To ensure water quality and safety under the Clean Water Act, the U.S. Environmental Protection Agency (EPA) regulates the amount of various types of nutrients that can be discharged from industrial facilities into nearby lakes, streams, or reservoirs. For the poultry industry, this means reducing the amount of phosphate (the inorganic form of phosphorus) in processing wastewater prior to discharge. When present in excessive amounts, phosphorous causes the growth of algae and other organisms that negatively affect the environmental and chemical balance of nearby water bodies.

In most poultry processing plants, aluminum, iron, or calcium-based coagulants are used to remove the phosphate from the wastewater. This process known as chemical precipitation has its drawbacks due in large part to the high cost associated with the use of metal salts and the resulting sludge, which creates an additional treatment problem. Could there be a more efficient and cost-effective way to remove the nutrient? Researchers at the Georgia Tech Research Institute (GTRI) believe magnetic nanoparticles (MNPs) may be the solution.

These extremely small particles have a larger surface area relative to their volume, making them very effective absorbents for just about any type of application where a quick reaction is the goal.

“The unlimited surface chemistry of magnetic nanoparticles and the ease at which they can be manipulated by external magnets enhance their absorption capabilities,” says Dr. Jie Xu, GTRI senior research scientist and project director. “This makes their use particularly attractive for phosphate removal.”

Xu and fellow researchers have developed a proprietary phosphate removal chemistry, which is applied to the surface of a MNP to specifically

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Earlier this year I had the honor of participating in the University of Georgia’s Agricultural Economic Forecast Seminar Series (Georgia Ag Forecast). During the tour, which included stops in Gainesville, Cartersville, Lyons, Bainbridge, Tifton, and Macon, I was reminded of what a great community of people we have working in agriculture in this state. While each part of the state may produce a variety of different products from poultry to peanuts and cotton to corn, the people who produce them are largely the same — down-to-earth, hard-working, warm, and welcoming folks who are passionate about agriculture and its contributions to Georgia. It was also abundantly clear that they appreciate and have a deep respect for UGA’s College of Agricultural and Environmental Sciences (CAES) and the great research and outreach services that its faculty provides.

At each seminar, I had the opportunity to highlight the long-standing relationship between ATRP and UGA, particularly with the Poultry Science Department. A great example of this collaboration is the growout audio research project where ATRP and UGA researchers are looking at using audio captured in the growout environment to detect the health and well-being of a poultry flock (see “In the News” on page 8 for links to recent interviews in The Wall Street Journal and NPR’s “All Things Considered.”). This project leverages the interdisciplinary expertise of ATRP engineers and technologists and UGA animal scientists to investigate a research question that neither would adequately be able to tackle individually. This ability to drive innovation at the intersection of traditional disciplines provides a unique opportunity for Georgia Tech and UGA to work more closely together.

More broadly, Dr. Scott Angle, CAES dean, and I have been talking with the leadership at both of our institutions and the Georgia Department of Agriculture to develop an initiative that more formally targets these collaborative opportunities. The goal of such a program would be to leverage the expertise and resources at all three institutions to foster interdisciplinary interactions and drive transformational innovation. This, in turn, would position Georgia as a thought leader in the development of technologies specifically focused on agricultural endeavors. This idea has been well-received by the general agricultural community across the state, and we continue to move forward with developing the initiative.

One thing that became clear to me the more I talked with our agricultural community is that, while loyalties run deep when it comes to football, everyone can get excited about working together to improve agriculture in the state of Georgia.

Doug Britton, Ph.D.
ATRP Program Manager

Email any suggestions, comments, or questions to: poultrytech@gtri.gatech.edu
In order to reduce core temperatures and control microbial activity on processed poultry, carcasses are currently immersed in specialized chillers. These large tanks are typically filled with chilled water that cools the carcasses to temperatures needed to inhibit pathogen growth, which are typically around 4°C. The process, however, uses a considerable amount of water and energy along with the additional cost of chemical disinfectants. Researchers at the Georgia Tech Research Institute (GTRI) are exploring the use of ice slurry as an alternative chilling medium.

Ice slurry contains tiny ice crystals that are formed by mixing water with a freezing point suppressant, such as salt, and utilizing a specialized mechanical means of forming or cutting/scraping. The result is a “two-phase” mixture of micro-sized ice and water with excellent chilling ability. The GTRI team, having learned of the fishing industry’s use of ice slurry as a coolant preservative, thought the same could hold true for poultry processing operations.

