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Development of a Wireless Sensor Network to Quantify Spatial and Temporal H2S Concentrations in Swine Houses (A Progress Report)

Robert T. Burns
Iowa State University

Nir Keren
Iowa State University, nir@iastate.edu

Ross Muhlbauer
Iowa State University

Hongwei Xin
Iowa State University, hxin@iastate.edu

Steven J. Hoff
Iowa State University, hoffer@iastate.edu

See next page for additional authors

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Robert Burns, associate professor of agricultural and biosystems engineering; Nir Keren, assistant professor of agricultural and biosystems engineering; Ross Muhlbauer, research associate of agricultural and biosystems engineering; Hongwei Xin, professor of agricultural and biosystems engineering; Steve Hoff, professor of agricultural and biosystems engineering; Randy Swestka, graduate research assistant

Summary and Implications

Transient hazards to human and animal health can occur in swine barns due to sudden bursts of high concentration hydrogen sulfide (H$_2$S) gas released when manure slurry is agitated during removal from sub-floor pits. This project will quantify the concentration of hydrogen sulfide (H$_2$S) that workers and swine in pork production facilities are typically exposed to in different production facility types during different operating conditions. Results from this study will be used to make recommendations to increase worker and animal safety by reducing risks of H$_2$S poisoning.

Introduction

Results of previous research by the investigators to develop a wireless hydrogen sulfide detection system for use in swine housing indicate research is needed on a multi-point detection system to adequately monitor in-house H$_2$S concentrations and gain more knowledge about the characteristics of H$_2$S burst released during slurry agitation. The goal of this project is to quantify the concentration of H$_2$S that workers and swine in pork production facilities are typically exposed to in different production facility types during different operating conditions.

Objectives

The Objectives of this projected were to; implement a wireless H$_2$S monitoring network in multiple swine facility types, measure the in-house distribution of H$_2$S concentrations before, during, and after pit agitation and pumping events and compare measured H$_2$S concentrations to OSHA worker exposure levels (during normal operation). Other goals include; characterizing animal exposure levels to H$_2$S (during normal and pit agitation and slurry removal), and developing management options that reduce worker and animal exposure to H$_2$S in swine production facilities.

Materials and Methods

A network of wireless H$_2$S sensors developed in a previous project (Fig. 1) are being placed in deep pit swine facilities and used to collect data during normal operating conditions, as well as during pit agitation and pumping events. Various agitation and pumping techniques are being used during data collection.

Figure 1. The previously developed wireless H$_2$S detection system deployed in a swine facility prior to slurry agitation and removal.

Simultaneous multiple–point H$_2$S concentration data will be used to identify the spatial distribution (horizontal and vertical) of H$_2$S concentrations that occur within the growing area of a swine facility. Time-weighted average assessment values will be used to calculate worker exposure levels in different swine facility types.

Results and Discussion

Spatial distribution of H$_2$S is expected to vary with facility type and operational phase; therefore, it is necessary to collect data from multiple production facilities before, during, and after pit agitation and pumping events. Doing so will allow for collection of representative data that will be used to assess exposure concentrations within the facility. Spatial H$_2$S distribution maps will be developed to suggest management practices to better safeguard animals during slurry agitation and removal events. Quantification of H$_2$S exposure to swine workers will help identify if current exposure levels meet OSHA worker exposure guidelines during normal (periods when no manure agitation or removal is occurring) operation. Since no swine workers should ever enter a building during manure agitation and removal, these data will be used to identify slurry removal

practices that minimize animal exposure to H_2S rather than using OSHA standards which are only appropriate for human exposure during normal operating conditions.

This specific project is still in progress and there are no final results at this time.