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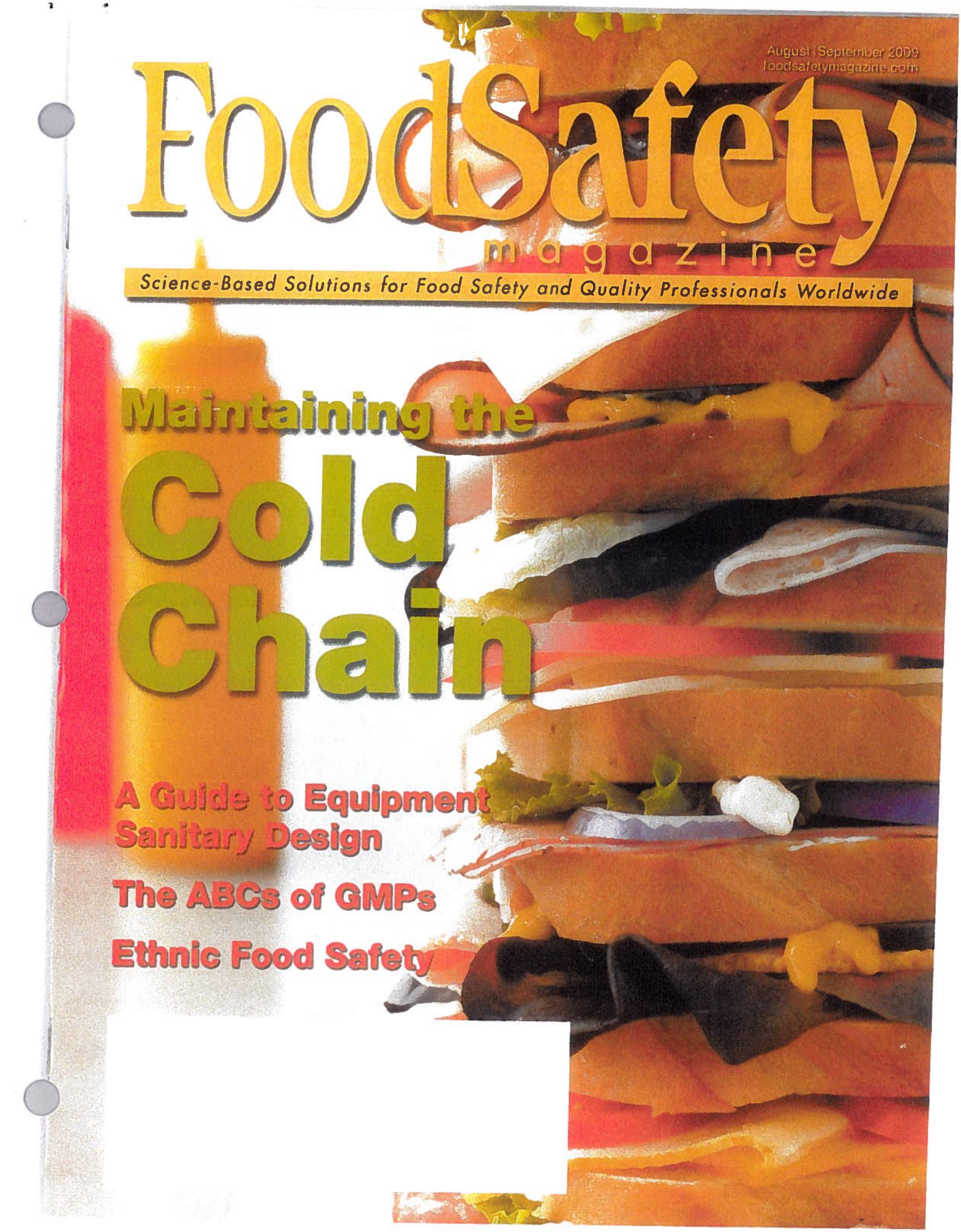

Maintaining the Cold Chain

A Guide to Equipment Sanitary Design

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FOODSERVICE DISTRIBUTION: Maintaining the Cold Chain

BY JORGE A. HERNANDEZ

Each day, millions of cases of product are delivered to restaurants, hospitals, universities and other food-away-from-home destinations. Moving these food products safely and efficiently from farm to fork requires an elaborate, highly coordinated series of links in a long chain of trading partners. Distributors serve as the intermediary between manufacturers and foodservice operators, procuring palletized and bulk inventory items from manufacturers, then breaking them down to case and unit quantities for foodservice operators.

While distribution may be the least highlighted link in the food safety chain, the safety and quality measures taken by successful distribution centers are no less important than the Hazard Analysis and Critical Control Point (HACCP) plan at the supplier's facility or the careful handling and preparation by the operator.

It's a Big, Big Distribution World

The U.S. distribution chain includes more than 15,000 companies operating thousands of warehouses and fleets of trucks. A typical broadline foodservice distributor may serve anywhere from 1,000 to 6,000 accounts from a single distribution center, and offer customers more than 10,000 food and non-food items. Other types include specialty distributors, which focus on specific product categories or customer segments; distribution systems, which serve large restaurant chains; and other businesses such as terminal markets and warehouse clubs.

In 2009, U.S. distributors' annual sales will be an estimated $211 billion, down from $217 billion in 2008 and $216 billion in 2007, according to Technomic Inc., a foodservice research and consulting firm. "The commercial foodservice market, particularly restaurants, is in a major slump, and distributors are a reflection of what the end-market is doing," says Robert Goldin, executive vice president of Technomic.

The largest distribution companies are Sysco Corp., headquartered in Houston, TX; U.S. Foodservice, based in Rosemont, IL; and Performance Food Group in Richmond, VA. Other major players included in Technomic's 2008 Power Distributors List include (in order of size): Gordon Food Service, Grand Rapids, MI; Reinhart FoodService, LaCrosse, WI; Services Group of America, Scottsdale, AZ; Maines Paper & Food Service, Conklin, NY; Shamrock Foods Co., Phoenix, AZ; Ben E. Keith Foods, Fort Worth, TX; and Cheney Brothers, Riviera Beach, FL.