“Ice slurry will give you more cooling capacity per unit mass of water, so the assumption is that if you use ice slurry you can reduce the amount of water needed and/or provide a quicker chill,” explains Dr. Comas Haynes, GTRI principal research engineer and project director.

The team is working with several industrial and government partners: an ice slurry machine is on loan from Ice Synergy Inc.; local poultry companies have donated carcasses for testing in support of GTRI’s Agricultural Technology Research Program; the USDA’s Russell Research Center has provided a laboratory-scale auger chiller; and representatives from Southern Company Services are providing sponsorship and technical advice in regard to electricity/energy savings.

Initial experiments were performed to benchmark the ice slurry’s cooling capacity. One set of experiments used the ice slurry, while another set used conventional chilled water. The team found carcass core temperatures decreased from 40°C to 4°C in 45 minutes, and with an average chilling media temperature of -1°C with the slurry — as opposed to a significantly slower and more limited decrease in carcass core temperatures with chilled water, notes Haynes.

The ability to pump slurry throughout a facility also adds to its attractiveness when compared to conventional ice, which can have sharp edges. “Some people even call it liquid ice,” says Haynes, referring to the ice slurry. “Even though technically it is ice, it is such a tiny, fine grain that it can literally be pumped like water.”

This would be a benefit over the current process in terms of handling and transportation. With an ice slurry machine and holding tank, the slurry can be made on-site and then easily pumped to the existing chiller. In addition, the ice slurry can be made during off-peak hours and stored for later use, helping to achieve energy efficiency and lowering electricity costs.

The team is currently investigating the slurry’s potential as an antimicrobial aid. Experiments are underway with one set of Salmonella-inoculated carcasses and one set without. Results are pending.

Haynes hypothesizes that the ice slurry’s grain may act as a “scrubber” along the carcasses’ skin, helping to loosen potential microbes directly into the chiller’s water, hastening disinfection and possibly reducing the amount of chemical disinfectant needed.

“Our ultimate goal is to develop a systems-of-systems approach to poultry chilling,” says Haynes. This includes establishing an ice slurry system as a thermomechanical innovation for food safety — thermal in its capacity for rapid and colder chilling and mechanical for its hypothesized “scrubber” antimicrobial effect.

Haynes believes that considering an ice slurry system for existing or future plant operations that is optimized for specific poultry processing applications like chilling and sanitation could be a winning proposition.
Researchers Develop Computer Model to Evaluate Poultry Plant Water Usage

Billions of gallons of water are used every year in poultry processing plants across the country. Water is used in just about every processing step, not to mention sanitation and maintenance tasks. Natural resource sustainability is a top priority of the poultry industry, and processors continue to look for ways to conserve, reuse, or recycle water.

Researchers at the Georgia Tech Research Institute (GTRI) believe computer modeling tools may help by simulating plant water usage, giving processors a new tool to help pinpoint areas for water savings.

“Unfortunately, no model currently exists to help plant managers evaluate their water use and conservation practices. We are seeking to fill this gap,” says Olga Kemenova, GTRI research engineer and project director.

Kemenova and fellow researchers in GTRI’s Agricultural Technology Research Program (ATRP) began by reviewing current poultry industry water management practices. Special attention was given to practices related to pathogen contamination reduction and wastewater content. The team used the information gained to design and populate a computer model dubbed, “Poultry System Simulation Model,” or PRYSSM for short.

PRYSSM includes multiple poultry process models. “It is a system-of-systems model for poultry processing,” explains Alex Samoylov, GTRI research scientist and project co-director. The current model includes a water model and wastewater model that work together seamlessly. And the team plans to expand it to include an energy use model and a labor requirements model as well.

The water model simulates general water consumption processes such as stunning, scalding, plucking, chilling, and general sewer discharge. The wastewater model depicts wastewater flow and treatment of water flowing through multiple cleaning stages. The team also developed a model for higher fidelity simulation of the poultry chilling process. This model keeps track of the temperature history of birds currently in the chiller and the water temperature of the chiller at various locations over time.

“Our goal is to have a model that fully describes any given poultry production facility, so plant personnel can use it to see the effects proposed changes in one process may or may not have on the entire system,” says Kemenova.

