

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

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Summary and Implications

Transient hazards to human and animal health can occur in swine barns due to sudden bursts of high concentration hydrogen sulfide (H₂S) gas released when manure slurry is agitated during removal from sub-floor pits. This project will quantify the concentration of hydrogen sulfide (H₂S) 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 H₂S 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 H₂S concentrations and gain more knowledge about the characteristics of H₂S burst released during slurry agitation. The goal of this project is to quantify the concentration of H₂S 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 project were to; implement a wireless H₂S monitoring network in multiple swine facility types, measure the in-house distribution of H₂S concentrations before, during, and after pit agitation and pumping events and compare measured H₂S concentrations to OSHA worker exposure levels (during normal operation). Other goals include; characterizing animal exposure levels to H₂S (during normal and pit agitation and slurry removal), and developing management options that reduce worker and animal exposure to H₂S in swine production facilities.

Materials and Methods

A network of wireless H₂S 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 H₂S detection system deployed in a swine facility prior to slurry agitation and removal.

Simultaneous multiple-point H₂S concentration data will be used to identify the spatial distribution (horizontal and vertical) of H₂S 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 H₂S 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 H₂S distribution maps will be developed to suggest management practices to better safeguard animals during slurry agitation and removal events. Quantification of H₂S 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

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practices that minimize animal exposure to H₂S 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.

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