"Customers should be aware of the food safety differences between distributors, especially in a down economy when many are making choices based on price."

It's All About Food Protection

Every distribution company has its own system for ensuring food protection, which includes food safety (protecting food from accidental contamination) and food defense (guarding food from intentional contamination).

"Best-in-class foodservice distributors go to great lengths and expense to protect the products they deliver," says Steve Potter, senior vice president of industry relations for the International Foodservice Distributors Association (IFDA), a trade association serving the foodservice distribution industry. Several federal agencies oversee food regulation and safety in America, including the U.S. Department of Agriculture (USDA), which regulates and monitors meat, poultry and egg products; the U.S. Food and Drug Administration (FDA), which ensures the safety of the production, processing, packaging and storing of domestic and imported foods; and the Centers for Disease Control and Prevention (CDC), which collaborates with USDA and FDA on disease surveillance and outbreak response.

Of the three, USDA and FDA interact most often with the foodservice supply chain. The "best practices" guidelines (more on these later) prepared by these agencies cover a multitude of processes, from general sanitation to packing and production to transportation and warehousing.

The common thread among best practices can be summed up in four words: "maintaining the cold-chain." A key part of every successful distributor's food safety program involves refrigerated docks, multiple refrigeration zones within distribution centers and multi-temperature trailers.

"In many ways, the transportation of food can be viewed as an extension of storage," writes Robert James Hart in his article "Food Science–The Transportation of Food," a scholarly examination of the chemical and molecular structure of foods and how they break down, for the book *Food Transportation*.[1] "A refrigerated [truck] is essentially a cold store on wheels. There may be additional engineering complications in designing and maintaining such a mobile storage facility, but the food science considerations are much the same."

Problems and Vulnerabilities

While food safety is a priority for every reputable distributor, it's often taken for granted by customers. Maintaining the cold chain from farm to fork is challenging. The average shipment–both inbound, from supplier to distribution center, and especially outbound to customers–consists of less-than-truckload quantities of food products. The number of products delivered to a customer can be in the hundreds. Each of these products must be loaded correctly to prevent cross-contamination with raw product and damage by heavier items at the bottom of a stack.. And they must be stored at the correct temperatures (frozen, refrigerated or dry) in the truck to maintain quality and safety. The food has to retain its chill throughout the multi-stop delivery process, especially in the heat of summer when the "reefers" (truck refrigeration units) have to work extra-hard to maintain temperature. In other words, there is plenty of opportunity for error.

Although food distribution companies must adhere to government regulations calling for greater food protection scrutiny (e.g., the Bioterrorism Act of 2002), enforcement is rare. On the supplier front, over-extended government food inspections run by FDA, USDA and state regulatory agencies continue to lag in both coverage and accuracy, as evidenced by the recent foodborne illness outbreak traced back to one less-than-scrupulous peanut processing company.

"Customers should be aware of the food safety differences between distributors, especially in a down economy when many are making choices based on price," says Greg Pallaske, director of regulatory compliance for food safety and quality assurance, U.S. Foodservice." That's why it's so important to evaluate the food safety policies and procedures and operations of your foodservice distribution company."

Frank Ferko, U.S. Foodservice's head of distribution food safety and quality assurance, agrees. "Most people are inward-looking when it comes to food safety," says Ferko, who has more than 33 years of experience in the restaurant, food processing and distribution businesses. "If you're in manufacturing, you

worry about food quality at your facility. If you're at a restaurant, you worry about your kitchen. That doesn't mean you can assume other areas are fully on target."

Areas of Food Safety Risk

The major areas of concern for food distributors start with the cold chain and time/temperature control, and include sanitation, cross-contamination and shipping logistics such as merge-in-transit. At the warehouse, food safety hot-spots include damaged goods and will-call.

Maintaining control of the cold chain is one of the biggest challenges for food distributors. Take mixed loads, for example, in which a trailer carries frozen, refrigerated and dry items in sections ideally separated by moveable bulkheads. There should also be chutes blowing the appropriately tempered air into the chilled compartments.

That's not always the case in the real world. "Some companies don't see a problem with putting frozen and refrigerated items in a trailer set at 26 °F and shipping the food halfway across the country," Ferko says. "We saw a lot of that last summer when gas prices rose above $4 per gallon, and companies were trying to cut corners."

> "Food safety works best when it is built into the overall design of both the facility and the trucks."

Combining frozen and refrigerated products is usually more of a food quality issue than a food safety issue, but it still ends up affecting operators' bottom lines. "French fries, for example, that are held at 20 °F and then brought back down to 0 °F will have moisture build-up on the surface," Ferko says. "When you dump them into the fryer, the surface moisture will cause problems with the oil and the fries will come out too dry."

Frozen breaded chicken held at too high a temperature suffers too, when moisture from the meat gets into the breading, which causes it to brown unevenly or flake off, while reducing the useable life of the fryer oil. Quality also takes a hit when refrigerated items are stored at the wrong temperature, as with delicate leafy greens that will freeze or wilt.

Certain foods–particularly seafood, sensitive pre-cut produce and ready-to-eat products–can become unsafe if not held at appropriate temperatures. Safety-conscious companies require time and temperature recorders for shipment of these foods. If the time-to-result indicates the temperature has exceeded safe limits, the best practice is to refuse the shipment and discard the product.

"We sometimes find that refrigerated seafood product shipped by vendors has been above 41 °F in the mid- to high-40 °F range for too long," Ferko says. "This can occur when the product is unloaded for redistribution to another truck, or when it's part of a longer-than-usual delivery that caused the truck's refrigeration unit to be turned off too long. In this case, the product should be rejected as unacceptable."

The practice of on-the-dock redistribution from one truck to another, called merge-in-transit or cross-docking, offers plenty of chances for temperature mishaps where food is involved *if* the docks are not refrigerated or if product sits for too long at the wrong temperature. The system was developed by retailers that ship dry foods or consumer goods as a way to speed deliveries while reducing warehouse and handling costs.

