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Biosecurity of Pigs and Farm Security

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IANR

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Table of Contents

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Risk factors for security of a farm and biosecurity of pigs on the farm are unique to that farm. Therefore, each biosecurity plan should be farm specific. The best plans are created by working with a swine veterinarian or veterinary consultant who has extensive knowledge of the farm, employees, and local risk factors.

A. Introduction

Biosecurity of pigs at the farm level is the set of practical measures taken to prevent entrance of infection into a pig farm and control the spread of infection within that farm. The goal of a biosecurity program is to keep out pathogens that the herd has not been exposed to and to minimize the impact of endemic pathogens. Pig farm security can be defined as the planning and implementation of a program to minimize various types of risk that can have detrimental effects on the farmstead and pigs. Biosecurity and security procedures are intertwined to enhance the health and productivity of pigs. Numerous factors are involved in the development and maintenance of a cost-effective program for biosecurity. These factors can be thought of as links in a chain; a biosecurity program is only as strong as its weakest link. The purpose of this publication is to provide information about the various aspects to consider when implementing and managing a biosecurity and farm security program. **It is not practical, nor is it recommended, for every farm to implement all of the procedures described.** All farm biosecurity and security risk factors are unique to that farm and, thus, each biosecurity plan should be farm specific. The best plans are created by working with a swine veterinarian or veterinary consultant who has extensive knowledge of the farm, employees, and local risk factors.

B. Biosecurity

The components of a pork operation that need to be biosecure are shown in *Figure 1*. The application of biosecurity measures differs among farms due to the geographic location of the farm, proximity to other pig farms, epidemiological situation (causes, distribution, and control of disease in the herd), type of swine operation, level of technology used for production, and whether other people are employed on the farm. The development and implementation of a biosecurity program provides an essential component of many on-farm food safety programs; greater consumer acceptability of the quality and safety of the food supply; healthy animals that are more productive; improved animal welfare; and improved efficiency and profitability for the pork producer. In addition, supermarket buyers and consumers want pork producers to use less medication when producing pork.

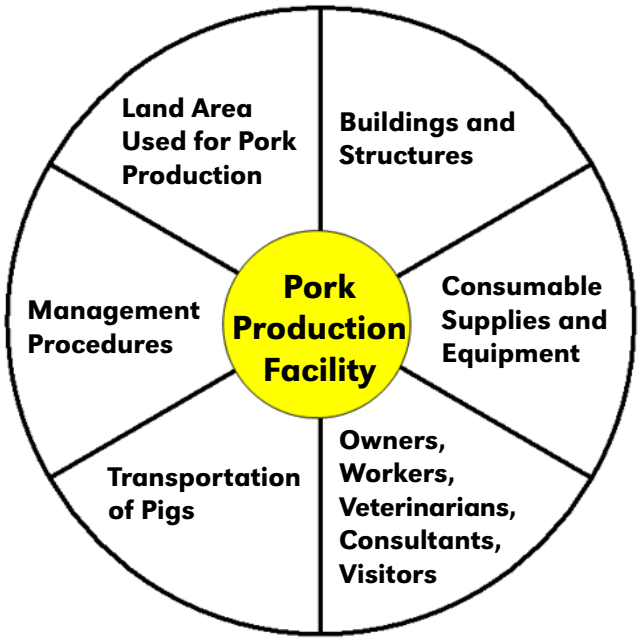

Figure 1. Components of a pig farm required for adequate biosecurity

Biosecurity is made up of three separate, but often blended, sets of actions and overlapping components. These are bio-exclusion, bio-containment, and bio-management. The goals of the production unit or farm will determine how these are blended into a biosecurity plan. Most often, producers focus on bio-exclusion and bio-management while neglecting bio-containment. The purpose of bio-containment is preventing the spread of disease agents to neighbors or even long distance transfer, but also the very important process of protecting the food supply for consumers. It is the single most important component of strategies that will be implemented if a foreign animal disease is introduced into the United States. Even though it is often ignored in day-to-day production biosecurity, this component is extremely important in any pig production system and often is the "right thing to do" for neighbors and other pig producers in a community.

Bio-exclusion is simply preventing the introduction of unwanted disease agents into the farm or system. This is where most producers focus and has been the focus of recent research. Bio-management is the combined effort to control economically important infectious diseases that are already present in the farm population. Room

disinfection, vaccines, all-in/all-out pig movement and many other procedures designed to reduce the pathogen level or enhance immunity levels in the pigs are key components of bio-management. Each of these areas can have significant impact on the economic viability of a producer or producers in a geographically linked animal agriculture area.

Disease control is one of the most challenging areas for pork producers, regardless of whether the pigs are housed indoors or outdoors. Pork producers aim for minimal clinical disease status (bio-management) because it is economically and technically infeasible to exclude all important pathogens from a herd of swine. However, certain disease agents should always be excluded since bio-management methods are ineffective while exclusion opportunities are practical. To develop a useful biosecurity plan, it is necessary to know: (1) the prevalence of diseases that can affect your herd; (2) how each disease is transmitted; (3) how each disease can be controlled; (4) how to prevent each disease from entering the herd; and (5) the potential cost of an introduction and outbreak.

All biosecurity efforts come with a cost, and ineffectual methods should be avoided. Likewise, production practices that impose the greatest risk should be the focus, rather than low-risk activities. It is essential to have a swine veterinarian help develop the written and detailed biosecurity plan. Biosecurity plans are intended to prevent adverse situations and improve the pork production business. All it takes is one breach of on-farm biosecurity to ruin a herd's health status or that of a neighbor's. This loss could have long-lasting and devastating production and financial effects on any farm. The following situations contribute the greatest risks to the health of pigs in a swine operation. These factors will be discussed later in more detail.

- Adding new pigs to the farm without a quarantine period.
- Failing to quarantine new additions for 30 to 60 days.
- Failing to require testing for specific diseases prior to addition.
- Failing to require vaccination for specific diseases prior to addition.
- Allowing pigs to return from fairs, shows, or exhibitions without quarantine and testing.
- Allowing other domestic or wild animals to have contact with the pigs, feedstuffs, or water sources.
- Failing to prevent disease transfer via pig transportation, human contact, other vehicular traffic, or equipment used with more than one animal or used at other locations such as a buying station, slaughter plant, or off-site farm.

It is common for small- and medium-sized pork operations to house their animals outdoors. Preventing the introduction of disease is difficult when pigs are housed outdoors or have access to outdoor lots because producers cannot control pig contact with wildlife, stray animals, rodents, insects, aerosols (containing disease agents), contaminated soil, and people. Feral and wild pigs are one of the greatest risks to outdoor producers since they carry most pig disease agents, including pseudorabies and brucellosis, which have been eradicated from U.S. and Canadian domestic pigs. Securing an outdoor facility is always challenging; however, various procedures can be used that discourage unwanted visitors and pests.

B1. Prioritization of Biosecurity Factors to Implement

B1.1. Small Farms. This publication provides information about numerous factors that can influence biosecurity of pigs and farms. Some factors are more important to implement for biosecurity on small farms (such as 100 sows or less). Farms with a small number of pigs typically do not have employees. Managers of small pig farms who work with a swine veterinarian and meticulously implement the following biosecurity principles generally have high herd health status:

- Bring in only clean breeding stock verified by a swine veterinarian.
- Always take extra care that biosecurity is a priority at the marketing access point and other trips to town.
  - Always make sure to keep boots, hands, pickup cab, and trailer a clean zone so pathogens are not hauled home.
- Use batch farrowing whereby all the pigs are moved at the same time and same age during each phase of production (weaning, nursery, grower, and finisher).
- Make sure all tail-end pigs from the growing-finishing phase are moved off-site before a batch of sows farrow.
- Use the same breeding stock for four to eight parities.
- When repopulating the sow herd,
  - Option 1. Replacing entire sow herd:
    - Make sure the entire sow herd has been depopulated.
    - Make sure all pigs from the growing-finishing phase are marketed or moved off-site before replacement animals arrive on the farm.

- If possible, have the depopulation period occur during the summer months to take advantage of the dry environment and high ultraviolet light period to help kill pathogens.
- All replacements should come from a single source, which could be home-raised gilts or purchased females.
- This option will affect cash flow due to lower productivity at the beginning and end of each turnover of the sow herd.
- If pigs are finished indoors, the availability of space might be a problem during the middle of the high productivity period.

– Option 2. Partial replacement of sow herd:

- A proportion of the sows are replaced on a regular quarterly or longer period.
- All the replacement animals should come from a single source (such as original source of the sows being replaced).
- The replacement source has the same health status as the farm. This requires monitoring of the source farm and communication, preferably veterinarian to veterinarian prior to receiving each group of replacement stock.
- If possible, have the depopulation period occur during the summer months to take advantage of the dry environment and high ultraviolet light period to help kill pathogens.

B1.2. Larger Farms. Strategies for biosecurity of the pigs and farm should be developed by using a Hazard Analysis of Critical Control Point approach. Knowledge from scientifically applied field trial methodology, peer-reviewed publications, and significant field experience should be heavily relied upon when establishing the critical control points (CCP). Extensive interviews and inputs from all farm staff should be included in the early stages of the hazard analysis assessments. Without participation of the farm employees, many CCPs will be overlooked.

Once the CCPs are identified, then and only then can biosecurity interventions be developed. Only those evidence-based biosecurity interventions that have demonstrable usefulness in the field are applicable. Based on relative risk assessment, a hierarchy of biosecurity interventions can then be developed; in the end, focusing on those factors that have greatest impact and opportunity for success. A helpful formula in determining appropriate implementation decisions is:

Appropriate Biosecurity Intervention Value (BIV) =

$$\frac{\textbf{DEV} * \textbf{RR}}{\textbf{DD}} - \textbf{IC}$$

Where:
DEV = Disease Exclusion Value per pig per year (often very difficult to determine other than historical experience)
RR = percent Risk Reduction per year for each intervention (from the PRRS Risk Assessment Tool, etc.)
DD = Degree of Difficulty (Ranking 1-10 with 10 = very difficult/maintain)
IC = Intervention Cost per pig per year

Using this formula, each agent and each intervention strategy can be qualitatively and semi-quantitatively analyzed. These computations can then be used for choosing those strategies that have a final BIV greater than zero. Although arbitrary, the DD allows consideration of a customized score for the complexity of an intervention and the ability of the farm staff to adopt, implement, and sustain an intervention procedure or process. It becomes farm or system specific, which is ideal in the real world. If several diseases have similar risk reduction for the same intervention, the DEVs can be added together and the sum entered into the equation. As multiple agents are considered, the strength of the intervention strategy becomes apparent. Of course not all the risk factors, values of disease exclusion, or the percent RR are known, but a veterinarian can arrive at reasonable approximations by using the risk assessment tool (Holtkamp et al., 2011), published information, and biosecurity experts.

Developing a value equation for each disease is often a matter of benchmarking diseased pigs with those that are free of disease in the same system. Some average disease cost numbers are published for porcine reproductive and respiratory syndrome (PRRS) (Neumann et al., 2005), transmissible gastroenteritis (TGE) (Mullan et al., 1994; Regula et al., 2000), *Actinobacillus pleuropneumoniae* (Losinger, 2005), and *Mycoplasma hyopneumoniae* (Maes, 1999). These estimates for cost of disease are useful benchmarks. The amount of RR for each biosecurity intervention and the perceived value for exclusion helps arrive at a logical expectation for those interventions. With this approach, only those interventions that have a value greater than zero are applied.

