

Title: Evaluation of the ammonia emissions from swine production units in Iowa - NPB # 02-040

Investigators: J.L. Hatfield and R.L. Pfeiffer

Institution: USDA-ARS, National Soil Tilth Laboratory, Ames, Iowa

Date Received: April 1, 2004

Abstract: Emission of ammonia from swine production facilities is of a major concern from an ecological viewpoint due to deposition and a potential health effect due to formation of 2.5 micron (μm) particles. One of the critical factors in ammonia emission is the variation in the emission rate from swine production facilities throughout a production cycle and the variation in the ammonia concentrations at various distances from a building. This study was conducted to measure ammonia concentrations in the air surrounding a 3,600 head grow-finish unit throughout a production cycle. Measurements were made at 16 m (50 ft) and 33 m (100 ft) downwind of the buildings at a height of 1 m (3 ft), 6 m (18 ft), and 12 m (36 ft) at 33 m (100 ft) from the buildings with a ion mobility spectrometer with an accuracy of 5 ppb_v. An additional study was conducted to measure ammonia concentrations during application of manure and anhydrous ammonia.

Ammonia concentrations varied during the production cycle with the concentrations near 1000 ppb_v at 50 feet and rapidly decreasing to less than 200 ppb_v at 100 feet from the buildings. This decrease in concentration was typical throughout the complete production cycle. There was a decrease in ammonia concentrations with height above the surface. The variation among days during a week was large and it was not uncommon to observe variations within a day from 50 to 1000 ppb_v. This magnitude of variation decreased with distance because of the lower maximum values. The large variation with time was due to the extreme turbulent regime observed within close proximity of production buildings. This degree of variation has prohibited the use of traditional micrometeorological methods to estimate emission rates from buildings. Ammonia concentrations at 1 m above the surface during manure application reached a maximum of 400 ppb_v within six hours following application and remained at 100 ppb_v for the next 24 hours. In contrast, ammonia concentrations at 1 m above the surface reached 250 ppb_v within 2 hours and then rapidly decreased to less than 10 ppb_v within 4 hours after application. The patterns of ammonia emission following application of manure were caused by manure being deposited on the surface compared to the ammonia being injected into the soil. Understanding variations in ammonia concentrations around swine production units provides increased confidence in evaluating management practices that reduce ammonia emissions.

These research results were submitted in fulfillment of checkoff funded research projects. This report is published directly as submitted by the project's principal investigator. This report has not been peer reviewed

For more information contact:

National Pork Board, P.O. Box 9114, Des Moines, Iowa USA

800-456-7675, Fax: 515-223-2646, E-Mail: porkboard@porkboard.org, Web: <http://www.porkboard.org/>