is *Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria* (SENASICA, the National Service of Health, Safety and Quality Agrofood). SENASICA, equivalent of USDA's Animal and Plant Health Inspection Service (APHIS), is divided in several general divisions; three of them are directly focused on animal health issues. These divisions are *Direccion General de Salud Animal* (DGSA, Animal Health General Direction); *Direccion General de Inspeccion Fitozoosanitaria* (DGIF, Animal and Plant Health Inspection Service General Direction); and *Direccion General de Inocuidad y Calidad Agroalimentaria* (DGICA, Agrofood Safety and Quality Control General Direction). The role of these divisions in CSF control in Nayarit and Mexico is discussed below.

The DGSA, headed by the Chief Veterinary Officer of Mexico, is comprised of three animal health divisions and is supported by three additional entities.

The *Dirección de Importación, Exportación, Servicios y Certificación Pecuaria* (Direction of Import, Export, Services, Animal and Animal Products Certification) is responsible for issuing import and export permits for animals and animal products; registration and regulation of the manufacture of veterinary products (chemical, pharmaceutical, biological and feed products); approval of animal disease diagnostic and product quality control laboratories; accreditation of veterinarians in certain disciplines (laboratory diagnostics, ruminants, poultry, swine, animal and animal product movement, slaughterhouses, and the manufacture of pharmaceutical, biological, and/or food products); and issuing health certificates necessary for movement of animals and/or animal products within Mexico.

The *Dirección de Campañas Zoosanitarias* (Direction of Animal Health Programs) is responsible for animal health programs conducted in Mexico to control and eradicate animal diseases, including the National Classical Swine Fever Campaign which is described later in this document.

The *Dirección de Vigilancia Epidemiológica* (Direction of Epidemiological Surveillance) is responsible for analyzing surveillance data and developing risk analyses in support of domestic and foreign regionalization decisions.

The animal health activities of DGSA are supported by the *Comision Mexico-Estados Unidos para la prevencion y control de la fiebre aftosa y otras enfermedades exoticas* (CPA, Mexico-USA Commission for the Prevention of Foot and Mouth Disease and other Animal Foreign Diseases), located in Mexico City. CPA assists with the management and control of exotic animal diseases and operates a foreign animal disease diagnostic laboratory.

Centro Nacional de Servicios de Diagnostico en Salud Animal (CENASA), Mexico's national veterinary services diagnostic laboratory, is centrally located in Tecamac, State of Mexico. This laboratory receives submissions for the diagnosis of animal diseases including CSF; verifies the quality control of biological products submitted to SAGARPA for their official registration; and accredits other laboratories in Mexico for animal disease proficiency and quality control. CENASA receives all submissions from Nayarit for evaluation for CSF.

A second national laboratory, *Centro Nacional de Servicios de Constatacion en Salud Animal* (CENAPA), located in Jiutepec, State of Morelos, is the toxicology laboratory responsible for toxic and pesticide residue analyses of food of animal origin.

DGIF, the second of three SENASICA divisions involved in animal health activities, is responsible for the *Sistema Nacional de Cuarentena Agropecuaria* (National System of Animal and Agricultural Quarantine), a system of Federal inspection check points providing internal and external movement controls for animal and animal products. The External Quarantine Service provides sanitary control activities at ports, airports and borders to prevent introduction of animal diseases into Mexico via animal and animal product importation. The Internal Quarantine Service manages all activities relevant to

preventing the spread of diseases already existing within the entire national territory, from affected areas into free areas. There are 43 permanent federally maintained inspection posts on major highways distributed along five corridors in Mexico, the northern, central, southern, isthmus and peninsular quarantine lines. These effectively divide Mexico into six regions. The northern line, running along the border between Sinaloa and Nayarit, has a Federal inspection post located on Federal Highway 15 in La Concha, Sinaloa. There are no Federal inspection posts in Nayarit although there are five State-operated inspection posts which are described later in this document.

DGICA, the third division of SENASICA with animal health responsibilities, has authority over federally approved slaughterhouses and meat processing and handling facilities, known as Federal Inspection Type Establishments (TIF). DGICA is equivalent to USDA's Food Safety and Inspection Service (FSIS). To ensure compliance, TIF establishments have permanent (i.e. stationary) Federal personnel with oversight over the animal health processes and products. These establishments comply with international sanitary requirements, have official veterinary officers and are certified by the countries to which they export. TIF supervisors, assigned to an area or State, verify the activities of the official veterinarians in charge at the TIF establishments. In Nayarit, there are no TIF facilities for swine; however there are State-inspected municipal plants slaughtering swine and processing pork for local markets and personal consumption.

In each State, including Nayarit, there is a Federal SAGARPA delegate in charge of all Federal personnel responsible for animal health activities. This overseeing official, who may or may not be a veterinarian, operates from an office in Tepic. In addition, Nayarit is divided into 5 Rural Development Districts (DDR). Each DDR is staffed by an official veterinarian from SAGARPA. In total, nine veterinarians from SAGARPA are stationed in Nayarit. Among other duties, these official veterinarians are responsible for ensuring compliance with Mexican Official Standards (NOMs) regarding animal health control and surveillance programs, including local prevention and control measures, reporting livestock census information, emergency response, sampling, premises identification, movement controls and record-keeping.

State Animal Health Infrastructure [1, 25-27]

The animal health infrastructure at the State level exists as collaboration between the SAGARPA Delegation in the State (SAGARPA State Delegation), the Government of the State of Nayarit, and a State animal health committee comprised of industry and producer representatives. The official State authority in Nayarit is the Agriculture and Livestock Production Ministry. The State animal health committee is the Comité Estatal Para el Fomento y Protección Pecuaria de Nayarit, S.C. (CFPP, The Animal Agriculture Promotion and Protection Committee).

In Mexico, much of the field work for SAGARPA's animal health activities is provided through the State CFPP which receives funding from the State government, the livestock industries in the State, and the SAGARPA State Delegation. Each of these parties

contributes a third of the budget required for supporting the yearly sanitary activities. The annual budget and program of activities of the CFPP is approved by SAGARPA.

As part of the National CSF Emergency Plan which is discussed later in this document, are the *Grupos Estatales de Emergencia en Salud Animal* (State Animal Health Emergency Groups, GEESAs). GEESAs are composed of animal health personnel from the Federal and State governments, CFPP, industry, swine producers, and private veterinarians. These individuals receive training in foreign animal diseases and participate in simulation exercises and respond to emergency situations at the State level.

Legal Authority [1, 25-28]

The Federal Law of Animal Health is the legal basis applied in all the Mexican Republic and is the equivalent of USDA, APHIS' Animal Health Act. Article IV of this Law, gives SAGARPA the authority to promote, encourage, organize, supervise, coordinate and execute, all types of activities pertaining to animal health in which different organizations and agencies of the municipal, State and Federal governments can participate as well as individual stakeholders.

The Mexican Official Standards or NOMs (*Normas Oficiales*) are the Federal laws regulating these activities. The NOM that regulates the National Classical Swine Fever Campaign is NOM-037-ZOO-1995 and is described later in this document.

Other NOMs which impact the control of CSF in Mexico are:

- NOM-046-ZOO-1996, National Epidemiological Surveillance System.
- NOM-018-ZOO-1995, Verification by Approved Veterinarians.
- NOM-003-ZOO-1994, Animal Disease Diagnostic Laboratory Criteria.
- NOM-036-ZOO-1996, Minimum Requirements for CSF Vaccines.
- NOM-054-ZOO-1996, Quarantine Procedures for Animal and Animal Products.

The applicable State regulations are contained in *Ley Ganadera del Estado de Nayarit* (Livestock Law of the State of Nayarit).

Discussion

Nayarit has the legal authority to enforce Federal and State CSF regulations and the necessary veterinary infrastructure to carry out CSF surveillance and control activities. One of the strengths observed by the APHIS/CFIA site-visit team was the apparent good communication and cooperation existing among the Federal, State and municipal government officials, the CFPP representatives, and swine producers. APHIS could not identify any risk issues associated with this factor that would pose an unacceptable risk to the United States if trade with Nayarit in swine, pork, and pork products were to occur.