Calculating IC can be difficult and often relies on farm or industry experience. The cost of building a shower facility is relatively straight forward, but the variable costs associated with implementing showers for all who enter the farm is highly variable. Clothing costs and frequency of replacement; increased use of water, shampoo, soap, the washing machine, clothes dryer, and

Table 1. Factors influencing risk of a breakdown in biosecurity program due to location of pig farm (modified from Barcelo and Marco, 2003)

• *Pig farms nearby:* A farm with 500 animals (sows, nursery pigs, and growing-finishing pigs) at a distance of .6 mile away represents less risk than a herd of 5,000 at 1.2 miles away. If the 5,000 animals are a breeding herd, the risk is much lower compared to a finishing site with 5,000 growing pigs. Locating your outdoor pig production unit at least 2 miles from other swine could minimize the risk of infection by aerosol and other natural routes of transmission. Although aerosol transmission does occur with some agents, it is probably extremely rare for most agents.
• *Local pig density:* Local pig density can be defined as the average number of pigs per .4 square mile within a 3-mile radius of the farm. *Figure 2* is a schematic of this principle. Densities of less than 100 pigs per .4 square mile are considered to have less risk compared to densities of greater than 1,000 pigs per .4 square mile.
• *Other possible sources of contamination:* A slaughter facility at less than .6 mile represents an enormous health risk, whereas at greater than 3 miles, the risk is reduced. Rubbish dumps represent a biosecurity risk when situated at less than .6 mile. The manner in which nearby pig facilities are managed for vegetation growth, drainage from the farm, and biosecurity procedures can influence the risk of a breakdown in biosecurity of other pig farms in the area.
• *Type of terrain:* Ideally, the land should be hilly and protected from winds. Flat land without trees or other kinds of protection would have a higher level of aerosol risk compared to hilly land.
• *Roads:* A road with a high density of vehicles transporting pigs at less than 55 yards from the herd represents an important contamination risk. Distances over .25 to .50 miles from the herd greatly minimize biosecurity risk. However, some breeding stock companies have concluded that transport risk associated with driving near pig sites along a route or in-route exposure to vehicles hauling slaughter pigs appears to be very low.
• *Other animals:* The presence of cattle, sheep, or poultry could be a biosecurity risk if housed at less than 110 yards.
• *Climate:* During optimal climatic conditions (such as winter months, high humidity level, constant moderate winds, flat land), windborne dust or aerosol droplets present in the air can infect swine. Cold and humid climates are more favorable to disease transmission than dry and hot days. Aerosol spread of pathogens is usually reported to occur up to approximately 2 miles around an infected farm. Many viruses like cold, dark, and wet conditions. TGE and PRRS viruses are susceptible to drying, ultraviolet light, and heat. Movement by aerosol likely occurs at night under very specific conditions; thus, aerosol transmission is rare. With respect to PRRSV, one aerosol transmission every two years is still a big issue for a producer in harm's way.

electricity; employee lost work time; morale; employee retention; and many other details should be objectively considered and calculated. Comparing this to a boot and outerwear exchange facility (Danish entry) is worth considering, especially for smaller operations. Downtime rules often create significant costs but have very limited exclusion value. Determining IC for downtime rules is difficult but no more difficult than the calculation of its DEV. Establishing universal DEV and IC for each economically important disease agent is worthy of considerable research dollars. For example, calculating the value of barn filtration also may be a daunting task, but disease (PRRS) exclusion must be near 100 percent with current filtration application and maintenance costs.

B2. Location of Farm

One of the main factors that increases the risk of a herd acquiring a new disease is often the proximity of the farm to other live pigs. The nearby presence of growing pigs is a much greater risk compared to a breeding herd that sends all weaned pigs to an off-site facility. Theoretically, pig production facilities should be located as far as possible from other pig facilities. *Table 1* indicates factors influencing risk of a breakdown in a biosecurity program due to location of a pig farm. Although location is important, factors within the farm can influence all aspects of biosecurity. The positioning of buildings within the unit, position of ventilation inlets and outlets, people movement, isolation procedures, pig movement, and other factors will affect the success of biosecurity plans.

B3. Sources of Swine Diseases

Swine diseases are a concern for nearly every pork producer, regardless of size of operation. A disease outbreak can be economically devastating to a swine operation. It is important that people involved with pork production understand how swine diseases are spread and how people can influence the spread of diseases among pigs and farms. Swine disease can be spread in a number of ways, including:

- through diseased swine or healthy swine incubating disease, or unaffected carriers,

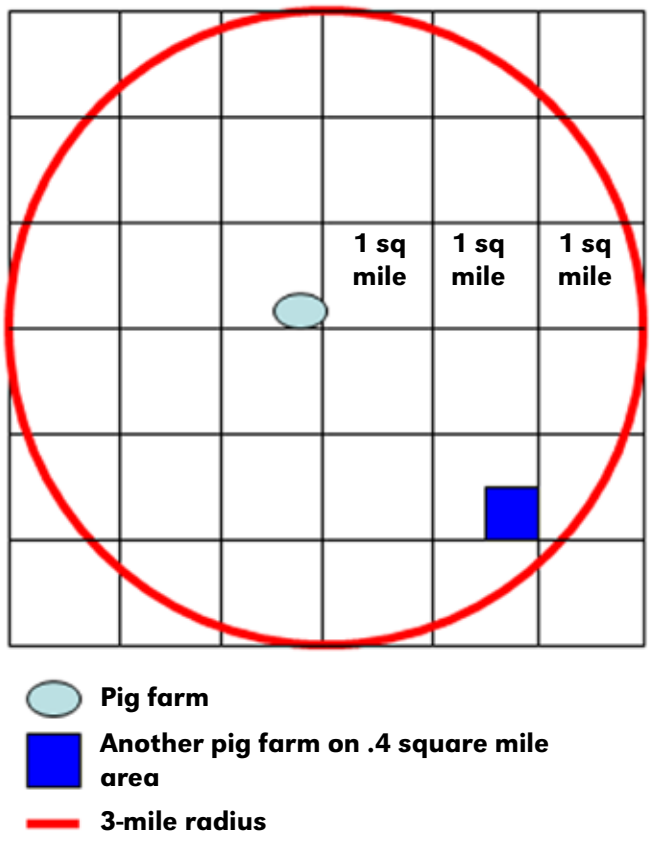

Figure 2. Schematic of a local pig density defined as the average number of pigs per .4 square mile (.63 mile x .63 mile = .4 sq. mi.) within a 3-mile radius of the farm

- through new replacement gilts and boars,
- purchased semen,
- through other farm animals, insects, pets, birds, and wild animals,
- on the clothing and shoes of visitors and employees moving from farm to farm,
- on employees who did not follow all the biosecurity procedures of the farm,
- any employee or visitor who has had recent direct contact with other pigs,
- on contaminated feed, water, bedding, and soil,
- from the carcasses of dead animals,
- on contaminated equipment and vehicles used on the farm,
- on contaminated veterinary equipment,
- any equipment that has been in contact with pigs from another site,
- on contaminated commercial vehicles hauling culls, slaughter, or growing pigs,
- delivering feed (truck and even more so the driver) in airborne particles and dust blown by the wind, and
- on consumable supplies entering the farm.

Unexplained disease transmission over short distances is often attributed to aerosol infection. Aerosol and airborne spread of infections depends on numerous factors, such as: the type of pathogen, number and density of animals excreting and susceptible to infection, method of housing, droplet size, relative humidity, ambient temperature, ventilation fans, wind speed, wind direction, sunlight, topography, natural barriers, and methods of manure application. Although a minimum distance (2 miles) between neighboring pig farms is desirable to limit the risk of aerosol disease spread, this may be impractical for existing pig farms. Many times disease agents have other routes of transmission that are more important and more frequent compared to aerosols but just as difficult to document. Like aerosols, distance from other pigs is also an effective deterrent against these methods. Distance has a dilution effect on all pathogens by reducing the likelihood of all means of transmission. The risk of aerosol is also related to the numbers of pigs on the distant sites. Large numbers of growing pigs increase the odds of a random introduction. There have been outbreak investigations that imply aerosol movements up to 5 miles with PRRS virus and as much as 2 miles for Mycoplasma. Aerosol transmissions are very difficult to substantiate but likely occur in special weather-related situations.

B4. Purchasing Replacement Gilts and Boars

Finding a source of minimal disease animals is not always easy. Essential elements of a biosecurity program are often ignored on small pork operations, such as procurement of new breeding animals from a reliable source and isolation of new animals before introduction into the herd. Word of mouth and testimonials often take precedence rather than direct veterinary knowledge from health monitoring and pathogen testing. Direct contact with other pigs is always the greatest risk for acquiring new diseases. The following guidelines are suggested when purchasing replacement gilts and boars:

- Know the disease status of both recipient and source herds.
- Consider the location and health history of the source herd.
- Select replacement gilts from a single source that has a documented genetic improvement program and sound disease control (biosecurity) programs.
- Select replacement boars from a single source that has a documented genetic improvement program and sound disease control (biosecurity) programs.

- Most breeding companies utilize a veterinarian and maintain an internal health-recording program. Have your veterinarian consult with the source herd's veterinarian to:
  - confirm that the source herd has not had any recent disease outbreaks,
  - determine what diseases have or have not been detected or tested for in the source herd,
  - determine what vaccination programs are used, and
  - determine what antimicrobials are being used in the feed or water.
- Maintain animal movement records. List the contact information of the seller(s), the origin of the pigs, the number of pigs purchased, date pigs are moved onto your farm, and, if available, the premise identification.
- In principle, fewer introductions of new gilts and boars into the herd would seem to reduce the odds of bringing a disease into the herd. However, the parity distribution and genetic improvement cost of infrequent introductions may offset the risk, especially if a good single source of replacement animals is involved. The risk of disease transmission is minimized when: (1) there is open communication between the producer's veterinarian and source herd's veterinarian, and (2) all new replacement animals are brought into the herd after spending 30 to 40 days in a biosecure isolation facility that has an excellent and functioning disease monitoring/detection program in place.

B4.1. Artificial Insemination. The alternative to purchasing replacement animals is to utilize a closed-herd policy. Artificial insemination is the easiest method to bring new genes into a sow herd. However, biosecurity risks can be associated with artificial insemination. Boar semen can contain a number of potential pathogens, such as Porcine Reproductive and Respiratory Syndrome Virus and Porcine Circovirus. Most boar studs routinely test semen from AI boars for the presence of PRRSV and only bring in negative boars that have never been exposed to PRRSV.

Generally, semen arrives at the farm by either a boar stud courier or an external courier, such as UPS or FedEx. Semen shipped via an external courier is normally packaged and sealed into a temperature-controlled (63°F), double-boxed Sytrofoam container. Semen delivered by a boar stud courier is generally transported in paper/plastic bags placed in a cooler during transport. When the courier arrives at the farm, the bags of semen are removed from the courier and placed in a semen cooler with a temperature of 63°F. The semen cooler is located in the "dirty" area of the farm.

All semen packaging (bags, Styrofoam cooler, etc.) should remain outside the farm. Only the semen should enter by passing across the clean-dirty barrier. Although the semen source may be free of those disease agents generally considered economically critical like PRRS virus, other pathogens may be present and a contaminated cooler could bring in unwanted bacteria or virus agents from the boar stud. Likewise, the courier should never enter the farm because his or her route is unknown and a courier would not have knowledge of potential disease agents that may be present at other drop destinations. Generally, an area outside the clean-dirty barrier is designated for drop off. This can be off-site at the producer's house or other location. In the latter situation, the producer may place the semen into a shuttle cooler to move to the farm. Before showering into the pork production facility, move the doses of semen from the shuttle cooler across the clean-dirty barrier into an appropriate container, such as a Styrofoam cooler. After showering, place the doses of semen into the farm's semen cooler.

When delivered by a courier directly from the stud, a dirty side semen refrigerator is often placed where the semen can be delivered after hours. Once again, this could be off-site. In this case, the semen should be double bagged so that any potential contamination that could occur during the courier's route will most likely be in the outer bag. The outer bag is often paper with a plastic bag with the semen placed inside and stapled by the boar stud employee who packages the semen for shipment. When placing the semen in the refrigerator, the courier first will take the two-bag package out of the vehicle cooler. The second step is pulling the inner bag out and placing it in the refrigerator. The outer bag goes back to the vehicle and is placed in a rubbish bag and discarded at an off-site trash collection location. This bag should never return to the stud or be left at the delivery point. When the semen is needed in the farm, personnel dump the semen across the clean-dirty barrier, only touching the bag. This bag is disposed of outside the farm. Some farms spray disinfectant on all supplies, including semen containers, entering the farm as they pass the clean-dirty barrier.

