**Dust and Ammonia Control in Poultry Production Facilities Using an Electrostatic Space Charge System**

*Cleaner Air means Healthier Animals*

Air quality within poultry production housing has been a major concern for years, particularly with regard to poultry health.

Environmental concerns and nuisance issues related to agricultural air emissions are now affecting all aspects of animal agriculture.

Dust or Particulate Matter (PM) is a component of air emissions that may play a role in the transport of gaseous and odorous compounds.

Dust concentrations in poultry houses have been reported to vary from 0.02 to 81.33 mg/m3 for inhalable dust and from 0.01 to 6.5 mg/m3 for respirable dust (Ellen et al., 2002).

Sources of dust in poultry houses include feed, down feathers, excrement, microorganisms, and crystalline urine (Aarnink et al., 1999).

Factors that affect dust levels in poultry houses include animal activity, animal density, and moisture conditions.

Dust can contain large numbers of microorganisms that could have potential impact on human and bird health.

Reducing airborne dust in enclosed animal housing has been shown to result in corresponding reductions in airborne bacteria, ammonia, and odor.

Studies have shown that reducing airborne dust levels by 50 percent can reduce airborne bacteria by 100 fold or more (Madelin and Wathes, 1988; Carpenter et al., 1986).

The search for strategies to reduce particulate matter and ammonia emissions from animal housing has led to considerable interest in the poultry industry for practical systems to reduce these air emissions.

Several approaches can be used to reduce dust concentration within animal housing.

These include the addition of fat to the feed, fogging with water and oil-based sprays, ionization, electrostatic filtration, vacuum cleaning, wet scrubbers, and purge ventilation.

Reductions reported with these approaches ranged from 15 percent for weekly washing of pigs and floors, to 76 percent with a rapeseed oil spray (CIGR, 1994).

Reports of ionizer efficiency have ranged from 31 percent (Czarick et al., 1985) to 92 percent (Mitchell et al., 2002).

Dust in broiler houses originates from the litter base. Bedding type, humidity, and temperature affect the dust concentration.

High moisture levels in the air facilitate the absorption of ammonia into dust particles. Inhalation of the dust particles containing ammonia can cause damage to the respiratory tract (Kristensen and Wathes, 2000).

Ammonia in broiler houses originates from the litter base. Bedding type, litter management, humidity, pH, and temperature affect ammonia concentration and release.

For broiler house ammonia, reduction of in-house aerial concentrations has been largely accomplished through ventilation.

Another trend in the industry is less-frequent; complete-house, clean-out resulting in birds being grown on built-up litter. The manure cake is removed between flocks and the remaining litter is top-dressed with new bedding material.

The combination of these trends can be detrimental to air quality in broiler houses if dust and ammonia levels are not managed, particularly during the brooding phase.

An Electrostatic Space Charge System (ESCS) described by Mitchell and Stone, 2000, has been shown to significantly improve air quality by reducing airborne pathogens and disease transmission in poultry.

The principle behind the ESCS is to transfer a strong negative electrostatic charge to airborne dust particles within an enclosed space.

The negatively charged particles will then precipitate out of the air as they are attracted to grounded surfaces.

Nitrogen compounds attached to the dust will also precipitate out with the dust.

Based on the work of Mitchell and others, an ESCS was designed to determine whether a practical system can be developed for operation in a commercial broiler production house.

The system was evaluated for effectiveness of this technology for improving air quality in the house through reductions in concentrations of dust and ammonia.

**Applicability:**
Results from this study suggest that an ESCS can be effective in reducing poultry house dust and ammonia concentrations in floor-raised meat-bird housing where bedding material is utilized.

The system will likely require considerable modification for use in high rise layer facilities or used as an emissions control device exterior to the animal housing.

However, the principles of the technology remain as follows: to produce an electrostatic space charge that will reduce aerial dust and ammonia concentrations.

**Limitations:**
The incidences of static discharge to workers were minimal.

The intensity of a discharge from direct contact with an ESCS ionizer was similar to touching a spark plug wire on a gasoline engine.

**Technology Summary:**
Electrostatic Space Charge technology can be used to mitigate dust and ammonia emissions within poultry production facilities and may have application as an emissions control strategy.

Research suggests that reduction in dust can exceed 40 percent while ammonia concentrations can be reduced 10-15 percent. The effectiveness of the system is increased with higher dust concentrations.

Reducing ammonia concentrations inside poultry houses may require other separate control strategies than those designed for dust reduction in order to ameliorate poor air quality and emissions attributed to ammonia.

Cost of the system for an individual poultry house will depend on mass production of the needed materials, though the overall cost will likely be lower than the $4,000 needed for the experimental unit described in this study.

Electrostatic fields have not been shown to produce adverse health effects in animals or humans.

No differences in bird activity were observed in the form of decreased water consumption or increased mortality and no adverse effects of the continuous charge were observed in the form of stray voltage or static discharge at the feeder and water lines.