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Ventilation Systems — Redundancy is Essential

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Summary and Implications

Ventilation system failure can kill many animals in a few minutes. This kind of loss is often non-insurable. Adequate backup systems can reduce the risk of loss. Producers should install backups, or system redundancy, consistent with the level of risk they consider acceptable.

Introduction

"Fans Quit — Pigs Suffocate." "Ventilation System Failure Kills Pigs." Most producers have seen headlines like these. Similarly, salespeople for various products have used these headlines as opportunities to merchandise their version of safety equipment or a "safer" system.

Mechanically ventilated buildings have long been recognized as a safety risk during an electrical system failure. Non-mechanically ventilated, modified-open-front (MOF) buildings are generally viewed as less risky, since they are not dependent upon fans for air movement. However, others have argued that MOFs are risky due to possible cable or rope breakage.

Currently, construction of buildings for growing-finishing pigs includes flat ceilings, curtain sidewalls, totally slatted floors and a hybrid ventilation system. Most of these buildings use fans for cold and hot weather ventilation (tunnel system) and non-mechanical ventilation during mild and warm weather. These buildings also pose safety risks during an electrical system failure.

When dealing with a piece of electrical or mechanical equipment, the question is not *"if"* failure will occur, but *"when"*. Therefore, the goal should be to ensure — to the best of our ability — that the system will fail-safe, i.e., with minimum risk of loss or injury to people and animals. A major challenge in designing livestock production facilities is in developing a system with an acceptable risk-loss level.

Redundancy implies excess. Alternatively, redundancy means having a backup. For example, spare tires are redundant to the four tires on a car. The extra tire costs money. Nonetheless, most people carry a spare tire in their car or truck to minimize a flat tire's inconvenience. Redundancy is

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needed in ventilation systems to minimize the risk or magnitude of loss.

Examples of Ventilation System Failures

The following examples help to illustrate why a redundant ventilation system is needed.

Example one, a swine nursery was constructed with raised decks. Minimum ventilation was provided with a fan ducted to exhaust air from beneath the decks. During cold weather one night, a water line broke and filled the pit, closing off the fan duct. Result: Non-insured loss of 242 pigs.

Example two, a multi-room, mechanically ventilated nursery had several rooms equipped with gravity/static pressure-controlled box inlets. An electrical system failure during mild weather resulted in no fans operating and all inlets closing in three rooms. Result: Non-insured loss of over 300 pigs. No losses occurred in five other rooms with positive controlled inlets which remained open.

Example three, a two-room nursery facility used a single, centralized, computerized controller to operate ventilation equipment and monitor conditions in both rooms. A resistor ($2 item) failed in the master control board. Result: Non-insured loss of over 250 pigs.

Example four, a 500-head growing-finishing building (one of six on the site) was equipped with total slats, two-stage air-inflated curtain sidewalls, four pit fans and a sidewall fan. A centralized control system with multiple sensors and relays was used to operate and interconnect various ventilation system components. The air-inflated curtains were sold as a "hedge" against electrical system failure—if the power goes off, the inflating fan stops and the curtain opens. As designed, if both stages of both curtains close, the pit fans should turn on. The contact points in the pit fan control relay (a $10-$15 item) arced and became pitted, causing intermittent operation. During a cool July, the curtains closed, but the pit fans did not turn on. Result: Non-insurable loss of 257 market-weight pigs.

Example five, a mechanically ventilated growing-finishing building was equipped with 230-volt fans. Electrical service to the building was lost when one phase conductor of the underground electrical service burned off. (The aluminum conductor was less than four years old.) Evidence indicated significant; pre-failure corrosion. Result: Non-insured loss in excess of $40,000.

Options for Redundancy

Options for redundancy to reduce loss risk when the ventilation system fails include:

1. Standby power source—automatic or manual start
2. Alarm system
3. Combination of 115/230-volt fans
4. Multiple circuits to fans, curtain controllers, heater, etc.
5. Multiple curtain controllers per room
6. Thermostatically controlled fan independent of centralized master controller
7. Smoke alarms
8. Carbon monoxide alarms.

In two of the five examples above (no. 1 and 4) , most alarm systems would have been ineffective. The most cost-effective backup system, i.e., redundancy, depends upon the system being protected and failure against which protection is desired. No backup system is 100 percent reliable.

Regardless what system is installed, routine maintenance and inspection are required to help ensure the system will perform as expected when it is needed. Complacency makes a nonfunctional backup system worse than none at all.

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