

Conducting effective PRRS case investigations to identify gaps in bio-exclusion practices



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Introduction

Reducing the risk of introducing PRRSV and other pathogens into a herd by improving bio-exclusion practices is like housework, it will never be done. Rather, the goal must be to continually reduce the gaps and weaknesses in bio-exclusion practices. Identifying those gaps is challenging but, a necessary first step. The task is further complicated by the fact that every farm is unique with its own circumstances, gaps and weaknesses.

Experimental research studies can tell us how a virus can be transmitted from one herd to another and what practices will reduce the risk of transmission. A comprehensive review of the literature on experimental studies done for porcine reproductive and respiratory syndrome virus (PRRSV) nicely summarizes what has been learned from these studies. However, experimental research cannot tell us the most frequent routes by which the virus is transmitted in the field and, therefore, where we should be devoting resources to shore up gaps in bio-exclusion. Only systematic observation can answer that question. One form of systematic observation is an epidemiological investigation of cases to assess the likely routes of pathogen transmission and help producers and veterinarians prioritize where to focus their bio-exclusion efforts to reduce the frequency of cases over time. For PRRS, for example, investigations of cases, defined as the introduction of a new isolate of PRRSV into a herd, may be conducted to identify the most likely route by which the virus was introduced. The objective is to identify the likely route(s) of introduction, identify gaps in biosecurity and reduce the frequency of cases over time.

Each case may be viewed as a mistake that led to some breach of biosecurity. Mistakes are opportunities to learn and improve but making mistakes don't guarantee we'll learn from them. If we fail to learn, we are destined to keep repeating the same mistakes. Case investigations can help you learn from your mistakes. A definitive determination of the route of determination is not possible and frequently the evidence is insufficient to identify a single most likely route. However, in every case, gaps in bio-

curity can be identified which can be used by the producer and herd veterinarian to prioritize where to devote scarce resources to improving biosecurity.

Definitions of Biosecurity

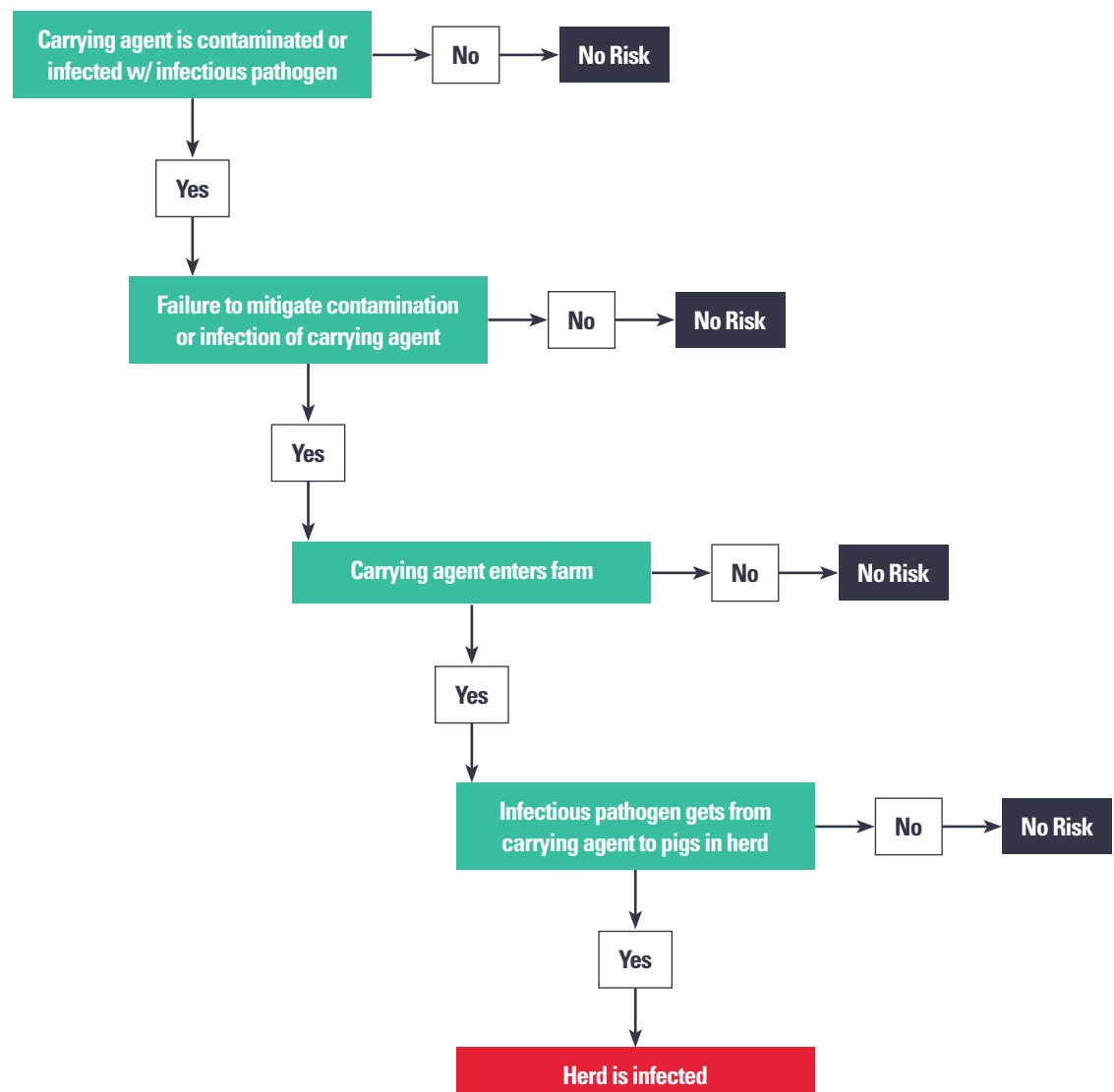
- Bio-exclusion - keeping pathogens out of a herd (also external biosecurity)
- Bio-management - managing pathogens already in a herd (related to managing immunity and within herd transmission) (also internal biosecurity)
- Bio-containment - not spreading virus from an infected herd

