

DAHS Swine Topics Feature Article

BIOSECURITY, AIR QUALITY AND AERIAL SPREAD OF PATHOGENS IN SWINE PRODUCTION

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- Pig pathogens such as PRRS, *Mycoplasma hyopneumoniae* and Swine Influenza virus are easily spread by air
- Air quality is greatly affected by the presence of dust and bacterial endotoxins which have a negative impact on the health of stockmen and pigs alike
- Studies demonstrate the benefits of improving air quality through improved hygiene and biosecurity practices
- Work by Persisco's team in Italy using DuPont™ Virkon® S shows that aerial disinfection can reduce the spread of pathogens such as Aujeszky's Disease Virus and the PRRS virus and improve food conversion, mortality and medication costs.

The air that pigs breathe can have a significant impact on their health and performance. Not only can it carry pathogens but also its quality can affect the pig. Importantly we can use biosecurity to help control these challenges to pigs' health.

Aerial Spread of Pathogens

It is well known that some pig pathogens are spread by air. The distance that they can travel varies by a huge amount. The furthest distance documented was the spread of Foot and Mouth Disease Virus from Northern France to the Isle of Wight, England, a distance of approximately 150 miles (240km) in 1987¹. While, *Mycoplasma hyopneumoniae* commonly spreads over distances of at least 1 mile (1.6km)².

Aerial spread of PRRS virus has been a contentious issue. Initially it was believed to occur over long distances, but then many scientists thought that spread was limited even over small distances. More recently, spread and infection have been demonstrated over several hundred metres and it is now believed that aerial spread has a significant role, at least in pig disease areas³.

More than this, aerial spread of pathogens is not just important between units but also within a pig unit. Pathogens, such as *Mycoplasma hyopneumoniae* and Swine Influenza virus readily spread both within an air space and between buildings. Others spread more locally by aerosolised droplets produced by coughing and sneezing (e.g. *Actinobacillus pleuropneumoniae*⁴ and *Streptococcus suis*) and move from pig to pig in a building.



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Air Quality

Apart from pathogens, the air within pig housing also contains other harmful contaminants. In a keynote lecture at IPVS 1998 Paul Baekbo concluded that dust and endotoxins (these are produced by certain bacteria carried on dust) in the air contributed to the development of respiratory disease in pigs. He suggested that they lead to a smaller dose of pathogens than normal being needed to cause clinical signs⁸.

Workers in the UK showed there are other ways in which air quality is important. They demonstrated that pigs exposed to dust, ammonia and endotoxins in a commercial pig unit had lower feed intakes and lower growth rates than unexposed pigs. The depression of both was dependent on the concentration of dust⁹. Interestingly in this study the severity of respiratory disease was mild⁷ showing that just because you are not seeing respiratory disease it does not mean that poor air quality is not affecting pig health and performance.

Finally we must be aware of the impact of air quality on operative health. There is evidence that a substantial number of pig stockmen suffer from occupational respiratory disease believed to result from chronic exposure to aerial pollutants over several years⁸.

How Can Biosecurity Help?

There are many ways in which a full biosecurity programme can improve the quality of air in a pig building and help reduce the aerial spread of pathogens.

In Australia a survey of 160 piggeries monitored the concentrations of total bacteria, respirable endotoxins, ammonia and respirable and inhalable particles. Concentrations of airborne bacteria and respirable particles increased as pen hygiene decreased. It was concluded that improving pen cleaning was likely to improve the health and welfare of both pigs and staff⁹.

To achieve these benefits it would be necessary to adopt a good complete biosecurity programme (such as the DuPont Pig Biosecurity Programme). This would need to include washing using a heavy duty detergent (DuPont™ Biosolve® Plus) followed by disinfection with a broad spectrum disinfectant (Virkon® S). Further benefits will result from aerial disinfection.

Aerial Disinfection

Aerial disinfection is the process of suspending disinfectant particles in the air for a period of time. It can have profound effects on both the spread of pathogens and air quality. Its benefits are not just limited to the air as shown by workers who demonstrated that aerial disinfection using Virkon® S in a large animal veterinary hospital caused a significant reduction in bacterial levels on the surfaces of the facility¹⁰.

