Characterization of United States breeding-stock companies international transport biosecurity practices - SHIC #18-193 Cesar A Corzo (PI) University of Minnesota Final Report May 29, 2019

1. Industry Summary

Introduction: Pig transport within and between countries continue to play an important role for production companies. These companies are always seeking the highest level of genetic makeup on their market pigs aiming at improving whole system economics and maintaining their competitiveness; therefore, investments into obtaining the highest genetic level involve import/export of breeding-stock animals. However, transport of livestock around the globe may represent risk as infected animals may harbor exotic pathogens that could be introduced into another country. Data on the frequency, quantity and type of pigs entering and exiting the United States is scarce. In addition, the process by which these exports/imports occurs is not well known; therefore, further understanding of the frequency of these events and procedures are warranted in order to understand whether these are risky events. Objectives: 1) Determine the frequency of international breeding-stock exports or imports and their country of destination and/or origin; and, 2) To characterize the procedures currently implemented by breeding-stock companies during the export or import processes. Methods: For objective 1, databases containing information related to breeding-stock imports/exports were obtained for analysis. More specifically, data sources were divided in two main groups, public databases and breeding-stock private databases. Public databases were identified through website searches whereas private databases were requested directly from individual breeding-stock companies by an invitation to participate in this project. For objective 2, participating breeding-stock companies were asked to share their transport protocols together with the possibility of us witnessing their import/export process. Results: Based on official USDA records, between 2007 and 2018, a total of 839,152 pigs (e.g gilts or boars) were imported into the United States. Most of these pigs originated from Canada, while less than 3% were imported from Western Europe. On the other hand, breeding pig exports accounted for 382,118 pigs between 2007 and 2018 with Asia being the main destination (54.0%), followed by Mexico (31.3%) and South America (5.7%). A total of 8 breeding-stock companies were invited to participate in this study, 50% of these accepted the invitation by sharing import/export protocols. Biosecurity procedures are across companies are similar which assure the maintenance of the health status of these pigs. Implications: The results of this study show that exports/imports are a frequent event. Imports from outside North America occurs less frequently. Keywords: swine, breeding-stock, transport, biosecurity, international

2. Scientific Abstract

Introduction: Pig transport around the globe continues to play an important role for production companies. These companies are always seeking the highest level of genetic makeup on their market pigs aiming at improving whole system economics and maintaining their competitiveness. However, transport of livestock around the globe may represent risk as infected animals may harbor exotic pathogens that could be introduced into another country.

Data on the frequency and quantity of breeding-stock type pigs entering and exiting the United States is scarce. In addition, the process by which this is performed is not well known; therefore, further understanding of the frequency of these events and procedures are warranted.

Objectives: 1) Determine the frequency of international breeding-stock exports or imports and their country of destination and or origin and 2) To characterize the procedures currently implemented by breeding-stock companies during the export or import process. Methods: For objective 1, databases containing information related to breeding-stock imports/exports were obtained for analysis. More specifically, data sources were divided in two main groups, public databases and breeding-stock private databases. Public databases were identified through website searches whereas private databases were requested through directly from individual breeding-stock companies by an invitation to participate of this project. For objective 2, those participating breeding-stock companies were asked to share their transport protocols together with the possibility of us witnessing their import/export process.

Results: Based on official USDA records, between 2007 and 2018, a total of 839,152 pigs (gilts or boars) were imported into the United States. Most of these pigs originated from Canada, while less than 3% were imported from Western Europe. On the other hand, breeding pig exports accounted for 382,118 between 2007 and 2018 with Asia being the main destination (54.0%), followed by Mexico (31.3%) and South America (5.7%). A total of 8 breeding-stock companies were invited to participate in this study, 50% of these accepted the invitation by sharing import/export protocols. Biosecurity procedures are across companies are similar which assure the maintenance of the health status of these pigs. Implications: The results of this study show that exports/imports are a frequent event although it mostly occurs with neighboring countries. Imports from outside North America occurs less frequently.