By having an evaluation tool at their disposal, plant managers could make water quality improvements or reduce water usage. In addition, because of the wide variation that can exist from one plant to another, the model is fully customizable. It can be easily adjusted to fit an instance of a particular poultry production scheme, and should be of benefit for planning purposes. For example, whenever any change is planned for a current process such as adding a new production lane or replacing old equipment, the model can be used to evaluate the impact of the change on water usage and wastewater content.

Where wastewater processes are of concern, the model can be used to estimate what components of the wastewater system will be needed to achieve a desired level of water decontamination. Plant managers can also use the model to run a cost-benefit analysis of wastewater treatment options.

The team continues to refine PRYSSM with the addition of degrees of freedom. Kemenova says the degrees of freedom will be varied to evaluate strategies intended to reduce water consumption without sacrificing quality, safety, or yield.
Federal Regulation: Touching All Aspects of the Poultry and Egg Industry

BY PAUL PRESSLEY, EXECUTIVE VICE PRESIDENT OF INDUSTRY PROGRAMS FOR THE U.S. POULTRY & EGG ASSOCIATION

There are a lot of moving parts in the poultry and egg industry. To name a few, there are genetics research, live production, food safety, processing, sales, marketing, and distribution. And although often overlooked, there are also major trucking operations within the industry. Many poultry firms have hundreds, even thousands of trucks on the road every day delivering eggs to hatcheries; feed, chicks, or poults to farms; birds to processing plants; and finished products to customers.

Just keeping up, and then complying, with an ever-increasing number of federal regulations is an increasingly arduous task for most businesses. I occasionally visit www.regulations.gov, a government website that lists proposed regulations and related documents published by nearly 300 federal agencies.

As I write this, there have been 5,632 documents posted in the last 90 days, which is almost 90 per business day. Imagine that every five minutes of every workday there is a new proposed rule, final rule, notice, or update that may impact your business in one way or another. Certainly, very few of these impact all industries, and most will impact a very specific issue or group, but how do you know unless you devote resources to evaluate each one?

The Federal Motor Carrier Safety Administration (FMCSA) is one such agency within the Department of Transportation whose primary mission is to reduce crashes, injuries, and fatalities involving large trucks. Using government data, the American Trucking Associations calculated the 2013 large truck-involved crash fatality rate as 1.44 per 100 million miles traveled, a 39.2 percent decline over the past decade and the lowest fatality rate ever. That’s 1.44 fatalities per year involving large trucks driving on increasingly congested roads and highways over a distance longer than from earth to the sun! Trucking safety has never been better.

Despite the trucking industry’s impressive safety record, FMCSA continues to add new regulations. Some of them include:

• Hours of Service regulations, which address driver fatigue, were revised even though the rules in place since 2004 had been effective in reducing crashes. Congress recently suspended the most egregious portions of the new rule until FMCSA conducts proper research.
• FMCSA is currently advancing regulations to require all drivers subject to Record of Duty Status rules (hours of service logs) to convert from paper logs to Electronic Logging Devices.
• FMCSA has proposed rules to establish entry-level training requirements for drivers of commercial motor vehicles.
• FMCSA is currently collecting information to evaluate driver safety as it relates to compensation systems, which comes with the unproven implication that hourly pay is inherently safer than paying drivers by the mile or load.

While all may sound like good ideas, they add complexity and expense to trucking operations, may require scheduling changes, and often are implemented without proof of real benefits or lacking sound research to justify them. And, as occasionally seen with regulations, unintended consequences may offset any perceived benefit. Increased regulations require businesses to devote considerable resources just to keep up with the number of new rules. Those resources could perhaps be better used to improve operations while achieving improved safety performance.

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Improving Processes Within Poultry Manufacturers

BY KATIE TAKACS, MARKETING MANAGER FOR THE GEORGIA MANUFACTURING EXTENSION PARTNERSHIP

The food processing industry, although different from traditional manufacturing, has numerous similarities. Plants and processes are set-up based on manufacturer’s needs, quality control measures are put into place, and metrics and return on investment are important to upper management.

So how can food manufacturers, and especially poultry manufacturers, put measures into place to continuously improve?

Crider Foods, a poultry manufacturer in Stillmore, Georgia, doubled throughput from 260 to 520 cans a minute, resulting in the ability to produce more product and expand into new markets. By making changes, based on Lean principles, Crider identified bottlenecks in its packaging line. Crider also consolidated three smaller warehouses into one large warehouse, and were able to maximize space, and save time, resources, and money by eliminating multiple daily trips between warehouses.

