

University of Delaware Uses Remote Monitoring System to Protect Poultry Flock and Research

The United States is the leading poultry producer in the world. In 2004 alone, the combined value of sales from eggs, turkeys and chickens (including broilers) was \$28.9 billion, up 24 percent from \$23.3 billion the year before (Source: U.S. Poultry & Egg Association).

To support this huge industry, significant ongoing research explores how to raise the birds more efficiently.

In poultry research, flock health is very important. At the Carvel Research and Education Center at the University of Delaware (Georgetown, Del.) several researchers study the effects of poultry litter amendments on ammonia produced from litter inside the poultry house and discharged by ventilation fans to the outside surrounding area.

Ammonia is released from litter on the poultry house floor that contains a mixture of bedding material, feces and uric acid. Typically, the birds receive high-protein, high-energy diets to promote growth, feed efficiency and health. The nitrogenous compounds in poultry waste break down, releasing ammonia into the air.

When producers fail to maintain proper air and litter quality through ventilation, ammonia generation can cause poultry health problems including blindness and respiratory disease. High ammonia concentrations compromise production because the birds eat less and convert less feed to body weight. The result is lower-weight birds that generate less economic return for the grower.

The objective of the research at the Carvel Center is to replicate conditions in commercial poultry houses as closely as possible while learning how to meet increasingly stringent U.S. Environmental Protection Agency requirements governing poultry house emissions that fall under the Clean Air Act.

“We know there is an industry-wide problem with the amount of ammonia that builds up. We’re trying to understand how much is emitted, as well as learn how to control it,” said Stephen Collier, poultry research associate for the Carvel Research and Education Center. He is responsible for the overall operation and maintenance of poultry housing used for research at the Carvel Center.

The university’s Animal Care and Use Committee mandates that the ammonia concentration not exceed 25 parts per million (ppm), which is in line with the 50 ppm guideline established by the U.S. Occupational Safety and Health Administration for human exposure.

By monitoring ammonia concentration along with environmental conditions like humidity and temperature that affect it, the research staff is able to protect bird health while gaining valuable data.

The Carvel Research and Education Center monitors flocks of up to 3,000 birds per house. The birds are raised on a floor covered with a litter of sawdust and wood shavings, just like a commercial poultry facility. There are two 2,300-square-foot clear-span enclosed houses with power ventilation, a standby power generator and a computer-controlled environment.

“The birds do not belong to us. They belong to the integrator, and we take care of them while we’re conducting our studies,” said Collier.

During the studies, Collier and his staff closely monitor the birds’ health and growth environment. “In real-world conditions, a company might leave the litter in a house for years,” Collier said.

In studying these effects, Collier monitors the environmental conditions in the poultry houses – power, temperature, humidity, water on the floor, etc. – making sure to maintain proper ventilation, heating and cooling. Changes in those conditions, particularly any rapid or sudden changes, could put the entire 3,000-bird flock in danger.

The center uses a two-tiered monitoring system as added protection for the birds. The first is the main controller unit, which controls and monitors all operations of the two houses. It monitors the power and records temperature, humidity, water usage and exhaust fan runtime, as well as other conditions.

The second system is the SCADA 3000 system, which monitors the performance of the main controller as well as specific environmental conditions like temperature, humidity, carbon dioxide levels and ammonia on the floor. This Sensaphone system monitors 48 parameters daily, collecting data on each parameter every minute and logging that data on a computer. The data is accessible through remote locations for snapshots of live conditions and trends.

“We have the SCADA unit collecting data for our ammonia emissions as well as controlling the timing of solenoid valves that direct the air sample through the ammonia and CO₂ sensors,” Collier said. “The SCADA monitors fan runtime, water usage, propane usage, electric usage, static pressure and temperature. The ammonia emissions monitoring operates from a "Ladder C" software program, custom-written by Sensaphone.”

Collier and others associated with this research project relied on the original main controller for data accuracy, until the Sensaphone system revealed some major flaws. “We saw some inconsistencies that we could not pinpoint. For nearly a year, we kept seeing things we didn’t have an answer to, and we could not say definitively what the problem was. We loaded the SCADA 3000 unit and it ran side by side with the controller that was controlling the house environment. Now we had numbers to identify the inconsistencies, and we decided that the controller had to go,” Collier said. “The Sensaphone system revealed the inaccuracy of a \$20,000 controller, which we then scrapped.”

Collier said one of the significant benefits of the SCADA system is its alarm capabilities. When environmental conditions change, the SCADA 3000 issues alarms via phone, pager and email to alert appropriate personnel who can take action to avoid harm to the birds. Collier or a member of his team can respond to the problem remotely.

“We have received many alarms, even while on vacation,” he said. “When I get a call, I use my laptop, connect to the Internet to see what’s going on, and make adjustments. Usually, I can fix the problem without having someone physically visit the site. We have found that the fewer fingers touching the system the better.”

Regardless of the circumstances of the alarm, Collier says the birds remain well protected. “I set the alarms so they go off long before any kind of emergency situation develops. I don’t ever want to find that one of the houses was out of spec for hours on any night,” he said. “I set the alarms to prevent that. I’d rather explain why the alarm went off and not reach the outer limit where the birds are in danger.”