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**Air Quality and Agriculture**

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*Air Quality and Agriculture: Challenges and Opportunities* was the title of a seminar held May 25 and 26, 2004. Sponsored by the Michigan State University Extension Manure Management Team, the objectives of the seminar were to increase awareness about air emissions from agricultural operations, to better understand the concerns about potential impacts of those emissions on livestock and human health, and to set the stage for future activities. Attendees included personnel from Michigan State University Extension (MSUE), Michigan Department of Environmental Quality (MDEQ), Michigan Department of Agriculture (MDA), Natural Resource Conservation Service (NRCS), and statewide agriculture organizations, and consultants. Indoor and outdoor air quality are concerns in agriculture.

Indoor air quality impacts human and animal health. Also, the increasing size and concentration of animal production units has given rise to concerns about air emissions on the earth's atmosphere — globally as well as locally. Of concern are odor, gases, and particulate matter.

**Odors, Major Issue Locally and Regionally**

Odor is the major issue locally and regionally (1). For example, over 330 different odor-causing compounds have been measured in swine manure. However, the particular compounds that are perceived as offensive are not well understood. Odor is also the most difficult to measure. Olfactometry, which uses trained individuals and standardized procedures to measure odor concentrations and describe the quality of odors, is a common approach. Efforts to correlate individual odorous gas concentrations have met with some success. However, there is no known relationship between the specific gas concentrations in a mixture and its perceived odor.

**Greenhouse Gases**

Agriculture's impact on greenhouse gases was discussed by Phil Robertson, Professor of Ecosystem Science, MSU. Carbon dioxide, nitrous oxide and methane are emitted to and(or) removed from the atmosphere through agricultural activities. Because greenhouse gases have a potential role in promoting rapid and undesirable changes in climate, mitigating emissions through improved agricultural practices is receiving increased attention. Because mitigation of greenhouse gas emissions in agriculture will not begin of its own accord, Robertson suggested that policies for "carbon trading" likely will be established at the national and international levels to facilitate reduction of greenhouse gas emissions.

**Animal Nutrition Related to Air Emissions**

Dave Beede, C.E. Meadows Endowed Chair and Professor, MSU, examined the relationships between animal nutrition and air emissions. Nitrogen-containing compounds, ammonia, nitrous oxide, nitric oxide and nitrogen dioxide, have major implications regionally, nationally, and globally. Ammonia emissions from animal agriculture account for about 50% of the total ammonia emissions into terrestrial systems (1). Ammonia, through chemical reactions in the atmosphere,

causes acid rain increasing acidity of surface waters and soils. Nitrogen emissions, as ammonia, are a major nutrition issue.

Overall, Beede recommends decreasing the animals' intake of all nutrients to dietary amounts that minimize nitrogen emissions without compromising health or productivity of animals. Of major concern is the nitrogen (as crude protein) in rations which when fed in excess of that needed to meet the animals' requirements for growth and milk production is excreted in manure. Using properly balanced amino acid formulations (protein) to more accurately meet the animals' needs shows promise in commercial swine, poultry, and dairy cattle feeding, when cost-effective, to reduce ammonia concentrations in manure. Unfortunately, we currently have poor understanding of protein (amino acid) metabolism in the rumens of and tissue utilization by cattle, greatly limiting effective implementation of "specific amino acid or protein feeding" to reduce ammonia excretion.

Beede also commented that nitrogen applied to pastures in grazing systems, if not managed effectively, can result in as much or more nitrogen emission compared with feeding well balanced rations to dairy cattle in confinement. The type of "system" is much less the issue than some people think, he commented.

The key is effective and responsible nutrient management (e.g., control of nitrogen inputs, flows, and outputs) in any animal feeding system. For example, ineffective use of feeds (grazed or harvested forages) with high amounts of readily ruminally degradable crude protein can result in increased nitrogen emissions. Interestingly, some byproduct feeds (e.g., dried whey or distillers dried grains) that would otherwise be industrial wastes from the food and ethanol industries, currently are largely fed in animal agriculture. However, these byproduct feeds contain excess or improperly balanced nutrient profiles (e.g., protein and phosphorus) compared with animal requirements. Therefore, the excess chemicals (e.g., nitrogen and phosphorus) transferred from other industries into animal feeding operations end up in manure and are current and future challenges for animal agriculture.

### **Lack of Information Confounds Regulation**

Efforts to regulate air emissions from agricultural sources is confounded by a lack of information. Indeed, air emission requirements in the Clean Air Act apply to animal production facilities even though agriculture is not referred to in the Act itself. But there are no uniform studies to determine the size of operations or which manure management methods produce air emissions that exceed legal thresholds of regulated pollutants—ammonia, hydrogen sulfide, particulate matter, nitrous oxide and volatile organic compounds. William Schrock, Environmental Protection Agency (EPA), and Carrie Monosmith and Maggie Sadoff (MDEQ), presented the regulatory perspectives. Wayne Whitman, MDA, described experiences in Michigan with Right-to-Farm and air emissions. The Air Emissions Consent Agreement, recently negotiated between the livestock and poultry industry and the EPA, is an effort to find the required answers before regulations are formulated and imposed. As described by Carrie Tengman of the National Pork Board, the agreement provides for a nationwide emissions monitoring program, funded by the livestock and poultry industry. Emissions data and accumulated best management practices and technologies will be used in formulating regulations for the future. Interestingly, the dairy industry is not part of Consent Agreement activities.

Larry Jacobson and David Schmidt of the Biosystems and Agricultural Engineering Department, University of Minnesota, brought to the seminar several years of experience related to air quality and agriculture. They described measuring air emissions and odors, and the use of biofilters for odor control. Along with Dann Bolinger and Jerry May, MSUE, use of the computer program OFFSET (Odor From Feedlots Setback Estimation Tool) to site animal production facilities was discussed. This information is especially useful when planning for expansion or siting new animal feeding facilities.

Community interactions are an extremely important aspect of the air quality issue. According to Pat Norris and Beth Moore, MSU, participation by many segments of the community that view the issue very differently is required. Those with involvements and interests in agriculture have an opportunity to step forward, taking leadership roles in providing forums for discussion.

In the future, sound science must be the basis for policies and regulations related to air emissions from agricultural sources. A combined effort of the agricultural industry, regulatory agencies, and the scientific community will enhance these developments. Encouraging the mitigation of air emissions from agricultural sources is the responsibility of all stakeholders.

*Note: In addition to his professorial position in the Dept. of Biosystems and Agricultural Engineering, Dr. Bickert currently serves as Director of College of Agriculture and Natural Resources Manure and Nutrient Management Programs.*

## **Reference**

1. National Research Council. 2003. Air Emissions from Animal Feeding Operations: Current Knowledge, Future Needs. National Academy Press, Washington, DC. ISBN: 0-309-08705-8; [www.national-academies.org](http://www.national-academies.org).