3. Introduction

Globalization has allowed countries to have a higher degree of connectivity. Currently, travelling between countries is fairly easy if a series of requirements are met (e.g. passport, visa). Passengers can enter and exit countries through different transport methods. On the other hand, globalization has also opened doors for businesses to import/export products. These products need to meet guidelines related to the importer's regulatory law in order to obtain an import/export permit. For products related to human health, these need to meet the local health authority guidelines. For animal health, similar procedures are followed in order to assure the safety of importing/exporting a product.

Unlike human passengers, livestock require to follow strict procedures for imports/exports due to the fact that each country has a specific health profile that is being protected. Countries with a high health profile are always interested in maintaining such high level; therefore, guidelines for introduction of livestock need to be met.

Live-pig transport around the globe continues to play an important role for production companies as these companies are always seeking the highest genetic makeup level on their market pigs with the ultimate goal of improving whole system economics and maintaining their competitiveness. Herds where genetic improvement occurs are located in remote areas as part of their biosecurity program. In addition, the number of these herds around the world is limited as they are located in countries where the health profile allows them to be eligible for exports. The United States and Canada are two of these countries eligible for exports.

The current world's swine infectious disease situation (e.g. ASF, CSF, FMD) has prompted to ask questions on the risk and pathways for pathogen entry. Within these questions, transport of live-pigs is perhaps one of the factors that generates interest from industry stakeholders. Therefore, the overarching goal of this project is to further understand the frequency and quantity of breeding-stock pigs together with import/export procedures that are followed by breeding-stock companies.

4. Stated Objectives from original proposal

Overall, the project examines practices that may potentially increase the risk to the United States swine health industry, allowing the swine industry to better understand whether the practices related to the international transport of live breeding-stock animals pose a threat or not to the country, setting the stage for further assessments from a risk standpoint should there be a need. Specific objectives were:

1) Determine a) the number of breeding-stock companies that currently are either exporting or importing breeding-stock and b) the frequency of international breeding-stock exports or imports and their country of destination and or origin.

2) Characterize the procedures currently implemented by breeding-stock companies during the export or import process.

5. Methods

Objective 1

Data on the frequency and quantity of live imports/exports of breeding-stock pigs was required for this study. Official import and export data from the US was obtained through the Annual and Cumulative Year-to-Date U.S. Hog Trade dataset publicly available on the USDA website (USDA 2019a). Only the numbers related to breeding animals were considered for the analysis. In addition, US breeding-stock companies were identified and individually contacted and invited to participate. Companies willing to participate shared their total of animals imported/exported by year and country of origin/destination. US trade data related to breeding animals was exported and summarized for the past 17 years (2003 to 2018) regarding total import/export for the complete period and total by year and country/region of origin/destiny. Similar analysis was performed with data from each participating company.

Objective 2

Current import and export regulations regarding swine (live, semen, and embryos) were obtained directly from the USDA website (USDA 2017, 2018b, 2018a, 2018c, 2019b) and in the Code of Federal Regulations (9 CFR Subchapter D - Exportation and importation of animals (including poultry) and animal products). However, US export requirements are minimal; each importing country dictates specific health requirements for entry of animals. Here, we summarize import and export regulations related only to US requirements focusing on policies directly related to measures of prevention of diseases introduction. In addition,

participating breeding-stock companies were also asked to share their transport protocols which were compared.

6. Results

Objective 1

The frequency of international breeding-stock exports / imports and their country of destination and or origin

According to data from the U.S. Department of Agriculture (USDA) Economic Research Service, the U.S. imported a total of 839,152 of breeding hogs from 2003-2018, with an average of 54,523 heads imported per year (USDA 2019a). Most of the breeding hogs imported throughout that period were from Canada, while imports from European countries accounted for less than 3% (Figure 1). Excluding Canada, the percentage contribution of each country for breeding hogs import is illustrated in Figure 2. For the cumulative period, the U.S. imported 1,273 heads from Ireland (in 2010), 268 heads from France (in 2018), 150 heads from Spain (in 2014), 47 heads from the United Kingdom (in 2005, 2011, 2012 and 2017), 31 heads from the Netherlands (in 2014 and 2016), 21 heads from Italy (in 2012), 10 heads from Portugal (in 2016), and 6 heads from Sweden (in 2007).