Disease status in the region [1, 25-27]

In Nayarit, the last reported CSF outbreak in domestic swine occurred in 1989. It involved one small commercial herd and two backyard holdings. Mexican officials were not able to provide historical information on these outbreaks because they occurred so long ago.

The Mexican government declared the State of Nayarit to be CSF-free on May 13, 1999, in accordance with the National Classical Swine Fever Campaign, as described in the Official Mexican Standard NOM-037-ZOO-1995 which is discussed later in this document [1].

Detailed information on wild boar population in Nayarit is not available. In response to questions raised during the site visit, State and Federal officials indicated that wild boar, if any, were few in numbers and likely confined to the remote, less inhabited, mountainous areas in eastern Nayarit. These areas are isolated from commercial swine production areas. Furthermore, hunting of wild boar was not known to occur in Nayarit, and wild boar are not known to populate the State. Therefore, there is no reason to conclude that wild boar are a risk for introduction or spread of CSF virus in Nayarit.

Discussion

Over 15 years have passed since the last reported outbreak of CSF in Nayarit. This time period exceeds that recommended by OIE for the disease-free period required for CSF disease freedom recognition [29]. The CSF surveillance program, discussed subsequently in this document, is sufficient to reasonably detect CSF if it were reintroduced into the domestic swine population. CSF surveillance in backyard swine would likely detect presence of the virus in Nayarit. APHIS could not identify any risks associated with this factor that would pose an unacceptable risk to the United States if trade with Nayarit in swine, pork, and pork products were to occur.

Disease status of adjacent regions [1, 25-27]

Nayarit shares borders with the States of Sinaloa, Durango, Zacatecas and Jalisco. In accordance with the National Classical Swine Fever Campaign, the Mexican government considers Sinaloa and Durango to be CSF-free. Sinaloa was declared free on November 16, 1993 and Durango was declared free on October 7, 1999. As of May 15, 2004, Zacatecas and Jalisco are considered to be in the eradication phase. The National CSF Campaign and the different phases are discussed in the next section.

Although APHIS considers Sinaloa to be CSF-free, APHIS has not evaluated Durango, Zacatecas, and Jalisco and, therefore, considers them to be CSF-affected [30-32].

Discussion

The existence of common land borders with CSF-affected regions does present a risk for re-introducing CSF into Nayarit. However, movement controls and certification requirements regarding region of origin and commingling concerns, are designed to mitigate this risk and are discussed in detail later in this document.

Extent of active disease control program [1, 25-27]

CSF is considered exotic to Nayarit; therefore it does not have an active disease control program. However, the Mexican government has an ongoing active CSF disease control program which includes surveillance, movement control, and emergency response provisions for CSF-free States such as Nayarit. In order to maintain its disease freedom status under the Mexican program, Nayarit must comply with these provisions of the Federal program. The following is a brief overview of the national CSF program. Surveillance, movement control, and emergency response activities are described in subsequent sections.

National Classical Swine Fever Campaign

Because of the economic importance of swine production to the country, the Mexican government is pursuing eradication of the CSF virus from Mexico. The Official Mexican Standard NOM–037–ZOO–1995, National Classical Swine Fever Campaign, proposed on October 11, 1995 and finalized on August 26, 1996, describes the CSF disease control program [1].

The campaign is basically directed towards domestic swine production, but its measures could be applicable to feral swine if deemed appropriate by the Mexican government. Responsibility for the campaign is shared by SAGARPA, State governments, livestock protection and promotion committees, producer associations, owners, dealers, transporters, and other individuals and entities involved in swine production.

The campaign calls for the recognition of States or regions within States to be classified as being in one of three phases: CSF-free, eradication, or control. Currently Mexico classifies 7 States as being in control, 12 as in eradication, and 13 States, including Nayarit, as being CSF-free (see Figure 1). The CSF-free areas are in the north of Mexico and the Yucatan peninsula. Inspection posts, discussed later in this document, have been placed to protect the status of the lower risk regions from the eradication and control phase regions. The eradication States are in the central area and the control States extend from the population center of the Federal District area south and east along the Pacific coast, the isthmus area to the border with Guatemala.

Figure 1.

Source: SAGARPA [25]

It is in the control phase States or regions south of Nayarit (red States on the map) where CSF outbreaks continue to occur. In 2004, a total of 3 outbreaks were reported in Mexico (all in the Federal District of Mexico). In control phase areas, CSF vaccination is allowed and intensive vaccination programs are directed at high-risk and high swine population zones. In accordance with the NOM, vaccine production, handling, and use are subject to authorization by SAGARPA. Each farm is requires to keep a record of vaccinations and vaccination certificates are issued by official or approved veterinarians. Monitoring and sentinel programs are implemented by SAGARPA as part of the ongoing epidemiological surveillance.

A State or region may move into the eradication phase of the program once vaccine marketing and use have stopped and at least12 months have elapsed since the last CSF outbreak. In the eradication phase, the State or region must control animal movement along the main routes of entry, conduct epidemiological surveillance, implement a sentinel program, develop an animal health emergency plan, and fund an emergency insurance or indemnity program. Six months after a State or region has moved from control to eradication phase, a sampling program must be carried out by Federal and State officials, in cooperation with producer groups.

After a State or region has been in eradication phase for at least 12 months and there has not been a case of CSF in at least the previous 24 months, it may seek recognition as CSF-free. A State or region will be declared CSF-free by a resolution of the Secretary of Agriculture and Rural Development published in the *Federal Gazette*. Free States must continue to verify their status by conducting serological sampling surveys every six or twelve months as scheduled by SAGARPA in cooperation with State officials.

The NOM prohibits the feeding of swill or garbage to swine throughout Mexico, regardless of phase in which the State or region is classified. As Nayarit prepared to seek CSF-free recognition, an education program was conducted and a questionnaire given to all backyard and commercial swine operations. This questionnaire specifically asked about feeding practices to reinforce the prohibition of swill or garbage feeding.

The protection of the status of CSF-free States and the status of States under eradication relies on strict control of movement of swine or pork products. State governments, in addition to the Federal government, operate animal health checkpoints within and between States. The NOM basically provides that swine move only between areas of equal CSF risk or from higher to lower CSF risk areas. Swine from control States or regions are prohibited from moving into free or eradication areas. Swine from eradication phase areas are also prohibited from moving into free areas. Movement of pork and pork products are similarly regulated, except an allowance is made to move heat-treated products from origins of higher risk to destinations of lower risk.

In the event of suspicion of CSF, SAGARPA must be notified and a precautionary quarantine established surrounding the affected premise pending laboratory confirmation. In control zones, sick animals are depopulated and other swine in the surrounding areas are vaccinated. In free and eradication States or regions, if CSF is confirmed the State or region is temporarily downgraded to control phase status and the affected and exposed premises are depopulated. If it is not feasible to depopulate, the region reverts to control zone status and would then follow the procedures established in the NOM to achieve free-zone recognition as the situation improves. Otherwise, affected premises are cleaned, disinfected and repopulated in accordance with standards outlined in the NOM. If there is no further evidence or suspicion of CSF during the six months following repopulation, then the free or eradication status of the area will be restored.

Discussion

Mexico has an ongoing National CSF Campaign which recognizes certain regions within the country as being CSF-free and is working to eradicate the disease from the rest of its territory. Nayarit has maintained its CSF-free designation since 1999. The APHIS site visit team concluded that Nayarit is in compliance with provisions of the program.

Vaccination status of the region [1, 25-27]

Vaccination for CSF ceased in Nayarit in March 1996 just before its status changed from control to eradication phase. Furthermore, once Nayarit was classified as CSF-free in May 1999, vaccination was prohibited in accordance with Article 6.7 of NOM-037-ZOO-1995.

While CSF vaccination continued at the time of the evaluation in the control phase States of Mexico (Chiapas, Federal District, Guerrero, Mexico, Morelos, Oaxaca, and Tabasco), there was no movement of live animals from those States into free States such as Nayarit.

The veterinary infrastructure of the CFPP allows for frequent monitoring of the local feed stores where animal health biological agents and vaccines are marketed. It is not likely that the illegal sale of CSF vaccines would go undetected.

