Gaseous Emissions from Animal Agriculture

Air quality concerns coming from livestock systems are controversial issues in Iowa. Rural residents are concerned with odors and emissions from livestock facilities that may affect their health, property values, and the environment. Livestock producers are concerned with possible effects on their own family members and employees, the environment, and the health and productivity of the livestock.

Type of Emissions

Emissions from animal production systems originate from three primary sources: manure storage facilities, animal housing, and land application of manure. Secondary sources include feed production, processing centers, and silage storage. Many of the compounds emitted from animal production operations are byproducts of anaerobic decomposition of livestock and poultry wastes. Aerobic decomposition generally produces fewer odorous byproducts but can enhance volatilization of gaseous compounds. Moisture content and temperature affect the rate of microbial decomposition.

Animal wastes include manure (feces and urine), spilled feed and water, bedding materials (i.e., straw, sunflower hulls, wood shavings), wash water, and other wastes. The compiled waste includes carbohydrates, fats, proteins, and other nutrients that are readily degradable by microorganisms under a wide variety of suitable environments.

As many as 200 volatile compounds have been identified as intermediate byproducts of decomposition. Some of the principal classes of odorous compounds present include amines, sulfides, volatile fatty acids, indoles, skatoles, phenols, mercaptans, alcohols, and carbonyls. If decomposition proceeds to completion, the resulting gases are carbon dioxide and methane; both of which are odorless.

Some of the gases emitted (i.e., ammonia, methane, and carbon dioxide) are considered contributors to global climate change and acid rain. It is estimated that one third of the methane produced each year comes from industrial sources, one third from natural sources, and one third from agriculture, primarily animals and manure storage units. Although animals produce more carbon dioxide than methane, methane's contribution to the greenhouse effect is fifteen times that of an equal amount of carbon dioxide.

Dust, pathogens, and flies are also airborne emission concerns from animal operations. Dust, a combination of manure solids, dander, feathers, hair, and feed, is difficult to eliminate from animal production units and tends to be more of a problem in buildings that have solid floors and use bedding as opposed to slatted floors and liquid manure. Dust emission rates are mostly unknown from animal production sites. Although pathogens are present in buildings and manure storage units, pathogens typically do not aerosolize but can be transported by dust particles.

Flies can be a concern for some poultry and livestock operations. Large populations of flies can be produced relatively quickly in the correct environment. To reduce fly numbers, a recommended practice is to keep spoiled feed and manure from under feeders, waterers, fences, and other areas animals do not reach. If not managed correctly, compost piles make an excellent fly habitat.

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Emission Dispersion

Dispersion of airborne emissions from an animal production facility is difficult to predict and is affected by many factors, including topography, prevailing winds, and building orientation. Odor plumes decrease exponentially with distance, but long distances are needed if no odors, gases, or dust are to be detected downwind from a source. Recommendations exist for separation distances of animal production facilities from residential developments and other public and private areas where people live and work.

A number of models are being developed to more accurately predict setback distances from livestock and poultry operations based on animal units or actual emission values. Prevailing winds should be considered so facilities are sited to minimize gaseous transport to close or sensitive neighbors. For many existing facilities, this is impossible. In those situations, emission reduction techniques may be needed. Producers are encouraged to closely evaluate siting issues to better understand the potential for emission concerns.

There is evidence that outdoor air quality issues have become a major concern in the siting of animal production facilities. Odors have been reported to reduce property values of residential homes near livestock production facilities. Another concern is the reduced use of land near livestock and poultry units for outdoor recreational activities. A siting assessment tool, such as that currently under development at Iowa State University and other institutions, can assist in identifying facilities or land application sites that present the greatest and least risk of causing concerns.

Research at Iowa State University

In addition to development of a siting tool, research is on-going at Iowa State University to quantify emissions, both at the sources (houses and storage) and downwind. These efforts address multiple species and management practices and represent interdisciplinary interactions within ISU and across the United States.

Resources

For a list of research reports, ISU Extension publications and links to current news regarding air quality and animal agriculture please visit the Air Quality and Animal Agriculture Web page at: http://www.extension.iastate.edu/airquality.

Air Quality Resources for Iowa Animal Agriculture, contains a list of air quality resources and extension publications available for distribution. This fact sheet is available through Extension Publications Distribution and may be ordered by calling (515) 294-5247. Please reference PM 1936 when ordering.

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