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Volume 22 Number 2
APRIL / MAY 2015

Food Quality & Safety

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Safety & Sanitation

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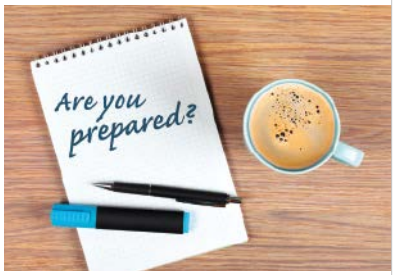

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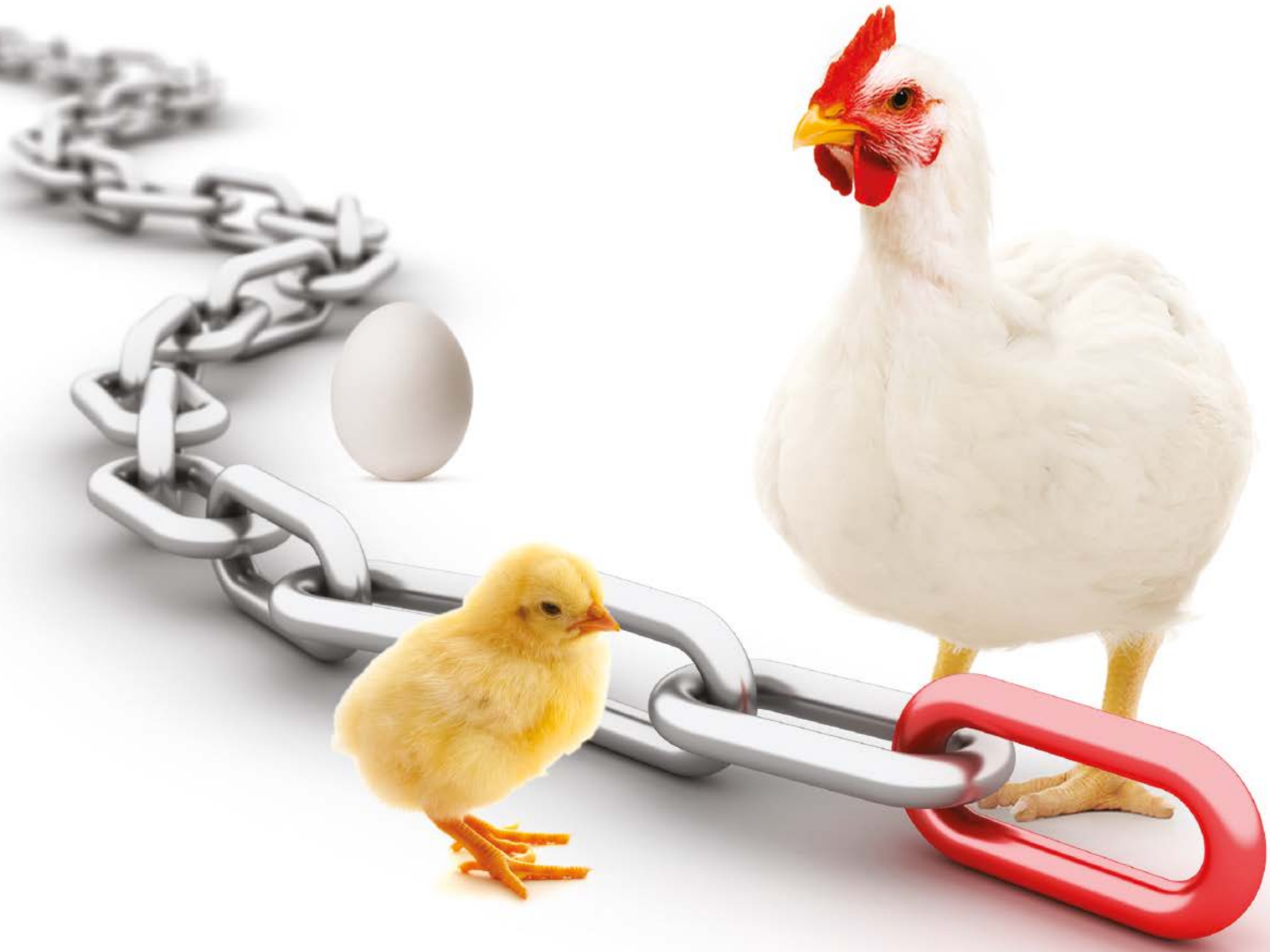

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From The Editor

The growing health concerns surrounding antibiotic-resistant bacteria are fueling the need for changes in food production. In fact, one of the world's biggest restaurant chains, McDonald's, made headlines in early March when it announced that its U.S. restaurants will gradually stop buying chicken raised with antibiotics.

Other food chains, like KFC, are feeling the pressure from consumer and environmental groups to follow suit and change the way its poultry are raised. The major retailer Costco has already decided to phase out the sale of antibiotic-infused meat at its stores.

The concern is that the overuse of antibiotics in animals may diminish their effectiveness in fighting disease in humans. Scientists say whenever an antibiotic is administered, it kills weaker bacteria and can enable the strongest to survive and multiply. When meat producers frequently use low-dose antibiotics, it can intensify that effect and create superbugs that might develop resistance to medically important antibiotics. According to the CDC, drug-resistant bacteria cause approximately 23,000 deaths and 2 million illnesses each year in the U.S.

These statistics are making the government take action. President Obama's FY2016 budget released earlier this year proposed nearly doubling the amount of federal funding for preventing antibiotic resistance to more than $1.2 billion. And at the end of March, the White House released a plan that identifies critical actions to be taken by key federal departments and agencies to stop the rise of antibiotic-resistant bacteria. The *National Action Plan for Combating Antibiotic-Resistant Bacteria*, which was developed by the interagency Task Force for Combating Antibiotic-Resistant Bacteria in response to Executive Order 13676: Combating Antibiotic-Resistant Bacteria, outlines steps for implementing the *National Strategy on Combating Antibiotic-Resistant Bacteria* and addressing the policy recommendations of the President's Council of Advisors on Science and Technology report on *Combating Antibiotic Resistance*. Specific activities over the next five years are targeted at controlling the spread of "superbugs" by the year 2020.

Although some are applauding the Administration's efforts in acknowledging the dangerous public health threat posed by antibiotic misuse, others think not enough is being done. In response to the recent *National Action Plan*, Mae Wu, health attorney at the Natural Resources Defense Council, states, "the Obama Administration needs to do more to reduce antibiotic use in animals that are not sick. The plan continues to allow the routine feeding of antibiotics to animals that live in the crowded conditions endemic to industrial farms."

Marian Zboraj
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FARM TO FORK SAFETY

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NEWS & NOTES

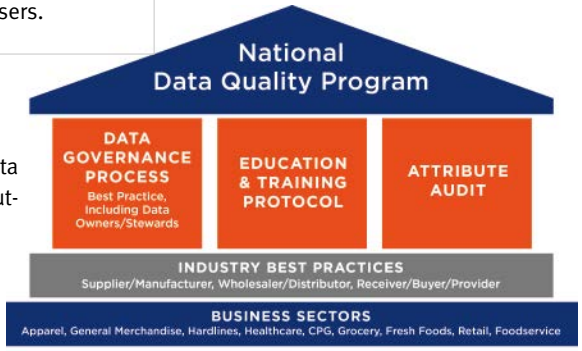
FDA and EPA to Share Data

The U.S. FDA and the EPA sign a Memorandum of Understanding to share data on pesticides and toxic substances. Memorandum establishes a process of disclosure of their respective databases to facilitate the decisions of each agency related to food safety, veterinary medicine, and cosmetics. This data sharing will provide up-to-date information and assist in coordinating reviews as sometimes a given substance may be regulated by both agencies. For example, a manufacturer of an antimicrobial food wash must prove to FDA that it doesn't adulterate food and might be required to prove to EPA it will not hurt the environment.

Updated FDA-iRISK Tool

The U.S. FDA releases FDA-iRISK 2.0, an enhanced version of the free web-based tool that helps users conduct their own quantitative risk assessments in support of food safety. FDA-iRISK 2.0 allows users to rank and compare risks and predict the effectiveness of prevention and control measures. Enhanced features include: advanced modeling methods, such as rare events and new dose-response modeling options; faster development of alternative scenarios; graphical representations of dose-response and variability in contamination and consumption to better understand and verify data; and data-sharing with other users.

Supporting Efficient Supply Chain Operations



The new GS1 US National Data Quality Program framework outlines the key components to help companies establish and sustain effective data quality programs based on GS1 Standards. It offers information about the assessment criteria and scoring for the three pillars of data quality: data governance process, education and training protocol, and attribute audit. It's developed for companies in consumer-packaged goods, grocery, fresh foods, retail and foodservice, and other industries. The program also enables each industry to add additional components to address industry-specific challenges.

Improved Method for Attributing Foodborne Illness

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The U.S. FDA, the CDC, and the USDA's FSIS have developed a method for analyzing outbreak data to determine which foods are responsible for illness related to four major foodborne bacteria. A report on the new method, titled "Foodborne Illness Source Attribution Estimates for *Salmonella, Escherichia coli* O157 (*E. coli* O157), *Listeria monocytogenes (Lm)*, and *Campylobacter* using Outbreak Surveillance Data," was produced by the Interagency Food Safety Analytics Collaboration (IFSAC)—a partnership of the three agencies. The report finds that more than 80% of *E. coli* O157 illnesses were attributed to beef and vegetable row crops, such as leafy vegetables. It also finds that *Salmonella* illnesses were broadly attributed across food commodities, with 77% of illnesses related to seeded vegetables (such as tomatoes), eggs, fruits, chicken, beef, sprouts, and pork. The agencies anticipate that IFSAC's work will enhance their efforts to prevent foodborne illness. The new estimates, combined with other data, may shape priorities and support the development of regulations and performance standards and measures, among other activities.

New Food Quality Alliance

The recently formed Food Quality Alliance is a consortium of food safety and quality service leaders working together to provide QA managers with a single source of over 40 testing, training, and certification services that include organic, kosher, gluten-free, non-GMO, and GFSI. It will unite products and services from: the Global ID Group (CERT ID, Genetic ID, and FoodChain ID), California Certified Organic Farmers, the Orthodox Union, and The Acheson Group LLC—a global risk and recall management expert for the food industry. The alliance also includes laboratory partners to offer an array of chemical and nutritional testing services.

Business Briefs

Quality Certification Services receives approval to conduct Harmonized Produce Safety Standard audits.

The national **Dykema** law firm launches its Food & Beverage Practice Group.

Silliker is rebranding to **Mérieux NutriSciences** as part of a global brand transition to be completed in 2015.

NSF International acquires **Erdmann Analytics** of Germany.

Bosch Packaging Technology expands its after-sales services support in Latin America with its regional service hub in São Paulo, Brazil.

Washington Report

Removing 'Food' From FDA

Amid budget wrangling, lawmakers and White House envision a new agency for food safety | BY **TED AGRES**

The Obama administration's recent proposal to remove food safety-related components from FDA and USDA's Food Safety and Inspection Service (FSIS) and consolidate them into a single new agency is unlikely to gain traction anytime soon, experts say. The proposal is included in FDA's Fiscal 2016 budget request, which seeks $1.3 billion in appropriated federal funds for food safety activities beginning Oct. 1, 2015 (a 9 percent increase of $109.5 million) and $206.2 million from food industry user fees ($191.8 million of it new). The net food safety increase would come to about $301.2 million, 25 percent more than at present.

The proposed new food safety agency would, like FDA, remain situated within the Department of Health and Human Services (HHS), which also houses the CDC and other public health agencies. (USDA is an independent agency and not part of HHS.) The proposed agency would have primary responsibility for food safety inspections, enforcement, applied research, and outbreak response and mitigation.

"The new agency would be charged with pursuing a modern, science-based food safety regulatory regime drawing on best practices of both agencies," the White House said in a budget document. It would also serve as the central point for coordinating with state and local agencies and would "rationalize the food safety regulatory regime and allow the federal government to better allocate resources and responsibilities."

While details have not been revealed, the concept has drawn mixed reactions from food industry experts, trade associations, lawmakers, and consumer groups. Some call it a good idea, but challenging to implement; others think it should be abandoned; and still others applaud the concept, but say it doesn't go far enough.

"The concept of a single food agency has been wrestled with for decades. People want greater efficiencies and would like to have more clarity in the food inspection process," says Craig W. Henry, PhD, vice president of business development for the Americas, Decernis LLC. "There are good reasons why a single food agency should happen, but there are a multitude of reasons why it would be very, very difficult to execute," he tells *Food Quality & Safety* magazine.

There are, for example, political turf issues at FDA and USDA. Other concerns include possible budget cuts, job losses, and funding reductions to the states. Pending Food Safety Modernization Act (FSMA) regulations will likely need to be addressed because they specify what are likely to become outdated regulatory and inspection processes. "It will be a pain both domestically and for everybody around the world," Dr. Henry says.

David Acheson, MD, founder and CEO of The Acheson Group and a former FDA associate commissioner for foods, supports the idea of a single agency. "But you would need a group of people to sit down and figure out what it might look like and how to structure it effectively," he adds.

Pizza the Poster Child

FDA has the lion's share of responsibility for food safety, overseeing about 80 percent of the nation's food products including produce, most seafood, dairy products, and shell eggs. FSIS oversees meat, poultry, processed eggs, and catfish. FSIS inspects manufacturers of packaged open-face meat or poultry sandwiches, while FDA inspects manufacturers of closed-face meat or poultry sandwiches. Manufactured frozen pizza has become the poster child of this fragmentation: A cheese pizza and its ingredients are regulated by FDA, but a pepperoni pizza is regulated by both agencies. The agencies differ in their inspection protocols: USDA inspectors are stationed at nearly every U.S. slaughterhouse, while FDA rarely inspects a facility unless a problem is reported or suspected. At ports of entry, FDA inspectors scrutinize less than 2 percent of shipments due to the sheer volume of imports.

