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# Animal Housing—Electrostatic Precipitation Overview

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# AMPAT Air Management Practices Assessment Tool

## Animal Housing—Electrostatic Precipitation Overview

**Application:** used within buildings

### Pros

- Works within the building to clean air.
- Workers may benefit from cleaner air.
- Animals may exhibit improved productivity.

### Cons

- Dust accumulation on surfaces.
- Potential for an unpleasant but not dangerous static shock if touched.
- Effectiveness may be influenced by relative humidity.

### Description

Dust (particulate matter) within livestock and poultry facilities is composed of dander and feathers, feed particles and dried manure to name a few sources. These particles, which can absorb gases, can play a role in the transport of gaseous and odorous compounds as they leave the building through the ventilation system. Removal of dust from the environment within livestock and poultry buildings not only reduces the overall emission of airborne bacteria, ammonia and odor, but also may have the potential side benefit of improved animal productivity.



Figure 1. A swine nursery with the electrostatic system mounted on a pipe.

Electrostatic systems work by imparting a negative charge on dust particles, causing them to stick to grounded surfaces such as gates, floors, and walls. These systems use suspended lines which are attached to a power supply which generates -30 kV DC at a low current level of up to 2 mA to ensure safety. This line has closely spaced stainless steel electrodes which create a high-voltage negative corona discharge which induces a charge on the dust particles.

Electrostatic systems have been installed in the exhaust air stream to remove dust and reduce the potential of down-wind nuisance to neighbors. However, systems that are installed within a building have been shown to improve the environment for animals and improve productivity. The most challenging aspect of this system is the removal of dust from the interior surfaces. The surfaces are typically cleaned with water, in which case the dust ends up in the manure pit, or with air, such as a leaf-blower, to loosen the dust so the fans draw it out. Normally the loosened dust is composed of larger particles that will settle quickly once outside.

Reports from on-farm research trials with swine nurseries indicate that using an electrostatic precipitator in the animal room improved average daily gain, and reduced mortalities. This study is not currently published in a refereed journal but was conducted on a significant number of pigs, Baumgartner Environics, Inc (2014). Results tend to be influenced by relative humidity levels.

## Effectiveness

Component	Reduction	Notes
NH3	-21 to 17% <sup>1</sup>	Winkel et al (2012) indicated NH3 may increase when dust is reduced due to the ability of dust to absorb NH3
H2S	Unreported	
Odor	12% + <sup>2</sup>	May reduce odor transmission potential
Particulate Matter	39 to 63% 49 to 57% 45 to 65%	Total Suspended Particles PM10 (<10 microns) PM2.5 (<2.5 microns)
Volatile Organic Compounds (VOC)	5%	Methane
Other	16%	Nitrous Oxide
Cost	\$\$	Electricity/Materials/Labor

<sup>1</sup>Winkel et al (2011) reported ammonia emissions increased in a broiler house study, possibly indicating dust was capturing ammonia when present in high levels.

<sup>2</sup>Nicolai and Hofer (2008) stated that there is a strong relationship between odor and dust concentration.

## Cost Considerations

Cost includes the initial construction of the corona system, electricity and maintenance (including dust removal from surfaces). Systems vary, but one commercially available system costs about \$16/pig space. Electricity costs are minor. There is a potential for payback if there is an improvement of pig performance due to improved air quality.

## References

- Baumgartner Environics, Inc. 2014. EPI Technology Data, Data & Statistical Analysis Collected and Provided by Murphy-Brown, LLC. <http://epiair.com/wp-content/uploads/2012/06/MB-Data-Book.pdf> Accessed: 1/22/2014.
- Jerez, S.B., S. Mukhtar, W. Faulkner, K.D. Casey, M.S. Borhan, and R.A. Smith. 2011. Evaluation of electrostatic particulate ionization and BioCurtain™ technologies to reduce air pollutants from broiler houses. ASABE Paper 1110550. St. Joseph, MI.
- Nicolai, R.E., B.J. Hofer. 2008. Swine finishing barn dust reduction resulting from an electrostatic space discharge system. ASABE 701P0408. Eighth International Livestock Environment Symposium. P. 125-131. ASABE, St. Joseph, MI.
- Ritz, C.W., B.W. Mitchell, B.D. Fairchild, M. Czarick, J.W. Worley. 2008. Dust and Ammonia Control in Poultry Production Facilities Using an Electrostatic Space Charge System. Mitigating Air Emissions From Animal Feeding Operations: Technical Summaries. p. 28.
- Winkel, A., J. Mosquera, J.W.H. Huis in't Veld, N.W.M. Ogink, and A.J.A. Aarnick. 2011. Measures to reduce fine dust emission from poultry: validation of an ionization system on broiler farms. Report 462. Wageningen UR Livestock Research. The Netherlands.
- Winkel, A. J. Mosquera, N.W. M. Ogink. 2012. Removal Efficiency of a Wire-to-plate Electrostatic Precipitator for Abatement of Particulate Matter Emission from Poultry Houses. Paper ILES12-0405. Ninth International Livestock Environment Symposium. ASABE, St. Joseph, MI.

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