Guidelines for conducting effective investigations

Confirm etiology of the case	Diagnostic confirmation is required and, if a case definition exists, all of the conditions defined by a case definition must be met. For PRRS, sequencing is done to confirm if new isolate was introduced.
Act fast	The most effective investigations are conducted within 2 weeks of when the case was first recognized. Good records are key!
Select an appropriate period of time to investigate	The investigation period depends on the pathogen incubation period and time to first clinical signs or diagnostic recognition of introduction. For PRRSV, recognition of first clinical signs is highly variable in breeding herds. Therefore, a 28-day investigation period ending on the date first clinical signs were recognized or when diagnostic results first implicated PRRSV is used.
Prepare ahead of time	Prior to initiating the investigation, collect diagnostic info, case history, geographical information about facility, weather info, connection with other farms with similar infection, etc.
Conduct an effective investigation interview	Farm manager or owners are primary parties to be interviewed. A systematic approach needs to be followed to collect key information about disease history, information about current case, herd characteristics and risks. Series of events and failures also need to be reviewed.

Table 1. Risk events that occur on swine breeding herds (breed-to-wean).

Risk event category	Risk event
Swine Movements	<ul style="list-style-type: none"> • Semen delivered to farm • Breeding replacements delivered to farm • Cull sows transported from farm • Weaned pigs transported from farm
Vehicles / Deliveries	<ul style="list-style-type: none"> • Removal of dead pigs from farm • Feed or feed ingredients delivered to farm • Propane and fuel delivered to farm • Garbage collection from farm • New tools and supplies delivered to farm • Transferred (from another swine farm) tools and supplies delivered to farm
People Movement	<ul style="list-style-type: none"> • Entry of on-farm employees • Repair /service personnel working inside barns • Repair / service personnel working outside of barns • Entry of other visitors (veterinarians, vendors, etc)
Pork / food product entry	
Manure removal	
Entry of other animals	<ul style="list-style-type: none"> • Birds, feral swine, other animals outside of barns • Birds, feral swine, other animals inside of barns • Rodents • Insects
Entry of air / water	

Figure 1. Introduction of pathogens into a herd is the result of a series of events and failures.


Common gaps identified while conducting investigations of PRRS cases

When we conduct investigations, we qualitatively assign each risk event a low, medium or high level of risk for the likelihood that it was responsible for the introduction of the pathogen into the herd. Common gaps we have observed in biosecurity for the risk events most frequently assigned a medium or high level of risk are outlined in this section.

Entry of Employees	This is the most frequent risk event on every investigated sow farm. One of the most serious breaches is when employees perform other jobs in addition to working on the sow farms.
Removal of cull animals	Although producers may view this as a low risk and less frequent event, the potential for contamination of livestock trailers, swine panels, other equipment and drivers is often very high because they come in contact with swine from many sources at the abattoir or collection points.
Repairs inside the barns	Repairs done on the inside of barns where repair personnel and their tools and equipment may contact animals in the herd occur infrequently but when they do, it often is a high risk event because repair personnel work on many swine farms, especially in swine dense areas, and frequently are unaware of their risk of being contaminated with PRRSV.
Weaned pigs transported from the farm	Transporting weaned pigs from the farm is a regular and frequent event. As weaned pigs are leaving the farm, none of the carrying agents associated with transporting weaned pigs from the farm come in direct contact with pigs in the herd from which they are removed. However, the potential for contamination of livestock trailers, swine panels, other equipment and drivers is often high because they potentially come in contact with swine on other swine premises.
Removal of dead pigs from farm	Removal of dead pigs is a relatively frequent event on most sow farms. Many farms continue to dispose of pigs off-site by rendering. The pigs are picked up by a rendering truck which is nearly always contracted to a third party who is collecting pigs from multiple swine sites with many opportunities to be contaminated with PRRSV. In the event that dead pigs are composted, it is not uncommon to find poorly managed composting sites which attract wild animals and birds that are potentially contaminated carrying agents.