This fragmented nature of the U.S. food safety system "has caused inconsistent oversight, ineffective coordination, and inefficient use of resources," concludes a recent report by the Government Accountability Office, the investigative arm of Congress. At least 30 laws related to food safety are administered by 15 federal agencies led by FDA and FSIS, but also involving the Environmental Protection Agency (pesticides and crops) and the National Oceanic and Atmospheric Administration (Seafood Inspection Program). While FDA and USDA coordinate some activities, "existing mech-

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anisms focus on specific issues and none provides for broad-based, centralized collaboration," the report says.

"I think it's a discussion worth having in terms of how we can best align the different components of government that are involved in food safety and what kind of an organizational structure would be necessary to best support that," outgoing FDA commissioner Margaret A. Hamburg, MD, told a House Appropriations subcommittee in March. Agriculture Secretary Tom Vilsack said Congress needs to give the Obama administration authority to reorganize the agencies. "This is a new way of thinking. The point of this is to get this [reorganization proposal] on the table so people can have a conversation about it," Vilsak told reporters at a USDA budget briefing in February.

But Senate Agriculture Committee Chairman Pat Roberts, R-KS, signaled early opposition. "In this tough economy, the last thing producers and consumers need is more red tape," Roberts said in a statement. Many agricultural and food industry groups have also expressed concern over the administration's proposal. Western Growers, an association representing half of the U.S. produce industry, believes the reorganization would pose a "major distraction" because key FSMA regulations are still being finalized. Similar sentiments were expressed by the National Milk Producers Federation and the National Cattleman's Beef Association.

On the other hand, many consumer advocacy groups support the consolidation effort. "Our current food systems are redundant and fragmented," says National Consumers League executive director Sally Greenberg. The administration's proposal to consolidate the responsibilities of FSIS and FDA "will ensure cohesive practices and superior response times in the event of an outbreak, ultimately keeping consumers and our food supply safer," she says.

But other groups think the proposal doesn't go far enough, and support the creation of an independent agency. HHS is a massive organization, says Christopher Waldrop, director of the Food Policy Institute at Consumer Federation of America. "A new food safety agency would be lost among the other priorities of the department, and would likely not receive the recognition or resources necessary for it to be effective," Waldrop says. And because FDA is also implementing FSMA, consolidation efforts "would seriously undermine FDA's implementation activities and hamper efforts to prevent consumers from becoming sick from contaminated food," he adds, supporting the establishment of a new independent food safety agency.

Along these lines, Democratic lawmakers Rep. Rosa DeLauro of Connecticut and Sen. Richard Durbin of Illinois have reintroduced legislation that would remove the food safety inspections, enforcement, labeling, and research responsibilities from FDA and USDA and merge them into a new independent agency to be called the Food Safety Administration. The lawmakers introduced the Safe Food Act of 2015 in the House (HR-609) and Senate (S-287) in January. The 90-page bill mirrors legislation that DeLauro and Durbin introduced four times previously in 1999, 2004, 2005, and 2007.

The Food Safety Administration would also have authority for mandatory recall of unsafe food; require risk assessments and preventive control plans to reduce adulteration; authorize enforcement actions to strengthen contaminant performance standards; improve foreign food import inspections; and require full food traceability to better identify sources of outbreaks.

As of publication time, the bill has attracted only 11 cosponsors in the House and three in the Senate—all of them Democrats—and is considered unlikely to gain traction this time around. "The bill was not written in a way to allow it to move forward," Dr. Acheson says. "It includes little detail on how the transfer and consolidation would work. In fact, details are turned over to an administrator to determine within 180 days after enactment. There is just no way this will happen and the resulting product be well thought out and practical," says Dr. Acheson. DeLauro and Durbin also support the Obama administration's HHS consolidation approach as being a step in the right direction.

Budget Wrangling Begins

FDA's overall Fiscal 2016 budget request totals $4.9 billion, a 9 percent increase. "This is the largest FDA request in recent history. [It] will be tough to swallow," said House Appropriations Committee chairman Rep. Hal Rogers (R-KY) during an FDA budget hearing in March. Dr. Hamburg told him that not getting the requested funding will result in fragmented food safety efforts. "We do need real money to get the job done. If we make this investment, it will benefit all," she said.

Of the agency's $109.5 million requested increase for food safety, $32 million would go to build a national integrated food safety system. This includes grants and cooperative agreements for additional facility inspection training for about 1,000 state and local inspectors, especially to implement the new preventive controls rules in late 2016. An additional $25 million would go to train a cadre of more than 2,000 existing FDA inspectors, compliance officers, and other food safety staff. Yet another $25.5 million would be used to implement the Foreign Supplier Verification Program, including training of more than 400 current investigative and compliance personnel and the hiring of more staff.

"Why do we need this money? Because a lot of work must be done right now to ensure that the FSMA rules are implemented smoothly and effectively in late 2016 and 2017," said Michael R. Taylor, JD, FDA deputy commissioner for foods and veterinary medicine. "The bottom line is that without investment now, and sustained funding afterwards, there is the risk that the implementation of FSMA will be uneven or even delayed. This would be bad for everyone, including those who must meet the new standards and those who must enforce them," Taylor said in an online posting.

A significant portion of FDA's new funding would come from food industry user fees (increasing from $14.4 million to $206.2 million). These include a food facility registration and inspection fee to fund agency activities related to FSMA, and a food import fee. While drug and medical device manufacturers pay FDA user fees, they receive expedited product reviews in exchange. The food industry generally opposes user fees and Congress has consistently refused to appropriate them. A group of about 60 food industry associations signed a letter in February to leaders of the House and Senate appropriations committees urging lawmakers to appropriate all of FDA's funding and not saddle industry with additional burdens. ■

Agres is a freelance writer based in Laurel, Md. Reach him at tedagres@yahoo.com.

Industry Insights

Blowing the Whistle on Wrong-doings

By speaking out about contaminated peanut products, a whistleblower helped federal authorities identify the source of a major *Salmonella* outbreak

BY **DARIN DETWILER, M.A.ED**

Editor's Note: *This is the second in a three-part account of a 2008-2009 nationwide food safety crisis.*

Hugh Parnell Sr. founded Peanut Corporation of America (PCA), originally named Parnell's Peanuts, in Gorman, Texas during the late 1970s. The company provided its products to bakeries and manufacturers of candy, ice cream, and snacks, and also directly to consumers. The company caught the eye of the FDA in 1990 when the agency found that PCA was distributing peanuts with unacceptable levels of aflatoxins—a potential risk to public health caused by mold that grows in nuts and seeds. Two years later, the American Candy Company sued PCA for lost inventory that included nuts because PCA falsely claimed that its product was free of aflatoxins.

In 2000, Hugh's son, Stewart Parnell, who owned a peanut plant in Blakely, Ga., decided to purchase the Gorman facility and within three years of ownership, he successfully tripled PCA's revenue. By 2005, Stewart Parnell was able to add facilities in Suffolk, Va. and Plainview, Texas. However, his success hit a roadblock in January 2006 when Nestlé completed an onsite audit of PCA's Plainview plant, giving it a "Does Not Meet Standards" score on nearly all 40 inspection areas.

An Eyewitness in the Plainview Peanut Plant

Several months after it failed the audit, PCA hired Kenneth Kendrick to serve as its assistant plant manager at the Plainview plant.

"When I was working there, [PCA had] nothing that resembled a quality assurance program," says Kendrick. "I came from a lab testing background in the meat industry. I thought there would be regular testing, like in the meat industry..."

Kendrick claims he immediately observed numerous problems in the plant, including rat infestations and roof leaks, both of which triggered his concern for feces in the product. According to Kendrick, "particularly with water leaking off a roof, bird feces can wash in and drip onto the peanuts."

A second Nestlé audit was scheduled for July 2006, but Kendrick commented to his plant manager that there was no way Nestlé would certify PCA with all its issues. As a result, Danny Kilgore, operations manager from PCA's facility in Georgia, flew out to the Plainview plant two days before Nestlé's second audit to allegedly hide the problems.

"Kilgore, Parnell, and everyone else in the plant were frantically patching holes in the walls, hiding roof leaks, pumping water out of the basement, and cleaning out mice traps (so the pest control guy would have a lower count)," according to Kendrick. In addition, Kilgore had Kendrick rewrite the food safety and quality assurance policies as Kendrick recalls, "at the time, nobody at PCA knew any of the *Salmonella* standards as they applied to peanuts."

While the second audit resulted in notations of "Much Improvement," the plant still did not pass Nestlé's inspection. Kilgore suggested to Kendrick that, in lieu of a third audit, Nestlé might look at improvements made after the July 2006 audit and approve PCA as a supplier. According to Kendrick, Kilgore insinuated that "microwaving the test sponges used for monitoring dangerous pathogens might gain better results and if PCA gained Nestlé's business, [Kendrick] might get a raise in pay."

Nestlé never did business with PCA; however, Frito-Lay and Kellogg's did purchase large amounts of peanuts from the company. These and other smaller companies decided to purchase products from PCA based upon inspections conducted by a third-party auditor that gave PCA the highest possible rating.

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From an Eyewitness to a Whistleblower

By late 2006, Kendrick claims he sent numerous anonymous emails and letters to the Texas Department of State Health Services and to companies that purchased products from the Plainview plant, but he never received a response. Then, after only a few months on the job, Kendrick left his position with PCA because as he put it, "I knew it was a train wreck and something unethical and bad was about to happen."

PCA began recalling its products in January 2009, which were ingredients in more than 3,500 foods produced by numerous companies.

Three years later while working at an orthopedic implants facility, Kendrick learned of the widespread *Salmonella* outbreak that traced to PCA's Georgia plant. He spent "hundreds of hours" trying to contact the media and federal food or health agencies to get attention placed on the Plainview plant. The only response he received was from the Chicago office of STOP Foodborne Illness, a non-profit food safety organization. Kendrick received a phone call from Donna Rosenbaum, the organization's CEO at the time, and Nancy Donley, a food safety advocate who lost her own son to *E. coli* some years earlier.

The leaders at STOP listened to Kendrick's story and his observations. They followed up by verifying his information with an anonymous employee from the Texas plant. STOP then offered to help by getting Kendrick in touch with the media and FDA investigators.

Kendrick soon appeared on ABC's *Good Morning America* after *The New York Times* published an article about the peanut plant based on his descriptions. However, by these and other news outlets incorrectly calling Kendrick the "plant manager" as opposed to his real title of "assistant plant manager," the media casted doubt on his motives, implying he was only coming forward to save himself since he was the so-called plant manager.

On a positive note, investigators from the FDA did set up a personal meeting with Kendrick to get his side of the story. Kendrick gave them copies of some emails he had sent to companies. He told of the lies that PCA's owner, Stewart Parnell, was selling the public. According to Kendrick, Stewart Parnell knowingly made false statements about how the peanut plant engaged in testing all the time. "What Parnell was saying was just not true," claims Kendrick. "Parnell would only do testing when a buyer requested one, and by 'testing' I mean that Parnell had an office worker simply change the dates on recent inspection sheets."

Kendrick also revealed how PCA was shipping product between production plants in different states. According to Kendrick, peanut meal, a sawdust-like product from chopping nuts, sat for over a year in large material containers until a full truckload was gathered—for the sake of saving money—before being shipped to Georgia for processing into peanut butter. He also said that the manager ordered employees to sweep the year-long collection of dust and rat feces off the containers so that they didn't look so bad upon arrival.

Kendrick even drew the FDA maps of the Plainview plant to show exactly where to find holes in the roof, evidence of the flooded basement, and where the dead rats could be found in a false ceiling. With this information, federal and state authorities found the evidence they needed to pressure PCA to shut down the Plainview plant.

The CDC was also able to link the facility to the multi-state *Salmonella* outbreak that sickened 714 consumers in 46 states and caused the deaths of nine people between 2008 and 2009. PCA began recalling its products in January 2009, which were ingredients in more than 3,500 foods produced by numerous companies.

The Food Truth Movement

The Government Accountability Project's Food Integrity Campaign aims to protect and empower employees who speak out against waste, fraud, abuse, or violations of law along the food supply chain. Through its website, www.Food-Whistleblower.org, whistleblowers can find out what legal rights they have, get details on the relevant laws, and decide whether to request legal assistance. There's also a list of tips for individuals considering blowing the whistle.—*FQ&S*

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The Aftermath

On Feb. 13, 2009, PCA filed for bankruptcy. Four years later, the U.S. Department of Justice indicted the following four PCA executives on 76 criminal charges related to adulterated and misbranded products that reached interstate commerce: Stewart Parnell, owner; Michael Parnell, peanut broker; Mary Wilkerson, former quality control manager; and Daniel Kilgore, former operations manager at the Blakely, Ga. facility. Though the Department of Justice never called Kendrick to testify against PCA, he was satisfied that Parnell was indeed found guilty.

After being terminated from his job at the orthopedic implants facility following a hospitalization for severe depression, Kendrick has not held a significant job in the six years since he gained the label of a "whistleblower." However, he has assisted a national project to help protect future whistleblowers. Even though acting as a whistleblower negatively impacted his professional and personal life, Kendrick understands what he did was for a larger cause and that had he not spoken up, the guilty parties may have gotten away with their crimes. ■

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Around The World

Europe Food for Thought: So Much Thought for Food

Diversity in cuisines and shared food safety priorities characterize this historic continent

BY **LINDA L. LEAKE, MS**

Editor's Note: *This is the third in a six-part series of articles that will showcase food quality, safety, and regulatory issues of each continent.*

Be it amazing apple strudel in Austria, fabulous fish and chips in the U.K., savory smørrebrød in Denmark, tasty tapas in Spain, or "zelicious" zabaglione in Italy, Europe abounds from A to Z with a rich and vibrant culinary culture as diverse as its 50-some countries. The birthplace of Western culture, Europe has played a dominant role in global affairs for several centuries, so it's no surprise this dynamic continent famous for great food is a world leader in food quality and safety today.