Companies using merge-in-transit should have refrigerated distribution docks and undergo a rigorous inspection process before such a program is implemented. In fact, U.S. Foodservice recently launched a pilot cross-docking program at two facilities in Chicago and one in Atlanta, with plans to expand the program to up to eight facilities throughout the country by next summer.

Returns and Will-Call

Returns and will-call areas, where customers can pick up product directly from the warehouse to meet last-minute needs, carry significant potential for both food safety and food defense to be compromised if the cold chain is not maintained. With returned product, the key point is to make sure that potentially unsafe product (food that has been out of the distributor's control) does not reenter the stream of outgoing goods for delivery to another, unsuspecting customer.

Reputable distributors will have a designated returns area, where all products are held for evaluation. Depending on results of the investigation, products will either be returned to the vendor, returned to shelves, donated to a food bank or destroyed.

Whether buying from a distributor, a terminal market or a warehouse club, "customers who want to put frozen or refrigerated product into their trunks and drive an hour or so back to their restaurant are creating risk," Ferko says. "The challenge lies in educating customers about transporting product safely. That said, you can't manage their business for them." Distributors should, however, limit customer access to the facility for their will-call business.

Food Defense Vulnerabilities

Protecting food from intentional contamination, a form of bioterrorism, is an issue that is sometimes overlooked. "Anyone with bad intentions can easily contaminate food–a customer at the salad bar, a restaurant employee, and so on," says Ferko, who sits on the food defense committee of the Conference for Food Protection. "Food defense is primarily about limiting access to products. It's also about understanding what might happen and monitoring who has access to food. If your company is limiting access by locking trucks, sealing cases within trailers with tamperproof tape, restricting access to distribution facilities, and performing background checks on new hires, you're already making progress on the food defense front."

Food defense measures taken by food companies are voluntary rather than mandated by government regulations. They're also relatively minimal, considering the critical nature of the nation's food supply and the shock wave that would ensue if a successful bioterrorism

attack on the food supply occurred.

"You do the things that are reasonable to protect the product, employees and customers," Ferko says.

A "Best Practices" Approach to Safe Food Distribution

For operators selecting a food distribution partner, or for distributors evaluating their own food safety operations, below is a series of questions followed by best practices suggested by regulatory agencies and the industry.

In the Distribution Center

What are some food safety aspects built into your distribution facility?

Food safety works best when it is built into the overall design of both the facility and the trucks. This includes having sufficient capacity for dry and refrigerated food products (chilled and frozen), providing easy access to all areas for cleaning, adequate insulation and temperature-control capacity. For facilities, it is important to restrict access by unauthorized entry through use of fences and locks, and of course, to have programs to prevent environmental contamination and infestation by insects or vermin.

How many temperature zones are in the distribution facility? How are they monitored?

A foodservice distribution warehouse typically has three temperature zones–ambient, cooler and frozen. Temperature ranges in the cooler area should properly protect meat, dairy and produce. The freezer should be at 0 °F or below. Larger facilities will have both an ambient and a refrigerated receiving dock area.

Best-in-class facilities are equipped with monitoring systems that track temperatures within each zone around the clock. Should a temperature go above or below the target range, the system sends a message (via email, text, fax or phone) to the warehouse manager so the situation can be corrected.

How do you ensure proper first-in, first-out product rotation at the warehouse?

Product rotation at distribution facilities is tracked and carefully managed. As each pallet of product is received on the dock, it is assigned a "license plate"–a bar code and a unique ID number that describes the contents. The product is then taken to the aisle and slot in which it will be stored, and the location number is entered into the system. Received product typically is placed into "reserve" slots. When the "pick" slot for that product becomes empty, warehouse staff will be directed by computer as to which pallet to insert next to ensure first-in, first-out accuracy.

How is food safety addressed in the picking process?

The slotting system at the warehouse is laid out in a manner that lets pickers assemble orders as they pass through the warehouse. As pickers move through aisles to fill food orders, they put the heaviest items on the bottom of the pallet for stability and to prevent damage. Typically, ambient products are placed with other ambient products, cooler with cooler and frozen with

Food Defense in Your Distribution System

An important part of safeguarding the nation's food supply involves protecting food in transit—90% of which is shipped by truck. Because of globalization, the journey that food takes from field to table can be thousands of miles, with many stops along the way. Challenges include the vast size of the area covered, the broad number of food distributors and their varied levels of knowledge about food defense, the relative lack of government regulation, the potential for unobserved access to food products, and a less-controlled setting that makes safeguards more challenging to implement. In short, today's world calls for food defense plans just as much as food safety plans.

A successful food protection program must focus on two areas: food defense and food safety. "Food defense" means preventing *intentional adulteration* by biological, chemical, physical or radiological agents. "Food safety" refers to guarding food against *unintentional* contamination.

"The distribution of ingredients and products is a vital component of our food delivery system, which is why it's important for food distributors and companies to know their suppliers and understand the food protection measures being used," says Jon Woody, policy analyst for the U.S. Food and Drug Administration's (FDA's) Office of Food Defense, Communication and Emergency Response.

Three food categories are considered to be especially vulnerable to contamination. Perishable products, such as meat or dairy products, must be monitored closely because their relatively short shelf-lives place an additional burden on the industry's ability to respond in a timely manner. The second category includes products that require extensive human interaction to be ready for market, such as produce or nuts that can come from multiple suppliers and are mixed and repackaged multiple times. The category of secondary ingredients, such as seasonings, breadings and peanut butter, is also especially susceptible to contamination.

Woody says food suppliers and distributors should have food defense plans in place that restrict access to facilities, and call for padlocks on truck trailers and regular, company-wide vulnerability assessments.

FDA's Center for Food Safety and Applied Nutrition (CFSAN) has released a number of initiatives designed to help suppliers, distributors and operators on the food defense front. Those initiatives are: ALERT (targeting foodservice managers), FIRST (aimed at employees, the first line of defense) and CARVER+Shock, a comprehensive online planning tool to help companies set food defense priorities. Information about all of them can be downloaded from the CFSAN Web site.