Regarding breeding hog exports, the U.S. exported a total of 382,118 pigs to 62 different countries during 2003-2018, with an average of 23,882 heads exported per year (Figure 3). Asian countries accounted for 54.0% of all exports during the period, followed by Mexico (31.3%), South American countries (5.7%), Canada (4.9%), Central American countries (1.5%), Caribbean countries (1.3%), and European countries (1.3%) (Figure 4). Among Asian countries, the U.S. exported breeding hogs to China (41.5%), Hong Kong (25.2%), South Korea (18.1%), Russia (4.6%), Japan (3.9%), Vietnam (3.2%), Philippines (2.3%), and to Singapore, Israel, Indonesia, India, Thailand and Malaysia (1.32% combined). Exports to South America were to Brazil (37.8%), Guatemala (18.1%), Venezuela (14.2%), Ecuador (11.9%), Colombia (9.4%), Peru (4.2%), Chile (4.0%), and Guyana (0.6%).

Participating breeding-stock companies that currently are either exporting or importing breeding-stock.

A total of eight breeding-stock companies were invited to participate in this project. Four of these companies accepted our invitation and shared information. Specifically, one company (A) provided information on their breeding stock imports, one company (B) on both imports and exports, and two companies (C) and (D) provided information on their exports.

Company (A) imported boars and gilts only from Canada from 2014 to 2017, all by land. Comparing to USDA data, this company alone was responsible for 7%-27% of all swine breeding stock imports to the U.S. from Canada in each year for that period. Company (B) imported gilts from Canada from 2013 to 2017. This company imported an amount of animals corresponding to 17%-35% of all U.S. breeding hog imports from Canada for that period. Together, these companies represented 24% of all imports in 2014, 26% in 2015, and 59% in both 2016 and 2017. Company (B) also exported animals, however only to Mexico. Their exports accounted for 9% of all U.S. exports to Mexico and 6% of all exports during 2015-2017. Company (C) exported boars and gilts between 2012-2017. The main countries this company exported to were Mexico (64% of all company's exports), China (10%), Russia (6%), Brazil (5%), Canada (4%), Vietnam (4%), Philippines (3%), and Spain (1%). The company also exported to Latin America, Europe and Asia; however less than 1% of all company's exports were to each of those countries. Comparing to USDA data, company (C) was responsible for 27% of the U.S. breeding animals between 2010 and 2017. Animals from this company were exported to Mexico (92%), China (5%), Brazil (2%), Canada (1%), and Costa Rica (less than 1%). Comparing to USDA data, company (D) was responsible for 14% of the U.S. breeding stock exports during the cumulative period of 2017.

Objective 2- To characterize the procedures currently implemented by breeding-stock companies during the export or import process.

This objective was achieved in two steps. First, we reviewed current policies and legislation on breeding-stock import and exports. Second, we obtained and reviewed biosecurity protocols from participating breeding-stock companies regarding transport, as well as witnessed export/import procedures by air.

Import/Export Legislation

Figures 5 and 6 summarize the U.S. guidelines for swine import and export, focusing on policies directly related to measures of prevention of disease introduction. Importing and exporting pigs requires a series of steps that include three main components, 1) Agreement between the exporting – importing country with regards to health requirements, 2) A health certificate from an accredited veterinarian which would be linked to an import/export permit issued by the USDA and 3) A visual inspection by USDA veterinarians. These main components drive the number of countries that can actually import from or export to the US.

