Ammonia emissions from hog farrow-to-wean waste lagoons

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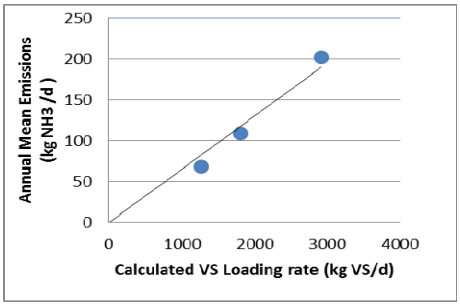
Ammonia (NH_3) is often viewed as a major contributor to odor from livestock farms, and is a reported gas under the Emergency Planning and Community Right-to-Know Act (**EPCRA**). NH_3 emissions were measured periodically over the course of two years at waste lagoons of farrow-to-wean farms in Indiana, North Carolina and Oklahoma as part of the National Air Emissions Monitoring Study (NAEMS). One objective of the study was to determine the variation in NH_3 emissions with time of year, atmospheric conditions, and facility operation. Sow populations varied from 1,400 to 2,800 at the three farms. At each measurement site, path-integrated ammonia concentrations were measured along 12 optical paths near the ground around each lagoon using two scanning tunable diode lasers (each laser measuring two adjacent sides of the lagoon). Air pressure, temperature, humidity, and turbulence, and lagoon temperature, pH, and oxidation-reduction potential were also measured. Lagoon volatile solids (VS) loading was calculated based on pig population and average weight. Emissions were calculated from these concentration and turbulence statistics measurements using a backward Lagrangian stochastic model (Windtrax). Analysis showed that daily emissions could be estimated to within 25% if valid measurements were obtained from at least 52% of the day. Applying this threshold resulted in totals of 76 (IN), 34 (NC), and 83 (OK) days available to determine the annual mean daily emissions. The annual mean NH_3 emissions varied from 27 to 52 g NH_3/d-sow (50 to 118 g NH_3/d-AU). Annual mean emissions were correlated with the calculated VS loading rates of the lagoons. The annual trend in daily NH_3 emissions showed the expected maximum mean monthly emissions in summer and minimum mean monthly emissions in winter. The annual variation in NH_3 emissions was apparently largely driven by the temperature influence on solubility of dilute NH_3 in water (although the temperature influence on urease activity may also contribute to the relationship). The correlation between the VS loading and the lagoon emissions had an R^2 of 0.96 (Figure to left). Generally, the operational activities and measured changes in lagoon chemistry did not correlate with the emissions, indicating the relative influence of these variables was less than the error of the measurement.



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