THERE ARE FOUR MAIN WAYS OF SUSPENDING DISINFECTANT PARTICLES IN THE AIR OF A PIGGERY.

- (1) By spraying with a knapsack sprayer or pressure washer. This produces large droplets which stay in the air for less time.
- (2) By misting or cold fogging. This produces smaller particles which have increased duration, penetration and uniformity.
- (3) By thermal fogging which is similar to cold fogging but heats the disinfectant to produce smaller particles with better penetration and suspension.
- (4) By fumigation which is the combination of two or more chemicals producing a vaporised form of disinfectant. This is only used with Formaldehyde and related products and so has negative health and safety impacts.

Within the pig industry the normal preferred method is by cold fogging using either hand held misters or computer controlled systems. Various disinfectants have been used. Formaldehyde and Glutaraldehyde products can cause irritation, sensitisation and other problems in operatives and have been subject to health and safety claims in hospital workers. Neither can be used safely in the presence of pigs or operatives and their prolonged release from treated surfaces is a hazard. Hyperox® is a peroxygen that is successfully used in thermal fogging as shown by excellent results in France¹¹. The most flexible and useful product for aerial disinfection is Virkon® S. This has high levels of activity against a wide range of pig pathogens and can be misted in the presence of pigs and livestock at a dilution rate of 1:200 (0.5%). As a result it can be used in terminal disinfection programmes or while pigs are in the building.

WHAT ARE THE BENEFITS OF ROUTINE AERIAL DISINFECTION?

- (1) It will reduce the spread of pathogens in a building.
- (2) It will reduce the risk of aerial spread of pathogens from adjacent buildings or farms.
- (3) It will reduce dust particles in the air by adhering to them and causing them to fall to the floor more quickly and stay there longer.
- (4) Endotoxin levels in the air will be reduced through the sedimentation of dust.

CAN WE MEASURE THE BENEFITS OF AERIAL DISINFECTION?

Trials in Italy by Persisco et al¹² have shown profound effects. Administration of an aerial disinfectant (Virkon® S) was carried out 3 times daily for 10 day on/off cycles as part of a continuous disinfection programme in a permanently occupied house holding pigs from 30–100kgs. There were profound improvements in food conversion, mortality and medication costs as shown on the following page.

	Average daily gain (gms)	Food conversion Ratio	Average daily Mortality %	Average weight Loss per dead pig Kg	Feed medication Cost/pig £/pig	ADV Positivity %
Control Period	599	2.87	0.39	50.3	0.179	100
Trial Period	597	2.75	0.37	39.0	0.065	46.7
Difference	-2	0.12	-0.02	-11.3	-0.114	-53.3

Aujeszky's Disease Virus (ADV) positivity was based on serology and shows reduced spread of this virus with aerial disinfection. In a second study they also showed reduced and delayed spread of PRRS virus.

ARE THERE OTHER WAYS OF CONTROLLING THE AERIAL SPREAD OF PATHOGENS?

The most obvious method is to place pig facilities in remote pig free areas and to keep smaller numbers of pigs in an air space. Unfortunately, these are not luxuries available to most commercial pig keepers. Work done by Dee et al¹³ and practical experience in France and the USA has shown that specialist filtration (HEPA filtration) of air entering pig buildings can prevent infection with PRRS virus even if the virus is outside the building. Unfortunately this is expensive, has high maintenance requirements and is not practical for many buildings. It has also been shown that addition of a disinfectant to the water in evaporative coolers in the intakes of pig buildings can reduce the chances of infection with PRRSV¹⁴.

Conclusion

To conclude we can see that the air pigs breathe has a profound impact on pig health. Air quality and aerial spread of pathogens can lead to respiratory disease and reduce production performance. A complete biosecurity programme including aerial disinfection can reduce this impact in both all-in all-out and continuous production systems.

Check with your DuPont representative regarding the ability to use Virkon® S for aerial disinfection in the presence of livestock.

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