Protocols for imports to the U.S. for swine breeding-stock purposes vary according to what is being imported (e.g. live swine, wild boars, semen, or embryos) together with the country of origin. Swine may not be imported from other countries not listed in the flowchart. Briefly, import requisites involves certificates stating that the pigs being imported are free and have not been exposed to diseases of interest in the country of origin and during transport. This may include specific health certificates, laboratory tests, and cleaning protocols. Animals are submitted to visual health inspection at the port of entry and quarantine may be requested. Import regulations for swine (live, semen, and embryos) are publicly available online (USDA 2017, 2018b, 2018a, 2018c).

Protocols for breeding-stock export from the U.S. vary according to the country of destiny. The United States has minimal requirements for animals to be exported to other countries. Briefly, health certificates emitted by accredited veterinarians, which include specific laboratory testing according to the importing country guidelines. A statement that the means of conveyance or container has been properly cleaned and disinfected might be included in the export documentations needed. Animals are submitted to visual health inspections before export. General Guidelines for live animals' exports are public as they are available online (USDA 2019b). However, each country may have other specific health requirements or certificates animal entry and exporters should contact the Veterinary Service office in their area before exporting for current requirements of the country of destiny.

Biosecurity protocols

Participating breeding-stock companies shared their procedures related to exports and or imports. Not all companies were involved in both exports/imports; however, the fact that these companies need to comply with USDA regulations plus their interest in delivering high health animals, make processes standard across companies with minimal differences.

Participating breeding-stock companies have strict biosecurity procedures as their objective is always to maintain status (Table 1). In general, protocols vary slightly especially when talking about driver procedures related to leaving the tractor and coming onto the trailer and when returning to the tractor.

The following are steps all participating companies implement for breeding-stock transportation.

- 1. Truck A clean, disinfected, inspected and dry truck will be used for pig transport. One of the companies explicitly highlighted the use of thermo-assisted drying and decontamination procedures for all their loads.
- 2. Driver The driver in charge of the procedure has a set of guidelines for both loading the pigs at the farm and unloading the pigs at the next stop (i.e. USDA facility, airport, farm). All breeding-stock companies have a clear demand for protecting the dirty/clean area as well as avoiding pigs from crossing the line of separation between the clean/dirty area twice. Pig flow is intended to be unidirectional.
- 3. Route Breeding-stock companies invest planning time into looking for routes that minimize the risk of proximity to other pigs.

Imports from Canada

Breeding stock companies mainly import pigs from Canada. The procedure follows the same process that is followed by weaner or feeder pigs indicating that a set of regulatory requirements need to be met before crossing the border. The main difference is that breeding-stock companies import pigs that will proceed to be introduced into either boar studs or breeding herds which forces the pigs to go through an isolation period for the herd veterinarian to confirm whether pigs maintain health status and also begin acclimation procedures whereas with growing pigs they will proceed to the growing pig facilities.

Imports from Other Countries

Companies that import pigs from countries outside North America, which from the data occurs seldomly, will need to meet USDA's guidelines to obtain import permits. Briefly, once import permits have been issued, animals will be received at the airport where USDA officials review the documentation and allow entry. Pigs arrive in wooden crates from the country of origin and then they need to be transported to one of three USDA animal import

center facility located in either New York, California or Florida to complete their official quarantine.

Unloading

Briefly, crates are unloaded and transported to a platform where they will be unloaded/loaded onto a cleaned-disinfected-inspected-baked trailer. Truck driver who wears a clean coverall and plastic booties brings pigs onto the trailer. Driver does not leave the truck until the process has been completed. Once the process is complete, driver leaves the trailer, takes off both coverall and booties, disposes them in a specific container where materials to the current import will placed for special waste management. Crates will be destroyed on-site and together with its contents all will be placed in the same specific waste container for disposal under USDA guidelines.

Transport-Isolation facility

Pigs are then transported to the USDA isolation facility where pigs will be unloaded and where the official 30-day quarantine begin as per procedures dictated by the USDA. Once infectious disease testing yields satisfactory results, pigs will be released for their new destination.

Exports

Exports occur mainly through air and land. The former process involves a series of coordinated events that we were allowed to witness for one company. Pigs that are exported from the US by air and land can either originate from farms in the US or Canada.