Discussion

CSF vaccination has been prohibited in Nayarit since March 1996; so it is unlikely that swine in this State would have vaccine titers to CSF. Therefore, the CSF surveillance program in Nayarit, which depends on serology, should be devoid of vaccine interference. The serological approach is discussed in the section on surveillance which appears later in this document. As required by the NOM, any positive result on surveillance testing would trigger an epidemiological investigation. Also as a naïve population, Nayarit's swine population would likely exhibit clinical signs fairly quickly after infection if CSF were to be reintroduced, which might enhance disease detection if appropriate diagnostic actions were undertaken.

Separation from adjacent regions of higher risk [1, 25-27]

The State of Nayarit is located along the Pacific coastline of central Mexico. Nayarit borders the States of Sinaloa and Durango on the north, Zacatecas to the east, and Jalisco on the east and south. Natural barriers to disease transmission include the Pacific Ocean to the west and the Sierra Madre Occidental Mountains to the east.

Surface movement into and out of Nayarit primarily occurs along the corridor from Sinoloa in the north and Jalisco to the south. This corridor is a strategic truck route from the northern Mexican States through Nayarit to markets in the population centers of Guadalajara and Mexico City. There is also some overland shipping from Puerto Vallarta, Jalisco transiting Nayarit to these population centers as well. Puerto Vallarta is separated from the rest of Jalisco by mountains which make it easier to drive northeasterly through Nayarit to connect with the north-south corridor.

There are no major seaports along the Pacific coast of Nayarit. Sea vessels consist primarily of private yachts, shrimp boats, and small fishing boats. Nayarit ports are not equipped to handle large vessels of any type including passenger cruise or freight ships.

Commercial air traffic into Nayarit is light, as it is limited to regional passenger service and private aircrafts. The sole risk from this exposure pathway would be from catering waste or passenger baggage containing CSF-contaminated material.

In accordance with the NOM, swine and pork or pork products may only be imported from countries or regions recognized as CSF free by Mexico unless the pork or pork products were heat-treated sufficiently to inactivate CSF virus.

Discussion

The natural barriers of the mountains and ocean and the few highways into Nayarit limit movement of swine and products into the State, thus reducing the risk of CSF virus introduction.

Movement controls and biosecurity from higher-risk regions [1, 25-27]

Nayarit, a CSF-free State, restricts movement of swine and swine products from States that are in eradication or control phases in accordance with the standards set out in NOM–037–ZOO–1995. Veterinary health certificates are required for interstate movement of live swine and must accompany the shipments. Only live swine and fresh pork from other CSF-free States to the north are allowed entry or transit through Nayarit. No live swine or fresh pork enter Nayarit from Jalisco in the south. Vehicles that move live swine through eradication or control phase zones must be cleaned and disinfected prior to return through a free zone.

Processed pork products from eradication or control phase zones may enter Nayarit if they are shipped from Federal inspection type establishments (TIF plants) under certain conditions as follows: 1) the facility must have a current TIF registration; 2) the TIF plant must be authorized by DGSA to market their products and byproducts into CSF-free zones; 3) these products must be processed according to the heat treatment standards described in the NOM (68.9º C for 30 minutes or 80.5º C for 3 minutes); 4) a veterinary certificate must accompany these consignments; and 5) the consignments must be properly identified, and must move via sealed vehicles. Typically these are products produced in the TIF plants in the Mexico City area and are being shipped to the markets in Tepic, Nayarit.

The State has five permanent inspection posts operating 24 hours a day to control interstate movement of animals and animal products. These inspection posts are located on the four roadways that enter the State (see Table 1) and are operated and staffed by CFPP personnel.[4] These veterinary inspectors undergo additional training in order to be certified in movement control. Nayarit does not receive imports directly from third countries, so there are no Federal border inspection posts in the State.

[4] During the Nayarit State Fair, a temporary inspection post is set up at the airport in Tepic primarily to monitor movement of fighting cocks.

Table 1: Nayarit Permanent Movement Control Inspection Posts

Name	Location
Pie de la Cuesta	Along secondary road in southern Nayarit near the stateline with Jalisco.
San José de Gracia	Along major north-south roadway, Federal Route 15, in southern Nayarit at the stateline with Jalisco.
Plan de Barrancas	Along major north-south roadway, Federal Route 15, in northern Nayarit near the stateline with Sinoloa.
Jarretaderas	Along secondary road in southwestern Nayarit near the stateline with Jalisco. Primary route for traffic between Puerto Vallarta, Jalisco transiting Nayarit to reach the population centers of Guadalajara, Jalisco and Mexico City.
El Atrancon	Along major north-south roadway, Federal Route 15, in northern Nayarit near the stateline with Sinoloa.

Source: SAGARPA [1, 26] and Nayarit CFPP officials [27]

Two inspection posts, San José de Gracia and Pie de la Cuesta, were visited by the APHIS site visit team. San José de Gracia was strategically located where the new four-lane toll highway and the old two-lane free access road, both being Federal Route 15, were adjacent allowing for inspection of traffic on both portions of the route. This inspection post is staffed 24 hours per day with a total of 7 inspectors for each of three shifts (a total of 21 inspectors). Pie de la Cuesta, located on a rural secondary road, also operated 24 hours a day with two inspectors per shift working in three shifts (a total of 6 inspectors).

Physical and documentary inspection is performed at these inspection posts. Inspection is performed for all readily identifiable animal and animal product shipments. In addition, other vehicles, including passenger cars and buses, were inspected randomly. About one in every ten vehicles was stopped for inspection. In addition to the veterinary certificates required under the NOM, Nayarit also requires vehicles to carry a movement permit while moving through the State. Vehicles will be issued a movement permit at the entry inspection control post. The permit lists the origin of the shipment, destination, number of animals, veterinary certificate number, and seal numbers. The movement permit must be surrendered at the exit inspection control post. Records are maintained at the inspection posts in a log of all consignments transiting the post. Monthly summary reports are submitted to the CFPP office.

In the event that any incoming swine, pork or pork products are not in compliance with established regulations, then these consignments are rejected and returned to their point of origin. At the two inspection posts visited by the APHIS team, only a few non-compliance rejections were noted. These violations were for such things as improper washing or disinfection of vehicle, broken seals, or missing veterinary health certifications (brucellosis free herd certificates). A report of each rejected consignment is

made and a copy of the report is sent to the CFPP office in Tepic. There are no import quarantine facilities in Nayarit for live animal shipments.

