Introduction

From an educator’s perspective, it is amazing the amount of technology the livestock industry has at their finger tips that can be used to help control the pigs’ environment. The livestock industry is constantly improving the welfare of the pigs by adopting new research proven environmental technologies. There is always room for improvement in any environment, thus change will continue. To effectively make changes in a pigs’ environment, we must first identify potential problems. New, easy to operate, diagnostic instruments can give farm owners and managers peace of mind. For example a great new tool is the hand-held laser temperature sensing device. They are easy to use and help identify problem areas in the pigs’ environment quickly and effectively.

What would you do if you could look into the future of your farm? What would you do if you had a better understanding of the environmental events that are going on right now in a swine unit? Would you change what you were planning to do today based upon what you see?

Example: If you walked into a farrowing unit and could visualize this infrared image, what would be your first response? The heat pad temperature is too hot. There are no pigs on the mat. Where are the pigs? What is the ambient temperature in the room?

( Picture: Heat Mat)
Infrared photography allows you to see potential environmental problems that you otherwise could not see. When you walk into a swine unit what are the environmental factors you notice first? Is it the heat, cold, draft, smell or humidity? The answer is possibly a combination of all of these environmental elements working together to produce an uncomfortable environment for the pigs. The problem is, it is hard to see a cold spot during an environmental check if other parts of the room are normal.

**Potential Problems**

In some instances, farm managers think the expensive environmental control unit will get the job done; all you have to do is set the control and forget it. This is due in part because the farm managers are under time constraints to complete many priority production related tasks in a given unit of time. The number of tasks completed in a day may not allow time for extensive pig environment evaluation. Many times management does not fully understand the pigs’ environment and the effects of a poorly maintained environment. It is essential to manage the effective environmental temperature of all pigs to reduce stress. EET is the temperature the pig actually feels based on such factors as drafts, cold slats, damp floors, etc. Sometimes it is hard to control ventilation on a daily basis. Another compounding problem is the constant changes in the pigs’ environment. The system must be re-evaluated frequently. Controller and sensor accuracy must be analyzed to successfully control the pig’s environment.

Periodically the sensor and controller should be calibrated with a known accurate source. Placement of the sensor is extremely important. Physical placement of the sensor may or may not be the farm manager’s responsibility, but if the sensor is not placed accurately it will be virtually impossible to keep the pigs’ environment comfortable. (Picture: Vent Placement)

The factors mentioned above can be compiled into three different categories. They include knowledge of the pigs’ environment, the ability to change the electronic controls to effectively manage the pigs’ environment, and time to evaluate and adjust the physical aspects of mechanical ventilation. The combined effects of these environmental challenges produce pig stress. Proper environmental management equates to stress management.
**Question:** If you could control pig stress more effectively, how would it affect the overall health of the pigs? How many dollars are spent each week on vaccinations for problems originating from poor ventilation management? Stress related health problems could easily push vaccination related cost over five dollars per pig.

**Question:** Could your time and dollars be better spent managing the house environment and reducing stress on the pigs, thus reducing pig health problems?

Since the beginning of mechanical ventilation technology, farm managers and owners have heard about 4 ways pigs lose heat, but are the concepts utilized on a daily basis to evaluate the effective environmental temperature of the pig?

- **Conduction:** Heat is lost from the body when it comes in direct contact with a cooler surface. The amount of conductive heat loss depends on the amount of contact area, the inside air temperature, and the thermal properties of the material.

- **Convection:** Heat loss from the pig takes place due to air in close vicinity to the skin being warmed, removed, and replaced by colder air. The warmed air moves away from the pig due to buoyancy or wind. Air temperature, air speed, and skin temperature influence heat loss due to convection. A pig normally loses 40% of its total heat loss through convection. Reduce convection heat loss in cold weather by reducing drafts and providing minimum ventilation rates. Maximize convection in hot weather by moving large quantities of air in combination with evaporation.

- **Radiation:** Radiative heat loss occurs when heat from a pig is transferred to a cooler object or surface. Direct contact with a cooler object is not required. Heat loss due to radiation is most critical during cold weather. A poorly insulated building will cause heat loss through radiation. A pig normally loses 30% of its total heat loss through radiation.