Exports - Air

The following are the steps after the export/import permit has been issued:

- a. A truck that has been washed, cleaned, disinfected, inspected and baked arrives to the breeding-stock farm where the pigs for export are located.
- b. Loading procedures follow the same procedure as any regular loading/unloading procedure in which the truck driver wears clean coveralls and two layers of plastic booties before stepping out of the tractor.
- c. Driver then proceeds to the back-side door of the trailer and before he goes on the truck he disposed one layer of booties and keeps the second layer. This step varied between companies.
- d. The driver does not leave the trailer and farm personnel do not enter the trailer. This procedure allows to maintain a line of separation.
- e. Once pigs have been loaded, doors are closed and the driver steps out. Before getting on the tractor, both coverall and plastic booties are placed into a plastic bag.
- f. Pigs are then transported to a USDA designated port of embarkation. There are 13 US States with designated ports of embarkation, of which CA, FL, GA, IL, LA, NJ, NY, OH, PA, Puerto Rico, TX, and WA have designated airports. On arrival, pigs may or may not be unloaded from the truck. Pigs will be held at this facility until it is time for the transfer to the export crate at the air cargo area at the airport. During this waiting time, USDA veterinarians inspect the

pigs to assure there are no clinical conditions that warrant diagnostics. Pigs may or may not be unloaded for this phase of the process.

- g. On the export date, pigs are loaded on the same truck they were brought to the pre-export animal facility and then transported to the airport.
- h. Truck backs up onto the unloading/loading dock in order to be positioned right in front of a mobile chute (Figure 7).
- i. Pigs will be unloaded from the truck and loaded onto the wood crate once they go through the chute. One individual on the mobile chute is the one in charge of unloading from the truck and loading onto the crate. This individual does not go onto either the crate or trailer.
- j. The crate is made specifically for this purpose and made with new materials. Wood shavings are placed inside the crate (Figure 8).
- k. Bottom part of the crate is wrapped in plastic. Crates are placed on what is known as a "cookie sheet". The cookie sheet is used throughout the world as a standard way to move cargo at airports and on airplanes (Figure 9).
- 1. Once pigs are loaded onto the crate, the individual loading the pigs seals the crate with screws (Figure 10).
- m. This whole process is completed before a USDA veterinarian who is always present during the whole process until pigs get loaded onto the plane (Figure 11).
- n. Once the crate is sealed and netting is in place, cargo area employees move the crates towards a specific area within the building so that they are then transported to the loading area (Figure 12).

Exports – Land

Most of the breeding-stock pigs are exported to Mexico through two main points, Brownsville, Texas or Nogales, Arizona. As with air exports, land exports follow a similar process, especially at the beginning.

- a. A truck that has been washed, cleaned, disinfected, inspected and baked arrives to the breeding-stock farm where the pigs for export are located.
- b. Loading procedures follow the same procedure as any regular loading/unloading procedure in which the truck driver wears clean coveralls and two layers of plastic booties before stepping out of the tractor.
- c. Driver then proceeds to the back-side door of the trailer and before he goes on the truck he disposed one layer of booties and keeps the second layer. This step varied between companies.
- d. The driver does not leave the trailer and farm personnel do not enter the trailer. This procedure allows to maintain a line of separation.
- e. Once pigs have been loaded, doors are closed and the driver steps out. Before getting on the tractor, both coverall and plastic booties are placed into a plastic bag.
- f. Pigs are then transported to a USDA approved export facility at the border in TX.
- g. On arrival, trucks back up into the cleaned, washed and disinfected facility on a day where there are no other pigs being exported.

- h. Driver wears a clean coverall and plastic booties following the same procedure mentioned above and proceeds to unload the pigs.
- i. Pigs go into the pens and are inspected by both USDA and a Mexican Agricultural and Animal Health Official from SAGARPA.
- j. Upon approval by the Mexican Health official, pigs will obtain clearance for importation into Mexico.
- k. A cleaned, disinfected and dry Mexican truck backs up and gets ready for loading the breeding-stock pigs that will enter Mexico.