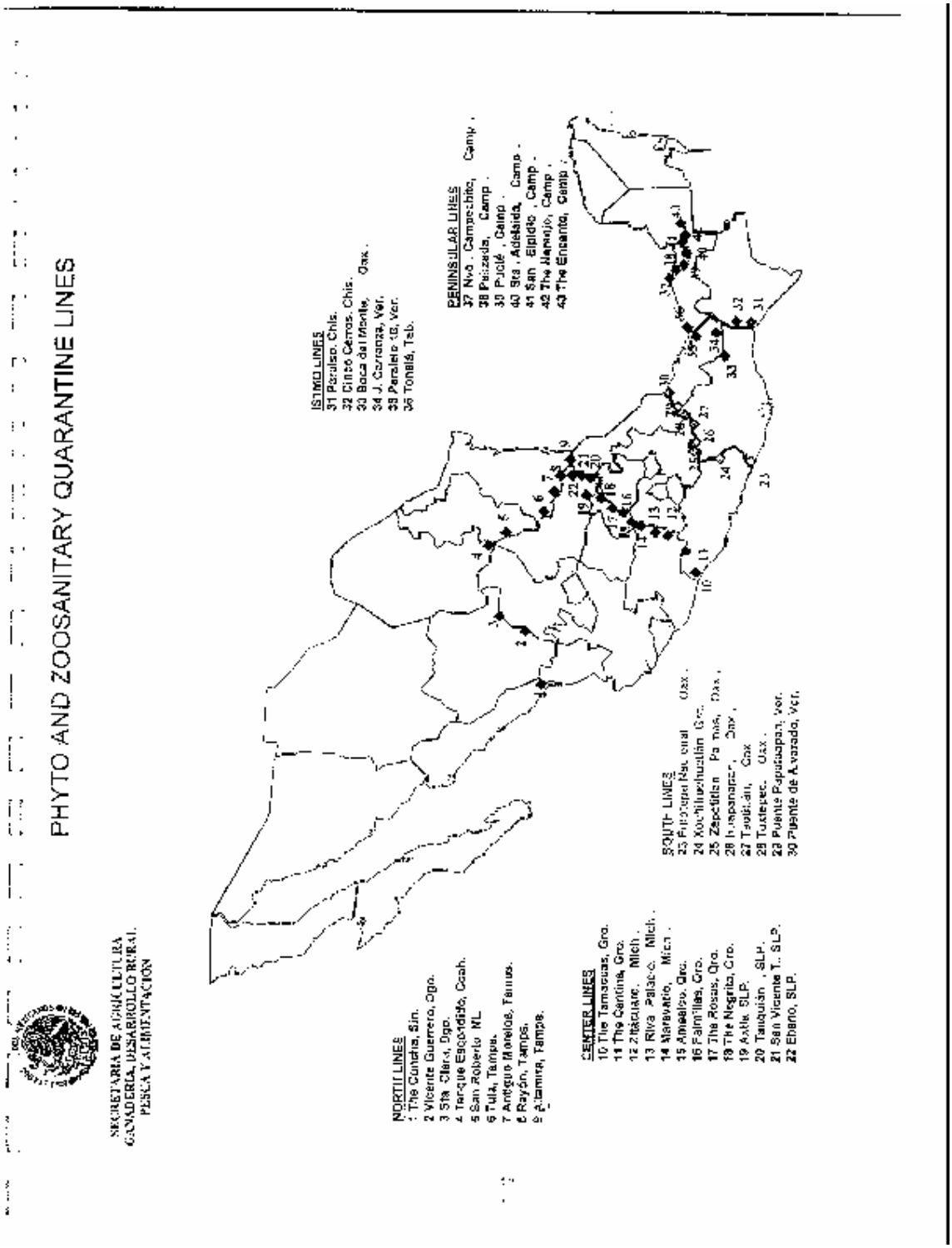
The five inspection posts use radio communication to remain in constant contact with each other and with the State office in Tepic. A new computerized system of communication with internet broadband access via satellite transmission was in the process of being installed at the time of the site visit.

In addition to these State inspection posts, Mexico has a system of national animal and agricultural product quarantines (Sistema Nacional de Cuarentena Agropecuaria) which consists of 43 control points for movement of animal and animal products (see Figure 2). None of these control points are located within Nayarit; however two of the lines form barriers between Nayarit and the higher CSF risk regions to the south.

Discussion

The movement controls established by the National CSF Campaign and implemented and enforced by Nayarit officials limit the illegal movement of swine or pork products from CSF affected zones. The system of inspection posts in Nayarit was cited by the APHIS site visit team as a strong point in the State's CSF control program. The system of inspection posts ensures reasonable enforcement of these provisions, significantly limiting the risk of CSF introduction into Nayarit.

Figure 2.



Source: SAGARPA [1]

Livestock demographics and marketing practices in the region [1, 25-27]

Mexico is an important producer of pork, currently ranked fifteen in world pork production and second in Central and South America after Brazil. Commercial farms are responsible for half of swine raised in Mexico, another 20% are produced on medium-sized (10 to 40 hogs) facilities, and 30% are raised in backyard farms (averaging 5 hogs). Seventy percent of pork produced is marketed fresh and the remaining 30% is processed. The States with the greatest pork production are Sonora and Jalisco.

Nayarit is not a major swine production area. The State has no major livestock markets and most of its swine are raised for local consumption. There are no federally-inspected slaughter/processing plants (TIF plants) handling swine in Nayarit. Slaughter and processing through a TIF plant would be necessary for pork to be exported to the United States as well as to CSF-free States in Mexico.[5] Slaughtering and processing of swine in Nayarit is currently handled by State-inspected municipal plants.

In 2004, there were 34 commercial swine farms in the State with a population of 30,634 animals. Only two farms had over 4,000 hogs (4,128 and 4,565). Another 18,650 hogs are reared in backyards intended for personal consumption by their owners. The following table lists the swine population in each of the 20 municipalities in Nayarit.

[5] Federal Inspection Type Establishments (TIF) are slaughterhouses and meat processing and handling facilities approved by DGICA, an agency equivalent to USDA, Food Safety and Inspection Service (FSIS). TIF establishments have permanent sanitary inspection of their processes and products through official veterinarians to monitor compliance with SAGARPA regulations. These establishments comply with international sanitary requirements and have official veterinary officers and are certified by countries to which they export. Pork or pork products must be processed through TIF establishments to be exported from Mexico to the United States.

Table 2. Nayarit Swine Population, 2004

Municipality	Commercial	Backyard	Total
Tepic	8,882	4,000	12,882
Sta. Maria del Oro	8,886	800	9,686
San Blas	4,865	1,000	5,865
Ixtlan del Rio	2,796	750	3,546
Ahuacatlan	2,515	600	3,115
Compostela	1,657	1,150	2,807
Bahia de Banderas	236	1,200	1,436
Amatlan de Canas	263	1,000	1,263
Tecuala		1,200	1,200
Rosamorada	80	1,000	1,080
Acaponeta		1,000	1,000
Santiago Ixcuintla		900	900
Tuxpan	454	400	854
Ruiz		800	800
La Yesca		700	700
El Nayar		500	500
Huajicori		500	500
Xalisco		450	450
Jala		400	400
San Pedro Laguillas		300	300
Totals	30,634	18,650	49,284

Source: SAGARPA [1, 25, 26]

Nayarit supplements its local production with swine and pork imported from other States and countries. In 2004, Nayarit imported 24 breeding swine from Canada, and received from other CSF-free Mexican States (mainly Sonora) approximately 26,000 hogs for local slaughter and 2 million kilograms of fresh pork. In addition, slightly more than 8 million kilograms of processed meats (sausages, etc.) came into Nayarit from TIF plants elsewhere in Mexico.

During the site visit, team members visited a commercial swine farm and observed good biosecurity measures. The team also visited a private home where a small backyard herd was kept in confinement although there were no sufficient barriers present that would prevent exposure to wildlife; however, wild boar are not known to be in the area. When asked about swill feeding the owner indicated an awareness of the prohibition against that practice.

Discussion

Currently, Nayarit consumes more pork than it produces and does not have the infrastructure, such as TIF plants, necessary to export pork to the United States. This dynamic limits the legal movement of swine and pork from Nayarit to the United States. Should Nayarit develop a desire to export, it must identify an appropriate TIF plant out of

State or designate a plant in the State for an FSIS equivalence evaluation. However, even if it were to accomplish this, APHIS considers the risk to be low.

Disease surveillance in the region [1, 25-27]

An active CSF surveillance program is conducted in Nayarit in accordance with NOM-037-ZOO-1995. In order to maintain its CSF-free status, Nayarit must conduct annual serological sampling surveys in commercial and backyard herds. Animals at slaughterhouses are not sampled. Each year CFPP submits a livestock census to SAGARPA. Working in coordination with the State government and CFPP, SAGARPA determines the sampling protocols for commercial and backyard herds, the sample size, and diagnostic laboratory. All samples from Nayarit are submitted to the Centro National de Servicios de Diagnostico en Salud Animal (CENASA), located in the State of Mexico**.**

The sampling protocol being used for commercial herds is designed to detect 5 percent prevalence with 95 percent confidence. All commercial herds are sampled where 80 percent of the samples must be from breeding sows, 10 percent from boars, and 10 percent from fattening pigs older than 4 months of age. A stratified random sampling protocol is used for the backyard herds to detect 1 percent prevalence with 97 percent confidence. SAGARPA determines the number of backyard herd samples to be collected annually in each of the 20 municipalities in Nayarit. CFPP in cooperation with municipal officials then selects premises to be sampled based on swine population density and proximity to commercial herds. Samples are taken from all swine on the premises selected.

Since gaining CSF-free designation, Nayarit has not had any CSF positive serological samples. A summary of the surveillance data is presented in Table 3.

