



## Troubleshooting Natural Ventilation Systems

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Troubleshooting naturally ventilated swine facilities generally involves two steps. First, you must evaluate the environment conditions in the building, even during operator absence. Secondly, if the conditions are not suitable for the animals, you must discover what is causing the undesirable effect in order to take corrective measures. These are both discovered by using troubleshooting tools.

### Troubleshooting tools

There are four tools that are effective in analyzing naturally ventilated systems. These include:

- a hi-low thermometer,
- a relative humidity sensor,
- ventilation smoke tubes, and
- your sensory perceptions.

The thermometer is useful in determining the temperature fluctuation occurring in the building. This is especially important during periods of operator absence, such as at night. Avoid thermometers that have a detachable magnet to reset the temperatures. Detachable magnets tend to end up in the manure pit. Push-button resets are best.

Relative humidity is useful in determining if the building is over-ventilated or under-ventilated. Properly ventilated buildings should have a relative humidity of 50 to 70 percent. The best tool to use for relative humidity measurement is a sling psychrometer. These have two thermometers, one with a sock that is moistened and the other left bare. The instrument is then “slung” around to measure the moisture present. Simpler, although less accurate instruments are available.

Ventilation smoke tubes may be used to find cold air drafts and stagnant air pockets within the building. Cigar smoke does not work well because it is hot and therefore will rise on its own. Commercial ventilation smoke tubes are made of chemicals that when mixed create smoke. They generally are considered to have a neutral buoyancy and therefore are considered best for visualizing air patterns.

Probably the most sensitive and the most overlooked troubleshooting tool is the operator's sensory perceptions. With practice, a person can watch pigs for signs of drafts and improper temperatures, smell stale air, and feel humid air. These are all things that a casual observer may miss, but an experienced operator will use on a routine basis.

### Problems

Most problems within naturally ventilated buildings involve improper regulation of openings. A manually controlled system always will be somewhat different from optimal due to the changing nature of weather. Automated systems can respond to changes but may either change too slowly or react in an improper way. Listed below are potential problems and suggested solutions.

**Excessive odors and high relative humidity** are caused by insufficient air exchange and by drying urine. Check for

- blocked or constricted ridge, eaves, or sidewall openings
- animal density (it may be higher than the ventilation system was designed for)
- the manure system

Manure that is not kept in an aqueous solution will increase ammonia concentration. Pit recharge will help to reduce the problem. Keep solid concrete floors clean.

**Poor dunging patterns** can be caused by cold air dropping into the animal area or improper pen configuration. Pigs prefer to dung in areas where they are least comfortable. If cold air is deposited in one location, that is where dunging will occur. In partially slatted buildings, make sure that the slatted area and the cold airflow exist in the same place. The pen configuration in partially slatted buildings should have solid partitions around the sleeping area and open partitions around the intended dunging area. The waterers should be placed in the dunging area. Pens should have a length to width ratio no greater than 2.5 to 1.

**Excessive condensation** is caused by surfaces being colder than the dew point of the air. The only solutions are to either reduce the humidity within the building by increasing the ventilation rate, or to increase the temperature of the surface where condensation is occurring. Surface temperatures may be increased by adding insulation to the ceiling or wall. An R value of 5 helps reduce

condensation in cold housing. Warm housing would use R values of at least 12 in walls and 25 in ceilings.

**Excessive inside summer temperatures** can be caused by excessive radiation coming from the underside of the roof, or by insufficient air exchange. To avoid radiation problems, the underside of the roof should be insulated with an R value of at least 5. If the air exchange rate is insufficient, check for obstructions to the sidewall openings. If air movement is still insufficient, use stirring fans to move air across animals.

**Excessive drafts in winter** can be caused by inadequate baffles or hovers. If drafts are a problem, check the summer ventilation openings. They should seal to prevent drafts from entering the building. Interior baffles may be installed to prevent wind swirl within the building. Hovers may be used, especially when housing young animals.

A windbreak could be added to the north of the naturally ventilated building. Solid windbreaks have a protection zone starting at a distance five times the height and ending 15 times the height down wind of the break. Porous windbreaks have a protection zone from 10 to 20 times the windbreak height.

**Large temperature swings** indicate either a lack of control or slow response to control. Manual systems often have large temperature swings because ventilation openings are set based on some assumed condition. Automatic controllers that respond slowly allow the temperature to drop too much before adjustments are made. Controllers with a quicker response time are one of the few solutions. Sensor placement also may be a problem. Sensors should be placed so they will respond quickly to the indoor conditions. Avoid mounting thermostat sensors on walls. Sensors should always be placed near the animal area and away from any heaters.

## File: Engineering 1-1

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Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Jack M. Payne, director, Cooperative Extension Service, Iowa State University of Science and Technology, Ames, Iowa.