In some instances, Canadian born breeding-stock pigs go through the US into Mexico. In this case, trucks cross the Canada-USA border as they normally do with any import into the US but they will continue towards the Mexican ports of entry. Upon arrival into the USDA facilities at TX, USDA officials break the CFIA trailer seals, pigs are unloaded as they need to be inspected by USDA before any other procedure occurs. Upon clearance, the Mexican authorities proceeds to assess and either approve or reject the import. Upon approval, the Mexican truck backs up and pigs are loaded.

7. Discussion

The results of this study clearly show the import and export activity of live pigs, including breeding-stock, into and out of the US. Data on the frequency and quantity of incoming and outgoing live pigs are publicly available and these are based on official records. For both imports and exports, the USDA has procedures that depending on the specific scenario, a series of required documents and veterinary inspections by USDA accredited and USDA veterinarians are required.

The US plays an important role when it comes to exporting breeding-stock as it serves as the port of exit for pigs from different breeding-stock companies based in the US or Canada. Most of the exported pigs are by land and into Mexico. Exports by air are mainly to Asian and South American countries and quantities vary by year and country of destination. It is important to mention that the US is a port of exit for Canadian born breeding-stock pigs that are exported to either South America or Asia.

Although the United States accounts for only 1–2 percent of global swine exports in most years, most U.S. exports are of purebred swine for breeding (Giamalva 2014). While a major concern for disease introduction in the U.S. through legal trade fall in importing ill animals, the U.S. imports of breeding swine come primarily from Canada. Thus, main concerns regarding disease introduction to the U.S. through swine exports relates to disinfection of fomites upon returning to the country. The U.S. exports swine breeding stock to countries with ongoing transmission of OIE (World Organization for Animal Health) notifiable diseases such as ASF. According to the World Animal Health Information Database (World Organization for Animal Health (OIE) 2018), ASF was present at some level in Russia during 2007-2018 and Poland during 2014-2017 among the countries to which the U.S. had exports of breeding hogs from 2003-2018. However, exports to Russia during that period represented only 2.5% of all exports and there were no more exports since 2014. Poland, on the other hand, only receive U.S. exports in 2001. It is important to note, however, that the World Animal Health Information Database lists China as one of the countries with no information on ASF. On the other hand, the African Swine Fever situation report from

Dez/2018-Jan/2019 mentions China as a country with ongoing outbreak (World Organization for Animal Health (OIE) 2019). Overall 22.4% of all US exports during 2003-2018 were to China, of which 5.5% occurred in 2018.

Participating breed-stock companies shared robust biosecurity protocols when hauling high health pigs for an import/export. Minimal differences were seen during the process related to transportation. If animals are to be imported/exported, these procedures are maintained and then all companies must comply with USDA guidelines which assures that every companies follows the same process as USDA veterinarians are required to oversee the process and authorize the entry or exit into/from the US. For imports, the fact that the majority originate from Canada lowers the risk of disease introduction due to a similar health status of this neighboring country. In the case of European imports, the very low frequency decreases risk and when this actually occurs, these pigs will be kept at a USDA facility until testing has concluded and the import is released. Semen imports occur with a certain frequency and that process even though it is stipulated in the requirements it was not investigated in depth during this study. In the case of exports, USDA takes control early in the process as an export permit is given which this mainly assures that requirements of the importing country are met. From then on, the process is mainly the same for all breedingstock companies as they need to arrive to an USDA approved facility before arriving at the airport as another USDA veterinarian needs to inspect and assure there are no clinical concerns. The last step before embarkation and leaving the country continues to be standard for all companies especially because the one logistics company that performs these exports has a 90-95% market share and they follow the same procedure as described above.

