

INDOOR AIR QUALITY AND POLLUTION EMISSIONS OF SWINE BUILDINGS

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Not pictured:
Jiqin Ni,
Agricultural Air
Pollution



Teng T. Lim
Agricultural Air
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Goals:

- To evaluate air quality inside swine buildings by measuring dust, gas and odor concentrations.
- To measure emissions of dust, gases and odors from swine buildings.
- To field test commercial products and equipment for improving air quality and reducing gas and odor emissions from swine buildings.

Recent Publications:

Heber, A. J. , R. K. Duggirala, J. Ni, M. L. Spence, B. L. Haymore, V. I. Adamchuk, D. S. Bundy, A. L. Sutton, D. T. Kelly and K. M. Keener. 1997. Manure treatment to reduce gas emissions from large swine houses. *International Symposium on Ammonia and Odour Control from Animal Production Facilities* 449-457. Vinkeloord, The Netherlands, October 6-10.

Ni, J. , T. T. Lim, A. J. Heber and C. A. Diehl. 1998. Gas release from deep manure pits in emptied and cleaned swine finishing buildings. Paper to be presented at the *International Conference on Animal Production Systems and the Environment*. Des Moines, IA, 19-22 July.

Statement of Problem: Recent increased public concern, legislation and environmental regulations have focused on pollution and have created a major threat to the viability and growth of the swine industry. Research is needed to significantly reduce or eliminate the sources of air pollutants and odors while sustaining efficient pork production operations which, due to economics of scale, have become larger and more concentrated. Quantitative information on concentrations and emission rates of pollutant gases is lacking, especially for ammonia, carbon dioxide and hydrogen sulfide. Research is needed to gain a better understanding of the characteristics of air pollution from large hog farms and to field test engineering and management techniques of pollutant reduction.

Current Activities: Field experiments were recently conducted in eight, 1000-head, swine finishing houses. Four of the buildings were naturally ventilated and four others were mechanically ventilated. This research involved high frequency measurements of carbon dioxide, ammonia, and hydrogen sulfide concentrations, building static pressure and relative humidity, inside and outside temperatures, fan and curtain operations, and wind speed and direction. Periodic dust and odor samples were collected for laboratory evaluation. About four million data were obtained for analysis.

In the mechanically ventilated houses, daily averages of ammonia and hydrogen sulfide concentrations ranged from 2 to 24 ppm and 50 to 1200 ppb, respectively. The daily average carbon dioxide concentration ranged from 500 to 5000 ppm. The average dust concentration was 1.5 and 3.0 mg/m³ in the naturally- and mechanically-ventilated buildings, respectively.

The average emission per kg of pig weight from the mechanically ventilated building ranged from 1 to 20 mg/hr for ammonia and 35 to 1800 µg/hr for hydrogen sulfide. As much as 75% of emitted ammonia and 55% of hydrogen sulfide were released from the deep manure pit.

Ammonia emissions were reduced by 30 to 70% by the application of the commercial manure additive. The influences of building type, management practice, ventilation rate and temperature on pollutant concentration and emission rate are being analyzed. Future research is anticipated in new Purdue University swine buildings with tight environmental control and accurate measurements.



Instruments at field test site for monitoring gas and odor emissions.