RESEARCH ABSTRACT

ENVIRONMENT

Title: Effects of Manure Handling and Application Method on Odor and Gas Emission Potential of Swine Manure – NPB #08-259

Investigator: Richard R. Stowell

Institution: University of Nebraska

Date Submitted: April 10, 2012

Scientific Abstract:

Manure composition and emissions potential of swine manure were investigated in opposing contexts of desired and undesired methane generation. In the main study, the full-scale treatment effects of anaerobic digestion on the air emissions potential of swine manure were investigated. Manure slurry and digester effluent samples were collected from a pork production facility in eastern Nebraska that utilizes a complete-mix anaerobic digester to treat the manure and produce biogas for use in generating electricity. Samples were collected from three sites in the manure stream (below-barn pit, digester outlet, and holding pond) from 9/22/08 through 12/2/09 in order to observe changes in manure composition as a result of manure treatment and over time. Significant differences were observed in nearly all chemical and odorous compound constituents between the samples collected from the three locations studied at this operation. When compared for each sampling date, the concentration of manure constituents usually decreased as the manure was digested and stored. This pattern held true on eight of the twelve sampling dates, but for three consecutive sampling events the methane digester was not functioning well and produced little methane. When the digester was operating as designed, chemical oxygen demand was reduced by an average of 45%, odorous volatile fatty acids were reduced by an average of 66%, and ammonia increased by an average of 58%. A very clear trend was for odorous compounds to decrease in concentration as the manure slurry moved through the digester and as the effluent was subsequently stored in the basin. Volatile fatty acids (VFA) were consistently detected in all samples with branched-chain VFA comprising <10% of the total VFA. The proportion of total VFA that were branched-chain VFA was higher in the digester than in the pit when the digester was performing as designed. Aromatic compounds were also detected, but were in lower concentrations compared to VFA. The project also facilitated extensive compositional analyses of twenty-six manure and foam samples that were collected from deep-pit pork production facilities in Iowa, Illinois, Minnesota and Nebraska. The analyses included a standard manure analysis (for pH, solids contents, and macro and micronutrient levels); a feed analysis (for protein, fiber and energy composition); and a fat analysis (for levels of 45 different VFAs). In subsequent statistical analysis by the University of Minnesota, correlations were found between fat content and foam, but no other correlations could be established.