From the export procedure and after interviewing exporting breeding-stock companies, it is important to mention that the crate containing the breeding-stock pigs does not come back to the US. In that crate, pigs are transported to their quarantine site. The crate will stay at the destination site as this is a "one-use" disposable-like crate as breeding stock companies are always interested in using brand new, clean and disinfected materials for transporting their high-health animals. However, the "cookie sheet" on which the crate was sitting on will be re-utilized for other trips around the world as this acts as a "container" traveling around the world and carrying different cargo. The double plastic wrapping the crate around the bottom is meant to capture any manure or wood shavings that may escape from the crate. Wood shavings will absorb urine and water, thus, the amount of liquids leaving the crate may be minimal increasing the chances of maintain the cookie sheet clean. It is important to keep in mind that in most cases, breeding-stock pigs that cross borders tend to be of a high-health status so their feces and urine may not contain high impact pathogens.

The results of this descriptive study clearly show that breeding-stock imports/exports play an important role in the industry. Frequency of events vary depending on whether imports/exports are considered. More importantly, most imports originate from Canada reducing risk of disease introduction, specially ASF, through live animal imports. Export procedures seem to represent low risk as potential contaminated fomites related to these exports do not return to the US. In addition, participating breeding-stock companies have robust biosecurity procedures for both import/exports.

Acknowledgments

This study was funded by the Swine Health Information Center (Project # 18-193). Authors would like to acknowledge the four-participating breeding-stock companies who kindly shared their protocols and data together with allowing us to witness their processes.

Bibliography:

- Giamalva J. Pork. Industry and Trade Summary. Washington-DC: U.S. International Trade Commission; 2014.
- USDA. Protocol for the importation of swine from Canada [Internet]. 2017. Available from: https://www.aphis.usda.gov/regulations/vs/iregs/animals/downloads/import_canadaswine_i ntous_update_June_2017.pdf
- USDA. PROTOCOL FOR THE IMPORTATION OF FARM RAISED "WILD" BOAR FROM CANADA [Internet]. 2018a. Available from: https://www.aphis.usda.gov/regulations/vs/iregs/animals/downloads/can-farm-raisedboar.pdf
- USDA. PROTOCOL TO IMPORT LIVE SWINE FROM A REGION OF THE EUROPEAN UNION (EU) RECOGNIZED AS LOW-RISK FOR CLASSICAL SWINE FEVER (CSF) [Internet]. 2018b [cited 2011 Aug 20]. Available from: https://www.aphis.usda.gov/import_export/animals/downloads/swine-import-pro-eu-reclow-risk-csf.pdf
- USDA. PROTOCOL TO IMPORT PORCINE SEMEN FROM A REGION OF THE EUROPEAN UNION (EU) RECOGNIZED AS LOW-RISK FOR CLASSICAL SWINE FEVER (CSF) [Internet]. 2018c. Available from:

https://www.aphis.usda.gov/import_export/animals/downloads/pro-eu-swine-semen.pdf

- USDA. Hogs: Annual and cumulative year-to-date U.S. trade All years and countries [Internet]. 2019. 2019a. Available from: https://www.ers.usda.gov/data-products/livestock-and-meat-international-trade-data/
- USDA. Program Handbook: Exportation of Live Animals, Hatching Eggs, and Animal Germplasm from the United States [Internet]. 2019b. Available from: https://www.aphis.usda.gov/regulations/vs/iregs/animals/downloads/9-CFR-Part-91-Program-Handbook.pdf
- World Organization for Animal Health (OIE). World Animal Health Information Database: African Swine Fever [Internet]. 2018 [cited 2018 Nov 2]. Available from: http://www.oie.int/wahis_2/public/wahid.php/Diseaseinformation/Diseasedistributionmap?d isease_type_hidden=0&disease_id_hidden=12&selected_disease_name_hidden=African+s wine+fever+%2528-

+-%2529+&disease_type=0&disease_id_terrestrial=12&species_t=0&disease_i

- World Organization for Animal Health (OIE). African Swine Fever (ASF) Report N° 8: December 15, 2018 – January 17, 2019 World Animal Health Information and Analysis Department [Internet]. 2019. Available from: http://www.oie.int/fileadmin/Home/eng/Animal_Health_in_the_World/docs/pdf/Disease_ca
 - rds/ASF/Report_8_Current_situation_of_ASF.pdf

Figure 1. Total annual U.S. breeding pig imports from 2003 to 2018. Data source: USDA Economic Research Service - Annual and Cumulative Year-to-Date U.S. Livestock and Meat Trade by Country.