B5. Isolation of Incoming Pigs

Pork producers should discuss with their veterinarian the procedures to use during isolation and acclimation of the replacement gilts and boars. Regardless of whether a pork producer is purchasing replacement animals from the same genetic supplier and health monitoring program, an isolation facility and program should be in place. Because the incubation period for different disease agents is highly variable and the replacements may not exhibit any signs of sickness for some time, it is essential these replacements remain in quarantine until test results and observation give reasonable assurance they are healthy.

The quarantine period also allows the source herd to discover any new disease introduced into that herd.

In addition, contamination could have occurred during transportation. It is important that incoming gilts or boars undergo a period of isolation for 30 to 60 days. The duration of isolation will depend on the specifications set by your veterinarian and particular disease(s) of concern. Isolation allows pigs to recover from the stress of transport to the farm, adapt to a new environment, and any incubating infections to become evident. The period of isolation provides an opportunity for inspection of animals by a veterinarian, a laboratory analysis of blood samples for diseases, and vaccination of animals before entering the herd. Guidelines for isolation units are:

- Make sure that biosecurity of the isolation facility is at least as good as the biosecurity of the main herd.
- The isolation unit should be in a location that is as far from other area pigs as possible, ideally more than 2 miles from the nearest neighboring pig facility. The ideal distance the isolation facility should be from the farm can vary depending on the management, testing protocols, biosecurity precautions, number of replacements in each quarantined group, and the disease(s) that are to be prevented. Work with your veterinarian to determine the best location in any specific situation.
- The isolation facility should prevent direct contact with all other pigs, domestic livestock, and wildlife. Where appropriate, a security fence should be erected around the isolation unit.
- The isolation facility should provide an air space, a water source, and a feed source that are separate from all other pigs and livestock.
- The isolation unit should be operated on an all-in/all-out basis.
- The risks of manure storage and drainage on disease transmission should be eliminated. Isolation facilities should have their own manure-handling facilities.
- The isolation facility should provide a clean, dry, comfortable resting space for all the pigs.
- When appropriate, animals should be provided with clean and dry bedding.
- Animals should be provided with clean and readily available water.
- During summer months, it may be necessary to move gilts housed outdoors to an area that will prevent sunburn. White-colored gilts can get severely sunburned.
- Where possible, use a separate person and equipment in the isolation unit. If one person cannot be dedicated to taking care of the isolation unit, the unit should be the last work task of the day. This person should shower, if possible, and put on clean clothes and boots prior to entering the isolation unit. Many successful isolation facilities have no shower, and the farmer checks the animals on the way to the house. A boot exchange, isolation-specific coveralls, and hand washing are highly effective. Make sure the indoor facility has good lighting and accessibility of animals for visual inspection.
- The isolation facility should provide adequate restraint facilities for examinations and administration of treatments.
- The isolation facility should have an equipment and storage area. This equipment (such as boots, clothing, scrapers, shovels, buckets, etc.) is only used in the isolation area.
- All animals should be closely observed each day for clinical signs of any disease, including coughing, excessive sneezing, diarrhea, blood or mucus in the feces, loss of appetite, skin lesions, or lameness. Rectal temperatures should be taken in pigs that show any of these signs. Any abrupt changes in behavior or onset of clinical problems should be immediately reported to the veterinarian.
- Your veterinarian should visit the isolation area for blood sampling and inspections of animals. Depending on the diseases that are to be excluded and the nature of test diagnostics utilized, sampling shortly after arrival and again three to four weeks later may be necessary to assure freedom from disease. Allow enough time for laboratory results and expect to retest on occasion.
- When possible, an acclimation program to the diseases on your farm should start in the isolation facility. Make sure the isolation facility is easy to clean and disinfect between batches of replacement animals. The cleaned and disinfected facility should remain empty and be allowed to completely dry before the next entry. This usually takes two weeks but can be shortened with heated drying.

B6. Pig Flow

Pigs should be moved as a group in an all-in/all-out (AIAO) manner. In other words, all the pigs are moved at the same time and same age during each phase of production (weaning, nursery, grower, and finisher). Once a group is established, younger pigs are never added to the group and, likewise, older pigs are never mixed with a younger group. The main reasons for using AIAO are: (1) to reduce exposure levels of disease causing pathogens in the pig's environment, (2) to prevent transmission of diseases from older pigs to younger pigs, and (3) to improve feed efficiency and rate of gain by maintaining a high health status. With careful planning, an AIAO system

Table 2. Guidelines for visitor risk assessment (modified from Dalrymple and Innes, 2004)

Item	*Low Risk*	*Moderate Risk*	*High Risk*
Number of farm visits per day	No other farm contact	One or occasionally more than one farm visit per day	Routinely visits many farms or auctions
Protective clothing	Wears sanitized shoes or boots. One pair of clean coveralls per site	Wears sanitized shoes or boots; if clean, may not change coveralls	Does not wear clean or protective clothing
Animal ownership	Does not own and/or care for livestock	Owns and/or cares for a different species of animal	Owns and/or cares for a swine production unit
Contact with animals	No animal contact	Minimal or no direct contact — exposure to housing facilities	Regular direct contact with swine
Biosecurity knowledge	Understands and promotes biosecurity for pork industry	Aware of basic biosecurity principles but is not an advocate	Little appreciation or understanding of biosecurity principles
Foreign travel	Does not travel out of USA	Limited travel outside of USA, without animal contact	Travel to foreign countries with animal contact in those countries

can be used in most pig production units. When pigs are housed indoors, a thorough cleaning and disinfection of the pen or barn between each group is required for best results. When possible, the facility should be allowed to completely dry before the next group enters. Care must be taken to properly clean the feeders, walls, ceiling, water troughs, penning, and flooring. High pressure with hot water and detergent is recommended.

B7. Fencing

Many small- and medium-sized pork operations often house their pigs outdoors in large dirt lots or pastures. They do not use an outer perimeter fence for biosecurity. A "pig proof" fence that surrounds your outdoor pig facility is recommended, especially if other pigs are close to your farm. However, a pig-proof perimeter fence is very expensive to construct.

There is no way to keep pigs housed outdoors away from all types of wild animals, birds, and blowing dust. In some geographic areas, the use of a 4-strand, high tensile electric fence is adequate to help increase biosecurity, and the cost is much less than a chain link or woven wire fence. Placing an appropriately designed and functional 4-strand electric fence 40 to 50 feet away from the pig production unit will enhance the prevention of stray livestock and feral pigs from obtaining nose-to-nose contact with the pigs. An electric fence with biosecurity signs will only keep out people who obey the signs.

B8. Assessing Visitor Risk and Controlling Access

B8.1. Risk Assessment. Risk assessment is a method of evaluating the likelihood and severity of the risk posed by a visitor. By identifying key risk factors, appropriate preventative procedures and protocols can be determined. *Table 2* is a guideline for assessing the risk level of visitors to a livestock operation.

B8.2. Entrance to Farm. Entry to the pig unit can be controlled by well-maintained fences, locking gates that enter the pig unit, using a communication system (such as buzzer, alarm, or two-way speaker system) at the locked entry gate for visitors to indicate their arrival, and signs at the entry gate or vehicle parking area that provide instructions for entry by authorized visitors (*Figure 3*). People can be discouraged from entering the

Go to office located at: _____

Or call: _____

Phone number: _____

Figure 3. Signage for a biosecure area

pig farm and contacting pigs by posting "No Trespassing" and "No Visitor" signs on the perimeter of the property and on entrance roads. Only one entrance road to the farm is best. Signs posted on the perimeter should direct visitors to a central sign-in area (office), away from fields, animal pens, and other restricted areas. Providing a phone contact number with clear instructions, including a no-entry policy, will prevent most biosecurity breaches by unwanted visitors. Periodically check the signs and replace or repair them, as necessary.

B8.3. Signage. Signs can help get the importance of the biosecure message across to both visitors and farm employees. However, poor wording or location of signs may undermine efforts to improve biosecurity. Signs that portray a professional image will convey a commitment to biosecurity and will be more effective than a piece of paper stapled to a door or post. Location of signs is also very important. Signs should be large and visibly placed where visitors cannot miss seeing them. Signs mounted off to the side of a door or among a number of other signs are likely to be missed or ignored.

Two simple ways to place signs effectively are to hang them from a barrier chain or mount them on a post placed in the visitor's path of travel. Chains made of yellow plastic links and posts made of scrap angle iron and set into a bucket of cement are effective, cheap, and easy to move out of the way when necessary. Post "Do Not Enter" signs outside of all buildings. Some producers who keep their pigs outdoors on pasture lots next to a road install signs that say "Do Not Feed the Pigs."

B8.4. Parking Area. Parking areas should be located away from pigs and other livestock, feed delivery areas, and manure-handling routes. Visitors' vehicles should be visibly clean of manure and organic matter. Only the farm's vehicles should be allowed in livestock handling and housing areas or around feed storage areas. If needed, the farm's vehicles should be used to transport visitors, employees, and agricultural service personnel. Parking should be outside the site perimeter fence.

B8.5. Unauthorized Entry by Intruders. You will not be able to prevent access to people with bad intentions; therefore, it is important to be aware of any signs of unauthorized entry or tampering. Security breaches are also biosecurity breaches. When pigs or farm equipment disappears, the culprits have often visited other pig sites during their clandestine operations with no concern for biosecurity.

- Evidence of trespassing might include non-explained injection sites on pigs, food wrappers, cigarette butts, tire tracks, footprints, and broken equipment.
- Evidence of pigs being stolen or disease-carrying pigs being added can be detected by taking frequent pig inventories.
- Appearance of unusual signs of disease can possibly indicate that trespassing occurred. Daily monitoring for disease can help detect an outbreak early.
- Farm entrance gates should be locked at night to serve as a deterrent and as an indicator of intrusion.
- Video security cameras may be useful if the cost can be justified.

B8.6. Authorized Visitors. All authorized visitors need to understand the possible risk they present when entering a farm with a swine operation and what precautions need to be taken between farms that are visited. The list of authorized visitors might include neighbors and friends; agribusiness and service representatives; veterinarians and consultants; regulatory personnel and inspectors; dead stock collectors; and custom manure haulers and applicators.

Equipment brought into the swine area to repair buildings and machinery, to treat or handle animals, and to carry out testing or other procedures can be potential sources of contamination. Ensure all equipment used by visitors has been thoroughly cleaned and disinfected appropriately before being used on your premises. The risk of a breakdown in biosecurity is increased with visitors who regularly go from farm to farm as part of their employment or routine.

All visitors wanting to enter the pig area should make an appointment and should ask the farm operator about the biosecurity protocol and whether special measures must be taken prior to the visit. Strict visitor policies should be enforced, with only necessary personnel allowed access to pig areas. Visitor entry to the pig area should be by a single entry point.

- Control all visitors' access to the herd.
- Prior to allowing them to enter the farm, all visitors should be briefed about the biosecurity procedures and policies. Determine if, when, and what types of farms the visitors have been to prior to visiting your farm. Do not allow foods of animal origin to be brought onto the premises. The visitors must state that they:
  - have showered and changed clothes since their last exposure to pigs,
  - have not returned from overseas travel within the last 7 to 10 days,
  - are not experiencing fever or any flu-like symptoms.
- Generally, a visitor's log is maintained at a location where people are required to complete the requested information prior to their taking a shower or

entering the pig facility. Information to be recorded in a visitor's log includes:

  - a place the visitor can check that confirms he or she understands and will abide by all the policies and procedures for biosecurity of the farm,
  - date of visit,
  - name of visitor,
  - address of visitor,
  - company name,
  - purpose of visit,
  - date of last contact with pigs,
  - time of arrival at farm,
  - time of departure from farm, and
  - signature.