"Even though not all European countries are part of the EU (European Union), the EU and the entire continent of Europe are nearly synonyms in terms of food safety ambitions, if you exclude Russia," says Ivar Vågsholm, DVM, PhD, a professor of food safety in the Department of Biomedicine and Veterinary Public Health at the Swedish University of Agricultural Sciences, Uppsala, Sweden.

Emphasizing that he does not speak for Russia, Dr. Vågsholm explains that it appears that Russia puts more emphasis on testing finished foods rather than on process control during food production, the latter being more commonplace in the rest of Europe. "This highlights the need for discussions on equivalence between the two food safety philosophies," he emphasizes.

Dr. Vågsholm believes the strengths of the European food system include a holistic approach from farm to fork, separation of risk assessment and management, and prohibition of animal feed antibiotics. "The same system applies in the whole of the EU, as well as in neighboring closely associated third countries, including my native Norway, Switzerland, and Serbia," he says.

Topping the list of weaknesses in the European food system, Dr. Vågsholm purports, is the large and long movements of live animals for slaughter, which results in animal welfare concerns and rapid spread of animal diseases. "These issues include long transportation times resulting in stress of animals, and larger risks of spreading diseases, such as classical swine fever," he says.

Bad Bugs

The main food safety issues in the EU, Dr. Vågsholm says, relate to foodborne *Campylobacter* and *Salmonella*, while an emerging issue is antimicrobial resistant bacteria as a foodborne hazard, based on findings of extended-spectrum beta-lactamase (ESBL) producing *E. coli* in broilers and methicillin-resistant *Staphylococcus aureus* (MRSA) infection amongst pigs.

Of note, studies from the Netherlands have found clonally related ESBL-producing *E. coli* and similar plasmids in broilers, broiler meat, and humans, suggesting broiler meat as a source of ESBL-producing *E. coli* causing infection in humans.

"MRSA is more of an occupational health problem for people working with pigs and possibly also an environmental health problem, rather than a foodborne risk," Dr. Vågsholm points out.

From a human disease burden perspective, *Listeria* and *Toxoplasma* are also a concern, Dr. Vågsholm says, adding that enterohemorrhagic *E. coli* (EHEC) has been an issue associated with large outbreaks linked to sprouted seeds and to beef, both uncooked and undercooked.

According to Dr. Vågsholm, *Salmonella* is dealt with using binding microbiological end product criteria (absence in 25 grams) in foodstuffs (as per Regulation EU 2073/2005). "In primary produc-

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tion, *Salmonella* is dealt with by formulating targets for acceptable prevalences in flocks or at slaughter for broilers, turkeys, and layers," he relates. "There may soon be regulatory targets for acceptable prevalences in slaughter pigs either at the slaughter house or at herd level, depending on the assessment of benefits and costs and political priorities."

Campylobacter is addressed with various national guidelines, along with catering and consumer recommendations for kitchen hygiene and cooking. "In the Nordic countries and the Netherlands there are initiatives for *Campylobacter* control, but there are no binding EU community regulations thus far," Dr. Vågsholm says. "There are ongoing discussions by the EU member states and the European Commission (EC) on the issue of establishing regulations for *Campylobacter*, however."

Listeria is subject to binding microbiological criteria in foodstuffs (Regulation EU 2073/2005) (absence in 25 grams) on the date of production, Dr. Vågsholm mentions. "For some foodstuffs, the criterion at the end of shelf life is less than 100 colony-forming units (cfu) per gram," he says. "This last criterion is to avoid wasting a lot of safe foodstuffs."

Listeria is hard to explain simply, Dr. Vågsholm adds. "The simple version is that no *Listeria* should be found on the date of production, interpreted as absence in a 25-gram sample, while at the end of the shelf life there should be no more than 100 cfu per gram sample," he explains.

Toxoplasma is dealt with by recommendations to risk groups, typically pregnant women and persons with immunosuppression, usually by national public health agencies of the EU. There is no agreement on the need for EU initiatives to control *Toxoplasma* in food producing animals.

"EHEC is being discussed by the EC and the EU member states," Dr. Vågsholm says. "Currently the control measures are at slaughter, including the process hygiene criteria for carcasses, and for minced beef for *E. coli*, and also by end-product criteria for sprouted seeds, as per Regulation EU 2073/2005."

Foodborne Illness Stats

Based on an analysis of information submitted by 28 EU member states and four non-member countries on the occurrence of zoonoses and foodborne outbreaks in 2013, the European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control (ECDC) published on Jan. 28, 2015 that campylobacteriosis was the most commonly reported zoonosis.

As per the EFSA/ECDC's latest annual report, "The European Union Summary Report on Trends and Sources of Zoonoses, Zoonotic Agents and Food-borne Outbreaks in 2013," *Campylobacter*, in fact, continued to be the most commonly reported gastrointestinal bacterial pathogen in humans in the EU and has been so since 2005. Specifically, the number of reported confirmed cases of human campylobacteriosis was 214,779 in 2013, with an EU notification rate of 64.8 per 100,000

population, which was at the same level as in 2012. Considering the high number of human campylobacteriosis cases, the severity in terms of reported case fatality was deemed to be low (0.05 percent).

According to EFSA/ECDC, a total of 82,694 confirmed salmonellosis cases were reported by 27 EU member states in 2013, resulting in an EU notification rate of 20.4 cases per 100,000 population. Fifty-nine fatal cases were reported by nine member states among the 14 member states that provided data on the outcome of their cases. This results in an EU case-fatality rate of 0.14 percent among the 40,976 confirmed cases for which this information was available.

The EFSA/ECDC reported that 27 member states had 1,763 confirmed human cases of listeriosis in 2013. The EU notification rate was 0.44 cases per 100,000 population, which represented an 8.6 percent increase compared with 2012. Sadly, 191 deaths due to listeriosis were reported with France reporting the highest number, 64 cases. The EU case-fatality rate was 15.6 percent among the 1,228 confirmed cases with known outcome.

A total of 13 *Listeria* outbreaks were reported by seven member states and one non-member state in 2013, which was reported as slightly higher than in the previous years. Eight of the outbreaks reported in 2013 were supported by strong evidence, where crustaceans, shellfish and mollusks, and products thereof, were implicated in three outbreaks.

According to EFSA/ECDC, 6,043 confirmed cases of verocytotoxigenic *E. coli* (VTEC) infections were reported in 2013. The EU notification rate was 1.59 cases per 100,000 population, which was 5.9 percent higher than in 2012. There were also 13 reported deaths due to VTEC infection, which resulted in an EU case-fatality rate of 0.36 percent among the 3,582 confirmed cases for which this information was provided.

Biohazard Toolbox

In light of ongoing concerns over biological contamination issues, EFSA recently asked its Panel on Biological Hazards (BIOHAZ) to evaluate the performance and data requirements of the available risk ranking tools, investigate methodologies for introducing uncertainty and variability in the risk ranking models, and design and develop a risk ranking toolbox for the BIOHAZ Panel.

Effective Jan. 15, 2015, the BIOHAZ Panel identified eight tools relevant to risk ranking applications of biological hazards in food. These are decision trees; the U.S. FDA risk ranking tool: the pathogen–produce pair attribution risk ranking tool (P3ARRT); the EFSA food of non-animal origin risk ranking tool (EFoNAO-RRT); Risk Ranger; microHibro; swift quantitative microbiological risk assessment (sQMRA); FDA-iRISK; and the ECDC Burden of Communicable Diseases in Europe (BCoDE) toolkit.

"The toolbox is primarily intended for experts of the Panel on Biological Hazards, but could also be used by EFSA's other panels and national food safety authorities, as it will support a timely and transparent risk ranking in many food applications," says Ernesto Liebana Criado, PhD, the acting head of the EFSA Biological Hazards and Contaminants Unit. "Moreover, experts have also assessed the available risk rank-

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ing tools and investigated how uncertainty can be taken into account in risk ranking models."

In a parallel exercise, experts have additionally developed a simple decision tool (different from the eight proper risk ranking tools in the toolbox) that will help risk managers and risk assessors select the most appropriate methodology depending on the risk ranking question, according to Caroline Merten, a scientific officer with EFSA's Scientific Committee and Emerging Risks Unit who coordinated the exercise.

"This additional decision tool was developed separately by an external contractor, covering not only microbiological but also chemical and nutritional hazards," Merten explains. "The difference lies in that this decision tool concerns the choice of methodology, while the BIOHAZ Panel report on risk ranking toolbox is more specific, as it evaluates existing tools for microbiological hazards instead of methodologies for a broader range of hazards."

Trade Issues

Relative to the impact of the Food Safety Modernization Act and U.S. food regulations on food production in Europe as related to European exports to the U.S., Dr. Vågsholm says there is current discussion in the EU on the equivalence of the different food safety risk management philosophies.

"This is now an issue with the Transatlantic Trade and Investment Partnership (TTIP), the proposed free trade agreement between the EU and the U.S.," he relates. "Issues of contention appear to include the use of decontaminants such as chlorine on broiler carcasses, which the EU thinks is wrong, while acceptable in the U.S., and the sale of unpasteurized milk products, most notably soft cheeses, brie and camber, which the EU permits subject to hygiene regulations, while apparently the U.S. is not in favor of. The idea in the TTIP talks is that each side should be able to keep their rules, while recognizing the achievements of the other side."

Concerning the TTIP, Dr. Vågsholm is quick to point out that food safety should be one of the easier of the difficult issues to resolve. "The key is that the EU and U.S. need to have a good mechanism for agreeing on the scientific facts, which can then be the basis of discussing equivalence or compensating measures," he says. ■

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For bonus content, go to April/May 2015 issue on www.foodqualityandsafety.com and click on "Food Safety in Europe."

Food Fraud: A Criminal Activity

Implementing preventative measures that increase difficulty in carrying out the crime

BY **DON HSIEH**

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Food fraud is the deliberate and intentional substitution, addition, tampering, or misrepresentation of food, food ingredients, or food packaging for economic gain and it is a growing problem in the U.S.

The Grocery Manufacturers Association estimates that economic adulteration and counterfeiting of global food and consumer products costs the industry $10 to $15 billion per year. In addition, the cost of one adulteration incident averages between two to 15 percent of yearly revenues.

Although food fraud has been around for thousands of years, it has only recently gained academic and regulatory interest due to the increasing global impact of some high profile cases. For example, the widespread coverage of the melamine adulteration. In addition, the General Office of Accountability 2009 report on seafood fraud signaled an increased awareness of the crime.

The melamine contamination of infant formula resulted in a $10 billion price tag and affected more than 300,000 babies around the world, hospitalizing more than 50,000 of them.

An unauthorized person could steal labels then place them on a substandard product for economic gain.

In response, the U.S. Pharmacopeia Convention, or USP, began building a Food Fraud Database in 2012. It compiles both "scholarly" and "media" records from 1980 onwards, and it now contains more than 2,000 records of food fraud.

Targeting Organics

A growing number of consumers are willing to pay a premium for fruits, vegetables, and other foods labeled "organic." According to the Organic Trade Association, sales of organic products in the U.S. jumped to $35.1 billion in 2013, up 11.5 percent from the previous year's $31.5 billion and the fastest growth rate in five years.

Since organic food can tout prices often twice as high as conventionally produced food, the risk for fraudulent labeling has grown just as fast. In addition, it is more difficult to identify organic food fraud. Currently, the most reliable authentication technique analyzes the stable isotope composition of nitrogen, and while techniques like nuclear magnetic resonance spectroscopy are being tested, nothing is fool proof. There is a lot of headway the industry can make in this area.

Common Fraudulent Foods

The first step in battling food fraud is understanding which foods are most commonly misrepresented. The Congressional Research Service compiled a top 10 list.

1. Olive Oil. Almost 70 percent of extra virgin olive oil is said to be adulterated. Higher priced extra virgin oil is often substituted with a lower cost regular olive oil or sold or thinned out with alternative oils, such as hazelnut, soybean, corn, peanut, sunflower, safflower, walnut, vegetable, canola or palm oil, and in one case, even lard.

2. Milk. In some cases, milk was found to contain vegetable oil, whey, caustic soda, cane sugar, detergent, and even toxic compounds like melamine and formaldehyde.

3. Honey. This sometimes is a mix of high-fructose corn syrup, sucrose syrup, invert beet sugar, water, and essential oils.

4. Saffron. It may be the world's most expensive spice, but in many cases, you

aren't getting the real thing. It often contains adulterants, such as glycerin, sandalwood dust, tartrazine (yellow dye), barium sulfate, borax, marigold flowers, and colored corn strings.

5. Orange juice. It may contain lemon juice, sugar water, paprika extract, marigold flower extract, and a synthetic sugar/acid mixture.

6. Coffee. In some cases, coffee contains roasted corn, ground parchment, barley, coffee twigs, potato flower, malt, chicory, and caramel.

7. Apple juice. It likely contains corn syrup, raisin sweetener, malic acid, beet sugar, and other juices, such as grape, pineapple, pear, and fig.

8. Tea. This can have a variety of issues. For example, inside the tea bag could be sand, sawdust, starch, China clay, used tealeaves, and color additives. However, the problems do not stop there. Tea bags are made with plastic, such as nylon, thermoplastic, polyvinyl chloride, or polypropylene. This could allow the bags to leach compounds of unknown health hazards into consumers' tea when steeped in boiling water.

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9. Fish. Higher value fish is substituted with lower cost, more abundant fish varieties. A study by Oceana checked seafood samples from popular California sushi venues, grocery stores, and restaurants and found more than half of the fish was mislabeled: snapper was tilefish and white tuna or expensive ono was replaced 62 percent of the time with escolar.

10. Black pepper. This spice can be altered with juniper berries, papaya seeds, starch, buckwheat flour, and millet seeds.

Other commonly altered foods include turmeric chili powder, cooking oil, shrimp, lemon juice, and maple syrup. The common threads, whether fraud in milk or fish, are alterations that are difficult to detect and offer high potential for financial gain.