- **Evaporation:** Heat is lost due to the evaporation of moisture from the skin and normal respiration. We can control evaporative heat loss. During cold weather, minimize heat loss by providing a dry, draft-free environment and in hot weather, moisten the pig’s skin with foggers or drippers and move a large volume of air at maximum velocity to promote heat loss. Without evaporative heat loss in hot weather, pigs remove excess heat by panting. Panting uses feed energy that could be used for growth. Pigs stop eating to keep cool. A pig normally loses 17% of its total heat loss through evaporation.

These principles are very basic, but the concepts are extremely important to completely and effectively control the environment of a swine facility. One of the biggest problems is trying to control something you can not see easily. For instance, it is impossible to see the effects of conduction on a pig’s body with the measuring instruments currently on the market. It is hard to measure how much heat a metal surface conducts from a pig’s body while he is lying down. Digital
temperature guns are a big improvement over a standard mercury thermometer, but you still can not visually see the effects of conduction on the pig’s body.

The picture below shows an infrared image of the effects of conduction. The picture is a close up view of the rear of a pig lying down. Notice the difference in color gradient on the floor. The floor was warmed by the pig’s body heat to reach a temperature close to the body temperature of the pig. Note, the warming effect of the floor is spreading from the rear of the pig. (Picture: Effects of Conduction)

Question: At what point does conduction create stress on the pig? What will the pig do next to satisfy the need for heat? What is the pig’s EET? Will the environment be sufficient to satisfy the need? Will the pig become stressed?

Many of these questions will never have a measurable answer. The infrared image does reveal a better visual image of what is actually happening to the pig. This visual also aids in the decision making process as it relates to pig stress. With or without infrared photography, the pigs’ behavior must be documented. (Picture Pad)
A pig / sow loses 30% percent of its body heat through radiation. Notice the potential effects of radiation heat loss from the metal and concrete floor. The concrete floor is 75 degrees, the metal crate ranges from 75 degrees at the floor to 80 degrees as the elevation increases. The body temperature of the sow is trying to equalize the room temperature. Management of the sow’s environment is critical; thus reducing health risk and poor production. The sow’s body will compensate for the radiation of body heat by eating more feed or burning body fat. Either of these compensations cost us money. (Picture: Gestation Alley)
Differences in genetics, age and disease exposure tend to have an effect on the amount of cooling an animal can experience before becoming stressed and developing respiratory problems and/or enteric disorders. A good example of this problem exists when a group of sows are drip-cooled too often or too long without a chance to dry. Some similar effects of this can be seen in a gestation barn near the evaporative cool cell pad. These sows could be stressed by the excessive cooling effects of convection. As the air moves across the moist back of the sow at high rate of speed, stress can increase due to extreme cooling effects. This picture uses infrared technology to show the temperature of the hair on a group of penned sows during a misting interval. Notice the 83 degree dermal temperature of the front sow. The sow in the middle of the picture is being sprayed directly on her face. She appears to be enjoying the cool bath. This system appears to be working properly.

Evaporative cool cells are a very effective method of cooling animals. The ability to cool animals is dependent upon two factors: the physical/mechanical operations of the pad or the relative humidity of the air. The humidity aspect is hard to control, but the physical capability of the pad is entirely in the hands of the operator. The photos below show two operating pads. Notice the dry spot temperatures on the first photo compared to the temperatures on the second photo. The dry pad will be very ineffective on a hot day. Sows could become extremely stressed. The dry section of the pad is indicated by the lighter color. This indicates poor pad maintenance. Discharge holes or filter could be stopped up. The properly working pad indicates a 65 degree working temperature throughout the pad. This pad is maintained well and will cause less stress on the pigs on a hot day. Attention to ventilation details is the key to less stress in the pig environment. Notice how easily the infrared laser sensor helps identify problem spots. (Picture: Cool Cell Pad)
Take Home Message:

It is important to detect ventilation trouble spots before hundreds of dollars are spent on health related issues. Example: One house breaks with a health problem and the house adjacent to the sick house never has the same health related problem. Could the problem be as simple as the cool cells not working at maximum performance, the curtain dropped on a cold day due to thermostat malfunction, or the mister’s interval was set too long on a group of sows? Most problems are simple to detect with training and the use of proper tools such as an infrared laser temperature sensor. In addition:

- Train employees on ventilation techniques
• Repeat ventilation basics regularly
• Manage ventilation daily
• Document Pig Behavior
• Make an environment to reduce stress
• Allow time daily to evaluate EET

Thought to Remember:

Ventilation Management Is The Key To Stress Management