- The duration of time a visitor needs to be away from all pigs before allowed entry into a pig farm is quite variable (12 to 72 hours). The farms that have used the 12-hour (overnight) pig-free period also require visitors to shower before entering the farm. The most common duration of time for people to be away from all pigs before entering a pig unit is 24 to 48 hours.
- Make sure all suppliers of products, maintenance service, and other farm visitors follow the biosecurity measures.
- Place restricted entry notices on the doors to animal facilities.
- Restrict access to animal facilities to essential visitors only. Keep visitors out of animal pens and feed alleys, and do not allow direct contact with animals if not essential.
- Clearly demarcated "clean" and "dirty" areas should be established to ensure there is no confusion about where people need to remove their off-farm "dirty" clothes and footwear. Require all visitors to wear clean boots, clothing, and disposable gloves while visiting the pig unit. Some biosecurity procedures may require visitors to shower and change into clothes and boots provided by the farm. To ensure that appropriately sized clothes and boots are available, visitors should make arrangements prior to visiting the pig farm. Some biosecurity procedures may only require visitors to wash their hands, scrub fingernails, and wear protective outerwear provided by the farm.
- Drivers of pig transportation vehicles should be treated as visitors and never allowed into housing areas. Like the front entry, a clean/dirty demarcation should be observed at loading areas.
- Drivers of feed delivery vehicles should never be allowed into the pig facilities and should fill bins from outside the perimeter fence when possible. Receipts can be placed in a mail-like box as the truck exits the site so the driver doesn't enter the office or shower area.

The below procedure has been used when showering is not required to enter a pig farm. This method is known as the S.P.F. Danish entry procedure (*Figure 4*). The use of a non-shower Danish entry procedure is a reasonable biosecure method to enter an area that only has finishing barns.

- Walk through the entry door of the building into the change room that leads to the pig production unit. The entry door should be locked at all times, except when authorized people enter the building. Ideally, a system should be developed to unlock the door without someone inside the building having to go back through the shower to open the door.
- Remove top clothes, shoes, and hat and leave them in the designated "dirty side" of the change room. Except for the floor grate area, a wall separates the dirty side from the clean side of the room.
- Walk onto the floor grate that separates the dirty area from the clean area.
- Wash hands thoroughly with soap and water and scrub under the fingernails. Dry hands with a clean towel.
- Walk off the grate to the clean side of the room.
- Put on the clothes and boots provided by the farm.
- When exiting the change area, walking through a footbath containing disinfectant, or scrubbing boots with a scrubbing brush and disinfectant, may be required before entering the pig unit.
- Provide a container or plastic bag for collecting dirty clothing or disposable items used by visitors.
- Ask visitors to wash their hands prior to leaving the premises, especially if in contact with the pigs. If hosting tours, provide hand-washing facilities or disinfectant hand gel. If food is to be served, do this away from the animal facilities and after hand washing.

The Danish entry method also has been used in combination with a shower. The Danish entry is a separate shed connected to the shower-in area of the farm office facility by a bird-proof walkway or sometimes a

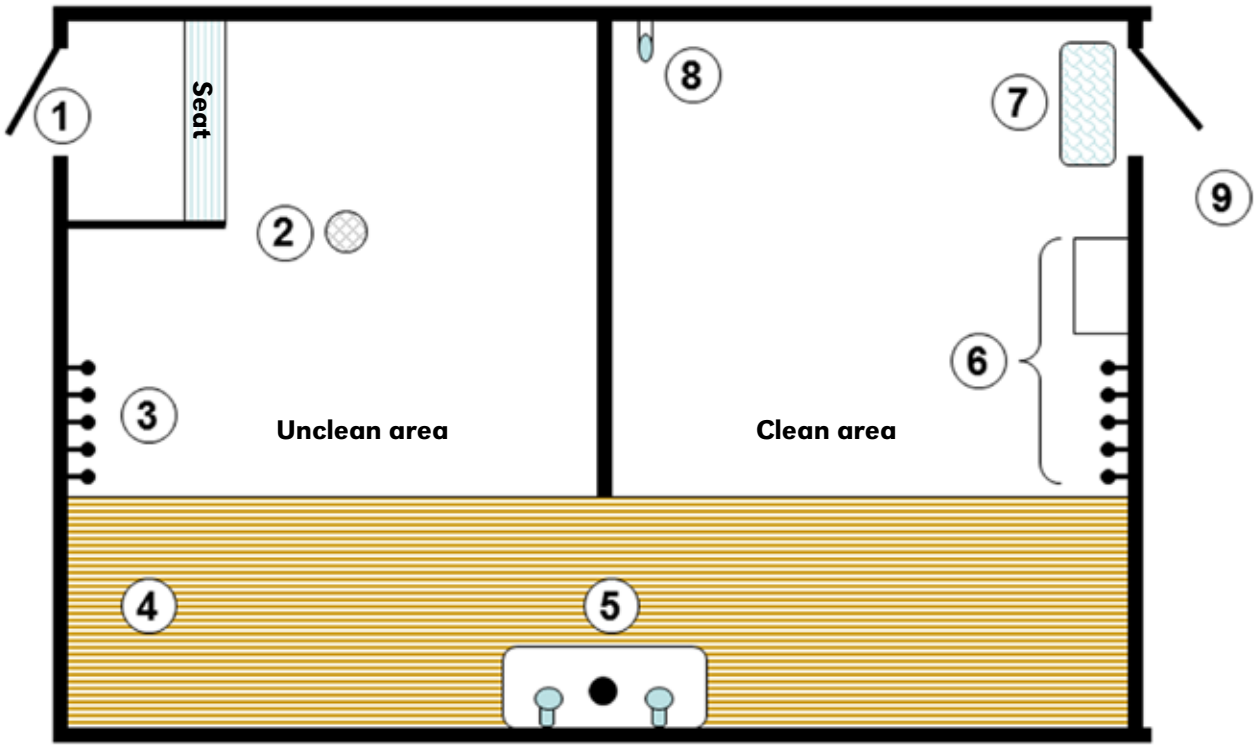

Figure 4. Danish entry method for a non-shower farm. 1. Only entrance to facility and footwear is removed; 2. Floor drain; 3. Street clothes are removed; 4. Wooden-grate passage is only entered in stocking feet; 5. Hands are washed and disinfected; 6. Protective clothing and boots; 7. Use footbath before entering unit; 8. Water-tap with hose; 9. Pig facility (adapted from Moore, 1992)

sidewalk. Inside the single room Danish entry, a bench divides the room in half. Jackets and hats are hung on hooks in the dirty side. The employee/visitor sits on the bench divider and removes his or her footwear (boots/shoes) without letting socking feet touch the floor. After removing footwear, the visitor turns around and puts on farm footwear to cross over to the shower area. This keeps dirt, mud, snow, etc. from entering the changing and shower area.

B8.7. Farm Employee. The term "farm employee" means anyone working on the farm (owner, family members, office staff, and daily pig unit workers). Some of the biosecurity procedures that all these people are required to abide by are:

- They are not permitted to own or work with other pigs.
- They are not allowed to live at another pig farm.
- They must not come to work if they have influenza-like symptoms. Flu-like symptoms include fever, cough, body aches, and sometimes vomiting and diarrhea. Some farms recommend that people with these symptoms be seen by a doctor immediately. Sick workers or family members should inform their doctor of their contact with pigs. Some farms recommend that all workers be vaccinated against the seasonal influenza virus. This requires the owner/operator to have a lenient sick leave policy. If an employee is forced to take vacation time or leave without pay, they may ignore this policy.
- Entering pork production facilities:
  - Procedure 1 — There is a demarcated "dirty" area with a shower where people have to undress, shower, and put on farm-provided clothes before entering the pig area. A Danish entry also may be employed, as described previously. Shower installation should be designed so that people have to go through the shower to the clean side to put on the clothes provided by the farm. After showering, no one is allowed to come back into the entrance or contaminated area.
  - Procedure 2 — There is a demarcated "dirty" area with a locked door where people undress and put on farm-provided clothes and boots before entering the clean farm areas. The use of the previously described Danish system should be considered.
- Clothing and boots used on the unit should be worn specifically on that unit and washed and cleaned on the unit itself.

B9. Worker Training and Abidance

With the assistance of a veterinarian, it is very important that protocols — developed in detail — cover all aspects of biosecurity to prevent diseases from entering or leaving the herd and to minimize the impact of those already present. The creation of detailed standard operating procedures (SOPs) clearly defines the procedures to be used to enhance biosecurity. However, the SOPs are of little value if the people who take care of the pigs do not believe in the concepts. The entire workforce has to believe in and abide by the SOPs to prevent diseases from entering the herd. The complete concept of biosecurity must become part of the work ethic and farm culture. This requires regular training and discussion. The most effective biosecurity efforts are on farms that have these meetings at least four times a year with all employees in attendance. An excellent training program needs to be developed whereby workers clearly understand:

- the purpose of SOPs for biosecurity,
- the risks associated with coming in contact with pigs outside of work, e.g., all types of livestock shows and agricultural exhibitions,
- how biosecurity enhances animal performance, minimizes disease, reduces death losses, reduces medication costs, and improves quality assurance of the pork chain,
- that biosecurity rules are non-negotiable,
- that willful neglect and ignoring of biosecurity rules will not be tolerated,
- that a monitoring method is in place to determine whether workers are abiding by the biosecurity procedures,
- how to conduct a regular checklist audit to monitor the practical implementation of the biosecurity procedures,
- how to look for signs of tampering or unauthorized entry to the pig production area and farmstead,
- how and where to report concerns or suspicious activities,
- how to recognize signs of disease in the herd, and
- where to promptly report any unusual signs of disease or unexplained deaths.

B10. Feed Delivery and Feed Storage

Because feed delivery trucks may be on several farms each day, they can be a serious risk for transmission of disease to a pig farm. In larger operations, dedicated feed delivery trucks are often required, but this is impractical for smaller farms. Ideally, trucks delivering feed to a pig production unit should be able to unload the feed without entering the pig site. This procedure requires that all bulk bins and facilities storing bagged feed be on the inside edge of the pig site perimeter. Having the feed truck fill all bulk bins without entering the pig site is not practical on many pig farms because numerous bulk bins are located at different sites within the pig unit; some bins hold a small volume of feed; and several different diets are simultaneously used. Therefore, other procedures to minimize risk of disease transmission by the feed truck and driver must be used. The driver is always the greater risk and must not come in direct or indirect contact with the pigs.

Clean commercial feed truck. It is impossible for feed transport vehicles to avoid dirty roads and possible contamination. Generally, a feed delivery truck is not used on Sunday; thus, the best day for delivery of feed is Monday morning. You need to let the feed company know that before feed is delivered to your farm, you would like: (1) the interior of the feed truck cab to be cleaned and disinfected, (2) the outside of the feed truck to be washed and disinfected at least the night before feed is delivered to your farm, and (3) the first load of feed on the truck that day is delivered to your farm. During the winter months in cold climates, the delivery of feed in a clean and disinfected feed truck is challenging and difficult to accomplish. Most likely, smaller farms will have little clout with feed mill operations, and their biosecurity requests may be ignored.

Commercial feed truck driver. Upon arrival at the farm, the truck driver must follow certain biosecurity rules, such as:

- The truck driver must put plastic boots over his or her shoes before exiting the cab. Because plastic boots can easily tear, the farm should provide the truck driver with easily accessible external farm boots.
- If the truck driver must exit and return to the truck several times, the driver should wear farm boots and then a set of boot covers so when he/she re-enters the cab, boot covers are placed on the shoes or boots. This is only appropriate if the interior of the feed truck cab was cleaned and disinfected before leaving the feed mill and the driver has not been on another pig farm prior to arriving. This procedure can be frustrating for the driver when he/she is having trouble lining up the feed delivery auger with the bin opening. A common option is to have disposable floor mats in the truck. When the driver exits the site, the disposable floor mats are left in a designated trash container with the farm-specific boots and/or boot covers.

- The truck driver should be able to open and close the feed bin lid from the ground while outside of the perimeter fence. Opening the feed bin lid from the ground also enhances safety of the truck driver.
- Invoices are left in a designated area, most commonly in mailboxes attached to the bin leg or at the entry to the farm.
- The truck driver must not enter the office at the farm except for an emergency.