One other useful tool comes from the U.S. Department of Agriculture's Food Safety and Inspection Service (FSIS). The FSIS *Guide to Developing a Food Defense Plan for Warehouse and Distribution Centers* is a 15-page, step-by-step document that includes evaluation forms covering everything from outside security to personnel to developing and implementing the overall plan.

The bottom line is that having a food defense plan helps suppliers, distributors and operators maintain the safety of the food products they handle—and most of all, helps protect everyone's business.

frozen to protect product integrity. Chemicals and cleaning products are segregated and placed separately on the delivery truck.

Who inspects incoming product for quality?

Distributors should have trained personnel inspecting the quality, condition and temperature of inbound products–especially perishable items. An in-house quality assurance program should include daily in-slot inspections of perishable products.

What happens to products that don't pass the quality test?

Products close to their expiration date or damaged while at the facility should be logged, segregated from other products for further inspection and returned to the supplier or dumped, if necessary.

Who inspects the facility? How often, and is it on a pre-determined schedule or by surprise?

Warehouse sanitation requires continuous effort at multiple levels. Supervisors should ensure floor and in-slot cleanliness on an ongoing basis. Audits should be regularly conducted by management. Many distributors contract with independent, third-party audit companies that conduct inspections at least once a year. Best-in-class companies hold inspections twice a year to identify and correct any food safety and sanitation issues. Distributors should be able to show you records of recent audit results.

On the Trucks

What are basic requirements for trucks to meet food safety standards?

Delivery vehicles should be of sturdy construction so as to permit easy rear- and side-door locking and sealing. Trucks should be sufficiently insulated and refrigerated so as to protect cargo against damage. Interior walls and floors should be clean and free of cracks or holes that could allow the entry of pests, vermin or dust, or negatively impact temperature control. As with the facility, the truck design should permit effective inspection, cleaning, disinfection and temperature control. Ideally, interior surfaces should be made of materials suitable for direct food contact, such as stainless steel or food-grade epoxy resins.

Regular cleaning programs are needed to keep the container interior free of dirt and debris. Equal attention to cleanliness is required for cargo pallets, load-securing devices and loading equipment such as hand trucks, forklifts and conveyors. When possible, transport vehicles should be reserved for "food use only" to reduce risks of cross-contamination.

What are your pre-loading procedures?

The pre-loading check should make sure that any residues from previous cargo have been removed. The cooling unit should be checked to make sure it's in good repair and operational. Portable bulkheads should be in good condition, free from tears or holes, and form a tight seal when in use. Air chutes (if present) should be properly in place for effective air circulation. Trailers should be pre-cooled at least an hour before loading to chill insulation and air.

How does a distributor handle loads that include both frozen and refrigerated products?

The optimum transport method for mixed loads is to use trailers with compartments set at different temperatures. These compartments are created through the use of portable, insulated bulkheads. Typically, frozen products are in the forward compartment at 0 °F or below, and cooler/dry product is in the rear at 41 °F or below. The practice of transporting frozen and refrigerated mixed loads in one compartment set at an intermediate temperature is not advisable for times longer than a few hours.

Cold Chain Assurance

How is the cold chain maintained during loading?

Product is typically brought to the dock in a sequence that minimizes the amount of time spent on the dock during loading and unloading. Best-in-class companies go to great lengths to ensure that product temperatures for meat, poultry and eggs do not exceed 40 °F before loading. Most larger distributors do their loading and unloading from refrigerated docks.

How is the product integrity maintained while in transit?

Once the truck pulls away from the dock, the product's safety and integrity becomes the responsibility of the driver. Leading companies have in-transit checks on temperature and refrigeration units. Some have implemented automatic time/temperature recording devices. Many also require warehouses to maintain log books documenting product condition upon arrival and during storage. A few companies have outfitted trucks with onboard computers and GPS systems so as to track location of product at all times.

What about unloading procedures? How is food safety ensured?

Product should be inspected for quality, damage and temperature (if appropriate) before being accepted at any point during the delivery process. Proper documentation is crucial to maintain records of product condition and packaging upon receipt. The documentation should also record temperature readings and note whether there was any sign of spillage, damage or pests. Perishable product should be moved immediately from the loading dock into the appropriate temperature zone in the warehouse or at the foodservice operation.

How are contaminated or returned products handled?

The distributor should have procedures for contaminated products to ensure they are separated from safe product. The procedures should cover products brought back by drivers upon their return to the warehouse. A monitoring plan and record-keeping system should document all steps taken. For food safety and food defense reasons, best-in-class companies would never sell a returned refrigerated/ready-to-eat product to another customer.

Useful links:

- International Foodservice Distributors Association, **www.ifdaonline.org**
- Center For Food Safety & Applied Nutrition, **www.foodsafety.gov/list**
- Conference For Food Protection, **www.foodprotect.org**
- Food Politics Blog, **www.foodpolitics.com**

A Matter of Balance

All of the food safety measures recommended by regulatory agencies and industry organizations–from a well-maintained refrigerated fleet to staff and driver training to inbound and outbound shipping standards–cost distributors both money and time.

"Food distribution is not just drayage–moving items from one point to another," Ferko says. "There's so much extra effort that we put into controlling the process to make sure product is safe."

Perhaps the most difficult question is, how do you put a value on doing the right thing? "What we do on the food safety front costs us time and money every day of the week," Ferko notes. "But it's all about delivering quality. The challenge is in choosing the right people and the right processes for the best reliability and safety, and negotiating a fair price that's acceptable to us and our customers. It's all about finding the right balance."

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Food Logistics

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Cold Chain Champions

Don Ratliff, Jaymie Forrest and Harvey Donaldson (from left) head up the newly launched Georgia Tech Integrated Food Chain Center.

COLD CHAIN CHAMPIONS

The newly launched Georgia Tech Integrated Food Chain Center will bring high value and market power to participants in the cold chain. By April Terreri

COOL COLLABORATORS: Jane Griffith of Wawa and Nick Pacitti of Sterling Solutions helped to pioneer the establishment of the Integrated Food Chain Center.