Types of Fraud

There are also a number of ways in which foods become fraudulent. Michigan State University identified the following food fraud incident types.

Adulteration: occurs when a component of the finished product is fraudulent (for example, adding melamine to milk).

Tampering: occurs when legitimate products and packaging are used in a fraudulent way; this could be through changing expiration dates or product up-labeling.

Over-run: a legitimate product is made in excess of production agreements.

Theft: a legitimate product is stolen and passed off as legitimately procured.

Diversion: the sale or distribution of legitimate products outside of intended markets.

Simulation: an illegitimate product is designed to look like but not exactly copy the legitimate product.

Counterfeiting: intellectual property rights infringement, which could include

Since organic food can tout prices often twice as high as conventionally produced food, the risk for fraudulent labeling has grown just as fast.

all aspects of the fraudulent product and packaging being fully replicated.

Consequences

Food fraud affects both consumers and food manufacturers. For consumers, one of the biggest concerns is health risk. While not all food fraud results in a public health risk, any act involving intentional adulteration of food has the potential to harm. From something as minor as a local fish market substituting a more expensive fish for a different type of seafood to something as widespread as the horsemeat scandal in Europe.

One of the most significant impacts of food fraud that affects both consumers and food manufacturers boils down to loss of consumer trust. A recent example of this is the horsemeat scandal in the European Union. This occurred when items advertised as 100 percent beef were in fact horsemeat. Market researcher Mintel found that six months after the scandal hit, only half of all Brits trusted the food industry to provide safe food to eat. Eighteen percent of consumers who had previously purchased ready meals labeled as beef said they would avoid ready meals with beef as a result of the scandal, while 10 percent said they will now avoid any frozen ready meals altogether.

Prevention

Since food fraud at its root is a criminal activity, companies need to combat food fraud by implementing preventive measures that increase the likelihood of detection or the difficulty in carrying out the crime. Organizations should consider a food defense strategy that addresses the entire food supply chain through the four

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The Cumin Scandal: Accidental or Fraudulent

BY **TED AGRES**

The recent recall of cumin and cumin-containing foods due to undeclared peanuts or almonds is almost certainly the result of purposeful economically motivated adulteration (EMA), food safety experts believe. Since late last year, food agencies in the U.S., Europe, and Canada have been tracking and reporting what the FDA calls the "largest recall of an allergen in spice." About 700 different products have been recalled by more than 40 manufacturers and retailers, including Goya Foods and Whole Foods, in the U.S. alone since late last year.

"Although we don't know who the bad guys are yet, it appears clear the motivation for the incident is economic gain, and that's clearly food fraud," says John Spink, PhD, director, Food Fraud Initiative, Michigan State University. David Acheson, MD, founder and CEO of The Acheson Group and a former FDA associate commissioner for foods, agrees. "I am 80%-plus confident that this is deliberate contamination. I can't explain it otherwise," he says.

"This is likely to be one of the largest allergen recalls ever because spice mix becomes part of a sundry of products and the multiplier effect—the domino effect—is inevitable," Craig W. Henry, PhD, vice president of business development for the Americas, Decernis LLC, tells *Food Quality & Safety*.

The geographic source of the adulteration is thus far unknown, but speculation centers on Turkey and India, the latter producing three-quarters of the world's cumin supply. Higher-than-normal temperatures there have decimated the current cumin crop, with yields expected to be 40% to 50% less than those of past harvests. Prices have skyrocketed as a result. Dr. Acheson and others suspect that suppliers there have added ground peanut shells and almond husks to "bulk up" ground cumin. "Adding just 1 % peanut shells at zero cost is essentially a profit of $350 to $400 on a sale of 10 tons of ground cumin," Dr. Acheson says. "Not a bad margin at zero cost for the grinder to put in their pocket."

Recent laboratory testing of cumin samples has found a range of contamination. Tests performed by Neogen Corp. found contamination levels ranging from zero to 4.6 ppm total peanut to more than 5,000 ppm, or 0.5%, says Tony Lupo, director of technical services. Other labs have found even higher levels. "When they back calculate the peanut content in the cumin itself based on the inclusion rate in the recipe, it can be concluded that the cumin contained greater than 100,000 ppm or 10%," Lupo tells *Food Quality & Safety* magazine. "Such levels, even when diluted in finished foods, are still well above published reference doses for many peanut allergic individuals."

There is no requirement that cumin or other spices be specifically identified on product labels. FDA issued a consumer advisory in February cautioning people with peanut allergy to avoid products containing ground cumin or cumin powder.

"My instincts are that this is a real EMA situation," Dr. Acheson says. "My advice to all those using cumin—and other spices that could be part of this EMA thinking—is to start testing incoming ingredients for allergens." He also recommends companies seek to trace back their spice supply chains as far as possible. But "the tracebacks that I have personal knowledge of go a certain distance back and every vendor says they don't have peanuts or almonds in their facility. So we don't know where they came from," he says.

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To read this story in its entirety, go to the current April/May issue at www.foodqualityandsafety.com.

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A's of actionable food defense: assess, access, alert, and audit.

First, businesses should *assess* the risks throughout their supply chains. Start by conducting a vulnerability assessment of critical control points to identify where someone could attempt product adulteration—with a special focus on upstream suppliers, not only direct suppliers, but suppliers to those suppliers.

Second, organizations should consider who has *access* to critical control points. In particular, they should pay close attention to who has access to labels to protect against counterfeiting and fraud. An unauthorized person could steal labels then place them on a substandard product for economic gain, putting both product safety and brand reputation at risk. Securing of cargo in transportation also should be a critical focus of a food fraud program,

One of the most significant impacts of food fraud that affects both consumers and food manufacturers boils down to loss of consumer trust.

as product could be stolen, diluted, or otherwise adulterated, and then sold, again causing risk.

Organizations should then employ technology to *alert* appropriate individuals of heightened food fraud risks. In this phase, response time is critical. Monitor the prices of the commodities and ingredients used, and have alerts set if they spike in price. Pay particular attention to products that are highly profitable and easily or commonly adulterated. To minimize risk, have a system in place to send alerts as quickly as possible should an adulteration be detected. Every passing minute is a minute when more health risks could develop, which lead to a greater chance of negative impacts on brands and most importantly public safety.

Lastly, organizations should *audit* operational and regulatory compliance to ensure and maintain best food defense practices and provide documentation of compliance to regulators. In 2015, several of the FDA's Food Safety Modernization Act (FSMA) rules will begin to be enforced and businesses will be required to document that they are following these types of practices. FSMA promotes the safety of the U.S. food supply by focusing on prevention, rather than reactive response. However, prevention is only as effective as the actual compliance processes put in place. Regular and random auditing using remote video technology can go a long way in confirming that appropriate preventative measures are in place and working.

Be Cognizant

In one of the most recent cases, Interpol, the international criminal police organization, announced that it seized more than 2,000 tons of fake food in 47 countries in a joint operation with Europol over the course of two months in early 2015.

In the seizure, Italy had 31 tons of seafood labeled as "fresh" but had actually been previously frozen. The fraudsters doused the fish with a chemical containing citric acid and hydrogen peroxide to hide that it was rotting.

The issue is just as prominent here in the U.S. as it is abroad. In the same seizure, the FDA found that illegal dietary supplements were being sent through the mail. The crackdown, known as Operation Opson IV, is the largest effort of the agencies to target fraudulent food. All of it was seized in markets, airports seaports, and shops both in the U.S. and abroad.

Food fraud is happening all around us, and while there's no one singular step a business can take to avoid it, it's important to be aware of the common areas where it happens and build a plan to create as many obstacles as possible to deter the crime. In the end, this will not only help to ensure the company's brand avoids being tarnished, but it may also end up saving lives. ■

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THE SCARLET LETTER OF FOOD INDUSTRY: ADULTERATED GOODS

The development of better supplier visibility and collaboration through automated solutions will prevent food fraud and its serious repercussions

BY **KELLY KUCHINSKI**

The food industry has been coping with a poor global economy, and as a result, there is a strong need to both reduce costs and increase operational efficiencies across the board. One route companies are taking to reduce costs is through competitive bids for ingredients and raw materials sourced from global suppliers. Often times, a decision will be made to purchase materials from the supplier with the lowest costs with the expectation that future ingredients will match sample material reviewed and accepted.

Unfortunately, this is not always the case. Many times during the initial review period the supplier will send the perfect samples to the company for evaluation to determine if the consistency and quality of the materials meet the company's standards. Once a material is accepted and a supplier is added to the preferred vendor list, materials can be included in the buying process and filtered into the bill of materials within an enterprise resource planning (ERP) system.

What is missing from this process is the automation of quality processes and safety checks on a consistent basis. As a result, over time, products that are below standards, out of specification, or blatantly fraudulent can find their way into the manufacturing process and supply chain. For example, some suppliers will (illegally) substitute or cut a key ingredient with a cheaper alternative or simply label a product incorrectly or ambiguously.

You might remember the case of Kobe beef a few years back, in which American consumers were more or less tricked into believing the luxurious Japanese Kobe beef was actually true to its label. Turns out, Japanese Kobe beef was not allowed for sale in the U.S. in any way, shape, or form.

Food fraud may seem like a victimless crime, but it can have serious repercussions if it's not identified before entering the supply chain. Since many products can be adulterated with cheaper ingredients that are not necessarily identified in the product's certificate of analysis (COA) or labeling, there is now a significant risk to consumers with food allergies. In the event of any illnesses or deaths attributed to a product that contains these undisclosed allergens, the impact to a company and its brands can be devastating.

The Grocery Manufacturers Association estimates that the cost of one adulteration incident can total between two and 15 percent of a company's yearly revenues. This could translate to a $400 million impact for a large $10 billion company, or a $60 million impact to a company making $500 million.

So what exactly can manufacturers do to protect their brands, products, and consumers? Developing better supplier visibility and collaboration can ensure superior product safety and quality, easier said than done. But with the latest technologies available to manufacturers today, visibility and collaboration are much easier to tackle than in the past.

The first step is to develop and maintain supplier scorecards, which basically act as a manufacturer's real-time view into the entire supply chain and all its processes. Whether your supplier is in non-compliance or there was simply a mix-up, supplier scorecards will help to ensure that the issue is identified and settled in a timely

and efficient manner. When developing a supplier's scorecard, it is typically best to segment suppliers into risk levels based on the ingredients they supply, their facility risk levels, service performance, and finally cost.

The ingredient risk level should be recorded on the specification requirements agreed to, and samples of each lot should be tested to ensure compliance with standard sample specifications as well as the COA document. Any ingredient that could be classified as high-risk for contamination or fraud should be tested regularly to verify safety and quality standards. Contact suppliers immediately if any ingredient fails testing or deviates from specification. An issue identified before production could save the company 10 times the cost of goods sold due to rework or disposal costs.

WHAT IS MISSING FROM THIS PROCESS IS THE AUTOMATION OF QUALITY PROCESSES AND SAFETY CHECKS ON A CONSISTENT BASIS.

The facility risk-level can be determined via an onsite audit and review of its standard operating procedures and quality processes. If any issues are identified during this initial visit, it is important for the company's auditor to share this feedback with the supplier sooner rather than later to ensure corrective actions or preventative actions (CAPAs) are implemented before the first order is produced and shipped out. This guarantees that both parties are working together to provide the best product possible for consumers while ensuring brand protection and profitability for each party.

Service performance will also need to be part of the scorecard because it provides clearer visibility into a supplier's ability to provide the right quantity of product, at the right time, within the set specifications. Delays in production can severely impact a company's ability to meet retailers' orders and ultimately may prevent consumers from switching brands.

Finally, cost should be the last part of the equation. What good is the cheapest priced ingredient if it results in a multi-million dollar recall or the demise of your brand?

Proactive Risk Management

Managing documentation requirements, audits, complaints, incidents, corrective actions, and change management internally can be challenging enough. When you increase the quality management footprint to hundreds or even thousands of suppliers and partners, it can be even more overwhelming for a small internal team handling the process.

It's crucial that companies upgrade their current paper-based records or spreadsheets documents to some sort of automated system so they have the ability to actively, and more quickly, connect with suppliers to verify product testing and standards are in compliance with the established partner agreement, and that CAPAs are being addressed in a timely manner. The ability to track and identify trends earlier in the process—whether through complaints, audits, or incidents—supports proactive risk management through the use of analytics tools.

This can explain why many food and beverage manufacturers are beginning to update their manual quality processes with an enterprise quality management system, such as TrackWise from Sparta Systems. Such solutions not only provide manufacturers with a central repository of all quality processes taking place and data that meets compliance requirements, but it also integrates with existing enterprise IT systems, such as ERP and CRM systems, to share master data or capture complaints in real-time to provide greater transparency to issues earlier on in the process.

Such automated solutions can also provide the transparency and visibility into supplier quality management so companies can ensure that products meet required specifications, and that incidents can be assigned to the responsible parties to expedite resolution and corrective actions. In the event of a regulatory audit, you have a central repository to provide proof of compliance for both the company and your vast supplier network.

Food fraud is a global problem affecting millions of consumers worldwide—whether they are aware of it or not. We've examined what manufacturers can do to prevent this fraudulent crime, but consumers can take matters into their own hands as well by being smarter about their food purchases. If it seems too good to be true, it probably is. ■

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Safety & Sanitation

SANITIZING

Internal system multiple-use plastic containers may be a cyclical conduit for foodborne pathogen transport, such as *Listeria monocytogenes*, between field or orchard and packing/processing facilities.

Minimizing Microbiological Risks in Multiple-Use Containers

Reusable plastic containers for shipping fresh products pose a risk of contamination from ineffective washing and sanitation processes | BY **TREVOR V. SUSLOW, PHD**

Dedicated food safety professionals do more than manage their company's risk by becoming skilled at passing audits. Nowhere is this more true or needed than in the fresh produce industry. Whether raw agricultural commodities (RAC), minimally-processed fruits, vegetables, or other edible horticultural crops (hereafter collectively called fresh produce), assessing hazards and defining both risk potential and risk exposure have become an evolving and expanding systems-based focus in food safety planning. In anticipation of the final rules fulfilling provisions of the Food Safety Modernization Act, produce-buying customer specifications, and global standards for prerequisite programs, a deeper analysis of diverse system inputs as sources of contamination and cross-contamination is being applied across the supply and marketing chain.