Figure 2. Country of origin of breeding pig imports into the U.S., excludes Canada. Data source: USDA Economic Research Service - Annual and Cumulative Year-to-Date U.S. Livestock and Meat Trade by Country.



Figure 3. Total annual U.S. breeding pig exports between 2003 and 2018. Data source: USDA Economic Research Service - Annual and Cumulative Year-to-Date U.S. Livestock and Meat Trade by Country.



Figure 4. Region of destiny of breeding pig exports between 2003 to 2018. Data source: USDA Economic Research Service - Annual and Cumulative Year-to-Date U.S. Livestock and Meat Trade by Country.



Figure 5. Protocols for imports to the U.S. for swine breeding stock purposes. VS: The U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Veterinary Services; FMD: foot-and-mouth disease; CSF: Classical Swine Fever; ASF: African Swine Fever; AIC: USDA animal import center; EU: European Union.



1. Pending protocols for swine embryos import from Canada and the European Union

Figure 6. Protocols for exports from the U.S. for live animals. VS: The U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS).



 When the surface vessel has last been used to carry livestock to or from a foot-and-mouth disease infected country, the approved disinfectantshall be a freshly prepared specific disinfectant solution as required by 9 CFR91.12. **Figure 7.** Mobile loading/unloading (picture on left) chute used to allow pigs to go from the trailer onto the export wooden crate.



Figure 8. Wood materials (Upper right and left) and crate (Bottom right and left) where pigs will be housed during the international flight.



Figure 9. Cookie sheet and cookie sheet identification number (green arrow). The cookie sheet is where the plastic (red arrow) wrapped crate is plane on as it facilitates cargo movement and identification. Each cookie sheet is individually identified (blue arrow)Cookie sheets go from airport to airport around the world.



Figure 10. Loaded pigs, crate door sealed (red arrow) and cargo netting is completed.



Figure 11. Pig transfer from breeding-stock trailer to export crate. USDA veterinarian, air cargo representative and breeding-stock representative follow the process from beginning to end.



Figure 12. Crates ready to be loaded onto the airplane are being moved to a specific area within the cargo building to await loading onto the plane.



	Company A	Company B	Company C	Company D
Truck washed before loading	Y	Y	Y	Y
Truck disinfected before	Y	Y	Y	Y
Truck disinfected before	Y	Y	Y	Y
Truck baked before	Ν	Y	Y	NA
Driver showers before driving truck to farm	Y	Y	Y	Y
Driver wears coveralls and booties before leaving tractor cab	Y	Ν	Y	Y
Driver wears booties before leaving tractor cab	Y	Y	Y	Y
Driver wears clean coveralls and booties before going onto trailer	Ν	Y	Y	Y
Use of new wood shavings	Y	Y	Y	Y
Use of line of separation trailer/loading chute	Y	Y	Y	Y
Driver disposes coveralls and booties without touching tractor cab surfaces	Y	Y	Y	Y
Driver unloads pigs at embarkation procedure	Y	Y	Y	NA
Driver wears clean coveralls and booties for unloading pigs	Y	Y	Y	Y
Exported pigs stop at USDA pre-embarkation facility	Y	Y	NA	Y
Pigs unloaded at USDA pre-embarkation facility	Y	Y*	NA	Y
Pigs unloaded at USA- Mexico border	Y	Y	NA	NA

Table 1. Summary of breeding-stock biosecurity transport procedures for both exports/imports of breeding-stock.

Y – yes

Y* - depends. Trucks arrive at USDA and companies avoid unloading and loading to minimize stress. Pigs rest on trailer while parked at USDA facility.

N – no

NA – not available. Not disclosed. Do not do it as it is not required due to no exports.