Biosecurity: The last line of defense against epidemics .

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In the US, improving biosecurity, as measured by reducing the frequency of PRRS outbreaks in sow herds, has not been sustained over long periods. The industry responded to the introduction of porcine epidemic diarrhea virus (PEDV) in 2013 by improving biosecurity. While the changes were made in response to PEDV, the annual incidence of outbreaks caused by porcine reproductive and respiratory syndrome virus (PRRSV) in sow farms, tracked by the Swine Health Monitoring Project, declined as well. Progress is possible when the industry focuses on improving biosecurity. However, by 2016, the annual incidence of PRRS outbreaks in sow farms began to increase again. In 2018, producers refocused on biosecurity in response to the introduction of African swine fever virus (ASFV) in China and the annual incidence of PRRS outbreaks in sow farms again declined. The industry appears to respond to a crisis or fear of a crisis effectively, but complacency quickly returns. What can be done to maintain a more consistent focus on biosecurity to sustain progress?

In the wild, animals of prey must maintain a certain level of vigilance against predators. Those that become complacent and let down their guard do not stay around long. The threat to swine herds is ever-present for endemic diseases like PRRSV and PEDV (now endemic in the US). Periodically assessing the hazards that may lead to the introduction of pathogens into our farms is an excellent way to maintain vigilance to establish a more consistent focus on biosecurity and sustain progress.

What happens when we are not vigilant

I had the opportunity to investigate an outbreak of PRRS on an Iowa sow farm in November 2017. The employees first observed sows off feed in the gestation barn. Three days later, an outbreak of PRRS was confirmed by PCR. During the outbreak investigation, it was learned that one of the employees on the sow farm had a second job caring for pigs at a wean-to-market site. ORF5 sequencing revealed that pigs at the wean-to-market site were infected with a PRRSV isolate that was 99.8% similar to the one that caused the outbreak at the sow farm. There were no other PRRSV isolates in the company and veterinary clinic database of ORF5 sequences of PRRSV that were >98% similar to the one that caused the outbreak at the sow farm. Was this the cause of the outbreak? While we can never be certain, it is highly likely that this was the cause of the outbreak.

· Caring for the pigs at the wean-to-market site created a hazard for the employee to almost certainly be contaminated with virus every day. **Failure to prevent contamination was almost certain.**

· There were hazards that pointed to the possibility that the employee may have failed to mitigate the contamination before or as they entered the sow farm. On some days, the employee would take care of the pigs at the wean-to-market site before coming to the sow farm to work with no change of clothing or shoes between the wean-to-market site and the sow farm. Upon entry into the sow farm, the employees were required to shower and wear coveralls and boots designated for the sow farm; however, the showers were dirty, and employees wore their outside shoes into the dirty side of the shower. A towel was observed on the dirty side of the shower in violation of the protocols in place that restricted towels to the clean side of the showers. **Failure to mitigate the contamination was very likely.** The timing of the outbreaks suggested that the employee did effectively mitigate the contamination for at least three weeks; however, their luck eventually ran out.

· Once on the clean side of the shower, the employee donned barn boots and then went to work in gestation. Recall that sows off feed was first observed in gestation. By interacting with sows, there were certainly opportunities for any viral contamination that remained on their hands, hair, fingernails, or other body parts, to be transmitted from them to the sows in the herd. **Failure to prevent transmission of the virus from the employee to sows in the herd was almost certain.** The nature of their job required them to interact directly with the sows.

The most notable finding of this investigation was that the employee was allowed to care for pigs at another site while working on the sow farm. How could such a significant hazard go unrecognized or be tolerated? There is no single answer. It may be that management and the employee were unaware of the hazard, or they were aware and chose to accept it for economic reasons. However, complacency is the most obvious answer. If biosecurity were a high priority, someone would very likely have recognized this as a significant hazard and implemented biosecurity control measures to reduce or eliminate the hazard.

01

Failure to prevent viral contamination.
Failure to prevent the pathogen carrying agent from being contaminated or infected w/infectius virus.

02

Failure to mitigate viral contamination.
Failure to mitigate contamination or infection of pathogen carrying agent.

03

Failure to prevent transmission of viral contamination to pigs.
Failure to prevent a pig(s) in the herd from being infected with virus from the pathogen carrying agent.

Figure 1. The series of failures required for the introduction of a virus into a susceptible herd. A pathogen carrying agent is anything that can carry a pathogen (e.g., a virus) from one herd to another. Pathogen carrying agents may be infected or contaminated with the pathogen.

A hazard analysis involves identifying the steps in the processes associated with typical production activities, such as entry of employees, removal of cull sows, entry of semen, and removal of dead pigs. The hazards that result in the failures in Figure 1 can occur at any step in the process. In the swine industry, the logistics of production are highly variable. For example, the steps involved in collecting, processing, delivering, entering semen into a farm, and using it to inseminate animals may be very different from the steps for another farm, even if they are in the same company. Therefore, to conduct an effective hazard analysis, where the purpose is to identify hazards for a farm, the steps involved with each production activity and opportunities for failure must be understood and documented for that farm.

Applying biosecurity control measures to address hazards

If properly conducted, a hazard analysis will reveal the most significant hazards, which may subsequently be addressed with biosecurity control measures. Critical control points (CCP) are steps in the process where a biosecurity control measure can be applied to prevent a failure or reduce the probability of failure. In the earlier example involving the sow farm employee who worked a second job, the most effective biosecurity control measure prohibited the employee from working on other swine sites. That measure alone would substantially reduce the hazards that led to the employee becoming contaminated with PRRSV while away from the sow farm.

What is at stake?

For countries that are presently free of potentially trade-limiting diseases such as ASFV, foot and mouth disease virus (FMDV), and classical swine fever virus (CSFV), the need to prevent these transboundary pathogens from entering and spreading rapidly has become more important as globalization has increased trade, and the world has become more connected. The recent spread of ASFV has put the world pork industry on high alert. Biosecurity at the farm level is the last line of defense against these diseases. The cost of failing to maintain a more consistent focus on biosecurity to sustain progress is high. Periodically conducting hazard analyses on swine farms is an excellent way to maintain vigilance to establish a more consistent focus on biosecurity and sustain progress.