The risk events we have most frequently assigned a medium or high level of risk

- Entry of employees
- Removal of culls,
- Repairs inside the barns,
- Weaned pigs transported from farm
- Removal of dead pigs from farm.

Delivery of semen and breeding replacement animals were less frequently assigned a medium or high level of risk. These risk events, for good reasons, have received more attention and, consequently, appear to pose relatively less risk than they may have 10 or 20 years ago. The PRRSV status of gilts and boar studs are nearly always monitored very closely reducing the risk that infected gilts or semen is entered into the farms. Bio-exclusion at boar studs is very good and it is rare now to find cases of PRRS caused by an infected boar stud. Transport of gilts is also done relatively well. Trailers are often dedicated to the farm or segregated from transporting other pigs that are infected with PRRSV. In nearly every case, the trailers were washed, disinfected and dried between loads. Gilts are also frequently isolated or quarantined for several weeks prior to entry in the sow herd. However, there are still opportunities for improvement. For example, it is common to find sow farms where semen is used before diagnostic results confirm the continued negative status of the boar stud. Aerosol transmission by entry of air is also infrequently assigned a medium or high level of risk. In about 17 percent of the cases we have investigated, there was another swine site with a similar virus (>98.5% nucleotide homology) within 4.8 kilometers (3 miles). However, the weather was not conducive for aerosol transmission (colder temperatures, cloud cover, moderate wind speed downwind from site with similar isolate) during the 4 week investigation period in any of the cases.

Entry of employees

Employee entry is the most frequent risk event on every sow farm we have investigated. Employees, and other carrying agents employees bring with them, such as watches and cell phones, directly contact animals in the herd. If an employee is contaminated, and remains contaminated after entering the barns, it is very likely that the virus will be transmitted to animals in the herd. One of the most serious breaches we have observed is when employees perform other jobs in addition to working on the sow farms. These jobs include managing a finishing site, performing maintenance on other swine farms, driving feed trucks, transporting pigs to and from other farms, managing a feed mill and loading market hogs. While every farm we have investigated has a shower, the design of the entryway

and entry procedures are frequently poor. In one case, the shower was located in a detached shed next to barns with no walk-through separating clean and dirty areas. Other observations include entryways that are cleaned infrequently and lack a bench entry where employees can place their socked feet in a cleaner area after removing their shoes. There are also frequent sightings of towels on the dirty side of the shower which blurs the line between the clean and dirty side of the shower and is an indicator of poor compliance with biosecurity procedures. Employees entering and exiting the barns multiple times daily for lunch, to smoke, to work outside the barns or work at other swine or swine-related premises sometimes dramatically increases the frequency of the employee entry event and, in some cases, they were not required to shower in again.

Removal of cull animals

Producers sometimes view removal of culls as a low risk event because the culls are leaving the farm and because it occurs relatively less frequently. However, the potential for contamination of livestock trailers, swine panels, other equipment and drivers is often very high because they come in contact with swine from many sources at the abattoir or collection points. It is still common to find that the trailers used to transport culls are not washed, disinfected and dried between loads. The carrying agents associated with removal of culls, including the livestock truck, trailer, driver, cutting boards and other equipment, do not typically enter the barns and directly contact animals in the herd. However, there are opportunities for the unloading area to become contaminated with virus, which could be then carried by employees on the farm, or other secondary carrying agents, to animals in the herd.

Transporting of culls is sometimes contracted to a third party that also transports pigs for other producers. Frequently the identity of those other producers is unknown. Producers usually establish requirements that the trailers be washed and disinfected between loads but rely on the contractor to establish protocols for washing and disinfection and oversight or auditing are rarely performed. Under these circumstances, the producers have no knowledge of where the trailer and driver had been, what types of swine it has transported or how well it has been cleaned and decontaminated prior to arriving at the farm to remove culls.

Using a cart that never leaves the farm and is dedicated to hauling culls to a location away from the barns where a bumper-to-bumper transfer to another trailer that transports them to the abattoir or collection point is made is an effective way to reduce the risk of virus being transmitted from a contaminated trailer to pigs in the herd. However, if done poorly, still poses a risk to the farm. For example, when the

same cart is also used to haul gilts from an on-site gilt development unit to the gestation barn, there is a high likelihood that gilts will be infected on the ride to the gestation barn if the cart is contaminated during the transfer.