Without question, this increasing recognition that the "devil is in the details" may be attributed to the numerous recalls of RAC and minimally processed produce in recent years. These recalls, often encompassing multiple lots, several weeks of production, or entire seasonal shipments, are largely triggered by detection of foodborne pathogens in random or category-targeted testing programs. Distinct from the goal of preventing the unknowing shipment of adulterated produce that may result in consumer illness or outbreak, minimizing the potential of positive outcomes from company internal or external testing of packed containers or finished product for pathogens has prompted the industry to seek risk reduction measures in under-evaluated system components. In 2014 alone, we can identify more than 18 non-outbreak recalls of diverse fresh produce and tree nuts as the result of the identification of pathogens, including Shiga toxin-producing *E. coli*, various *Salmonella* serovars, and *Listeria monocytogenes*, on product introduced to interstate commerce (U.S. FDA). The full economic impact and ripple effect of these incidents, from suppliers to receivers in food service and retail outlets, can be substantial as evidenced by the large recall of California stone fruit during the summer of 2014. Other recalls and actual outbreak incidents just before and, especially, closely following the various *Listeria*-associated recalls have activated a broad call to action within the industry not experienced since the 2006 *E.coli* O157:H7 outbreak on spinach and among the cantaloupe category during and following the 2011 *L. monocytogenes* outbreak originating from a Colorado shipper.

Expanding View of Contact Surfaces

Driven by this increasing concern applied to the expanding view of system control points and presumptive contamination transfer surfaces, practices associated with food safety assurances applied to multiple-use containers are being scrutinized. In the fresh produce supply chain, multiple-use containers encompass many different types of containers, fabrication materials, and system uses. Multiple-use containers may be divided into two broad categories based on ownership and control of the containers. Simplistically, these include exclusively internal (closed-loop) systems or multiple-user pool system containers with limited traceability and knowledge of prior use-history, potentially among many international shippers and receivers. An additional category of concern is the widespread practice of single-use produce

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T. SUSLOW

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packaging and shipment containers that are handled as reusable containers and find their way into both interstate commerce and local-grown produce, which is direct-marketed. This topic will be covered very briefly later in this article.

Each of these forms of multiple-use containers fit appropriately into any system analysis of food contact surface (FCS) cleanliness and sanitation programs. The uncertain linkage and limited documentation of the potential for diverse primary and secondary use of these containers to serve as vectors of contamination, within and among lots, does not negate the necessity to include their consideration in a comprehensive preventive control program. Whether an internal, closed-loop system or a pool-system of reusable units, these containers intended for multiple-cycles of use with fresh produce may contact product directly during various harvest practices.

In addition to direct FCS interactions with fresh produce, there is the likely potential for indirect transference of contamination from external container surfaces during stacking and palletizing but more broadly by water transport. Soil, non-product organic matter (e.g. leaf matter, non-crop vegetation, decayed or damaged crop), and other foreign objects may be introduced into water dumps and flumes in recirculating wash or cooling systems, onto dump tables and spray-brush beds, and onto conveyors during harvest container inversion.

In some systems, the reusable harvest container, which may be wood or plastic, is introduced into a flotation tank or pool to gently release the produce to a water conveyance system to minimize bruising and other forms of injury. These container-adherent potential sources of contamination are often acquired in the produce field or orchard. Adhering soil and some of the non-product organic matter is impacted onto multiple crevices on the footings, corners, bottoms, and sides of containers, most pronounced with RPC, if placed directly on the soil of row crops on the orchard floor. In water-based post-harvest handling systems, there is the high risk potential for any microbiological contamination to be broadly spread among multiple containers in a single lot and among multiple lots if the water quality is not maintained under high-process control standards.

PRIMUSLABS

Decomposing plant residues attached to RPC delivered from a central depot, signified as cleaned and sanitized, represented 48% of the units swabbed For Cause due to a visual "cleanliness" defect in the six-week UCD study.

In a closed-loop system, these containers are typically cycled back into harvest operations, which may involve a single grower or farm location or be co-mingled and distributed to multiple farm locations and among multiple growers. Invariably, these are dedicated-use containers that only hold produce. In pool-system RPC use, these containers are shipped to a processor or retail distribution center and ultimately consolidated and shipped back to the RPC-owner depot for distribution back directly to a grower's harvest location, shipping yard, or a secondary container distributor. Regionally, these may be commonly used or reserved for produce packing but many pool-RPC pass through many non-produce operations or uses as well.

Cleaning and Sanitizing

For growers and produce handlers with a closed-loop RPC system for harvest and wash-cooling operations, it is fair to expect that full responsibility for meeting expectations for FCS cleanliness between cycles-of-use resides with that company. In this regard, many of the questions that arrive at my desk are seeking best practice guidance for sanitizing of harvest totes and bins and appropriate schedules for routine and deep cleaning. This is not a new subject matter for the produce industry, especially in the tree fruit category, as problems arising from cross-contamination with postharvest decay microbes, primarily fungal pathogens, has been a longstanding issue. As with more recent concerns for human pathogen transference, this carryover contamination is generally an implementation barrier rather than a lack of evidence and protocols for proper cleaning and sanitation or disinfection with available chemistries. For the purpose of this article, the focus will be on plastic/polymer containers, intentionally avoiding the issue of wood bins and wire-bound wood crates that become multiple-use packing and shipping units. There are few current studies that provide cleaning and sanitization validation data and address the establishment of a Master Sanitation Schedule for multiple-use plastic containers with much more than a finger-in-the-wind best guess. Naturally, in the absence of hard data that covers a multitude of conditions and practical logistics and harvest/shipping unit availability, there's a wide range of management schemes that are rigorously or more loosely followed within each company. In many operations, practical inabilities to allow adequate time for complete drying post-washing, originally essential for minimizing the issues of fungal decay spore germination during refilling with produce, are causing packers to eliminate washing altogether. The standard practice is a simple bin or tote inversion to clear most adhering soil and leaf trash. More recently this practice has been retained or adopted in produce operations meant to remain dry due to concerns for residual moisture, elevating the risk of survival and growth of pathogens. In these cases, cleaning and sanitation is typically conducted between seasons. In both wet and dry applications it's common, but not uniform, that single-use polymer liners are placed inside of multiple-use harvest and shipping containers to alleviate the concern for incomplete or inadequate sanitation options.

For growers, handlers, and shippers that use RPC, for direct field-pack or packaging after post-cooling, washing, and grading steps, there has always been an inherent understanding and expectation that these pool-system units would be delivered between each use in a clean and sanitary condition. Whether using pool RPC by preference or conforming to customers' requests and requirements, suppliers have pointed to a lack of control and

General ATP-Bioluminescence Unit Reading Outcome *(Relative Light Units – RLU)*	Hard Surface Cleanliness Expectation Outcome	Typical Correlative Aerobic Plate-Count Expectation
‹ 50 RLU	Acceptable – "Very Clean"	‹ 60 CFU/cm^2
100 ‹ x ‹ 300 RLU	Acceptable – "Reasonably" Clean'	‹ 500 CFU/cm^2
300 ‹ x ‹ 1,000 RLU	Corrective Action Needed • Re-clean & sanitize • Re-test before use	1,500 ‹ x ‹ 3,000 CFU/cm^2
› 1,000 RLU	Unacceptable – Immediate Corrective Action Needed • System analysis • Re-training • Sanitizer selection and use review	› 5,000 CFU/cm^2

Table 1: Example of interim guidance for ATP and aerobic plate count outcomes of harvest and shipping container microbiological swab-analysis.

knowledge of the cleaning and sanitizing practices by the central RPC provider. Produce quality and safety specifications derived primarily from buyer mandated criteria have expanded, especially over the past five years, to include all forms of packaging and packing materials. Although there's been a level of grumbling over the years about where the RPC was last in non-produce uses, both food and non-food shipping, it wasn't until the recent release of a "RPC cleanliness" study report by Keith Warriner, PhD, professor of food science at the University of Guelph, that the issue heated up. In response to that media-based communication, multiple concerns from grower/shippers and produce handlers were shared anew in the U.S. Issues raised related to foreign objects, impacted soil, decaying organic matter, presumptive excess cleaner residues, excess free water, and multiple adherent stickers and sticker-adhesives made it apparent that the concerns raised by the Guelph report were not likely regionally-limited issues.

The issue of excess free water, alone, within a folded RPC arriving for packing fresh produce is significant for many packers, as any water in contact with the dry surface of produce such as dry onions, garlic, and items with a tender calyx (stem-cap), such as many types of eggplant, will likely stimulate decay microbes to infect. In some areas, this moisture will evaporate quickly if erected (unfolded and locked) RPC sit out in the field for even a short time, but this is not always the case in high humidity field environments or in many packing facility rooms. Packers have commented that they assign crews to hand wipe RPC prior to use to remove pooled water.

Since the initial Guelph study, my colleagues at the University of California, Davis (UCD) and I conducted a similar microbiological survey in California over a six-week period and Dr. Warriner conducted a second, expanded study. These collective outcomes uniformly point to an inconsistency of microbiological cleanliness, which would be prudent to address among RPC providers. While our study did not specifically address the issue of actual pathogen detection, by design, the relatively high numbers of viable bacteria on the interior surface of the swabbed RPC strongly indicate that current cleaning and sanitation practices lack the rigor needed or expected by their customers. In the UCD survey, while many individual RPC were below the limit of detection, (less than 0.9 colony-forming unit (CFU)/swab) and would be classified as "clean" (less than 60 CFU/centimeter^2), individual RPC across pallets and sampling dates exceeded log 5 CFU/swab nine of 24 times or 37.5 percent and the range of outcomes exceed log 6 CFU/swab two times or 8.3 percent. Details of the methods used and study outcomes are contained within the current report. To expedite availability to the industry, a more lay-technical presentation was released; a more formal journal manuscript is being developed with additional evaluations and reported data.

Current Actions and Corrective Measures

Fortunately, a major RPC provider has been taking steps to improve handling at its central depots and to stabilize confidence in pool system contribution to supply chain food safety.

Switching exclusively to single-use packing units for shipping to processors and other market receivers is clearly one option to essentially eliminate concerns for cleanliness of FCS containers with intimate product contact points. In a recently completed study of the microbiological status of single-use corrugated packing containers, with the participation of UCD in the study design, representing six different manufacturers, third-party findings supported the expectation that the FCS area was "clean" and well below presumptive comparable standards derived from the Guelph study.

Naturally, protection from contamination during staging and use in field harvest or during on-site storage at a packing or fresh-cut processing facility is an essential and long-standing expectation in all prerequisite produce safety programs. Single-use liners also greatly reduce concern with diverse multiple-use shipping containers; however, this practice is not always applicable with some produce handling systems. For example, these liners will interfere with prompt cooling or drying of product and may be associated with a greater level and persistence of condensation on product leading to decay and food safety concerns.

While adopting single-use only packaging policies among shippers and receivers would alleviate concerns for all forms of multiple-use packaging, this is not a realistic approach. Until such time as there is abundant evidence that RPC units arrive from a depot in an acceptable condition as a sanitized and dry FCS, ready to receive fresh produce, we recommend that growers and shippers adopt a consistent inspection protocol for each pallet received. We strongly suggest that inspection be combined with replicated adenosine triphosphate-bioluminescence swabs to support visual inspection (Table 1) and, over time, to design and implement a random 10-RPC swab protocol for total Enterobacteriaceae and total thermotolerant coliforms. This data should be provided openly to RPC providers and receiving customers in order that overall system improvement may be broadly supported and expedited. To support this standardized protocol, we are developing additional validation data to strengthen science-based guidance values for cleanliness of multiple-use harvest and packaging containers. ■

Dr. Suslow is produce safety specialist at the department of plant sciences at the University of California, Davis. Copies of his study are available on request. Reach him at tvsuslow@ucdavis.edu.

Enforcing Hand Hygiene

The installation of hand hygiene compliance technology minimizes the consequences of improper hand cleanliness as opposed to washing stations and hand sanitizer dispensers

BY **MATT ROBERTS**

Ensuring thorough and properly-practiced hand hygiene is a vital aspect of the food industry. The consequences of improper hand cleanliness can be severe; both from a financial standpoint and for the reputation of food processing and production companies. One employee with contaminated hands could spread harmful pathogens across a facility and to food in preparation areas.

In many cases food safety relies heavily on employees adopting a responsible and proactive attitude to hand hygiene and maintaining a rigorous hand hygiene regime. Facilities where food is handled at any point on the production line will undoubtedly be aware of the risks of improper hand hygiene, with many installing wash stations and educating employees of the risks associated with the spread of harmful bacteria. The major issue with depending on employees to ensure they keep their hands clean is that this approach places a great deal of faith in workers knowing how to clean their hands to a sufficient standard. If workers enter the production line after the leaving the restroom without washing their hands or without washing them properly, they are putting the entire production process at risk of contamination. Despite the probability that workers in food production and processing facilities are more aware than the general population of the risks of improper hand hygiene and the importance of thorough handwashing, the statistics regarding the general public make for worrying reading.

Statistics

A report released by Initial Washroom Hygiene to coincide with Global Handwashing Day in October last year found that one in four people in Britain admitted not washing their hands after visiting the restroom. Another U.K. study showed that over 10 percent of people don't wash their hands, and of those who do wash, 95 percent fail to do so properly; with only two out of three people actually using soap. Another damning report published in the U.K.'s *The Sunday Times* by Val Curtis, PhD, director of the Hygiene Centre at the University of London, showed that, averaged out, more than one in four Britons had faecal matter on their hands.

