Air Quality Around Animal Feeding Operations

Jerry L. Hatfield [1], Richard L. Pfeiffer[2], and John H. Prueger[3]

Air quality has become one of the primary issues surrounding the development and operation of animal feeding operations. These concerns range from nuisance due to odor complaints to health associated with small-sized particulates (2.5 millimeters). However, there are many unknowns about air quality surrounding animal feeding operations. Some of these unknowns are: type and amount of gases and particulates that are emitted, effect of changing management systems on the emission and dispersion rates, effect of changing atmospheric conditions on the emission and dispersion rates, and effect of seasonal changes on the emission and dispersion characteristics.

We have been evaluating methods to measure air quality around animal feeding operations. These methods include those that trap the gases in a volume of air and those attached to particulates. These different constituents have been captured on organic absorbing materials and on foam plugs. The constituents captured on these media can be extracted and quantified on a gas chromatograph/mass spectrometer to identify the different volatile organic compounds emitted from buildings and manure-storage units. These techniques have been used to measure air quality around swine production units and have revealed that there are five major classes of compounds present in the air volume: acids, indoles, phenols, cresols, and disulfides. These compounds are in addition to ammonia, methane, nitrous oxide, and hydrogen sulfide. Dispersion characteristics of the atmosphere are the major determinants in changing concentrations downwind from the source. These determinants have also proven to be one of the major challenges in placing the sampling equipment in the plume in order to represent the proper conditions. Sampling of air has proven to be a critical part of the development of methods for quantifying air quality.

Air quality that emanates from buildings is different than from manure-storage units. Data were collected around lagoons in Iowa and Oklahoma to evaluate the changes in the microclimate and the emission rates of volatile organic compounds. The microclimate, air temperature, relative humidity, and windspeed were a function of the position around the lagoon and changed throughout the year. Short-term observations of the turbulent fluxes on the side and from the middle of a lagoon have been used to demonstrate how air patterns move across the lagoon and disperse the compounds emitted from the lagoon surface. These changes can have a major impact on the dispersion patterns around the lagoon. These data, coupled with the observations of volatile organic compounds, show that air quality is rapidly changing around livestock-production facilities. Unfortunately, there are no long-term observations of air quality in animal feeding operations that can be used to develop a baseline of emissions.

---

[1]U.S. Department of Agriculture-Agricultural Research Service, National Soil Tilth Laboratory, 2150 Pammel Drive, Ames, IA 50011-3120 (hatfield@nst1.gov)

[2]U.S. Department of Agriculture-Agricultural Research Service, National Soil Tilth Laboratory, 2150 Pammel Drive, Ames, IA 50011-3120 (pfeiffer@nst1.gov)

[3]U.S. Department of Agriculture-Agricultural Research Service, National Soil Tilth Laboratory, 2150 Pammel Drive, Ames, IA 50011-3120 (prueger@nst1.gov)