Table 3. Nayarit CSF serological surveillance 2000-2003

Year	Commercial Production				Backyard Herds		
	No. of farms	Population	Sample size	Samples submitted	Population	Sample size	Samples submitted
2000	33	10,809	1,806	1,596	30,006	1,675	1,465
2001	45	36,799	2,293	2,293	29,587	1,665	1,645
2002	45	34,279	2,328	2,092	30,890	1,035	1,035
2003	44	36,665	2,277	2,096	25,010	1,750	1,750

Source: SAGARPA [1, 25, 26]

When a case of CSF is suspected on a farm, or when a positive result is obtained through serological tests, the animal owner**,** the attending veterinarian, and the laboratory are required by Federal law to immediately report the suspicion or finding to the SAGARPA State delegation. Immediately upon suspicion, a precautionary quarantine is imposed on the affected premises and an official epidemiological investigation ensues. Since being designated CSF-free, Nayarit has not reported any clinical suspicions.

Discussion

The active serological surveillance program in Mexico appears sufficient to detect the presence of CSF virus if it were to be introduced into Nayarit. In fact, APHIS has evaluated the national serological approach as used in the States of Baja California, Baja California Sur, Campeche, Chihuahua, Quintana Roo, Sinaloa, Sonora, and Yucatan, Mexican States that APHIS has recognized previously as CSF-free. However, if CSF virus were to be introduced, it could spread rapidly if it were not soon detected. Clinical suspicion therefore, is important for early detection. Because CSF can cause clinical presentations similar to other more common swine diseases, CSF should be in the diagnostic workup of any disease condition in pigs characterized by depression, anorexia, persistent high fever, abnormal bowel activity, and mortality.

Diagnostic laboratory capacity [1, 25-27]

The State of Nayarit does not have a diagnostic laboratory accredited for CSF diagnosis. All samples for CSF suspicion and surveillance are sent to the Centro National de Servicios de Diagnostico en Salud Animal (CENASA), located in the State of Mexico. This laboratory has been previously evaluated in other risk analyses and was not re-evaluated during the site visit to Nayarit [32-37]. Based on these prior assessments, APHIS has confidence that CENASA would be able to detect CSF in samples submitted for serological testing.

Discussion

Considering the relatively small swine population in Nayarit, this arrangement is satisfactory for CSF diagnostic and surveillance needs. However, if the swine population increases significantly this factor may need to be reassessed.

Emergency response capacity [1, 25-27]

Mexico has an established national system for surveillance and reporting of exotic animal diseases operated by SAGARPA in collaboration with the Mexico-United States Commission for the Prevention of Foot and Mouth Disease and Other Exotic Animal Diseases (CPA). As a disease-free State, CSF virus is considered to be exotic to Nayarit.

Whenever CSF is suspected, SAGARPA must immediately be notified and a precautionary quarantine is implemented in the focal and perifocal area to include the affected, exposed and at risk premises. If CSF is confirmed by CENASA then the quarantine becomes definitive. Movement controls are implemented, sick animals are killed, dead animals are sanitarily disposed, and an epidemiological investigation ensues.

If CSF is detected in a free or eradication-phase State, the *Dispositivo Nacional de Emergencia de Sanidad Animal* (National Animal Health Emergency Operation, DINESA) becomes activated. DINESA functions to control and eradicate the outbreak in accordance to the National CSF Emergency Plan as provided in NOM-037-ZOO-1995.

Operating at the State level under the direction of DINESA, are the *Grupos Estatales de Emergencia en Salud Animal* (State Animal Health Emergency Groups, GEESAs). In the event of an animal emergency, a GEESA is activated to function at the local level to quickly and effectively respond to the outbreak. A GEESA includes specialized technical personnel who have experience with animal health and outbreak control. This group is composed of individuals from Federal and State government, CFPP, industry, and swine producers. The GEESA includes both official and private veterinarians who receive periodic training in foreign animal diseases and participate in simulation exercises. In Nayarit, the GEESA was organized in 1994 and now includes 56 veterinarians. If necessary, the military can assist the GEESA in animal health emergencies.

In the event of a CSF outbreak in a free or eradication State, once the extent of the outbreak is known, a determination will be made as to the financial and technical feasibility of depopulating affected and exposed premises. If feasible, in a free State like Nayarit, a stamping-out without vaccination policy would be implemented and indemnity would be paid to producers out of the State's insurance plan or contingency fund. If depopulation was deemed not feasible, then the State would revert to a control phase status and would then follow the procedures established in the NOM to achieve free-zone recognition as the situation improves.

If a stamping out without vaccination policy was implemented and the affected premises were cleaned, disinfected and repopulated in accordance with the National CSF Emergency Plan, then six months must pass without evidence of CSF virus before officially regaining either their free status or eradication-phase status, as the case may be.

Discussion

A close association and cooperation was observed between the Federal, State and municipal government officials, the CFPP staff and swine producers. This cooperation was especially effective in the operation of Nayarit's existing animal health checkpoints. Although no CSF suspect cases have been reported in Nayarit in recent years, these officials demonstrated knowledge of processes required under the National CSF Emergency Plan. These observations give APHIS confidence that an effective veterinary infrastructure exists in Nayarit capable of responding to a CSF outbreak. APHIS was unable to identify specific limitations in this system that would pose a risk to the United States.

Release Assessment Conclusions

APHIS found no evidence that CSF virus exists in Nayarit. CSF has not been detected in Nayarit since 1989 despite ongoing surveillance.

Nayarit is relatively isolated by the mountains and oceans and has few points of entry into the State. Mexico has a National CSF Campaign to eradicate CSF from all of its territory. As a tenet of that campaign, movement of swine and swine products from regions of higher CSF risk into Nayarit is prohibited, thus reducing the greatest potential source of virus introduction into the State. To verify and enforce compliance with that provision, Nayarit is located in a region of the country protected by a quarantine lines across Mexico. It also has animal health inspection control posts along the highways entering the State. However, APHIS considers that the potential for introduction of CSF into Nayarit is greater than the current potential for introduction of CSF into the United States because Nayarit shares common land borders with regions considered affected with CSF.

In this regard, the risk profile of Nayarit resembles that of other Mexican States currently recognized as CSF free (Baja California, Baja California Sur, Campeche, Chihuahua, Quintana Roo, Sinaloa, Sonora, and Yucatan) which also share common land borders with regions considered affected with CSF.

Current U.S. regulations require certification that swine have been kept in a region entirely free of CSF for 60 days prior to export (9 CFR § 93.505) and also require upon entry into the United States a minimum quarantine of 15 days for all imported swine (9 CFR § 93.510). These requirements serve to reduce the risk of exposure by increasing the probability of CSF detection prior to contact with susceptible swine in the United States.

Additional certifications are required of live swine, pork and pork products imported from certain regions, including the Mexican States of Baja California, Baja California Sur, Campeche, Chihuahua, Quintana Roo, Sinaloa, Sonora, and Yucatan. These additional certifications are described in 9 CFR § 94.25. [6]

Under 9 CFR §94.25, swine imported from listed regions must be accompanied by certification that the swine originated in and were exported from regions free of CSF, and furthermore, that the swine must never have commingled with swine that have been in regions affected with CSF. Likewise, pork and pork products imported from listed regions must be accompanied by certification that the swine from which the pork or pork products were derived were born and raised in regions free of CSF, and that the swine

[6] Regions listed under 9 CFR §94.25 are in a special category because, even though APHIS has determined that the region is free of CSF, one or more of the following conditions occur: (1) the region supplements its pork supplies with fresh (chilled or frozen) pork imported from regions designated in §§ 94.9 and 94.10 as being affected by CSF; (2) it supplements its pork supplies with pork from CSF-affected regions that is not processed in accordance with the requirements of part 94; (3) it shares a common land border with CSF-affected regions; or (4) it imports live swine from CSF-affected regions under conditions less restrictive than would be acceptable for importation into the United States [3].

were slaughtered in such a region at a federally inspected slaughter plant eligible to export to the United States. Additionally, the pork or pork products must never have been commingled with pork or pork products that have been in regions affected with CSF. These certification requirements mitigate the risk of importing CSF virus by reducing the likelihood of exposure of exported swine, pork, or pork products to potentially infected swine or CSF contaminated pork or pork products from regions that are CSF affected.

Based on this evaluation, APHIS considers the export risk from Nayarit to be equivalent to that of the Mexican States listed in 9 CFR §94.25. Applying the provisions of 9 CFR §94.25 to Nayarit would address the risk from sharing common land borders with regions affected by CSF.