Farm-owned vehicle. If a farm-owned vehicle (truck, pickup, and trailer) is used to deliver feed to the farm, the vehicle must be thoroughly cleaned, washed, and disinfected prior to picking up the feed. The driver should avoid contact with other people involved with pigs, wear rubber boots when out of the vehicle, and wear boots and disposable coveralls when loading feed at the feed mill/distribution center. Prior to departing the feed mill/distribution center, the boots should be placed in a "dirty box" for cleaning and disinfection between loads.

Bagged feed. Bagged feed deliveries should be minimized to reduce the number of deliveries. Bags should be transported in a manner to prevent road contamination or in a separate compartment of the bulk truck. Bagged feed should be dropped in a designated storage area where the bags undergo disinfection prior to farm entry. Dirty, opened, or otherwise damaged bags should be rejected and sent back to the supplier. If the bag drop area is within the pig production site, the truck driver should follow the same biosecurity procedure as previously described. After the bags have been disinfected, the bags of feed or feed ingredients should be stored off the floor (e.g., on pallets) in a manner that will prevent contamination and access to rodents, birds, dogs, cats, and other wildlife. Opened bags should be placed in or emptied into barrels with tight lids. Materials or containers that have been used on another farm should never be allowed on the pig unit. Make sure water is not entering the storage area.

On-farm feed manufacturing. If feed is manufactured on the farm, feed ingredients and pre-mixes should be purchased from a reputable supplier with a recognized quality assurance system. Generally, corn and soybean meal are not identified as a frequent source of pathogen introduction. Ideally, feed ingredients and pre-mixes should be delivered to storage facilities located on the perimeter of the farm. Do not haul feed ingredients in a vehicle that is used to haul pigs or other livestock. Bagged ingredients should always arrive clean, sealed, and undamaged. Like bag feed, they should be rejected and returned if not in good order.

Bulk bins. Regularly emptying and cleaning bulk bins helps ensure they remain watertight and dry, and prevents the development and buildup of mold or bacteria in the bin. The opening and closing mechanism should ensure that the lid is tightly and securely held closed.

B11. Water Supply

- If water storage tanks are used, they must be clean and have a lid to prevent rats, mice, and birds from using or falling in the tanks.
- Make sure a regular cleaning schedule of water troughs and tanks is followed.
- If the water supply is from an on-farm well, test the water regularly for bacteria and contamination.
- If the water supply comes from surface water (river, stream, lake, pond, or shallow well), it should be filtered, treated, and routinely monitored to assure it meets potable municipality standards.
- Be sure the water supply system is secured with locks on wellheads, pump houses, and outdoor water storage tanks.
- If necessary, flush and disinfect water lines and drinkers.

B12. Air filtration

Preventing the spread of PRRSV within and among pig populations is a priority on pig farms. Pigs may become infected via exposure to PRRSV by any of several routes, including saliva, nasal secretions, urine, feces, intramuscular injections, vaginal, mammary gland secretions, semen, fomites (boots, coolers, shipping parcels, and vehicles), transport trucks, and aerosol. To reduce the risk of spreading PRRSV by aerosol, some pork producers have installed air filtration systems on their buildings such as boar studs, sow facilities, and growing-finishing buildings. Factors that influence whether an air filtration system is installed depend upon the individual producer's budget, the location of the site (high pig density vs. low pig density), the level of acceptable risk, and the type of production system (breeding stock or commercial).

Filters have been installed either in the attic through insertion of filters into the ceiling inlets or in the form of a filter bank preceding the cool cell pad. If an air filtration system is installed in a building, all areas of the barn that could serve as potential air leaks need to be sealed. This includes cracks in the building and around windows and doors, shutters, and idle fans. In addition, double door entry/exit systems must be installed to prevent potentially contaminated air from entering the animal air space at high risk points, such as personnel entryways, live/dead animal load-out rooms, delivery

and disinfection rooms, etc. In addition to contacting a swine veterinarian and an agricultural engineer with experience in the design and management of an air filtration system for pig facilities, the following references discuss various aspects about air filtration systems: Dee et al. (2010), Groth (2008), Jordhal (2010), Mohr (2010), Pitkin et al., and Reicks (2006, 2008, 2009).

B13. Vehicles

Vehicles and their drivers that present a risk of transmitting diseases into a pig production unit include straight trucks, semitractors, semitrailers, pickups and trailers, cars, ATVs, motorcycles, farm tractors, livestock carts, farm equipment, etc. A biosecurity risk due to vehicles occurs when: (1) replacement gilts and boars are transported to the farm, (2) market pigs and cull sows are transported off the farm, (3) feed, bedding, equipment, pharmaceutical supplies, semen, etc., are delivered to the farm, (4) manure and dead animals are removed from the farm, (5) workers, outside maintenance personnel, veterinarians, consultants, sales people, visitors, and others arrive at the farm, and (6) vehicles taken off the farm are returned to the farm. The degree of risk depends on how recently the vehicle has been exposed to other pigs or livestock farms and if the pigs on the farm have direct or indirect contact with the vehicle. Biosecurity procedures for handling these vehicles are:

- All vehicles of visitors, consultants, workers, and owners should be kept outside the perimeter of the pig unit.
- The only vehicles and machinery allowed within the perimeter are those owned or completely controlled by the pig unit.
- Designate a cleaning area for pig unit vehicles and equipment that have been used off the farm, such as farm vehicles used to haul pigs and cull sows to market. Make sure these vehicles are cleaned, washed, and disinfected on a hard surface located outside the pig unit. Allow them to dry between each use. Particular attention should be paid to any part of the trailer or truck that pigs have contact with. It is also important to thoroughly clean and disinfect the tires, wheel arches, and underside of the vehicle. To prevent the workers from getting contaminated while cleaning the vehicle, they should wear protective clothing and boots that remain outside the farm perimeter. It is difficult to adequately clean and disinfect the interior of a truck/pickup cab but it should be kept as clean and dry as possible. Floor mats should be washed and disinfected along with the truck and trailer.
- Keep commercial feed delivery and livestock transport vehicles as far away as possible from the pigs and pig unit.
- Require livestock transport vehicles to be properly cleaned and disinfected before arriving on the farm.
- Inspect commercial pig haul vehicles before loading pigs. Contaminated trucks or trailers should be rejected and not allowed to load or back up to the load-out.

Cleaning and disinfecting livestock trucks and trailers. Proper cleaning and disinfection of vehicles used to transport live pigs is one of the key methods to prevent transmission of disease to a swine operation. In addition to commercial vehicles, farm vehicles hauling market pigs and cull sows need to be properly cleaned and disinfected prior to returning to the farm perimeter.

Truck and trailer wash facility. Ideally, the facility used to clean and disinfect vehicles should be enclosed, heated, and well lit. This type of facility design improves the quality of the washing procedure and may provide an opportunity to dry vehicles during winter months when freezing of the disinfectant greatly decreases its effectiveness.

B14. Equipment and Consumable Supplies

All equipment and consumable supplies brought into the pig operation should arrive clean and undamaged. Many farms bring supplies through a fumigation room or spray them with disinfectant at the entry point. The greatest risk that accompanies consumables is that they may have been delivered to another farm, returned, and then redistributed by the supply company. Likewise, the delivery driver poses significant risk if other pig farms are on the delivery route. It is wise to discuss this with the local delivery carrier. Possessing a proper location and facility where items enter the farm helps ensure biosecurity compliance. The physical structure to receive items entering the farm should be located on the fence perimeter (dirty side). A door allows access to the outside. All new equipment or consumable supplies are delivered to this structure. Consumable supplies (e.g., pharmaceutical products, heat lamp/light bulbs, artificial insemination supply containers, etc.) should be disinfected by hand. If possible, all of the new equipment (e.g., sort boards, pen partitions, wrenches, hammers, etc.) should be put in a solution of disinfectant. Some operations use fogging or fumigation devices to disinfect items. However, fogging does not always reach the entire area of the bottom of items unless the items are placed on woven wire shelves. In small operations, it may be best to deliver all consumables to the owner's

home where they can be inspected and disinfected prior to moving them into the pig facilities.

Many times, equipment and supplies brought into the pig operation by contract people providing a service to the unit are not new, and, in many cases, these tools frequently are used on other farms. Therefore, it should be mandatory that the service person's equipment and supplies be thoroughly cleaned before coming to the farm, and these tools pass through a disinfection room. It is a good idea for the farm to have some of the general tools needed by service personnel. Ideally, equipment used on another pig operation by a consultant or adviser (such as an ultrasound device or individual pig scale) should not be allowed into the pig operation.

Biosecurity procedures also need to be established for the following items used on the pig operation: notebooks, paper, pencils and pens, laptop computers, mobile telephones, wrist watches, cameras, etc. These items should be farm-dedicated equipment and supplies. In addition, the office and workers' accommodations should be kept clean and uncluttered.

B15. Farm Machinery and Equipment

Farm machinery and equipment can be a risk for transmitting disease to a pig operation, especially if the machinery and equipment were used outside of the pig operation. The following procedures will help prevent disease transmission:

- Avoid borrowing equipment (especially manure handling equipment) and vehicles from other farms.
- Avoid bringing farm machinery or equipment to the pig unit unless it is essential.
- Any equipment brought into the unit must be thoroughly cleaned and disinfected prior to entry. This procedure especially includes machinery used for manure and/or slurry handling.

B16. Bedding Material

- Store bedding so it is protected from the weather. Ideally, bedding storage also should prevent contamination by vermin.
- Straw should come from a source that has not exposed the straw to livestock. Purchase bedding material from suppliers that have dedicated trucks and/or trailers that only haul bedding.

B17. Hygiene and Sanitation of Buildings

- Rubbish should be promptly and correctly removed from the pig unit. If a garbage pickup service is used, the rubbish containers should be placed outside the clean/dirty perimeter as far from the pigs as feasible.
- Buildings, barns, equipment, clothing, and footwear that pigs come in contact with should be routinely cleaned and disinfected. Disinfection should be accomplished only after thorough cleaning. Cold temperatures and organic material reduce the effectiveness of all disinfectants. The chemical agents commonly used require several minutes of contact with disease-producing agents to be effective. Cleaning and disinfection procedures should include:
  - removal of all bedding, manure, and feed. These items contain a high level of contamination and interfere with effective cleaning and disinfection.
  - thorough cleaning of the under-surfaces of equipment. If possible, removable equipment should be taken out and cleaned separately.
  - turning over feeders after the inner surfaces are cleaned so all water drains from them and the floor can be sanitized.
  - thorough cleaning with hot, soapy water, preferably through a pressure wash.
  - rinsing with clear water to remove all residues.
  - correct application of an approved disinfectant to everything pigs come in contact with, including the under-surfaces of equipment.
  - an adequate drying period for the area before the introduction of new animals. Consult a veterinarian for the specific recommendations pertaining to the situation.
- Many infectious agents survive in wet, dark places. Sunlight and drying will destroy many bacteria and viruses, but not all.
- Some infectious agents will survive in feces and mucus on boots and clothing so clothing and footwear should be routinely laundered or cleaned.
- Clean and disinfect any equipment that has been used on sick animals prior to use on healthy herd mates.

B18. Boot Baths

Boot baths have been shown to be practically useless in eliminating bacterial contamination. To provide any protection, boots must be free of organic matter and spend more than five minutes in the disinfectant solution. Some pig farm personnel do use boot baths in an attempt to prevent mechanical transmission of pathogens among groups of pigs. However, maintenance of boot baths in most facilities is poor. Most boot baths are grossly contaminated with organic matter (fecal material). Workers commonly avoid stepping into the

boot baths, or quickly step through the boot bath without stopping to clean their boots. Two studies at Purdue University (Amass et al., 2000 and 2001) have shown that simply stepping through or standing in a boot bath without first removing all visible organic debris from boots does not provide effective boot disinfection. Virkon® S is a suitable disinfectant for use in boot baths when used appropriately. A suggested procedure is:

- Make sure the boots do not leak.
- Have a clean/dirty demarcation at each boot bath site.
- Use a boot bath that contains 1 percent Virkon® S.
- Have the people wash the organic material off their boots with a water hose and brush prior to stepping in the boot bath. This allows the disinfectant to be changed less frequently and costs less.
- Step in the boot bath for a few seconds (count to 10).