Finally, the food logistics industry will have a research and resource center to utilize for questions about and solutions to every aspect of managing and monitoring the food cold supply chain. The Georgia Tech Integrated Food Chain Center—formed by The Georgia Tech Supply Chain & Logistics Institute (SCL) at The Georgia Institute of Technology and by Sterling Solutions LLC—will be housed within SCL in Atlanta.

The Center—integrating academia with seasoned industry experts—will launch this May and will operate as an international center for applicable knowledge in the fragile cold chain.

Operation Integration

While a few other organizations operate in the cold chain, they are composed primarily of trade associations. This is the first time the industry will ever have a research center that will integrate all cold supply chain and logistics participants, including distributors, retailers, foodservice companies, distributors and transportation providers.

"There is currently no one entity that studies, researches and applies economically feasible industry-wide cold chain solutions," notes Nick Pacitti, partner with Sterling Solutions LLC, Memphis. "So this will be a center of knowledge providing research into specific areas affecting these respective participants. It will serve as a center of knowledge providing research into tracing and protecting perishable foods as they move through the cold supply chain."

The Center will focus on a number of areas of concern to the industry, including product safety, product quality, environmental impact and economic benefit. Funding will come from industry members and sponsors and through government grants.

The goal of bringing together all of these various players is to establish an overarching understanding among cold chain participants of their respective responsibilities for maintaining the cold chain and how those responsibilities affect cold chain management of the other participants downstream in the cold chain.

"One of the reasons for the Center is to mitigate the risks we saw in dollars spent on product for development, manufacturing, consumer testing and regulatory compliance," explains Pacitti. "These costs are at risk throughout the cold chain from supply to delivery because if the cold chain is not managed right, brand integrity, customer confidence and market share are at risk."

Jane Griffith, senior director of quality assurance and food safety for Wawa Inc., based in Wawa, PA., notes that she and Pacitti have been pursuing getting this concept established for a number of years, talking with colleges and universities about the feasibility of such a center.

'The food supply chain is a lot more complex than any other supply chain and the cold chain is the most fragile; the quality of food is dependent on how food products are handled at every touch point throughout the food chain.' —Don Ratliff, SCL

"But many of them didn't have the ability to really move the needle and help us bring all these central partners together," says Griffith. "When we approached Georgia Tech, they immediately saw the value to the industry and to the entire food supply chain. And since they have a reputation of expertise and strength in the supply chain anyway, it was a natural fit for them to do this."

Bill Hudson, president and CEO of Alexandria, VA-based Global Cold Chain Alliance, weighs in on the value to the industry of the Center. "As the Center will integrate the examination of the cold supply chain and the operation of the chain, we see this as a tremendous opportunity in bringing together the industry, academia, government and food science in order to study the challenges in food logistics."

Hudson adds that his organization also strives for integrity of refrigerated foods throughout the distribution chain. "We look forward to aligning our programs and our members' needs with the Center's mission."

Georgia Tech: The Natural Choice

John Bartholdi is research director for the Integrated Food Cold Chain Center. He points out that Georgia Tech's Supply Chain and Logistics Institute (SCL) has long been a global leader in supply chain and logistics.

"Georgia Tech's SCL is the largest industry/academic collaborative in the world, with research offices globally," he says. So the fit was perfect as the home for the new Center. A number of centers focused on food science do operate currently, most having grown out of schools of agriculture, explains Donald Ratliff, Ph.D. at SCL. "But there is no center focusing on the food supply chain and food logistics. So we are bringing something new and necessary to the industry through this Center."

Jaymie Forrest notes that for the last consecutive 19 years, Georgia Tech has been rated the top industrial engineering school in the country. "So in leveraging our systems and design engineering processes, coupled with our expertise in the supply chain and logistics arena, we offer this sweet spot of ours that brings a lot of value to the industry," says Forrest, director of business development at SCL.

SCL already has been involved in studying the temperature control chain as it relates to international shipments, continues Forrest. In fact, the institute has established several research centers throughout Asia, South America and Latin America. "These centers focus on logistics strategies," she explains.

"We are leveraging the knowledge we gather in order to collaborate and integrate the entire food chain." This knowledge will help inform the Center's work as anticipated international regulations become law.

"Its time has come for something like this Center," notes Jane Griffith, senior director of quality assurance and food safety for Wawa Inc. "Everyone saw there was the need for this, but nobody really understood what the best approach should be. I am so grateful that Georgia Tech has seen the value of this by embracing the concept and becoming an owner of this, helping all of us in the industry to move this along quickly." —*A.T.*

TEAMWORK: From left, Ratliff, Forrest and Harvey Donaldson, SCL managing director.

Chain Reaction: The Fragile Cold Chain

There has been increasing recognition in the last few years of the uniqueness of the food cold chain and food logistics, says Don Ratliff, Ph.D., at SCL at Georgia Tech.

"Our goal is to make sure that everyone understands the food chains," explains Ratliff, executive director of SCL. "They differ depending on where they originate—by product and by type of processing, for example. So we are not talking about just one food chain; there are many different food chains involved. What we hope will happen is that the issues causing trouble in any of these chains will bubble up so that we can address problems around quality, safety, energy efficiency and economics. The food passing through these supply chains has to be safe and of the highest quality, while also being economically feasible for the operators and for consumers."

The U.S. imports about 60 percent of all of the fruits and vegetables that the nation consumes. "So there is an increasing focus on food safety relative to products that are imported as well," says Ratliff. "The food supply chain is a lot more complex than any other supply chain and the cold chain is the most fragile; the quality of food is dependent on how food products are handled at every touch point throughout the food chain."

Methods that work in a typical food supply chain do not work effectively in a cold chain because the food is highly perishable and fluctuations in temperature and humidity, mishandling or expired codes can wreak havoc on the quality of the products and, by extension, on customer loyalty, notes Sterling Solutions' Paciti. He adds that about 25 percent of product is wasted due to poor handling or the inability to track shelf life.