In the U.S. the picture is alarmingly similar. A hygiene report from Michigan State University found that 33 percent of people didn't use soap when washing their hands, while 10 percent didn't wash their hands at all. The CDC recommends at least 15 seconds of vigorous handwashing with proper soup to successfully kill germs, yet the Michigan study reported that in its study the typical amount of time spent washing hands was barely six seconds.

Sanitizer Dispensers

While proactive handwashing steps, such as installing wash stations and technological reminders to wash hands at regular intervals, are useful in tackling hand hygiene ignorance, additional interventions can prove to be very beneficial. Hand sanitizer dispensers are a worthwhile addition to handwashing and as a protective barrier should handwashing not take place.

Yet hand sanitizer dispensers are associated with similar drawbacks to handwashing initiatives, being that their use is often merely optional. When use of the aforementioned *hygiene stations* and wall-based gel dispensers is optional and down to the individual worker, hand hygiene can never be 100 percent ensured.

Compliance Technology

Several food facilities are turning towards hand hygiene compliance technology; installing products that ensure hand hygiene practice, rather than merely encourage it. This is because, while useful when used, products such as wall-based gel dispensers do not guarantee use by every passerby.

While staff may be heavily encouraged to use wall dispensers and even penalized if found not to be using them, their installation on walls means they are not enforcing use on every occasion.

Technology fitted onto door handles has been found to dramatically raise compliance with hand hygiene. From technology that sprays cleaner onto door handles each time they are used, to a specialist hygienic door handle that dispenses sanitizing gel onto users hands upon grip, products exist for the purpose of going beyond encouraging hand hygiene to actively *ensuring* hand cleanliness. A number of large food companies across the world have embraced this approach with products such as Pure Hold Hygiene Handle, which is fitted onto pull-doors and dispenses sanitizing gel onto users' hands upon grip.

The installation of full-compliance technology is a simple but effective way of ensuring a cleaner and healthier workplace. In addition to a healthier workforce, the likelihood of contaminating the facility is lower. The financial elements are also significant. A contamination incident will cost a company a significant sum, which can be avoided with simple hand hygiene enforcement technology. ■

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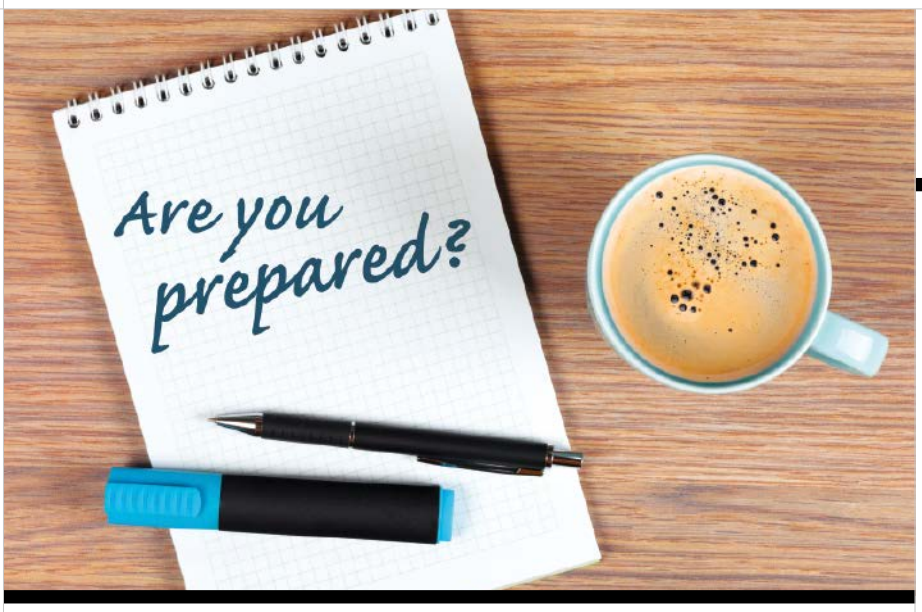

How to Fit Training Into Your Production Schedule: Part 2

What employers and workers can do before a course even begins to make sure they get the most out of their training investment | BY **MARGARET KOLK** AND **MARIE LEFAIVE**

Editor's Note: *This is the second in a five-part series of articles that will explore each concept behind the five moments of need in training.*

Our first article for this training series in the February/March edition of Food Quality & Safety magazine discussed training for the first of the five moments of need, as described by Conrad Gottfredson, PhD and Bob Mosher, learning for the first time. This article discusses the second crucial moment of learning need, which occurs when people want to expand the breadth and depth of what they already know. They need more knowledge, information, or techniques to begin the transition from novice to expert, whether with in class, online, or blended training.

But don't worry. This is not an article on how to build a better training class. It is a three-rule primer on how to ensure your employees get the most out of any training program.

Set Clear Learning Goals and Performance Expectations

The first rule of ensuring that employees get the most out of training is to set clear performance expectations and concrete outcomes. When employees demonstrate measurable improvement in workplace performance, the goal of training has been achieved. And yet, time and again, we've seen great courses delivered by great trainers result in less-than-great returns in the workplace. With budgetary pressures being top of mind, this is not a result that anyone wants to see.

A variety of reasons have been identified for poor training outcomes, but studies show one of the greatest predictors of how workers perform after a training event is how well they are briefed before training even begins.

Think about the last time you asked someone to teach you something. You had a clear learning objective, and the training didn't end until you reached that objective. If you were learning to tie your shoes, success was a well-tied shoe. If you wanted to sum a range of cells in Excel, a final number was proof of learning.

> A trainer can easily spot those who are prepared to learn.

Why is it then that we often send employees to a training course without telling them what success should look like? "I want you to take this GMP course" is not the same as "I want you to take this GMP course so you can update our current GMPs." Attending the course achieves success in the first scenario; a freshly updated GMP manual is the outcome for the second.

Goal setting doesn't have to be complicated, but it does need to be specific. If learners know what success should look like and how success will be measured after training, they will be primed to get the most out of that course.

A trainer can easily spot those who are prepared to learn. They ask thoughtful questions and show enthusiasm. They relate the information presented to how things are done at their plant. You can almost see them putting the training into practice.

A trainer can also spot those who are not engaged. They come in two broad categories.

1.) "Hostages" who attend because the boss has sent them. They don't know what the training is about, and they don't care or understand how it might be used on the job. Chances are, very little of the training will translate into improved job performance.

2.) "Tourists" who think of training as a paid holiday. They might become active participants in the course, but they do not understand the purpose of the training or how they are expected to use it. Improved job performance is possible, but not likely.

Clearly, a motivated learner is critical to protecting your training investment.

Lead by Example

Rule number two is to lead by example, and it speaks to your role as a learning champion. It is critical that you celebrate

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an employee's new knowledge and reinforce the prospects for improved workplace performance. Furthermore, you must do this even if it means uncovering your own knowledge gaps.

We once delivered a three-day training program to a company's Hazard Analysis and Critical Control Points, or HACCP, team. The team's manager politely declined the first two days of training, explaining that she was well versed in the topics. She joined for the final day's advanced session, which began with a review quiz of the material presented to date. Unfortunately for everyone concerned, she scored very low. Such loss of face was not acceptable. The course was blamed, the trainer was criticized, and even the quiz questions were condemned. In 30 minutes, she succeeded in nullifying two days of valuable training. It was money down the drain.

Think how different the outcome would have been if the manager had praised her team for their successes. They would have felt empowered and motivated to continue learning; and she would have seen a positive return on her training investment.

Be open to new learning and willing to admit when you do not know something. If you do, you'll surely see an improvement in your company's learning culture.

Provide Post-Training Support

The final rule focuses on providing post-training support because unless learners have the opportunity to apply the new skills, the learning will be lost. A sanitation engineer may learn better methods for environmental swabbing, for example, but initially he will be slow in putting them into practice because they are unfamiliar. Give him time. If necessary, re-assign some of his duties until he feels confident in the new skill. Remember that you embarked on this training program to address a performance gap or business need; now is not the time to lose focus.

There are other actions that can be done post-training to strengthen the transfer of knowledge to the workplace.

- Ask the learner for immediate feedback on the program. This reinforces the learning and signals that you take this seriously.
- Set performance goals. If you provided clear expectations pre-training, these are easily mapped. If not, discuss goals with employees and be sure they take responsibility for their learning.
- Look for continuous improvement. A training program is only the beginning of the journey. You might schedule follow-up meetings to reinforce what was learned or consider whether job aids, mentors, and coaches would be beneficial. Ask the learners how you can support their goals.

Ultimately, learning must be viewed as a process, not a single event. To draw the most benefit from formal training programs, you must provide employees the support they need to attain and then maintain successful on-the-job performance.

By applying the steps discussed in this article, you will recognize a return on your company's training investment and employees will reap the benefits of a successful learning process through improved competency on the job. ■

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Quality

CERTIFICATIONS/LABELS

Moving Towards FSSC 22000 Certification

The fast-growing food safety management system links food safety and business processes

BY **JOHN BUCHANAN**

Consumers not only want to know where their food is coming from, but also are more concerned about food safety. The globalization of food production to meet the ever-growing needs of increasing populations means food supply chains have evolved into longer and more complex businesses than ever before. Rapid and widespread growth has increased the risk of food safety incidents.

To help mitigate the risks, many regional and customized food safety standards have evolved in order to enhance food safety and address the issues raised by manufacturers, suppliers, retailers, and consumers. At a global level, ISO 22000 provides the specification for an international management system for food safety across the supply chain. Tailor-made for the food manufacturing and packaging industry, FSSC 22000 provides the specifications necessary to build on ISO 22000 and meet the standards set by the Global Food Safety Initiative (GFSI) Guidance Document (version 6), including prerequisite programs (PRPs).

FSSC 22000 covers the following activities within the food supply chain:

- Perishable animal products,
- Perishable vegetal products,
- Products with a long shelf life at ambient temperature,
- (Bio)chemical manufacturing,
- Food and feed for animals (manufacture), and
- Food packaging manufacture (food containers in direct and non-direct contact with food).

Why FSSC 22000 Works

FSSC 22000 incorporates many of the principles of other GFSI-approved food safety standards and combines them in a single approach. It is a business management tool that successfully links food safety and business processes.

FSSC 22000 stipulates measurable senior management commitment and requires organizations to analyze customer

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requirements, define processes, and demonstrate consistent control over identified hazards—updating and improving the system to adapt to changes in process, requirements, or regulations. It provides real value to an organization irrespective of size or complexity and levels the playing field for suppliers and buyers throughout the food chain and around the world.

FSSC 22000 is a comprehensive food safety management system (FSMS) standard because it:

- Is based on a management system certification scheme, so the audit approach is in line with that of other management systems;
- Can be easily integrated with your existing management system, such as quality, environmental, and safety management schemes;
- Fully incorporates international and independent standards of ISO 22000:2005 and PRPs, Hazard Analysis and Critical Control Points (HACCP), and its application steps as set out in the Codex Alimentarius guidelines, as well as specific additional requirements regarding service specifications, specific regulatory requirements, the management of inputs, and supervision of food safety related tasks;
- Is approved by GFSI;
- Controls/reduces food safety hazards and promotes continuous improvement on food safety aspects;
- Fosters legal compliance;
- Increases transparency throughout the food supply chain; and
- Allows small and/or less developed organizations to implement an externally developed system.

In addition, FSSC 22000 has an integrity program in place to review the performance of all contracted certification bodies to ensure they are meeting the specific FSSC requirements.

Implementation

Successful implementation can realistically be achieved in three to six months, depending on the complexity of the operation. An organization already ISO 22000 compliant may be able to achieve certification more quickly.

Any organization choosing to implement FSSC 22000 should appoint a management representative, with overall responsibility for the system, to oversee and drive the project. It is also recommended that relevant personnel undertake training to ensure a thorough understanding of what is required and how the standard can be implemented in their organization.

HACCP is the starting point for any implementation, followed by an internal audit and management review. It is also good practice to conduct a gap analysis before the full certification audit.

Safer Food Suppliers

FSSC 22000 enables organizations to meet the needs of clients, at the same time as improving their own operating systems, thereby becoming more efficient, more effective, and able to produce better quality products consistently. The standard incorporates the food safety benefits of a HACCP-based program, the cornerstone of all food standards, with added focus on the quality aspects of production managed by the core of ISO 9001 quality management principles. As a FSMS, FSSC 22000 places emphasis on continuous improvement rather than one-off compliance, in the drive to deliver consistently safe, quality products.

Fast Growing

A relatively young certification scheme, FSSC 22000 has grown from 1,000 certifications in 2012 to 7,000 in early 2014, including 900 for food packaging manufacture. Food manufacturers seeking to meet retailers' compliance standards, as well as those looking to extend their capabilities and reach new clients, are choosing FSSC 22000. Developed by a non-profit foundation, unallied to any specific stakeholder, FSSC 22000 certification enables manufacturers to focus their food safety efforts on scientific and technical advances, and their audit resources on improvement rather than compliance.

Understanding the Requirements

To fully understand the certification requirements of FSSC 22000 it is important to include an overview of ISO 22000:2005 and PRPs, as they form the core of the FSSC 22000 scheme.

ISO 22000:2005 was designed to cover all the processes along the food chain that deal directly or indirectly with the end product being consumed. In addition, it specifies the requirements for a FSMS by incorporating all the elements of Good Manufacturing Practices (GMPs), PRPs, and HACCP systems together with a comprehensive management system. The ISO 22000:2005 standard is made up of eight core elements.

Scope. The scope focuses on control measures to be implemented to ensure that processes are in place to meet customer and regulatory food safety requirements.

Normative reference. This refers to materials that can be used to determine definitions associated with terms and vocabulary used in the ISO standard document.

Terms and definitions. The ISO 22000:2005 terms and definitions section refers to the use of the 82 definitions found in ISO 9001:2008 and lists definitions that are specific to this application.

FSSC 22000 Certification Process

Step 1: Preliminary self-assessment, conducted against the standard's requirements and guidance.

Step 2: Address any non-conformities identified.

Step 3: Select a certification body.