Repairs inside the barns

Repairs done on the inside of barns where repair personnel and their tools and equipment may contact animals in the herd occur infrequently but when they do, it often is a high risk event. Most repair personnel work on many sites with swine, especially in swine dense areas, and frequently are unaware of their risk of being contaminated with PRRSV. Repairs are often contracted to third parties over whom the producer has little control. In several cases we investigated the repairs were unplanned and done as an emergency. In those circumstances, the urgency of the situation sometimes overrides biosecurity concerns. In some cases, repairs required special tools and replacement parts that must be entered into the barns. Sanitation and decontamination of some tools and parts is challenging and not a high priority for those performing the repairs. It was not uncommon to find that entry of the repair personnel, tools and replacement parts bypassed normal entry biosecurity procedures.

Weaned pigs transported from farm

Transporting weaned pigs from the farm is a regular and frequent event. As with removal of culls, weaned pigs are leaving the farm. None of the carrying agents associated with transporting weaned pigs from the farm come in direct contact with pigs in the herd from which they are removed. However, the potential for contamination of livestock trailers, swine panels, other equipment and drivers is often high because they potentially come in contact with swine on other swine premises. There are frequently opportunities for the unloading area to become contaminated with virus, which could then be carried to the herd by employees on the farm, or other secondary carrying agents, to animals in the herd. The trailers that transport weaned pigs are sometimes not washed, disinfected and dried between every load. Formal auditing of trailer washing and decontamination procedures is done rarely. The trailers also haul weaned pigs from multiple sow farms to multiple growing pig sites and the PRRSV status of the pigs being transported is not always known or no effort is made to segregate trailers that transport positive pigs from those that do not. The loadout area at the sow farm is sometimes washed and disinfected between loads, but it is rare to find facilities built to capture the runoff to prevent it from flowing into the barns or from contaminating the area around the loadout. A line of separation between the driver and employees on the farms is usually defined but compliance is frequently poor.

Removal of dead pigs from farm

Removal of dead pigs is a relatively frequent event on most sow farms. Many farms continue to dispose of pigs off-site by rendering. The pigs are picked up by a rendering truck which is nearly always contracted to a third party who is collecting pigs from multiple swine sites with many opportunities to be contaminated with PRRSV. When the dead pigs are stored on-site, the rendering truck must enter the site and there is an increased risk that areas surrounding the barn will be contaminated by the rendering truck or driver. A common strategy to avoid this is to locate the pick-up location off site. While this keeps the rendering truck away from the barns, it does create other risks. The tractor, loader or other equipment used to transport dead pigs from the barns to the off-site location is a carrying agent that is at risk of being contaminated. It is common to see poorly designed off-site pick-up where the tractor or loader bringing pigs from the farm is forced to cross paths with the rendering truck and where the employee delivering the dead pigs must exit the tractor or loader to dump pigs in the collection receptacle. Whether the pick-up location is on-site or off-site, removal of dead animals from the barns is usually done at the end of the work day. However, on many farms we have investigated, the employee, after showering out, wears the clothes and shoes in which they arrived at the farm. After the chore is completed, the employee goes directly to their personal vehicle and drives to

their residence. In those cases, there are multiple opportunities for the employee, their vehicle and residence to become contaminated with PRRSV. If the employee returns to the farm the following day, the pressure is placed on the employee entry procedures to prevent the transmission of the virus from the potentially contaminated employee to pigs in the herd.

Disposing of dead pigs on-site is done by composting or incineration. This approach significantly reduces risk by eliminating the rendering truck. However, it is not uncommon to find poorly managed composting sites which attract wild animals and birds that are potentially contaminated carrying agents. In one case, the compost was located next to an outdoor trailer wash area that was used by trailers that may be contaminated with the virus leading to an increased risk that the employee managing the composting facility will become contaminated and carry the virus into the herd. Furthermore, on-site disposal does not eliminate the risks associated with removing dead animals from the barn and delivering them to the compost or incinerator. As with off-site disposal, removal of dead animals from the barns is usually done at the end of the work day and, on many farms, the employee wears the clothes and shoes in which they arrived at the farm. The same opportunities for contamination of employees, their vehicles and residences are present, however, are lower due to the absence of the rendering truck.

References

- Perez A., Davies P., Goodell C., Holtkamp D., Mondaca-Fernández E., Poljak Z., Tousignant S., Valdes-Donoso P., Zimmerman J., Morrison R. 2015. Lessons learned and knowledge gaps about the epidemiology and control of porcine reproductive and respiratory syndrome virus in North America. *J. Am. Vet. Med.* 246 (12):1304-1317.
- Baker K.L., Mowrer C., Canon A., Linhares D.C.L., Rademacher C., Karriker L.A., Holtkamp D.J. 2016. Systematic Epidemiological Investigations of Cases of Senecavirus A in US Swine Breeding Herds. *Transbound Emerg Dis.* 64:11-18.