

# Research Core Evaluation: Air Quality Projects

The GPCAH is home to large animal feeding operations, which are associated with persistent respiratory symptoms that represent a lasting disease burden throughout the GPCAH nine-state region. Addressing *inhalation hazards in swine confinement* has been a priority topic for many cycles. In the 2016-22 cycle, researchers have developed and tested cost-effective devices to help reduce respiratory ailments among swine workers as well as reduce bioaerosol concentrations to lead to an improvement in both worker and pig health. This work built on previous study findings, as illustrated.

Stage 0  
Hazard  
Identification

## 2006-2011 (O'Shaughnessy): NEEDS ASSESSMENT

**CONFIRMED**  
Elevated levels of CO<sub>2</sub>, dust, and endotoxin in all aspects of swine farming



**RECOMMENDED**  
Respirator use among hog workers



**BUT...**

- Low adoption of respirators unless mandatory
- Respirator use requires ongoing education
- Respirator use does not prevent inhalation of gases

Stage 1  
Development

## 2011-2016 (Anthony): INDUSTRIAL FILTRATION

**DEMONSTRATED**  
EFFICACY of Recirculating Ventilation System (RVS) in reducing dust, CO<sub>2</sub>, endotoxin, NH<sub>3</sub> and H<sub>2</sub>S in swine farrowing

**THIS MATTERS BECAUSE RVS:**

- Does NOT rely on voluntary respirator use
- Does NOT negatively impact pig health
- Is cost effective \$\$\$

**RECOMMENDATION**  
**Vented Heaters**



Air Cleaners with Recirculating Ventilation      Heater

**BUT...**

- RVS not tested in commercial swine farms: "Will it work in real life?"
- Study did not develop a "product" for swine producers

Stage 1 & 2  
Development  
and Testing

## 2016-2022 (Nonnenmann): FILTRATION + UVC DISINFECTION

**DEVELOPED**  
A trailer-based RVS (tRVS) that integrates air filtration **AND** ultraviolet light (UVC) radiation

**DEMONSTRATED**  
EFFICACY of tRVS in controlling dust **AND** bioaerosols

**THIS MATTERS BECAUSE tRVS:**

- Found to be effective in a commercial swine operation
- Reduces bioaerosols (in addition to dust), which improves BOTH worker and pig health, leading to cost savings for producers



tRVS: New duct work for air filtration (L)  
UVC treatment in duct work (R)

**BUT...**  
External trailer-based technology requires complicated building ductwork

**Next...(2022-2027):**  
Test miniaturized RVS (+UVC) installed inside swine farms based on producer input

Stage 1,2,& 3  
Development,  
Testing, &  
Institutionalization  
(2022-2027)

Evidence of research output adoption includes:

- Training:** The project trained multiple health and safety professionals. For example, one postdoctoral researcher developed skills in industrial hygiene method development, equipment and sampling media preparation, field data collection, sample analyses, electronic data collection and analyses, and report writing.
- Partnerships and Presentations:** The project strengthened collaborations with the National Pork Board and local swine producers. These relationships have facilitated input in new RVS designs and a focus on research questions most relevant to producers.
- Education and Outreach:** The project findings were incorporated in the GPCAH Core Course curriculum for agricultural safety and health professionals. Workers were trained at the study site. Lessons learned to conduct this project included the development of new lab techniques for virus aerosolization, sampling, and infectivity assays, which were then used to inform hospital-based COVID research in 2020 and additional airborne virus studies now being conducted in other settings.