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## Improving Air Quality in Swine Farrowing Operations: Results of Engineering Interventions

A multi-year study has examined engineering controls to reduce concentrations of hazardous wintertime contaminants in indoor swine farrowing buildings. Field interventions incorporated ventilation and equipment replacement in an educational swine farrowing room over three winters. A ventilation system, which included dust removal and recirculation, was installed. Respirable and inhalable dust concentrations were significantly reduced: the system with a pocket-filter (Shaker-Dust Collector SDC-140-3, United Air Specialists) performed better than an equivalently-sized cyclone (Model 16, Donaldson Inc.). Room concentrations of hazardous gases were measured to examine whether increased air movement in the room resulted in drawing these contaminants from the manure pits: hydrogen sulfide (H<sub>2</sub>S) and ammonia (NH<sub>3</sub>) were *not* increased by using the ventilation system. In year 1, carbon dioxide (CO<sub>2</sub>) concentrations exceeded the recommended 1540 ppm limit (mean = 2480 ppm) when common unvented heaters were in use. Mathematical modeling indicated that standard barn heaters (Guardian 60, LB White) heater generated significant contributions of CO<sub>2</sub>. Hence, heaters in the study room were replaced with a model that vents combustion gases outside of the building (Effinity 93, Modine Manufacturing), which reduced in-room concentrations (mean = 1420 ppm). The heater itself was associated with 800 ppm CO<sub>2</sub> reduction, while between-winter differences in temperature and pig counts accounted for a 200 ppm CO<sub>2</sub> reduction between study years. Replacing heaters present a low-cost solution to reducing one of the three main air contaminants in this building. We have partnered with producer organization to communicate findings and begun outreach to agricultural extension agents and livestock builders to communicate the low cost solution. Testing the ventilation system in a production barn while tracking human and animal health improvements is under way to demonstrate the cost benefit of ventilation to producers.



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