If CSF virus were reintroduced into the State, it would likely be detected and contained before spreading. This would be accomplished through the cooperation of Federal, State and municipal government officials and industry representatives serving in the State animal health committee. The swine population in Nayarit is relatively small and swine density is low. Wild boar are not known to exist in the State; so no apparent wildlife reservoir for CSF exists. Domestic swine are naïve to CSF since vaccination has been prohibited for 10 years. Clinical signs should appear soon after infection. Although clinical suspicion of CSF must be reported to veterinary authorities and epidemiological investigations conducted, there have been no suspicious cases of CSF reported since Nayarit was declared CSF free in May 1999. Also since this time, an active CSF surveillance program has been conducted annually in both commercial and backyard herds, and all samples have tested negative for CSF.

CSF virus is not likely to be exported from Nayarit to the United States through trade of swine, pork, and pork products. The strength of Mexico's National CSF Campaign, as it is applied in Nayarit, is based mainly on active serological surveillance and strict movement controls. Under the national program, Nayarit, as well as 12 other States, eradicated CSF to achieve free status and have continued to maintain that status. APHIS considers the level of surveillance to be adequate and movement controls to be strong. However, since Nayarit shares a common land border with regions considered affected with CSF, a risk of exporting CSF exists. This risk is low. If the mitigation measures described above for Nayarit are implemented the risk would be reduced even further.

Exposure Assessment

An exposure assessment as defined by the OIE describes the biological pathway(s) necessary for exposure of animals and humans in an importing country to the hazards released from a given risk source, and estimates the probability of the exposure(s) occurring [2]. Since APHIS' regulatory authority is limited to animal health, the potential risks to animals are the primary focus of this evaluation.

APHIS considers that the most likely pathway of exposure of domestic swine to CSF virus in pork and pork products is through feeding of contaminated food waste to swine [38]. Other exposure pathways are more direct and include contact with imported infected live animals or contact with infected genetic material.[7]

Waste feeding to susceptible swine

The likelihood of exposure of susceptible species to virus-infected meat was evaluated in previous APHIS studies. In 1995, APHIS conducted a pathway analysis to estimate the likelihood of exposing swine to infected waste [39]. The analysis included two pathways for exposure of swine to contaminated waste; namely, exposure associated with illegal household imports, and exposure associated with legal imports. The latter is the exposure pathway that would be applicable to importing pork or pork products from Nayarit. With 95% confidence, APHIS estimated that 0.023 percent or less of plate and manufacturing waste would be inadequately processed prior to feeding to swine [39]. Based on this fraction, less than 1 part in 4,300 (reciprocal of 0.023 percent) of imported meat is likely to be fed to swine as inadequately cooked waste.

APHIS conducted a survey in 2001 of the U.S. swine waste-feeding sector to update a similar study done in 1994 [40]. Based on this survey, VS estimated that the proportion of plate and manufacturing waste fed to swine diminished by about 50 percent between 1994 and 2001 due to a decrease in the number of waste-feeding premises. The study also found that:

- The number of waste-feeding premises decreased significantly since 1994;
- Several more States prohibited feeding food wastes to swine;
- The number of waste-feeding premises in the continental United States decreased by 40.5 percent from 1994-2001, and in Hawaii and Puerto Rico decreased by 37.5 percent and 52.3 percent, respectively; and
- Institutions and restaurants provide nearly 90 percent of all plate waste fed to swine.

APHIS considers that prohibiting the feeding of unprocessed plate waste to swine has further contributed to the reduction of waste-feeding to swine. In this regard, waste-

[7] APHIS considers all of Mexico to be affected with blue-eye disease of pigs, a disease which is not known to exist in the United States [4, 5]. APHIS has not evaluated Mexico, including the State of Nayarit, for blue-eye disease. As a result, APHIS denies permits for the importation of live swine and semen from all of Mexico, including Nayarit (9 CFR § 93.504(a)(3)). CSF is the hazard being evaluated in this analysis. The analysis does not address the status of blue-eye disease in Nayarit.

feeder operations must be licensed and inspected regularly by USDA inspectors (9 CFR §166). The licensing process requires that producers adequately cook the waste fed to swine according to methods designed to reduce the probability of survival of foreign animal disease agents in the waste.

Based on the 1995 estimate that a very small proportion of food waste is inadequately processed prior to feeding to swine, and the substantial reduction in waste-feeding operations in recent years, APHIS considers the likelihood of exposure of susceptible swine to CSF virus through inadequately processed food waste to be low. Based on the results of the release assessment, APHIS further considers the probability of exposure of susceptible swine to these viruses through inadequately cooked infected meat from Nayarit to be low.

Imported live animals

The likelihood of exposure of susceptible swine to infected live animals was evaluated by considering virus persistence and shedding in infected live swine. APHIS considers exposure of a susceptible U.S. animal population to illegally imported infected live animals from Nayarit to be unlikely.

The survival period of CSF virus within live swine ranges from 1 week to greater than 6 months depending on various host-pathogen factors. The unmitigated potential for exposure to the CSF virus via live swine imports would be comparatively high. However, SAGARPA veterinary officials will provide certification that appropriate mitigations are applied to reduce that risk (9 CFR 93.505). APHIS considers the mitigations adequate. In addition, live animals are subject to 15 day quarantine upon entry into the United States (9 CFR 93.510) during which they are observed for clinical signs, providing additional mitigations. Given the low likelihood of importing an infected animal estimated by the release assessment and considering the certification and quarantine requirements, APHIS concluded the probability of exposure of susceptible U.S. swine to CSF virus via infected swine from Nayarit to be low.

Imported genetic material

Genetic materials have been implicated in the introduction of foreign animal disease into susceptible populations, as well as the spread of established disease epidemics over considerable distances. For example, two semen collection centers became infected during the course of the 1997-1998 CSF epidemic in the Netherlands [41]. Potentially contaminated semen was distributed to 1,680 swine herds over the course of 5 weeks, during which the disease remained undetected in the donor boars. Although investigators concluded that only 36 farms had been infected through artificial insemination, all suspect farms were subject to quarantine and testing, resulting in a tremendous expenditure of resources.

Survival of CSF virus in semen has been estimated in experimental studies to be 12 to 72 hours at 20º C but ranges from 1 month to several years at 4º C or below [42]. Survival

in embryos and ova is unknown [42, 43]. Based on the extended period of survival of CSF virus in frozen semen, APHIS considers the unmitigated likelihood of exposure of susceptible animals to CSF in infected semen to be high. However, based on the results of the release assessment (i.e., that infected semen are unlikely to be imported), APHIS considers the probability of exposure of susceptible animals to CSF via infected semen from Nayarit to be low.

Consequence Assessment

A consequence assessment describes the biologic and economic consequences of introducing the hazards under consideration into the United States. This consequence assessment addresses both direct and indirect consequences as recommended by the OIE [2].

The magnitude of the biologic and economic consequences following an introduction of CSF virus would depend on the location of the introduction, the virus serotype introduced, the rate of virus spread and whether other environmental conditions at the introduction site that might facilitate this spread, ability to detect the disease rapidly, swine demographics and movement patterns, and the ease of employing eradication procedures [44]. In addition, depending on the extent of export of swine, pork, and pork products, trade restrictions imposed by trading partners may result in severe economic consequences.

Direct consequences include effects of the disease on swine health and the subsequent production losses, the total costs of control and eradication, the effect on the environment, and public health consequences. Indirect consequences include impacts on international trade and associated domestic consequences.

Animal health consequences

Acute and chronic courses of CSF have been described. The severity of the disease depends largely on the age of the animal and virulence of the viral strain, with young animals usually more severely affected than older animals. In older breeding pigs the course of infection is often mild or even subclinical, whereas mortality rates may reach 90 percent in young pigs [45]. Low virulence strains may manifest primarily as poor reproductive performance and birth of piglets with neurologic defects.

Economic consequences

The overall cost of control and eradication depends on the mitigation or policy option chosen to control and eradicate the disease. Potential costs include disease control measures such as imposing quarantine measures and movement controls, direct costs related to stamping out of affected and other herds, indemnity payments, vaccination costs, surveillance and laboratory testing, etc. For disease-free countries like the United

States that have a substantial export market for swine, pork, and pork products, the preferred option for control and eradication has traditionally been to stamp-out infected herds without the use of vaccine.