As to ownership of the cold chain, there is not a single owner, but many. So cold chain management throughout the chain becomes an exercise in integrating the processes required by each participant as the food passes through the participant's portion of the cold chain. "If you know what the processes are up and down the chain, you can integrate all the processes so there is continuity in cold chain management up and down the chain," says Ratliff.

The industry strives to deliver safe, fresh, high-quality food products cost-effectively to consumers. However, just one error at any touch point along the cold chain can jeopardize product quality, freshness, brand image and food safety, no matter how excellent the cold chain management practices are downstream from the error.

"Most of the focus of research has been on how you deal with these touches within a facility and they have been one-point solutions," explains Ratliff. "But every handoff point has to be perfect; for instance, the handoff between production and transportation and between transportation and storage. We felt there was a need in the industry for an entity that would pull all of these groups together to guide cold chain technologies, management processes and methodologies."

To assure quality throughout the chain, the approach must change from one of inspecting all the food—which is not a realistic solution—to instituting a process that will incorporate quality in the chain. Thus, safety and quality will be consistent, similar to the philosophy of total quality management employed in the

Enhancing Traceability

IBM will act as an industrial advisory board member to the Integrated Food Cold Chain Center, reports Jane Snowdon, Ph.D., senior manager, industry solutions and emerging business, smarter building research, for the IBM T.J. Watson Research Center in Yorktown Heights, NY.

Jane Snowdon

"We will provide guidance and ideas to direct the Center's research agenda," Snowdon says. "We also anticipate fostering interactions with Georgia Tech and with the international ecosystem of university partners and industrial partners in joint workshops and seminars."

Of course, consumer confidence is won or lost based on the capability of cold chain participants to deliver safe and fresh food to consumers. In a study conducted last year, shortly after the tragic peanut debacle, IBM found that consumer confidence and trust in retailers, manufacturers and grocers is increasingly declining. "So now is really the time for all the players in the food supply chain to rebuild consumer confidence by modernizing the global supply chain so the production, safety, and quality of food can be improved," says Snowdon.

"I think what Georgia Tech is doing to bring together these stakeholders will really make a positive difference," continues Snowdon. "Now companies will have a trusted source of updated information relating to traceability. Companies will have brand empowerment because this information will enable them to make claims that they have real-time information about where their products are along the chain."

Supply chain efficiencies will enable companies to accelerate their product flows, thereby allowing them to reduce their inventory levels through increased supply chain visibility, explains Snowdon. Companies will be better able to protect their brand through risk mitigation by identifying risks and isolating contaminated products. Companies can assure regulatory compliance with individual retailer mandates and government regulations. "So traceability plays a very critical role in creating transparency that allows companies to mitigate recalls and support product marketing claims."

A few of IBM's traceability projects can offer ideas to the Center to drive technologies to enhance traceability. For instance, IBM is working with a major German food retailer who is applying RFID smart labels to meat products.

"The meat is tracked by the date it was placed into a refrigerated display case and the date it is removed from the case by a consumer," explains Snowdon. "This helps provide workable information for the store to monitor the freshness of the products while controlling the environment in which the products are stored. It also helps manage inventory levels by matching sales data. This is one example of how we are teaming with food retailers to ensure that food in the freezer stays fresh."

For a Norwegian food retailer, IBM developed a smarter food-tracking solution using RFID technology to track and trace meat and poultry from the farm to the store shelf. "Offering transparency throughout the cold chain ensures that food is maintained in optimal condition," Snowdon explains. "It also helps suppliers and grocers reduce their costs and improve food safety, thereby increasing consumer confidence."

Another practice worth noting in food traceability advancements is the example of A&P, who is applying bar codes to every individual egg in egg cartons. "These are examples of the shift we are seeing in our foods that provides more accountability in the food chain. So there is more information available today to do analytics to be able to look for trends and to more quickly pinpoint and react to any type of problem in the food chain before it becomes a problem. The next wave will be to use information to help us make better business decisions that can help mitigate recalls." —*A.T.*

automotive industry. "Rather than randomly testing product as it is delivered, it is less expensive to develop and coordinate a cold chain standard upstream starting at the producer and ending downstream at the store," explains Sterling's Pacitti.

Common concerns in the industry will be on the Center's agenda, such as improving supply chain efficiencies, monitoring traceability and quality, minimizing waste and spoilage, and improving bottom-line performance. Cold chain management is evolving into a regulatory tool, notes Pacitti. "It must be done right or the stakes are high."

The repository of information and research the Center will contain on supply chain management technology and product quality characteristics will have market appeal to cold chain participants. The Center will also promote a deep understanding of the economics relative to the development, production and distribution of perishable foods.

Front And Center: Numerous Opportunities

The Center will collaborate with the industry, academia and the federal government in information sharing and in pilot studies. It will bring value to the industry as well as to all partners of the cold supply chain, Wawa's Griffith points out. "It will provide research on technologies and processes for us to monitor and improve cold chain efficiencies, which is really critical to the industry and it is something that we hadn't had before in the industry," she says.

'We will be looking for guidance from Georgia Tech as to where there is opportunity for value to occur as we move inventories of highly perishable products.'

—Chris Lofgren, Schneider National

It will be an important link in assuring safe, high-quality foods from sources throughout the globe. "Consumers expect strawberries in December, but they don't understand that we have to source foods from faraway places to be able to offer them year-round," says Griffith. "The only way we can provide consumers with safe, high-quality food is through a system assuring efficient and effective cold chain management."

The integrated philosophy brings enhanced value to the industry. "It's critical to our industry that the Center develop solutions in joint research projects involving industry players and academia who can offer recom-

Transportation: Critical Point In Cold Chain Management

Transportation is a critical element in the cold chain, notes Nick Pacitti, partner with Sterling Solutions LLC in Memphis. "The transportation piece in the food cold chain is referred to as 'the last mile' in the supply chain and it is the area in the cold chain that places food at its most vulnerable if temperature abuse occurs," he says.

Numerous environmental conditions can cause temperatures to fluctuate, including the number of times doors are opened to deliver products, the volume delivered, time of year (summer opposed to winter) and geographic area (south or north).