Step 4: Stage 1 and Stage 2 audit conducted by the selected certification body. After analysis and review of the findings, an audit report on the assessment will be issued.

Step 5: When all non-conformities have been resolved, a certificate will be issued—valid for three years.

Step 6: Surveillance audits will be conducted annually, or bi-annually for larger/more complex operations, to ensure standards are maintained and non-conformities are addressed.

Step 7: Shortly before the third anniversary of initial certification, a re-certification audit is required. The cycle of surveillance audits begins again.—*J.B.*

Food safety management system. In this section, the emphasis is on establishing, documenting, implementing, and maintaining an effective system. This includes the procedures and records that are needed to ensure effective development, implementing, and updating of the food safety management system. This clause also covers the requirement for the organization to take ultimate responsibility for the competent performance of any outsourced activities that impact food safety control.

FSSC 22000 certification enables manufacturers to focus their food safety efforts on scientific and technical advances, and their audit resources on improvement rather than compliance.

Management responsibility. This section outlines the commitment of top management to the implementation and maintenance of the food safety management system. The key elements include assigning a food safety system manager and team; setting clear policies, goals, emergency contingency plans, and responsibilities; and establishing effective communication mechanisms within the organization and with suppliers or customers.

Resource management. An effectively implemented food safety management system requires that top management provide adequate resources, budgets, and personnel to effectively run the system. Scheduled, documented training and evaluations of key personnel and provision of a safe work environment and infrastructure are crucial to the continuity of the system.

Planning and realization of safe products. This section incorporates the elements of GMPs and HACCP, including any regulatory requirements applicable to the organization and processes. Adequate PRPs (e.g. training, sanitation, maintenance, traceability, supplier review, control of nonconforming product, and recall procedures) are required to provide a foundation for the production of safe food.

Validation, verification, and improvement of the food safety management system. To maintain and demonstrate the effectiveness of the FSMS, the organization must validate that all assumptions used within the system are scientifically sound. In addition, the organization must plan, conduct and document regular verification of all components of the system to evaluate whether or not the system is operating as designed, or if modifications are needed. The verification must also form part of a continual improvement process whereby the organization reviews verification.

Prerequisite Programs

Among the specific food safety requirements that ISO 22000:2005 was established for is the need to create, implement, and maintain PRPs to assist in eliminating food safety hazards in the manufacturing process:

- ISO/TS 22002-1:2009 supplements the prerequisite programs for food and ingredient manufacturing;
- PAS223:2011 supplements the prerequisite programs for food packaging manufacturing; and
- PAS222:2011 supplements the prerequisite programs for animal food and feed manufacturing.

The PRP requirements apply to all organizations, regardless of size or complexity.

Transitioning to FSSC 22000

An organization with any of the existing food safety programs discussed here can build on their existing platform and seamlessly transition to FSSC 22000 certification. The FSSC 22000 scheme, through its inclusion of ISO 22000:2005 and prerequisite programs (ISO/TS 22002-1:2009 standards or PAS223 or PAS222 based on its sector), covers key requirements contained in major existing food safety standards or programs, including GMP/PRPs, HACCP, SQF, BRC, IFS, and GlobalGAP.

It has been SGS' experience that organizations with an existing food safety program can incorporate the elements of FSSC 22000 into their existing system by using a stepwise approach (see sidebar on page 34) to achieve compliance with global food safety management principles. ■

Buchanan, global product manager ISO/FSSC 22000 at SGS, is a food and food safety expert, managing a number of accredited food programs. With an extensive career in the food industry, including time as a chef, that spans Australia and the U.K., Buchanan joined SGS as an auditor in 2006. Reach him at John.Buchanan@sgs.com.

Product Marking: The Critical Link in Supply Chain of Custody

Many manufacturers take the most basic of sanitation practices for granted when it comes to trusting suppliers to protect direct food contact labels and pressure seal products

BY **SHANE LAUTERBACH**

Press operators should wear hair nets, beard masks, and gloves when running food labels.

During the time between the farmers' fields and consumers' tables, food encounters potentially hundreds of vulnerable touch points that could cause harm to the end product.

In 2014, the FDA issued nearly 400 food recall actions. Most cases are due to practices failing—not the food failing.

Product marking, labeling, and printing companies are a critical link in the supply chain of custody that food manufacturers need to consider.

As food manufacturers bear in mind who is handling their product mark—whether its the insert label, a pressure closure, or product tag—they should be sure to ask their supplier several questions. Here are some areas they should be investigating.

Established federal and private sector guidelines. Does your current supplier follow design standards and information requirements issued by the FDA? Does it follow Good Manufacturing Practices and have an NSF Food Safety Certification?

Basic sanitary measures. Do you know if the team handling your run is required to wear rubber gloves, hair, and facial nets when handling the product? This sounds like an obvious practice, but that is not always the case.

Internal policies and procedures. Is your supplier using a Hazard Analysis and Critical Control Points plan? Find out if it is using a documented version control standard. For example, at the Lauterbach Group, color management strategies and production color measurements are recorded in a master library within the OmniMark Management System for quality control evaluation and publication.

Facility-wide sanitation processes. Not only should the printing floor be spotless, but a facility-wide commitment to sanitation ensures clean conditions. It should also be given, but if not, ask your supplier what disinfection process it uses for the equipment.

Shipping and logistics. All pallets need to be sanitized before the product is loaded into the truck, and all trucks should be inspected before the product is loaded and shipped out.

Material solutions. Not all materials or inks are created equally. Whether it's a top of the line Euro-style silk cheese paper, product inserts, or food safe inks, the materials and types of labels used on products make a big difference. There are specific FDA-approved inks that absolutely must be used when your product has contact with a mark.

All of these processes described are critical in ensuring sanitary integrity when using direct food contact labels.

In addition, a growing product area in the food packaging and marking business are resealable packages. Currently being used for products like baby wipes, more food manufacturers are looking to resealables. If your company is looking to go in this direction, the same processes and procedures apply.

There are many vulnerable touchpoints in the process when your brand is most at risk for damage or exposure. Partner with suppliers that strive to eliminate those vulnerabilities through airtight processes and practices.

In the case of direct food contact, the stakes are even higher, as there is a need to be protecting what's on the inside as well as the outside mark. ■

Lauterbach is president and CEO of Lauterbach Group. He is currently serving a second term as Wisconsin representative to the Board of Directors of the Great Lakes Graphic Association. Reach him at 262-820-8102.

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ANTIVIRALS

Eliminating the Threat of Bird Flu

Implications of avian influenza in the food supply and the control measures to contain the spread of this flu in poultry flocks

BY **JOE KREBS, PHD**

Avian influenza is a major health and economic risk throughout the world. For example, the most notorious influenza epidemic, the Spanish Flu of 1918, caused the death of 20 to 50 million people worldwide. The avian influenza virus (bird flu) has been detected in six western states in the U.S., British Columbia, Asia, and Europe since the beginning of December. This disease is caused by certain strains of the influenza A virus, a type of highly infectious, negative sense, single-stranded RNA virus. Bird flu virus can be intermittently detected in chicken and turkey flocks in many parts of the world. These viruses can sometimes infect humans in food production sites and rapidly mutate to produce strains capable of causing global pandemics.

The World Health Organization (WHO) states that the primary risk factor for human transmission is exposure to live or dead poultry or contaminated environments in farms and animal markets. Additionally, the U.S. FDA says transmission is possible by exposure to environments contaminated by infected birds. It is transmitted by saliva, feces, and nasal secretions of infected birds. While the virus is generally located in the gastrointestinal and respiratory tracts of infected animals, it can also be found in the meat of infected birds. Avian influenza virus can also be located outside surface shell or within the interior of chicken eggs. According to the FDA, avian influenza is not transmissible by eating poultry or eggs that have been prepared properly and the chance of infected poultry or eggs entering the food chain is extremely low because of the rapid onset of symptoms as well as the safeguards in place. However, because of the devastating economic consequences of avian flu to poultry producers and the potential zoonotic hazards presented by exposure to infected birds, avian influenza is a major disease concern to poultry producers and human health officials alike. A great deal of time, effort, and expense is expended each year in curtailing the spread of avian influenza in chicken and turkey farms worldwide.

Individual strains of avian influenza viruses are classified according to the specific structures of two antigens, hemagglutinin (H) and neuraminidase (N), on the viral surface. These antigens control virus-host cell binding interactions during infection. Different virus strains possess different pathogenicity and zoonotic characteristics and can be classified into two different types: weakly pathogenic strains and highly pathogenic strains.

While weakly pathogenic strains of avian influenza can adversely affect poultry (chicken and turkey flocks), the more deadly highly pathogenic strains can cause tremendous economic damage to poultry farms and, more importantly, pose a direct threat to human health by occasionally crossing over the "species boundary" to infect and sicken humans. Highly pathogenic strains tend to be of type H5 and H7 and can rapidly infect an entire flock, killing 100 percent of the birds in less than 48 hours, according to WHO; infection can

BIOSCIENTIFIC

easily destroy an entire flock and threaten neighboring farms in the region. Some highly pathogenic strains, called zoonotic strains, can be transmitted to humans; these strains also usually possess the H5 or H7 subtype of hemagglutinin antigen. It is important to note however that some H5 and H7 avian influenza strains can possess low pathogenicity at first and gradually mutate to high pathogenicity forms. A minority of avian flu strains can be transmitted from birds to humans. These strains are most problematic since zoonotic strains, such as H5N1 and H7N9, can put farm workers' health at risk and trigger global human influenza pandemics.

Measures to Detect and Control

The serious disease risks posed by poultry farming have created a need to prevent, detect, and control the spread of avian influenza throughout poultry farming regions and into the human food supply chain. The rapid mutation rates of the influenza virus make effective implementation of these control measures especially challenging.

Vaccination. Over the years, there have been numerous efforts to vaccinate poultry against bird flu to prevent infection or spreading of the disease. However, these programs have been generally unsuccessful and actually may hasten the evolution of more pathogenic influenza strains.

Improved sanitation and hygiene. Influenza is spread between birds through contact with feces as well as saliva and nasal secretions. Considerable reductions in the rate of spreading of influenza are achieved in farms and throughout neighboring farms through improved hygiene and feces handling techniques. For example, removing soiled shoes or boots after walking through influenza-contaminated areas can help to reduce the spread of the disease within a farm. Thorough cleaning and disinfection of contaminated areas has also been shown to be essential to limit the spread of the disease.

Detection/surveillance. There are a number of approved diagnostic techniques to detect the presence (and subtype) of influenza in bird flocks.

These methods include agar gel immunodiffusion, ELISA (enzyme-linked immunosorbent assay), AGP (alpha acid glycoprotein), ACIA (antigen capture immunoassays), and rtRT-PCR (real-time reverse transcriptase polymerase chain reaction). While a number of these diagnostic assays can be performed using "home brew" methods, a number of influenza assays are commercially-available including FluDetect, Binax, or Directigen.

Between 2006 and 2013, 569,000 flocks of broiler chickens in the U.S. were monitored by the USDA for the presence of either H5 or H7 avian influenza using these diagnostic tests; no samples from these flocks contained H5 or H7 type avian influenza virus.

Culling and quarantining of infected poultry. The adverse economic and human health consequences of the spread of avian influenza through poultry flocks creates a need for drastic measures; accordingly, the appearance of avian influenza in poultry flocks often necessitates the culling of infected birds in flocks and using quarantines to restrict the movement of eggs, poultry, and poultry products within infected areas. This very common practice has been shown to be highly effective at limiting the spread of bird flu in flocks and between farms. However, this practice tolls a heavy economic price on individual affected producers, in some cases all the birds in a large region are culled to eliminate bird flu from an agricultural region. In the case of persistent infections, culling and instating quarantines must be repeated over several years to completely eliminate the virus.

Antiviral drug treatments. Veterinary drugs are highly useful for the control of many diseases in livestock and poultry farms. For example, antimicrobial agents such as antibiotics and anticoccidal drugs are routinely used in poultry farms to combat a wide variety of diseases such as mycoplasmosis and coccidiosis. Several different antiviral agents, such as amantadine and ribavirin, have been shown to have strong anti-influenza virus activity. These drugs inhibit influenza virus replication at different points in the viral life cycle: Amantadine blocks the release of the virus into the cytoplasm from endocytotic vesicles by binding to the M2 channel; and ribavirin, on the other hand, is a nucleoside analogue which blocks viral RNA replication. Consequently, there was a great deal of initial interest in using antiviral drugs to control the spread of bird influenza.

Initially considered to be a useful facet of controlling avian influenza in poultry flocks, farmers sometime treat their flocks with antiviral medications to prevent and control avian influenza. Unfortunately, antiviral drugs are not effective at preventing or in controlling the spread of bird influenza in poultry flocks. It also has been shown to increase the mutation rate of the influenza virus towards higher pathogenicity and increased resistance to antiviral

(Continued on p. 40)

(Continued from p. 39)

drugs. These changes have greatly reduced the therapeutic efficacy of these drugs in humans, and also created concern that poultry meat products will contain toxic residues of antiviral drugs. *For these reasons, governments have banned the use of amantadine and ribavirin antivirals for veterinary use*. Nevertheless, there are continued reports that these drugs are still being illegally used to combat bird flu in poultry farms and there is concern that residues from these drugs will adulterate the food supply. In fact, researchers have recently detected amantadine in chicken meat samples using liquid chromatography–mass spectrometry, or LC-MS. These residues pose a hazard to human health and have created great concern among international food safety regulatory agencies regarding the adulteration of poultry food products with antiviral drug residues. This concern has created an imminent need for methods to detect anti-influenza drug residues in poultry and egg products.

Antiviral Drug Detection in Meat

While several analytical methods have been developed to detect the amantadine and ribavirin antivirals, there are only two methods to detect these chemicals in poultry meat: LC-MS and immunoassay. While LC-MS methods work quite well for low-throughput meat sample testing applications, they have significant limitations that reduce their usefulness for routine and cost-effective sample analysis required to screen the world's poultry meat and egg supply, these include:

- Expense and time: LCMS instrumentation can be expensive and operation requires considerable time for sample preparation and to perform the actual test;
- Throughput: Each instrument can only test one sample at a time; and
- Operator skill: A high degree of technical skill is required to perform LC-MS assay methods as well to perform maintenance on the instrument.