Proper disinfection has been accomplished after manure-free boots were soaked in Roccal®-D Plus for five minutes. But, removing all visible manure from boots and then soaking boots in a clean disinfectant boot bath for at least five minutes is not practical on most farms. The use of a "soaking boots bath" might be an option in areas containing valuable breeding stock or sick animals. A soaking boots station could contain a wash area for scrubbing and cleaning off manure and a disinfectant soaking bath containing spare boots. Workers remove contaminated boots, clean the boots, place them in the tub of disinfectant, and put on the spare boots that had been soaking in the disinfectant.

An alternative to the boot bath is: (1) Boots worn outdoors are removed at the entry door for the pig facility. Some farms have a bench for workers to sit on while removing their boots. The workers swing their legs over the bench to put on indoor footwear. The area under the bench is enclosed to prevent dirt from entering the building. (2) Outdoor boots are stored outdoors. (3) Boots to be worn indoors are immediately available inside the door. (4) Indoor walkways are cleaned daily. (5) Boots worn indoors are washed at the end of each day in a location that has a large drain, detergent, scrub brush, disinfectant, a pressurized water spray, and a boot drying rack. (6) Boots worn outdoors are washed, disinfected, placed on a drying rack, and kept in an appropriate storage area away from the pig facilities at the end of each day. The storage area used for boots worn outdoors may need to be heated during the winter months.

B19. Dead Pig Postmortem and Disposal

Pork producers need to seriously consider developing a plan to deal with postmortem examinations and disposal of dead pigs. If a postmortem will be performed on the farm, an area outside of the farm perimeter should be established. This procedure allows a veterinarian who may not have been away from pigs to perform the postmortem examination.

The method used for disposal of dead pigs and afterbirth can create a biosecurity hazard. Dead pigs and afterbirth must be disposed of in a manner to prevent the attraction of wild animals, birds, and insects. Excreted body fluids must be cleaned up, and the area cleaned and disinfected. Because states are continuing to modify their environmental regulations and the availability of rendering services continues to shrink, pork producers need to contact the appropriate state agency (agricultural and/or environmental) to determine what methods can be used to routinely dispose of dead animals and afterbirth. The methods include burial, rendering, composting, and incineration. When a pig dies, it needs to be disposed of in a prompt and correct manner. *Table 3* indicates the advantages and disadvantages of various swine mortality disposal methods.

B20. Wild Mammals, Birds, Parasites, and Pets

Preventing birds, rodents, pets, and other animals from coming in contact with the pigs will be impossible when housing the herd outdoors. However, you can do some things to make the farm less desirable to these creatures. Examples include keeping the unit clean and tidy by controlling the vegetation/weed growth within and surrounding the pig area; immediately cleaning up spilled feed; discarding rubbish and debris in a timely manner; and promptly removing dead animals. The insect population can be lessened by spraying and eliminating areas with standing water.

- ***Rodents (rats, mice).*** Rodents can transmit swine diseases such as leptospirosis, trichinosis, toxoplasmosis, erysipelas, swine dysentery, and others. Mice and rats can spread diseases from contaminated areas to uncontaminated areas via their droppings, feet, fur, urine, saliva, or blood. For example, mice may walk through infected manure and then contaminate the food and water of healthy animals several hundred feet away, or take a disease to nearby uninfected barns. A large rodent population represents a significant amount of feed wastage. One rat can eat ½ pound of feed per week and contaminate about 10 times the volume of feed eaten. Rats often travel long distances and are a significant bio-exclusion and bio-containment risk. Rodents also

Table 3. Advantages and disadvantages of swine mortality disposal methods (modified from Harper and Estienne, 2009)

Method	*Item is an advantage (+) or disadvantage (-)*	
Burial	Prompt burial gets dead stock out of public view.	(+)
	Prompt burial coverage prevents odor, flies, and scavengers.	(+)
	Poor or delayed coverage can result in odor, flies, and scavengers.	(-)
	Burial pits can collect rainwater.	(-)
	Burial potentially results in pollutants going into the soil; thus, environmentally sensitive locations are not acceptable for burial.	(-)
	Depending on burial location, groundwater could be contaminated. Proximity to water sources, wetlands, wells, shallow water tables, and bedrock are important considerations.	(-)
	States may require permits for the burial of waste materials, including animals.	(-)
	Burial pits can be difficult to dig in winter.	(-)
Rendering	Rendering converts animal mortality into useful byproducts.	(+)
	Prompt transport to rendering plants removes dead stock from the farm.	(+)
	The collection area for dead animals should be located away from the pig unit.	(+)
	The collection point and associated equipment used to transport dead animals to the collection point needs to be cleaned and disinfected after every use. If cleaning is done by farm workers, cleaning should be done at the end of the day so workers do not need to re-enter the farm or buildings that day.	(+)
	Rendering trucks are a serious risk for a breakdown in biosecurity. There should be a clear demarcation between the farm access and the collection service access. Ideally, the rendering vehicle should not be allowed to come closer than 1 mile from the pig unit. Contact with the driver and farm personnel should always be avoided.	(+)
	Some states only have a few rendering plants that process dead stock. Thus, some pork producers do not have access to a rendering plant.	(-)
	Some rendering plants charge fees for accepting carcasses.	(-)
	Vehicles and personnel traveling to and from the farm and rendering plant can compromise biosecurity.	(-)
	Storage of dead hogs in "dead boxes" or other methods prior to being picked up by the rendering truck can cause odor and attract flies and scavengers unless refrigerated.	(-)
Composting	Proper composting generates minimal odor, fly, or scavenger problems.	(+)
	Prompt composting gets dead stock out of public view.	(+)
	Proper composting has low potential for pollution and produces a final product that can improve soil tilth and fertility.	(+)
	On-farm composting is considered biosecure.	(+)
	A readily available supply of carbon-rich bulking material such as sawdust, ground cornstalks, or other suitable material is required.	(-)
	Some initial capital cost is necessary for construction of composting facilities.	(-)
	Poorly managed compost units (inadequate bulking material, delayed carcass coverage, etc.) will result in odors and attract flies and scavengers.	(-)
Incineration	Prompt incineration gets dead stock out of public view.	(+)
	Modern incinerators reduce carcasses to ash and are biosecure.	(+)
	Older, less efficient incinerators may generate smoke and odor. Many environmental agencies are reluctant to permit burning of carcasses because of serious problems with air pollution.	(-)
	Modern incinerators have large capital costs and fuel requirements of 1 to 2 gallons per hour.	(-)
	State law may require that incinerators be equipped with an "afterburner" for pollution control.	(-)
	State law may require a separate Department of Environmental Quality permit for on-farm incinerators.	(-)

Figure 5. Feral pigs (Rouhe and Sytsma, 2007; Hutton et al., 2006)

may chew the insulation off of wires, causing a fire hazard. Biosecurity cannot be assured if rodents are tolerated in or around swine facilities. All pig farms should have an active rodent control and monitoring system in place. To control rodents, identify and routinely bait places where rodents could potentially den in storage areas or barns.

  - Inspect buildings and feed storage areas for evidence of rodents, such as droppings and nests.
  - Identify their source of food and prevent their access to it.
  - Destroy their denning places and block off any small holes to prevent them from re-entering.
  - Eliminate hiding areas around barns and storage facilities. Consider installing a 10-foot area of 1 inch rock around buildings and removing all vegetation close to building entrances. Rodents do not like crossing wide open areas.
  - Use traps or bait stations placed 10 to 20 feet apart to catch rodents.
  - Use tamper-resistant bait stations to protect farm pets, especially dogs, from rodent poison.
  - Search for dead rodents and dispose of them appropriately. Do not touch them with bare hands.
  - Prevent more rodents from coming on the farm by maintaining a clean and regularly inspected facility.

- ***Predator and scavenger animals.*** Predator animals that might need to be controlled on the pig farm are wild dogs, foxes, coyotes, badgers, raccoons, opossums, and weasels. Coyotes are wild canines with dog-like features. They are well-adapted to populated areas and are not strangers to farms, fields, and woods. Coyotes are less likely to attack livestock where wild game such as rabbits, squirrels, and mice are plentiful. How dead livestock are handled may enhance a farm's predator population and encourage predatory attack of swine housed outdoors. Predators may carry disease-causing agents (leptospirosis and others) so they should be kept out of areas where swine are pastured or housed.

- ***Feral and wild pigs.*** Feral swine (*Figure 5*) are defined as free-roaming animals that are not being held under domestic management or confinement. Feral pigs come from several sources and include released or escaped domestic swine and the truly wild European boar. When free-roaming in North America (*Figure 6*), all are included in the term "feral swine," as are hybrids of the two types. Although morphologically distinct, both the feral swine and European wild swine are recognized as *Sus scrofa*. Feral swine are highly mobile disease reservoirs and can carry at least 30 important viral and bacterial diseases in addition to a minimum of 37 parasites that can affect people, pets, livestock, and wildlife. Feral swine carry brucellosis and pseudorabies, which have been eradicated from domestic U.S. swine. Feral swine are one of the greatest risks to domestic swine because reintroduction of either of these diseases will lead to farm depopulation.

- ***Birds.*** House sparrows, starlings, pigeons, and swallows commonly inhabit barns on livestock farms. Large numbers of birds in and around swine facilities can cause damage and unsanitary working conditions. Because birds consume and contaminate feed and water, they can potentially transmit diseases to swine. Birds are known to mechanically transmit transmissible gastroenteritis (TGE) virus to pigs, especially pigs housed outdoors. Avian tuberculosis is frequently transmitted to outdoor pigs. Infected slaughter pigs are condemned, causing the packer and producer significant economic losses. Not only

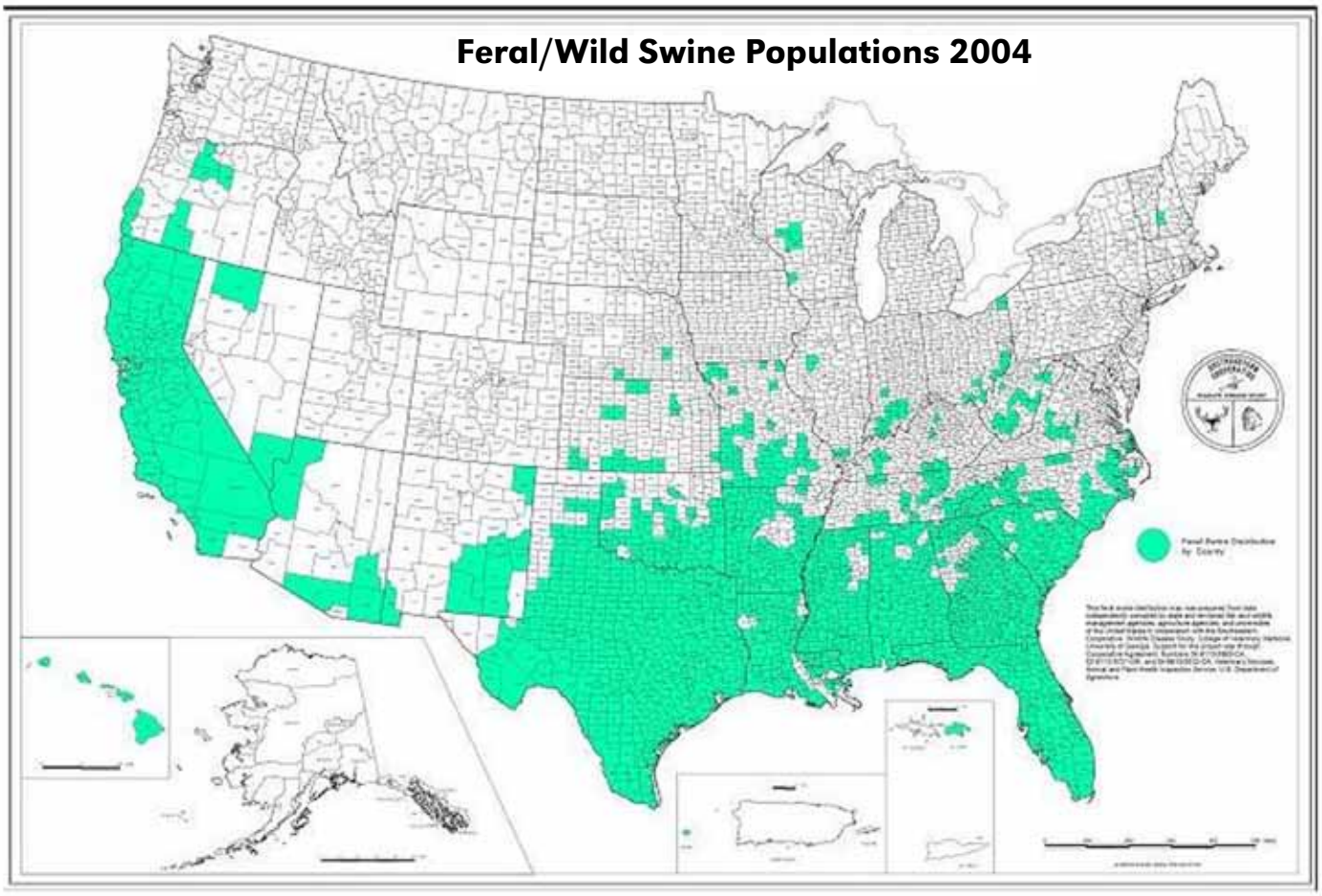

Figure 6. Distribution of feral pigs in United States (Southeastern Cooperative Wildlife Disease Center Study, 2004)