"Most carriers cannot tell you when there is an issue, except when there is a major reefer breakdown," continues Pacitti. "Some will say they do what their customers tell them to do, which in many cases relates to what the temperature of the trailer should be. Temperature abuse plays havoc on product and most of this happens in the final mile of delivery."

Carriers and logistics providers must manage temperatures in a more scientific way, asserts Pacitti. "The Center offers a resource for carriers and their customers to come to learn the best way to protect products and to recognize that product abuse is a cumulative process. Cold chain management is evolving into a regulatory tool, as well as into a supplier-retailer-specific requirement."

Jane Griffith notes that the Center's mission to integrate all participants in the cold chain will bring independent haulers into the fold. "This is a very large group that needs to understand their role and responsibility in maintaining the cold chain," says Griffith, senior director of quality assurance and food safety for Wawa Inc. "Many of us use them and sometimes they are not as aware of their responsibilities as they could be. So we see the educational opportunities the Center will offer helping greatly to improve this situation."

Risk management is a critical element for transportation providers to consider. Phil Dunavant notes that he expects the Center to bring discipline to the transportation process. "I believe it will help us raise the bar relative to the capabilities of independent haulers," says Dunavant, COO of Memphis-based ReTrans Inc. The company is a multi-modal transportation provider working with independent haulers nationwide.

Protecting the safety and quality of food is a major concern especially considering the number of participants in the cold chain, Dunavant continues. "So from a risk management perspective, we want to make sure that our carriers have the required controls in place to provide the proper environment for the food cold chain."

Phil Dunavant

He envisions guidance from the Center will help relative to establishing KPIs that measure carrier performance. "We expect that the Center will shed light on what is needed out there to ensure that carriers are responsible in making the cold chain even more efficient. It will offer carriers a better understanding of their responsibility to maintain the cold chain and it will also give them an exposure to what the rules are and what is expected of them."

Transportation is, after all, the integrating function of the cold chain, reminds Chris Lofgren, president and CEO of Schneider National in Green Bay, WI. "We will be looking for guidance from Georgia Tech as to where there is opportunity for value to occur as we move inventories of highly perishable products. I think the Center will help us leverage information and communication and how that relates to understanding how the information flows relative to the physical flow of goods. This information will help us learn how we can drive efficiencies even further as we identify additional opportunities."

Lofgren looks for guidance from the Center in how to balance backhauls with refrigerated equipment. "The value you generate across that asset is diminished if you are not using it to transport refrigerated or temperature-controlled products. So we hope to learn how to have these operations work a lot more efficiently." —*A.T.*

mendations in advancing the effectiveness of cold chain management," says John Owen, vice president of logistics for the Midwest/Southeast supply chain services region of Minneapolis-based Supervalu Inc.

Employing a multi-disciplinary role in cold chain management, the Center will bring numerous opportunities to the industry, including:

Ongoing research: Laboratory simulations of things such as how temperature and humidity fluctuations affect product quality and shelf life will provide the industry with actionable information.

"We will develop thresholds and trigger points across the cold chain," says Pacitti. "This will alert us hours before something goes wrong that there is a problem brewing so we can be proactive and fix the problem. Then we can begin to manage shelf life by integrating quality, traceability and replenishment strategies."

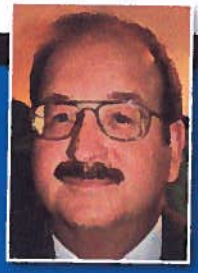
Next practices will direct methods of how to be more efficient in delivering perishable product from both a quality and economic perspective, Pacitti says.

SCL's Ratliff notes that industry will be a major participant in helping identify top problems. "Industry members will work with us to help resolve these problems. It is our desire to have regular ongoing projects that will monitor food as it moves through the chain as we examine things like temperature and humidity from end to end."

Supervalu's Owen looks to the Center to provide ongoing cold chain research to protect food throughout the chain. "The issue that any one particular company has is really an extension of the problems the industry faces," he says. "We deal with very sensitive products that need to be handled at critical temperatures and humidity. So anything that improves these processes helps all of us in the industry."

Suggesting technology solutions: The Center expects to determine how various technologies can be utilized effectively yet affordably, says Jaymie Forrest, director of business development for SCL. "We plan to work with companies who develop these technologies so we can determine how best to use their technologies," she says.

Griffith looks forward to emerging technology from the Center's research. "This is very essential to Wawa and we would like to see how this research can translate monitoring the cold chain into product traceability. If we can couple these two aspects—cold chain management and traceability—that will be a big win for many organizations in the food industry.



'Considering the ongoing regulatory activity focused on food safety, the industry must take the lead. The Center will be an important partner in this endeavor.'

—Frank Ferko, U.S. Foodservice

Traceability is something everyone needs to truly understand to be able to manage the cold chain properly."

These technology solutions should interface easily among participants and should be cost effective and affordable to everyone, she adds.

Another developing area relates to how to manage replenishment strategies while keeping very small inventories. "We are evaluating and understanding technologies that instantly capture data and report that your product sold so much of a percent of inventory on a particular day. This information converts into a production plan for the following day. So what happens at the cash register is critical in developing production and replenishment plans," notes Pacitti.

Assuring food safety: There is nothing more important to the strength of U.S. Foodservice's business than food safety, stresses Frank Ferko, director of distribution food safety and quality assurance for U.S. Foodservice headquartered in Rosemont, IL.

"As food safety leaders in the industry, we are acutely aware that the food cold chain really needs a world-class program like this Center," says Ferko. "The industry needs sophisticated educational and research programs that can provide analytical evidence to drive further development in the cold chain and distribution logistics."