Around the middle of the 20th century, Toyota began implementing Lean practices – tools and techniques to improve processes. The automobile manufacturer discovered that these tools helped it eliminate waste, become more efficient, reduce operating costs, and most importantly free up capacity to grow its business.

Today, these concepts are applied to all areas of manufacturing and are customized based on industry and company needs and goals. Since the 1960’s, the Georgia Manufacturing Extension Partnership (GaMEP) at Georgia Tech has been helping manufacturers grow and stay competitive, and the poultry industry is no exception. In the last couple of years, the GaMEP has worked with poultry manufacturers to cut lead times in half, reduce equipment set-up times, and double throughput.

Why have these poultry manufacturers been successful in implementing Lean practices? Time and again, the GaMEP has seen the most successful implementation come from manufacturers with leadership buy-in and participation across the plant. These companies attain top-level support by pitching ideas that show how efforts and change can positively impact bottom-line. As the leader of an organization, what would you respond to better:

A. Our team was able to identify areas of improvement that can better meet demands of our customers.

OR

B. Our team was able to identify areas of improvement that can better meet demands of our customers, but also take on additional business to grow our sales by 20 percent in the next year.

As a team member, proposing ideas by using terms around sales growth, profit, and return on investment are key to gaining buy-in.

What about the rest of the organization? Get them involved in the decision-making. Take inter-departmental teams, with all levels of employees that are immersed in the day-to-day and use their input to drive change. Start off with a process that will show quick results. Then use these results to help fuel change in other areas. Employees will begin to feel empowered and excited about the changes taking place.

GaMEP worked with Crider’s management team and production workers to apply Lean to their operations and realized fantastic results. Lean is an important tool for all types of manufacturing companies, including poultry. By gaining top-leadership support and employee buy-in, improvements and business growth opportunities are within reach.

The Georgia Manufacturing Extension Partnership (GaMEP) helped Crider Foods apply Lean practices to its packaging line. GaMEP works with the Georgia Tech Research Institute’s Agricultural Technology Research Program (ATRP) and other sources to assist poultry processors with process improvements and energy and sustainability solutions.

About the Georgia Manufacturing Extension Partnership (GaMEP)

The GaMEP, a federal and state funded program out of Georgia Tech, is a member of the National MEP network supported by the National Institute of Standards and Technology (NIST). The GaMEP helps manufacturers increase top-line growth and reduce bottom-line costs. With nine regional offices across the state, GaMEP offers a solution-based approach through coaching, implementation, and training in areas such as: Business Development, Process Improvement, Sustainability, Energy, and ISO Standards.

Visit www.gamep.org for more information.
On April 23, the Agricultural Technology Research Program (ATRP) held its annual Advisory Committee Meeting. Project directors provided committee members with an update on program research projects as well as technology transfer and outreach activities. A round-table session was also held where committee members provided feedback and discussed future research opportunities, challenges, and directions with researchers. The annual meeting serves as a key step in ATRP’s efforts to identify and conduct research projects that best address priority industry needs. ATRP extends its appreciation to the Georgia Poultry Federation and the individual committee members who give of their time and experience to help review and focus ATRP’s research program.

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### Technical Assistance Is Just a Phone Call Away

The Agricultural Technology Research Program (ATRP) provides no-cost technical assistance to Georgia-based firms and individuals in the poultry industry. These assists range from simple inquiries regarding information or help needed to address a problem to extensive on-site consultations in which researchers collect data and provide a report on their findings and recommendations. In-plant energy usage/cost assessments and workplace safety evaluations are also offered.

The Technical Assistance program also facilitates interaction between the poultry industry and the Georgia Manufacturing Extension Partnership (GaMEP) program at Georgia Tech (see “Improving Processes within Poultry Manufacturers” on page 6).

For more information or to schedule a technical assist, call ATRP Program Manager Doug Britton at (404) 407-8829 or email him at doug.britton@gtri.gatech.edu.
USPOULTRY Releases Video Providing an Inside Look at U.S. Poultry Processing

The U.S. Poultry & Egg Association (USPOULTRY) has released a new video that provides a look at how chickens and turkeys are processed in the United States. The video takes a behind-the-scenes look at today's high-tech, highly efficient poultry processing plants and highlights the food safety and sanitation practices employed by the modern poultry industry.

The video is viewable on USPOULTRY’s website, www.uspoultry.org.