can birds spread disease onto healthy farms, they also can be an expensive nuisance. A starling will eat 50 percent of its body weight in grain each day. Nests that are made in barns close to the heat of a light fixture or faulty wiring can be a fire hazard. Accumulated bird droppings can corrode equipment. The insulation of a building can be destroyed by birds. Before beginning a bird control program, you should be familiar with the laws protecting birds. The nature of a particular bird species determines which methods to use for controlling problems the birds cause. To reduce the exposure of pigs to birds and their droppings, first evaluate the current presence of birds on the farm.

- Identify the species of birds contributing to the problem.
- Identify places on the farm where birds like to nest, bathe, and perch.
- Inspect the farm for places where there are lots of bird droppings.
- Observe whether birds perch on or above the pigs.
- Observe whether birds bathe in pig water troughs.

The following are options for detracting birds. However, use of these methods is no guarantee that all birds will stay off the farmstead.

- Install bird screening to prevent birds from accessing barns.
- Ensure lids are kept on feeders and bulk bins.
- If needed, clean out water troughs and feed troughs daily.
- If pigs are housed outdoors, keep them away from ponds where birds congregate.
- Destroy nests and eggs of nuisance birds.
- Thin stands of trees where starlings roost.
- Promptly clean up spilled feed.

  - Discourage migrating flocks of birds from stopping at your farm.
  - Play recordings of distress calls.
  - Blow whistles that make an irritating sound.
  - Use visual detractors.
  - Install reflectors.
  - Attract raptors like red-tailed hawks.

- ***Parasites (flies, mites, mosquitoes, lice, ticks, worms).*** All pig farms should control internal and external parasites. All incoming replacement pigs, unless specifically free, should receive two treatments, two weeks apart, with external and internal parasiticides. Fecal samples should be monitored from each production area on a quarterly basis to determine the presence of internal parasites. Further refinement of the deworming program is based on the results of these examinations. An effective fly and mosquito control program should be implemented. Mosquito and mite bites can reduce carcass value due to trim loss at slaughter.

- ***Dogs and Cats (pets or feral).*** Dogs can transmit leptospirosis but are most often a biosecurity risk if they travel to different farms. *Toxoplasma gondii* is a protozoan (single-celled) parasite found in muscle and other tissues of many warm-blooded animals, including pigs and people. Cats and other felids are the only hosts in which the parasite can complete its entire life cycle, and the only animals that excrete the environmentally resistant and infectious stage called the oocyst ("eggs") in the feces. Cats may shed more than 10 million oocysts per day for 3 to 10 days after infection. Pigs become infected when they accidentally ingest oocysts in soil or water or eat tissues of rodents, wildlife, or meat containing cysts. Because it takes only one oocyst to infect a pig, protection of pigs from environmental contamination, contamination of feed, and transport of oocysts on boots is vital to control. Risk analysis of management factors associated with positive pigs showed that infection correlated with the presence of infected juvenile cats (sources of oocysts) and *T. gondii* infected mice.

B21. Loading/Unloading Chute and Load-Out Area

Loading and unloading pigs is most likely one of the most common ways to bring disease into a minimal disease herd. The loading/unloading chute and entire load-out area is a serious biosecurity risk for pathogens to enter the farm. Some suggestions for minimizing the risk of diseases entering the farm at the load-out area:

- The loading/unloading chute and loading area should be sited on the perimeter of the pig unit and away from pig buildings and lots. It has been suggested that the loading area should be 65 to 165 feet from any area containing pigs. Thus, commercial vehicles used to haul livestock do not enter the farm.
- The only vehicles allowed to travel the road that connects the production unit to the loading/unloading area are farm vehicles.
- Design or redesign the loading/unloading area so that:
  - the livestock transport driver can easily and continuously see the loading chute from the left side of the transport vehicle when backing up to the chute.
  - there is easy control of pig movement and the pigs cannot return to the building or loading area.
  - there is no physical contact between farm workers and the livestock transport vehicle and the transport driver. If the pigs are loaded directly out of a building, the farm workers should not exit the building; plus, the transport driver should never enter the building.
  - the transport driver can load the pigs without any assistance from farm personnel.
  - the area can be easily cleaned and disinfected after each use. If cleaning is done by farm workers, cleaning should be done at the end of the day so workers do not need to re-enter the farm or buildings that day.
  - the cleaning water drains away from the unit.
- The vehicle used to remove animals from the farm should always arrive clean, disinfected, and empty.
- The transport driver should provide and wear clean clothes/coveralls and boots. This requires the driver to maintain a clean box and a dirty box for boots and outerwear used during the pig transfers. If clean and disinfected boots are not provided for the livestock transport driver, provide a bucket of clean water, cleaning brush, and disinfectant (Roccal-D Plus) "soaking boot bath." After the driver has appropriately cleaned the boots (all manure removed), have the driver place the cleaned boots in the disinfectant boot bath for five minutes. Renew the boot dip solution every time the loading bay is used. During the winter months, provide the driver with appropriate clothing and boots.
- Ideally, the loading/unloading chute should be enclosed, bird-proof, have a lockable door on the truck end, and a means to be heated after washing to

prevent freezing during the winter months. Freezing temperatures reduce the effectiveness of disinfectants.

- Workers need to have discipline in accomplishing loading area biosecurity. The development and posting of the protocol for use and washing the loading area is advisable.
- A clean-dirty line should be established for the driver and farm personnel based on the biosecurity methods employed.
- Bump chutes or off-site loading/unloading areas are used by some production units to further separate the over-the-road hauler from the farm. This requires shuttling the pigs to the loading area.
- Do not use the load-out area to hold dead animals for pick up by the dead animal truck.

B22. Manure Disposal and Waste Management

Many important diseases and parasites can be transmitted by manure or urine, either directly or indirectly, via contaminated clothing and equipment. The pathogens responsible can be classified into four major types: bacterial (e.g., salmonella, {ileitis, dysentery}, *E. coli*); viral (e.g., PRRS, TGE, hog cholera, foot and mouth disease); protozoal (e.g., coccidiosis); and parasitic (e.g., round worms). Fungal diseases, such as aspergillosis, are less likely to be shed in manure, but may be present in contaminated bedding and litter. Use of sawdust/shavings can be a threat from bacteria. To reduce the risk of spreading disease via manure or urine, prevent contamination of feed and water.

- Plan and install a manure system to prevent environmental contamination and comply with your state's acceptable agricultural practices.
- If pigs are housed outdoors, maintain clean water troughs, water bowls, and feed troughs.
- Use separate shovels, forks, and skidsteer or loader bucket for handling manure and feed operations.
- Remove manure frequently from barns, yards, and holding areas to prevent completion of life cycles by intestinal parasites and flies.
- Control the fly population. Methods include flypaper, parasitic wasps, and insecticides (baits and sprays).
- Store manure so it is inaccessible to pigs, especially young pigs. The most popular method for storing manure is the deep pit under the floor. If a lagoon is used, the pipe used to carry the manure should be rodent-proof to prevent rodents from entering the building.
- Prevent runoff of adult manure to young pig rearing areas or contamination of feed fed to young pigs.
- If slurry is spread onto fields or pasture, pigs should be kept off the land for at least three weeks.

Because production costs and manure value have increased, more producers are contracting professional handlers and haulers. However, hiring custom labor and equipment creates the risk of introducing disease. Improper sanitation procedures between farms can potentially spread a number of diseases. Ensure manure management equipment is properly maintained and cleaned, especially if being used at several farm sites. Wash all exterior surfaces of manure handling equipment; check that they are visibly free of organic matter before arriving on a farm. The operator should not enter the farm buildings and should not come in close contact with farm personnel unless they remain outside the perimeter until an overnight and shower. Ogejo and Maguire (2010) prepared a very useful publication on nutrient management for small farms.

B23. Herd Health Management

- Employ veterinary services to help implement herd health programs.
- Immediately report any unusual signs of illness to your veterinarian.
- As recommended by your veterinarian, vaccinate pigs against certain diseases.
- The health of all pigs should be monitored daily.
- All sick animals should be treated immediately.
- It is inevitable that in every swine production system, animals will become ill or injured and euthanasia will be necessary. Euthanasia is defined as a humane death without pain or distress. Because it is usually impossible or impracticable for the veterinarian to be available for all on-farm euthanasia, producers often need to perform humane euthanasia. A publication (On Farm Euthanasia of Swine — Recommendations for Producers) that describes the various approved methods to humanely euthanize pigs can be obtained from the National Pork Board's website as indicated in the reference section. Euthanasia should be performed when:
  - The animal has an inadequate or minimal prospect for improvement after two days of intensive care and treatment.
  - The animal is severely injured, non-ambulatory, and unable to recover.

– Any animal that is immobilized with a body condition score of one on a scale of 1 to 5 (Karriker et al., 2006).

B24. Facility Maintenance

It is always a biosecurity risk to allow service personnel into a pig unit to perform repairs. Therefore, good quality materials and equipment should be used in pig buildings. The equipment should be easy to wash and long-lasting. Other factors related to facility maintenance and biosecurity are:

- Off-farm maintenance personnel must be educated on the importance of biosecurity and follow all required farm biosecurity protocols.
- Any necessary tools or materials brought in to fix facilities should be new. If used equipment is required, it needs to be thoroughly cleaned and disinfected before entering the facility.
- Replace fly bait and trapping tape routinely and when necessary. Knock down and residual sprays are needed during summer months. Follow EPA, state, and local requirements. If the pigs are in contact with the insecticides, use only those approved for livestock preparations and follow withdrawal regulations.
- Be aware of hiding and denning places for rodents.
- Inspect and repair holes in buildings to prevent rodents from living in them.
- Remove piles of boards, wood, trash, or other junk from the interior and exterior of buildings.
- Keep farm grounds mowed and free of brush, weeds, or high grass.
- Check for rain and stormwater damage.
- Identify and correct manure runoff problems.
- Remove standing water, which can be a breeding ground for mosquitoes.
- If pigs are housed outdoors, check fences along farm and pasture perimeters. Damaged fences should be repaired. If appropriate, use 4-strand high tensile electric fences wherever possible.
- Make changes to bird detractors or other control methods as needed.
- Replace bird netting where needed and change bird detractors so that birds do not ignore their presence.