Establishing standards: There are a number of organizations developing international standards for the food chain, SCL's Ratliff notes. While they focus primarily on providing services to their members (composed of a subset of service providers to the food chain), Ratliff explains the distinction of the Center is that it is focused on bringing together in an integrated approach to the chain all of the stakeholders, such as produc-

Continued Research And Development

The Georgia Tech Integrated Food Chain will address the following issues:

- **Temperature control (stability and challenge) testing:** Provides cumulative supply chain effects of time, temperature and other environmental effects on product quality.
- **Food and distribution engineering:** Provides abuse testing to determine product design and packaging and distribution methods.
- **Cold chain assessment and audit.**
- **Predictive modeling:** Provides predictions of the deterioration process.
- **Supply chain modeling:** Develops models and methodology for designing supply chains to optimize costs.
- **Automated data capture and processing:** Engineers onboard vehicle systems for automatic data capture.
- **Performance reporting and index:** Provides customer- and product-specific performance ratings.
- **Supply chain management technology:** Develops technologies and methodologies for visibility, tracking, and tracing.
- **Continuing education and certification:** Provides a learning center for cold chain participants.
- **Supply chain management technology showcase:** Demonstrates how technologies perform.
- **Sustainable energy management:** Assesses and correlates the impact to product quality of temperature management.
- **Risk and loss assessment and management:** Assesses vulnerabilities leading to product loss, quality deterioration and public health hazards.
- **Policy analysis:** Develops policies and models of success at regional, national and global levels for resilient and sustainable food chains.
- **Benchmarking and analytics:** Provides industry and best-in-class comparisons contributing to sustainable and resilient food chains. —*A.T.*

ers, processors, transportation providers, exporters, importers, wholesalers, distributors and retailers.

Currently, there are no cold chain standards to drive assurance and customer loyalty, adds Pacitti. "The costs of information have contributed to market failures in perishable product safety provisions, thus making the design of effective interventions difficult. Cold chain standards can reduce product safety risks and companies are seeking comprehensive answers to product integrity and supply chain effectiveness in light of the rapid rise in public health issues."

Pacitti reports that the Center will develop cold chain standards, processes and applications that will help overcome the expense of setting and monitoring levels of microbial food-borne pathogens and other product threats. "The Center will provide an economy of scale for solutions that the majority of perishable supply chain members would not be able to design or afford," he says.

Providing educational opportunities: Ferko at U.S. Foodservice reports his company intends to utilize the Center for educational opportunities and research partnerships.

"We have been looking for an academic partner for some time and the Center presents a solution for our team to enhance our performance. We would like to work with the Center to develop science-based metrics that measure food safety and quality within the cold chain," says Ferko. "We would also like to share some of the results of our own programs back to the Center, as I think there could be many valuable give-and-take opportunities between the industry and academia."

The Center expects to be on the cutting edge of advancing processes and technology, notes Owen at Supervalu. "We are always considering ways to further develop our associates, so the Center will offer us this great educational opportunity."

As a leader in supply chain and logistics, Georgia Tech also lends itself as a recruitment resource, he adds.

Griffith perceives the Center as an excellent source for educational opportunities for both herself and for members of her team at Wawa.

"We will use the Center as a resource for research on how to improve product quality throughout the cold chain. That might mean that they develop a standard for us of maximum temperature a product can reach before its quality begins to deteriorate or before we have a food safety issue," she says.

Informing regulations: The impact to the industry of government regulations will be another facet of the Center's research component, notes David Sterling, partner at Sterling Solutions.

"The amount of food safety regulations on the horizon could fundamentally impact how the industry does business. There is no true focal point for this kind of study today. The Center will be able to translate governmental regulations to indicate to the industry what the impact will be on their businesses," says Sterling. "Our goal is to be proactive and have a voice in governmental discussions as they relate to regulations."

Ferko at U.S. Foodservice notes: "Considering the ongoing regulatory activity focusing on food safety, it is especially important for the industry to take the lead. I think the Center will be an important partner in this endeavor."

Supervalu's Owen looks to the Center to examine best practices and best processes as they relate to regulations coming from various branches of the government. The industry can look to the Center to recommend regulations relative to food products sourced internationally, he adds.

Providing economical benefits: Of particular interest to Owen will be the methods the Center will develop to expand the cold life in the perishable portion of the grocery distribution business. "Applying these methods to our business and to the industry will be beneficial and will provide great economic value as well," he says.

'We deal with very sensitive products that need to be handled at critical temperatures and humidity. So anything that improves the process helps us all in the industry.'

—John Owens, Supervalu Inc.

Owen is also looking to the Center to discover ways for companies to lower their energy costs while maintaining cold chain integrity. "Many of our facilities of ours are very large and use a lot of electricity. We are always looking for ways to become more efficient."

Learning sustainability efficiencies: Ferko notes that sustainability aspects are a priority at U.S. Foodservice. He says the company was able to reduce the production of carbon dioxide by 22,000 metric tons in 2008. "We did this by simply reducing idle times, installing maximum speed controls, and routing deliveries more efficiently."

He adds that the company, involved in its own research projects, would like to work with the Center in developing other initiatives that reduce undesirable impacts on the environment. "We look forward to interactions between Georgia Tech, our company and the industry to find more of these kinds of environmental solutions."

Integration Articulation

Through the resources of the Center, improved applications can be brought to market a lot quicker. "Where you have consensus among different groups like government, private industry, and academia, this will provide a great resource for the industry to really be certain that we have the world's leading cold chain environment and that we are protecting food integrity all the way to the consumer," says Supervalu's Owen.

"I work very hard at Wawa to assure our cold chain is the very best we can provide, yet I know there are opportunities to improve," says Griffith. "Improvements will translate to increased shelf life, increased product quality, increased availability of products throughout the year to my consumers and increased consumer confidence that Wawa's products are high in quality. Of course, all of these things translate to a profit, which makes Wawa very happy."

The only other way to ensure safe food is to pasteurize or irradiate everything, notes Griffith. "But nobody wants to eat food that has been overprocessed. Going down that road is just not what the consumer wants. Everyone throughout the world wants the safest and freshest food possible. Having this Center as a resource will help us monitor and improve every aspect of the cold chain, and it will provide us with a deeper understanding of the processes that need to be implemented in order for the industry to manage and maintain an effective and efficient cold chain," she adds. ❀

For more information about the Georgia Tech Integrated Food Chain Center, go to www.sci.gatech.edu or call 404-894-2343. The Center can also be reached via email at ifc@sci.gatech.edu.