The U.S. policy for most significant foreign animal disease emergencies is to follow strict quarantine measures and stamping-out of infected and contact herds with ongoing assessment for the need for and implementation of strategic vaccination. Available data do not allow quantification of the number of herds/farms that would be infected if one of these diseases were introduced. Nevertheless, the cost of control, eradication and compensation is likely to be significant.

Since there have been no CSF outbreaks in the United States from which economic estimates can be derived, estimates of economic effects in other countries are provided as illustrations. Saatkamp et al [46] reviewed the economic aspects of control of small and large CSF outbreaks in the EU from 1990–1997. For the largest outbreak, involving 429 herds over 14 months, the cost of removal of affected swine was 426.9 million Euros, slaughter for welfare purposes cost 1.2 billion Euros, and program operational costs were 134.3 million Euros. Overall, the outbreak cost pig producers 712.4 million Euros, the national government 230.5 million Euros, and the EU 807.8 million Euros. Approximately 10 million pigs were destroyed during the course of the outbreak, primarily for welfare reasons (overcrowding or overweight) [47]. The total cost of smaller outbreaks ranged from 10.9 million Euros (8 affected herds over 2 months) to 208.7 million Euros (113 affected herds over 10 months) [46].

Garner et al [48] estimated the potential economic impact of CSF on the pig industry of Australia using a stochastic modeling process. The model estimated a loss in gross income of 28–37 percent for the pig industry in the affected region, and a 9–11 percent loss in gross income for the national pig industry.

While these examples estimate a more severe outcome of an outbreak, the consequences could be lessened if the outbreak was detected earlier and appropriate controls implemented to quickly eradicate the disease.

Environmental consequences

Environmental consequences resulting from CSF introduction would primarily occur in relation to disposal of carcasses due to death from disease or depopulation of herds, as well as disposal of contaminated bedding and manure. The method(s) of disposal employed in response to an outbreak would impact the environment differently. Disposal of contaminated materials could potentially impact air, water and soil quality, as well as potentially releasing live virus into the environment.

Disposal options, previously employed in other countries in response to large scale animal disease outbreaks, include rendering, burial, and incineration. Factors influencing the decision as to which method(s) of disposal to use include the volume of contaminated material (dependent on the number of animals affected), geographic features (e.g., soil

and surface water) of the areas where outbreaks occur, other environmental considerations (e.g., weather and ambient temperature), and available emergency resources (e.g., funds, equipment, and personnel).

The environmental consequences of a CSF outbreak in the United States could vary from marginal to extreme depending on factors related to disposal of contaminated carcasses and materials.

Public health consequences

Although public health consequences are not issues under APHIS' regulatory authority, the issue is briefly addressed in this assessment. Direct public health consequences are insubstantial in that the occurrence of CSF virus in humans is quite rare. In fact, the number of cases reported is so small when compared with the number of persons exposed to these viruses that the World Health Organization generally does not consider CSF to be a threat to humans.

Perhaps more importantly, a substantial foreign animal disease outbreak can result in severe psychosocial effects on farmers and farming communities. Farmers and their families can suffer from grief over losing animals, in some cases blood lines kept over many generations, as well as loss of control over their lives due to movement restrictions, disruptions in community life, and short- and long-term stress over their financial future. For example, a study of the social consequences of the 2001 FMD outbreak in the Cumbria community of the United Kingdom revealed high rates of depression, alcohol consumption, and mortality among farmers during the crisis [49]

Indirect consequences

In addition to the direct costs of CSF introduction, impacts on international trade and related domestic consequences need to be considered. Export losses due to restrictions imposed by trade partners on swine, pork, and pork products could run into billions of U.S. dollars. The value of U.S. exports of pork and pork products, which could be immediately lost if an outbreak of CSF occurred, was an estimated $1.3 billion dollars in 2003 [50]. Again, this example estimates a more severe outcome of an outbreak, the consequences could be lessened if the outbreak was detected earlier and appropriate controls implemented to quickly eradicate the disease.

The impact of an outbreak of a foreign animal disease on the rural and regional economic viability, including businesses reliant on livestock revenue, could also be substantial. For example, Paarlberg et al. [51] conducted a study to estimate the potential revenue impact of a foot and mouth disease outbreak in the United States similar to the one that occurred in the United Kingdom in 2001. This study estimated the gross revenue losses for the swine sector alone to be 34 percent for live swine and 24 percent for pork. Equivalent losses would reasonably be expected from a similarly extensive CSF outbreak.

Risk Estimation

Risk estimation consists of integrating the results from the release assessment, exposure assessment, and consequence assessment to produce overall measures of risk associated with the hazards identified at the outset. Thus, risk estimation takes into account the whole risk pathway from hazard identification to the unwanted event.

APHIS concludes from the release assessment that there is no evidence that CSF virus currently exists in Nayarit. APHIS considers the risk potential for introduction of CSF from Nayarit into the United States via export of swine and swine products to be low. If mitigation measures discussed for Nayarit are implemented, the risk would be reduced even further.

APHIS concludes from the exposure assessment that the probability of exposure of susceptible U.S. livestock to CSF virus via swine, pork, or pork products from Nayarit is low. Applying risk mitigation measures similar to those described in 9 CFR §94.25 to these commodities would reduce that low risk even further.

Conversely, APHIS concludes that the animal health and economic consequences of a CSF outbreak in the United States would be severe. Although control and eradication measures would be costly, the major economic impact would likely result from export trade losses.

In summary, although a CSF outbreak in the United States would be likely to have severe animal health and economic consequences, APHIS considers the risk of infected live swine, pork, or pork products entering the United States from Nayarit and exposing U.S. swine to be low. This risk is further mitigated if Nayarit is subject to the mitigation measures discussed in this document.

References

1. Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentacion. *The State of Nayarit Request for its Recognition as Free of Classical Swine Fever and Velogenic Newcastle Disease.* Official SARGARA submission received, April 2004. Available at: http://www.aphis.usda.gov/vs/ncie/reg-request.html

2. Office International des Epizooties (OIE), Terrestrial Animal Health Code - 2005, Part 1, Section 1.3. Risk Analysis. Available at: http://www.oie.int/eng/normes/mcode/en_titre_1.3.htm.

3. Rinderpest, foot-and-mouth disease, fowl pest (fowl plague), Exotic Newcastle Disease, African swine fever, classical swine fever, and bovine spongiform encephalopathy: Prohibited and restricted importations. Restrictions on the importation of live swine, pork, or pork products from certain regions free of classical swine fever. In Title 9, Code of Federal Regulations, Part 94.25. Animal and Plant Health Inspection Service.

4. Classical Swine Fever Status of Mexican States of Baja California, Baja California Sur, Chihuahua, and Sinoloa; Final Rule. Federal Register, August 12, 2003. 68(155): p. 47835-47842.

5. Classical Swine Fever Status of Mexican States of Campeche, Quintana Roo, Sonora, and Yucatan; Final Rule. Federal Register, March 28, 2005. 70(58): p. 15563-15570.

6. Rinderpest, foot-and-mouth disease, fowl pest (fowl plague), Exotic Newcastle disease, African swine fever, classical swine fever, and bovine spongiform encephalopathy: Prohibited and restricted importations. In Title 9, Code of Federal Regulations, Part 94. Animal and Plant Health Inspection Service.

7. Office International des Epizooties (OIE), Terrestrial Animal Health Code - 2005, Part 2, Section 2.1. OIE Listed Diseases. Available at: http://www.oie.int/eng/normes/mcode/en_titre_2.1.htm

8. Wengler, G., D. W. Bradley, et al. (1995). Flaviviridae. In Virus Taxonomy: Sixth Report of the International Committee on Taxonomy of Viruses. F. A. Murphy, C. M. Fauquet, D. H. L. Bishop et al (Eds). New York, Springer Verlag: 415-427.

9. Depner, K., T. Bauer et al. (1992) "Thermal and pH stability of pestiviruses." Rev Sci Tech OIE 11: 885-93.

10. Harkness, J. W. (1985). "Classical swine fever and its diagnosis: a current view." Vet Record 116: 288-93.

11. Office International des Epizooties (OIE). Animal diseases data, Classical Swine Fever (hog cholera). Available at http://www.oie.int/eng/maladies/fiches/a_A130.htm. Accessed March 2006.