B25. Maintenance of Biosecurity Program

- A critical review of the measures in place to prevent entry of disease and spread of disease within and between herds should be conducted regularly.
- Constantly be aware of any diseases in the area and adjust the biosecurity program to meet specific needs.
- Train new workers so they clearly understand the concepts of biosecurity and its implementation on the farm.
- The success of a biosecurity and farm security plan is strongly influenced by the quality and the quantity of communication among all people involved with the farm and pig operation. It is important to hold regular meetings (such as quarterly or twice per year) that are convenient for everyone involved with the pork operation. A meeting involving everyone indicates the importance of biosecurity and security of all farm enterprises. Provide a setting in which everyone feels free to ask questions or mention concerns about the current biosecurity and security procedures. They need to clearly understand that teamwork is the key to a successful biosecurity and farm security plan.
- Be an excellent neighbor by visiting with your neighbors and respecting their biosecurity practices. In addition, make sure your neighbors are aware of your security and biosecurity practices.

C. Farm Security

A small- and medium-sized farm with a pork operation is diversified. These farms also have crops, forage, and, many times, other livestock species. Both security and biosecurity procedures are important for minimizing the risk of intentional or unintentional introduction of pathogens to a pig farm. Security of a pig farm can be compromised in three ways. First, intruders could use forced entry to break into a pig farm. Second, someone could use false identification to enter the farm. Third, an employee or other person who already has access to the farm could intentionally harm the farm and pigs, or steal pigs. Because threats to farm security can be varied and numerous, security of the entire farm presents unique challenges for producers. Even so, farms that do not have a functional security plan don't have a viable biosecurity plan. Some basic measures can be instituted at the farm level to help increase the security of the pork producer's farm. Sandy Amass at Purdue University prepared an excellent publication for The National Pork Board titled *Security: Guide for Pork Producers*. The 14-page publication can be used to understand risks to farm security and create a farm-specific security program. Due to the unique nature of different agricultural production operations, not all recommendations presented in the publication are appropriate for all operations. The publication can be obtained by contacting the National Pork Board (Telephone: 515-223-

2600 or downloading a copy from its website: *http://www.pork.org/filelibrary/Biosecurity/SecurityBook.pdf*.

C1. Develop Farm Security Plan

- Develop or update a risk management plan and share it with employees, family, and local law enforcement.
- Identify areas or activities where threats might occur and increase security in those areas.
- Consult with experts when you are developing your plan. Include your veterinarian, crop consultant, extension educator, university scientist, and state Department of Agriculture experts.
- Plan how to respond to threats or tampering with your animals, crops, equipment, chemicals, supplies, and energy and water sources.
- Update your plan regularly. Make sure you have contact names and telephone numbers. Include how you will notify appropriate local law enforcement officials, as well as federal and state agriculture officials.
- All security plans should make it as difficult as possible for intruders to enter both during and after business hours. Locked entrance gates, routine lock changes, locking all doors during non-working hours, security cameras, perimeter fences, and many other techniques will thwart unwanted intruders. Neither employees nor visitors should be allowed to bring cell phones, cameras, or video equipment into the facility.
- Develop a biosecurity plan that includes requirements for quarantining new stock, cleaning and disinfection procedures, and disposal of fallen stock.

C2. Training for Emergency

- Make an emergency preparation and response plan that includes:
  - current emergency phone numbers (fire, police, hospital, veterinarian) posted for easy access,
  - information that may be needed by first responders (location of farm, type of chemicals, location of all chemicals),
  - person to whom employees should report security problems,
  - plan for evacuating animals and people from buildings,
  - prioritization list of supplies, equipment, and facilities needed to maintain function of the farm,
  - current roster of employees,
  - name of person to handle news media, and
  - frequent safety and security meetings with all employees and family members who work or live on the farm.
- Train all people involved with the livestock operation to recognize and report clinical signs of foreign animal diseases. Clinical signs are:
  - unusually high number of sick animals,
  - unusually high number of deaths,
  - blisters or vesicles on the animals' snouts or feet,
  - large number of lame animals,
  - large number of animals with fever,
  - large number of animals not eating,
  - large number of animals that do not want to stand,
  - discoloration of the ears, bellies, rumps, legs, or tails, and
  - animals act uncoordinated or show other neurological signs.

C3. Access and Barriers to Farm

- Limit farm entry to one gated road. Keep the gate locked when not in use.
- Distribute keys to employees on an as-needed basis and verify when they are returned. Stamp all keys with "Do Not Duplicate." This procedure can prevent unauthorized copying of keys. Swap padlocks from different areas when an employee leaves or is terminated. This will prevent you from having to re-key or purchase new locks. Changing entrance locks several times a year helps assure that non-employees have less access to the farm.
- To help prevent unauthorized intruders, have an occupied home or office at the road leading to the farm. Place buzzers on gates to alert you when a vehicle or person has crossed the farm entrance.
- Minimize the number of places where people can easily hide around the farm. Trim trees and shrubs that could provide concealment to criminals or block visibility of security patrols.
- Use fencing to secure the farm perimeter and maintain fences in good repair.
- Minimize the number of entrances to restricted areas within the farm. Keep restricted areas locked when not in use.
- Secure hazardous materials, energy sources, and production inputs like feed and nutrients.

- Be sure your water supply system is secured with locks on wellheads and pump houses, water storage tanks, or other water supplies, and identify alternative water sources as backups.
- Install entry prevention devices on exterior ladders, protecting the ladders from unauthorized use and preventing access to the top of bulk storage bins.
- Make sure that the areas surrounding and within farm buildings are well lit.
- Install backup lighting for emergencies.
- Install alarms, motion detection lights, cameras, and/or other appropriate security equipment as needed. Use electronic sensors around sensitive areas during times when no one should be working at these sites.
- Install locks on all doors and seal or lock all windows and vents on buildings that contain critical inventories and equipment.
- Lock all vehicles parked outside at night or during times of owner and employee absence. Keep the keys in a secure area. Frequently inspect trucks, tractors, and other farm equipment for signs of tampering.
- Use deadbolt locks on doors with a minimum 1.5-inch throw.
- Padlock entry and discharge points of exterior liquid tanks (aboveground and belowground) and all other storage areas when not in use.
- Keep padlocks locked on hasps while not in use.
- Keep windows, doors, and storage areas locked when rooms are not in use. Metal doors are more secure than wooden doors.
- Restrict access to computer data systems, secure online communications, and safeguard them with virus protection. Back up all files at least weekly and securely store backup files off-site.

C4. Hazardous Materials

- Maintain an up-to-date inventory of anhydrous ammonia, ammonium nitrate, bulk urea, pesticides, herbicides, disinfectants, drugs, and other hazardous materials. Immediately investigate missing materials or other irregularities. Notify law enforcement authorities of any unresolved or serious problems.
- Purchase hazardous materials from known, licensed, or permitted suppliers.
- Make sure that all storage areas for hazardous chemicals and drugs are secure and reasonably isolated. Make sure these facilities are built and vented according to national and state codes. Supervise employees with access to these materials.
- Secure chemical containers inside buildings, whether or not they are empty.

C5. Visitors and Personnel

- Have only one (clearly marked) entryway for use by visitors.
- Designate a specific area for visitor parking, and post signs to inform all visitors of the rules.
- Require all visitors who do not provide a regular, known service to the farm to check in with a designated farm representative.
- Have a separate policy for essential visitors such as consultants, service people, and health professionals that are both (1) known to you, and (2) have visited the farm on a regular basis, and understand and respect the biosecurity protocols.
- Maintain a record of non-service visitor names, companies, arrival times, departure times, and purpose of the visits. Have unknown, non-service adult visitors provide an authorized, valid reason for entry and proof of identity (valid driver's license).
- Develop a system that easily identifies visitors. Explain disease prevention procedure to visitors.
- Do not allow unknown individuals, including delivery personnel, drivers, customers, government officials, reporters, sales people, contract providers, service support, and others, to have unlimited access to the premises (e.g., storage areas for gasoline, fertilizer, and pesticides; locker rooms; computer areas; or areas where keys are kept). Clearly mark these areas with a "No Visitors without Escort" sign. Non-service visitors are escorted at all times.
- Screen prospective employees, check with references, and consider regular background checks on all employees.

C6. Hiring New Employees

- Require all applicants to completely fill out a written job application, including references from all previous employment. Straightforward questions should be asked, such as: Has the applicant ever changed his or her name? Is he/she currently working for an organization that is paying the applicant to collect information about your farm? Does the applicant intend to use any equipment that can collect audio, video, or still photographs? (Establish a policy that either prohibits their use or requires that all such tools be declared upon being hired and that they cannot be used without prior consent.) Require that these questions be answered in writing, and ensure the application is signed.

- Conduct thorough background checks on all prospective employees (seasonal, temporary, contract, and volunteers) to verify previous employment references, addresses, telephone numbers, qualifications, and employee demeanor. You will need to check state and federal regulations before performing vehicle or criminal background checks. Find out from previous employers if their previous experience was undercover or legitimate.
- Check immigration status with the U.S. Immigration and Naturalization Service.
- Have a written security policy to show prospective employees.
- Obtain permission to perform drug and alcohol testing prior to and during employment.
- Require that all new hires sign an animal care agreement. Train all employees in animal handling and specify that any employee who observes or receives information about animal mistreatment must immediately report that information to a supervisor. Abuse of animals is cause for dismissal and potential criminal charges.
- Have new employees sign and date a written security/biosecurity policy in the presence of a witness.
- Have a probationary period of 30 to 90 days.

C7. Employee Training

- Start all new employees on a day shift.
- Provide all new employees with direct supervision.
- Mandate that all new employees become certified in the National Pork Board's Pork Quality Assurance Plus program. Have a zero tolerance policy for workplace violence and animal abuse. Employees are required to promptly report such incidents.
- Train employees on how to periodically conduct random security checks along the perimeter of all fields and pastures for signs of suspicious activity or unauthorized entry.
- Train employees how to report any suspicious activity or any unauthorized personnel on or near the facility to designated contact or backup contact people. Post telephone numbers by each telephone for on-farm contacts and emergency contacts (fire department and law enforcement).
- Train employees that part of their daily job responsibility is to be alert for signs of possible tampering with crops, livestock, supplies, equipment, and facilities.
- Train employees and family members to watch for sick animals, including wildlife, especially birds, or unusual changes in the appearance of crops.
- Tell employees they can't bring smoked or uncooked pork products into the farm.

C8. Employee Monitoring

- Appropriately supervise employees at all levels, especially new hires.
- Make employees aware of who belongs on the farm and who doesn't.
- Use time clocks to monitor employee arrival and departure times.
- Require employees to notify management if they will be arriving early or staying late.
- Require employees to notify management if they are leaving the premises at an abnormal time.
- Restrict personal items allowed on the farm.
- Notify employees that contents of lockers, bags, and vehicles can be inspected when on farm property for safety and security reasons.
- Notify employees that taking or removing farm property from work is theft.
- Delegating specific responsibilities to key employees without overlap also prevents theft. For example, only a specified employee should have access to certain medications, the tool room, farm vehicle keys, etc.
- Monitor employees for suspicious activities:
  - staying unusually late after work,
  - arriving unusually early,
  - accessing or attempting to access files, information, or areas of the farm outside their area of responsibility,
  - removing documents from the facility,
  - asking questions about sensitive subjects,
  - bringing cameras or cell phones to work,
  - not wearing clothing provided by the farm,
  - wearing personal belts and using personal pens,
  - signs of tampering with equipment or facilities,
  - suspicious materials or devices, and
  - misplaced equipment.

C9. Community Involvement

- Get to know your neighbors.
- Initiate or join a local community "Crime Watch" program.
- Do not make known when you will be away from your facility, except for the person designated to take care of the facility while you are gone.

C10. Law Enforcement Involvement

- Talk with your local or county sheriff or state police office to find out if your farm or facility is subject to any specific risks based on its locality. If your farm is at risk:
  - arrange to have a security survey of your facility by local law enforcement or your insurance agent,
  - request that local law enforcement routinely conduct patrols along your facility's perimeter, and
  - immediately report any unusual or suspicious persons, vehicles, or activity to local law enforcement.

This publication has been peer reviewed.

UNL Extension publications are available online at *http://extension.unl.edu/publications*.

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