12. Trautwein, G. (1988). Pathology and pathogenesis of the disease. In Classical Swine Fever and Related Infections. B. Liess (Ed). Boston, Martinus Nijhoff Publishing: 24-27.

13. Wood, L., S. Brockman et al. (1988). "Classical swine fever: virulence and tissue distribution of a 1986 isolate in pigs." Vet Record 122: 391-4.

14. Elbers, A. R., A. Stegeman, et al. (1999). "The classical swine fever epidemic 1997-1998 in The Netherlands: descriptive epidemiology." Prev Vet Med 42(3-4): 157-84.

15. Edwards, S. (2000). "Survival and inactivation of classical swine fever virus." Vet Microbiol 73(2-3): 175-81.

16. Fritzemeier, J., J. Teuffert, et al. (2000). "Epidemiology of classical swine fever in Germany in the 1990s." Vet Microbiol 77(1-2): 29-41.

17. Dahle, J., and B. Liess (1992). "A review of classical swine fever infections in pigs: epizootiology, clinical disease and pathology." Comp Immun Micro 20: 261-74.

18. Elbers, A. R., J. A. Stegeman, et al. (2001). "Factors associated with the introduction of classical swine fever virus into pig herds in the central area of the 1997/98 epidemic in The Netherlands." Vet Rec 149(13): 377-82.

19. Biagetti, M., I. Greiser-Wilke, et al. (2001). "Molecular epidemiology of classical swine fever in Italy." Vet Microbiol 83(3): 205-15.

20. Laddomada, A., C. Patta, et al. (1994). "Epidemiology of classical swine fever in Sardinia: a serological survey of wild boar and comparison with African swine fever." Vet Rec 134(8): 183-7.

21. European Commission (1999). Classical Swine Fever in Wild Boar. Brussels, European Commission, Directorate-General XXIV, Scientific Committee on Animal Health and Animal Welfare (XXIV/B3/R09/1999).

22. Moennig, V., G. Floegel-Niesmann et al. (2003). "Clinical signs and epidemiology of classical swine fever: a review of new knowledge." Vet Journal 165:11-20.

23. Paton, D. J. and I. Greiser-Wilke (2003). "Classical swine fever--an update." Res Vet Sci 75(3): 169-78.

24. Importation of animals and animal products: Procedures for requesting recognition of regions. Application for recognition of the animal health status of a region. In Title 9, Code of Federal Regulations, Part 92.2. Animal and Plant Health Inspection Service.

25. Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentacion. *Solicitud de Reconocimiento de Nayarit en Fase Libre de Fiebre Porcina Clasica*. Presentation provided by SARGARA officials to APHIS during site visit to Nayarit, Mexico, September 2005. Available at: http://www.aphis.usda.gov/vs/ncie/reg-request.html

26. Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentacion. Personal communication: Information provided by SARGARA officials to APHIS during site visit to Nayarit, Mexico, September 2005. Available at: http://www.aphis.usda.gov/vs/ncie/reg-request.html

27. Comite Estatal Para el Formento y Proteccion Pecuaria de Nayarit, S. C. Personal communication: Information provided by Nayarit CFPP officials to APHIS during site visit to Nayarit, Mexico, September 2005. Available at: http://www.aphis.usda.gov/vs/ncie/reg-request.html.

28. Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentacion. NOM-054-ZOO-1996, *Quarantine Procedures for Animal and Animal Products*, English translation provided by SARGARPA, March 2006. Available at: http://www.aphis.usda.gov/vs/ncie/reg-request.html

29. Office International des Epizooties (OIE), Terrestrial Animal Health Code - 2005, Part 2, Chapter 2.6.7. Classical Swine Fever. Available at: http://www.oie.int/eng/normes/mcode/en_chapitre_2.6.7.htm

30. Rinderpest, foot-and-mouth disease, fowl pest (fowl plague), Exotic Newcastle Disease, African swine fever, classical swine fever, and bovine spongiform encephalopathy: Prohibited and restricted importations. Swine from regions where classical swine fever exists. In Title 9, Code of Federal Regulations, Part 94.10. Animal and Plant Health Inspection Service.

31. Rinderpest, foot-and-mouth disease, fowl pest (fowl plague), Exotic Newcastle Disease, African swine fever, classical swine fever, and bovine spongiform encephalopathy: Prohibited and restricted importations. Pork and pork products from regions where classical swine fever exists. In Title 9, Code of Federal Regulations, Part 94.9. Animal and Plant Health Inspection Service.

32. APHIS Evaluation of Classical Swine Fever Status of Sinaloa, Mexico, 2001. United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services. Available at: http://www.aphis.usda.gov/vs/ncie/reg-request.html

33. APHIS Evaluation of Classical Swine Fever Status of the State of Chihuahua, Mexico, 2001. United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services. Available at: http://www.aphis.usda.gov/vs/ncie/reg-request.html

34. APHIS Evaluation of Classical Swine Fever Status of Baja California Sur, Mexico, 2001. United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services. Available at: http://www.aphis.usda.gov/vs/ncie/reg-request.html

35. Evaluation of Classical Swine Fever Status, State of Sonora, Mexico, 2001. United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services. Available at: http://www.aphis.usda.gov/vs/ncie/reg-request.html

36. Evaluation of Classical Swine Fever Status, The Yucatan Penixula - Mexico (States of Yucatan, Quintan Roo, and Campeche), 2001. United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services. Available at: http://www.aphis.usda.gov/vs/ncie/reg-request.html

37. APHIS Evaluation of Classical Swine Fever Status of Baja California, Mexico, 2001. United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services. Available at: http://www.aphis.usda.gov/vs/ncie/reg-request.html

38. Pathway assessment of foot-and-mouth disease (FMD) risk to the United States: an evaluation in response to international FMD outbreaks in 2001, (2001). U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, Center for Epidemiology and Animal Health.

39. Risk Assessment of the Practice of Feeding Recycled Commodities to Domesticated Swine in the U.S. (1995). U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, Center for Epidemiology and Animal Health.

40. APHIS 2001 waste-feeder survey (unpublished data) (2002). U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, Center for Epidemiology and Animal Health.

41. Hennecken M., J. A. Stegeman et al. (2000). "Transmission of classical swine fever virus by artificial insemination during the 1997-1998 epidemic in The Netherlands: a descriptive epidemiological study." Vet Q. 22(4): 228-33.

42. Floegel, G., A. Wehrend (2000). "Detection of classical swine fever virus in semen of infected boars." Vet Micro 77(1-2): 109-116.

43. Glossup, C. E., and R. Cameron (2002). Transmission of viruses through pigs and products of pig origin. In: Trends in Emerging Viral Infections of Swine, A. Morilla, K. Y. Yoon & J. J. Zimmerman (Eds.). Ames, Iowa: Iowa State Press: 3-11.

44. McCauley, E.H. et al. (1979). Potential economic impact of foot-and-mouth disease in the United States. St. Paul, Minnesota: U.S. Government Printing Office.

45. Moennig, V. (2000). "Introduction to classical swine fever: virus, disease and control policy." Vet Microbiol 73(2-3): 93-102.

46. Saatkamp, H. W., P. B. M. Berentsen et al. (2000). "Economic aspects of the control of classical swine fever outbreaks in the European Union." Vet Microbiol 73: 221-37.

47. Stegeman A., A. Elbers et al. (2000). "The 1997-1998 epidemic of classical swine fever in the Netherlands." Vet Microbiol 73: 183-96.

48. Garner, M. G., I. F. Whan et al. (2001). "The expected economic impact of selected exotic diseases on the pig industry of Australia." Rev Sci Tech OIE 20 (3): 671-85.

49. Anonymous (2004). Unpublished report. Lancaster University, United Kingdom.

50. FAS (2003). U.S. beef, pork and poultry trade charts. Accessed on the internet at: http://www.fas.usda.gov/dlp/tradecharts/.

51. Paarlberg, P.L., J.G. Lee et al. (2002). "Potential revenue impact of an outbreak of foot-and-mouth disease in the United States." J Am Vet Med Assoc 220(7): 988-92.