Immunoassays utilize the binding power and specificity of antibodies to overcome the practical limitations of LC-MS methods for the cost-effective detection of amantadine and ribavirin in chicken and turkey products.

Antivirals and Immunoassays

Immunoassays present many powerful benefits for the screening for antiviral drug residues in food samples. They are rapid and inexpensive to perform. ELISA immunoassays are used in microwell plates so many assays can be performed simultaneously. The highly specific nature of the detection minimizes the need for extensive sample preparation while allowing detection at very low levels similar to those achievable with LC-MS techniques.

Because of the recent use of amantadine to try to prevent bird flu in flocks and the danger it poses to the food supply, Bioo Scientific has developed an ELISA assay to detect amantadine in poultry products, including meat and eggs. The MaxSignal Amantadine ELISA Test Kit, with detection limits of 0.25 parts per billion (ppb) in poultry meat and 0.5 ppb in egg, is based on a competitive colorimetric ELISA assay. This kit incorporates a rapid sample preparation protocol for the extraction of amantadine from poultry samples. Amantadine residues present in the sample will compete for HRP-conjugated antibodies against amantadine, thereby preventing the amantadine-HRP from binding to the antibody attached to the well. The resulting color intensity, after addition of the HRP substrate (tetramethylbenzidine), has an inverse relationship with the concentration of amantadine residue in the sample. This assay can be completed in less than one hour. The kit is manufactured to the international quality standard ISO 9001:2008 (ISO CI#: SARA-2009-CA-0114-02-A).

In addition, Bioo Scientific is developing an ELISA for the detection of ribavirin in turkey and chicken food products. The ribavirin ELISA kit should be commercially available in the second quarter of 2015. ■

Dr. Krebs is director of Protein Chemistry and Engineering for Bioo Scientific. Reach him at jkrebs@biooscientific.com.

Few Drug Residues in Milk

The U.S. FDA released results in March from its milk sampling survey, involving the testing of nearly 2,000 dairy farms for drug residues in milk. More than 99% of the samples were found to be free of drug residues of concern. According to the FDA, these findings provide evidence that the nation's milk safety system is effective in helping to prevent drug residues in milk, even in those limited instances when medications are needed to maintain the health of dairy cattle.

The agency initiated the study to determine whether dairy farms with previous drug residue violations in tissue derived from dairy cows were more likely to have violative drug residues in milk than other dairy farms. FDA tested samples from two groups: a "targeted" list of farms with known previous tissue residue violations and a control group of farms. Results show that the occurrence of drug residues in milk is very low, even in targeted group. However, the limited number of residues detected involved drugs that are not included in routine testing under the current milk safety program.

The FDA will work with state regulators to consider modifying testing to include collecting samples as necessary from milk tanks on farms when investigating illegal drug residues in tissues involving culled dairy cows. The agency is also working with its milk regulatory partners to update the existing milk safety program to include testing for a greater diversity of drugs and to educate dairy producers on best practices to avoid drug residues in both tissues and milk.—*FQ&S*

Reducing Shiga Toxin-Producing *E. coli* in Cattle

The U.S. FDA's draft Guidance for Industry #229: *Evaluating the Effectiveness of New Animal Drugs for the Reduction of Pathogenic Shiga Toxin-Producing E. coli (STEC) in Cattle* provides recommendations on study design and the criteria drug manufacturers should use when evaluating the effectiveness of animal drugs intended to reduce STEC. The draft guidance addresses topics such as protocol development, study conduct, animal welfare, nutritional content of experimental diets, the assessment of drug concentrations in experimental diets, experimental parameters, and substantial evidence of effectiveness. Comments on guidance are due April 27, 2015.—*FQ&S*

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A Freshness Assay for Seafood

An application note on ATP degradation and the assessment of farmed frozen shrimp

BY **WENDY GOODRICH** AND **LARISSA BALAKIREVA, PHD**

Adenosine triphosphate (ATP) is the principal energy source for cellular processes. When cellular activity ceases, ATP is naturally depleted through a combination of autolytic enzyme and bacterial action that sequentially degrade ATP into smaller nucleoside and purine end products starting with adensoine diphosphate (ADP) and following progressively through adenosine monophosphate (AMP), inosine monophosphate (IMP), Inosine (Ino), and hypoxanthine (Hx) respectively (Figure 1).

Because these catabolites are produced early post-mortem, their measurement in animal tissue can determine food QC parameters such as muscle age and storage time, important indicators of freshness. The quantity of these nucleotides in tissue products can also influence sensory attributes, such as taste and texture.

The freshness of fish tissue was first quantified by a Japanese team of food scientists more than 50 years ago using a six parameter equation that solved to a value K based on all of the freshness pathway products shown in Figure 1. Another team of Japanese scientists later abbreviated this to a three parameter equation solving for a Ki (%) value by using the latter stage catabolites of IMP, Ino, and Hx (Figure 2). The %IMP and %Hx can be expressed as

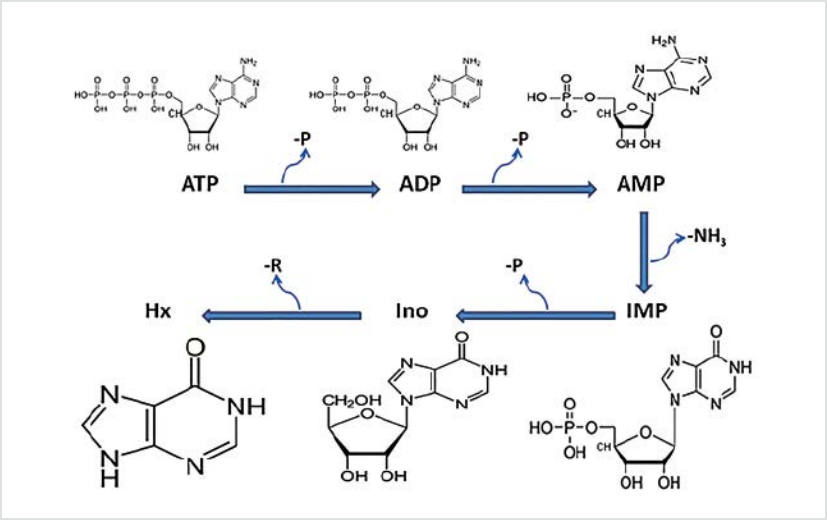

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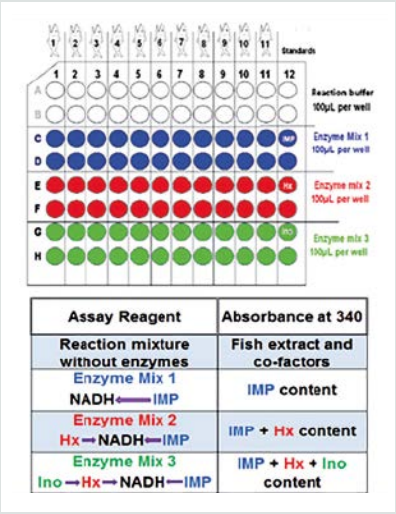
Figure 1: ATP degradation pathway to Hx following the arrest of cellular respiration post-mortem in muscle tissue.



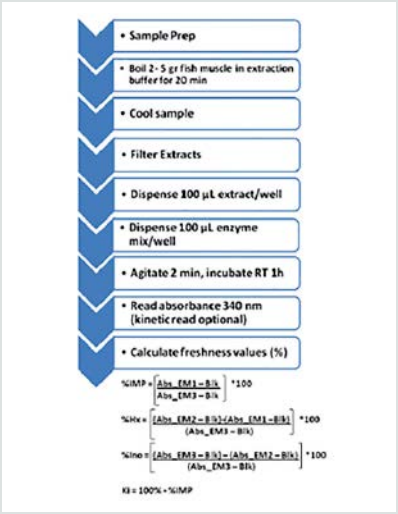


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Figure 2: NovoCIB Precice Freshness assay principle and workflow. The assay works as three assays in one on up to 11 individual samples in a fixed 96-well microplate format with column 12 reserved for pre-filled standards (top left). Relative content of (%) IMP, (%) Hx, and (%) Ino is calculated following enzymatic conversion of nucleotides to NADH, and detection of NADH at 340 nm (lower left, and right).

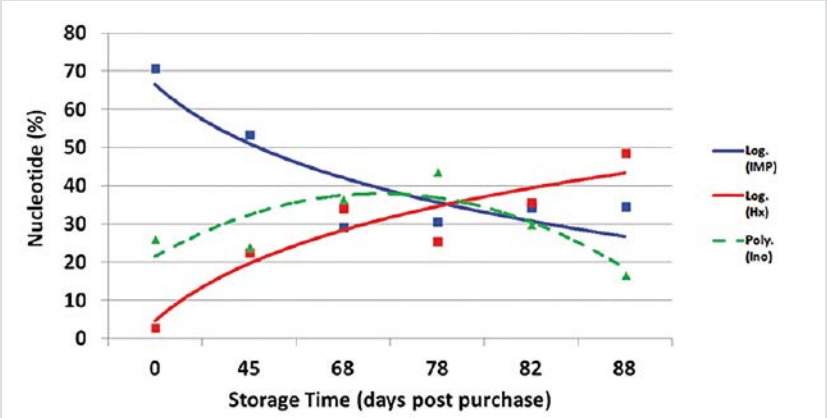

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Figure 3: Quantification of freshness pathway (% IMP, % Ino, % Hx) over three months for raw, whole, peeled, imported, farmed, frozen shrimp stored at -20°C.

This assay involves multiple microplate additions that can be facilitated by inexpensive automation, such as an automated pipetting station.

an equivalent freshness index by their relationship in Ki such that the higher the %IMP the fresher the fish, whereas higher %Hx values indicate a transition from freshness to spoilage in muscle tissue.

Recently, the Precice Freshness assay has been developed by NovoCIB that quantifies the levels of these three latter catabolites in a microplate format by enzymatic conversion of each catabolite to nicotinamide adenine dinucleotide (NADH), which can be measured colorimetrically at 340 nanometers using a microplate reader. Figure 2 illustrates the methodology used in the microplate assay.

This assay involves multiple microplate additions that can be facilitated by inexpensive automation, such as an automated pipetting station. BioTek Instruments has collaborated with NovoCIB to develop an automated cost-effective platform for routine Precice Freshness assays. This involves the BioTek Precision Pipetting System, Epoch 2 Microplate Spectrophotometer, and Gen5 Data Analysis Software. This laboratory instrumentation and software provide automation for the reagent addition steps, NADH detection, and subsequent calculation of %IMP, %Ino, and %Hx in the workflow of the Precice Freshness assay as shown in Figure 2. This automated workflow has been used to assess the freshness profile of a number of commercial products, among them raw, frozen shrimp (Figure 3).

The parabolic shift of Ino reflects a decomposition dynamic as IMP is depleted in the tissue over time and Hx is formed. This data suggests that between 78 and 82 days higher levels of %IMP (more fresh) begin to cross over to higher levels of %Hx (declining freshness). ■

Goodrich is an applications scientist at BioTek Instruments. Reach her at goodrichw@biotek.com. **Dr. Balakireva** is the president and chief scientific officer at NovoCIB. Reach her at lbalakireva@novocib.com.


Loading dock shelter serves liftgate trailers and trailer doors that open inside the building.

Farm to Loading Dock to Fork

Properly outfitted docks maximize the ability of operations to maintain the quality of their product while enabling trucks to hit the road quicker

BY **WALT SWIETLIK**

Many safety-minded companies in the food industry are taking proactive measures to comply with both the current Food Safety Modernization Act statues and anticipated future regulations. These proactive measures—many of them focused on distribution—are helping secure America's food supply, which ensures safe, reliable food is served at restaurants and kitchen tables across the country. They are also helping companies protect themselves from the damaging and lasting impact of a major product recall.

There are a wide variety of links in the food supply chain. At almost every level—from processing and manufacturing to distribution—loading docks play a significant role in bringing fresh, safe food to consumers. However, there are a host of potential threats related to dock operations that businesses need to address, from cold chain integrity and contamination issues to cargo theft and even terrorist threats.

Cold Chain Integrity

When fresh or frozen foods are being transported, the procedures and equipment needed to maintain the integrity of the cold chain are critical. Any breakdown can adversely affect the quality and freshness of food and, in some cases, lead to serious food contamination. By the time food becomes contaminated, it has often been mishandled in several spots along the food production chain. According to the CDC, loading docks are a frequent area of concern, particularly when refrigerated food is left on a loading dock for long periods of time during warm weather.

When it comes to the loading dock, a common breakdown in the cold chain occurs when the security seal on trailer doors is broken outside the building and the doors are opened in the drive approach, exposing the product to outside elements. If the security seal is broken by the driver, or some other party, companies have no way of knowing if the contents have been tampered with—potentially creating a number of security issues. In addition, product may be exposed to warm weather outside the building, which allows bacteria to grow. Temperature and humidity control also become important once product is unloaded in a facility. Any gaps in the dock station perimeter make it difficult to control environmental conditions. A company's inability to control temperature and humidity can lead to spoiled or damaged goods.

Contamination

An unsecured or poorly designed loading dock station creates a gaping hole in a building. These holes are entry points for unwanted pests, including rodents, insects, and other creatures. Cracks of daylight visible from inside a closed dock (often called "white space") also indicate gaps that can allow dust, snow and other contaminants into a building—not to mention hot outside air. For obvious reasons, this is a major concern when it comes to supply chain integrity. Organizations like the American Institute of Baking International have strict standards when it comes to inspections at food manufacturing facilities and distribution centers. According to its Consolidated Standards for Inspection guide, all external doors, windows, or other openings must be close-fitting or otherwise pest-proofed to less than 0.25 inches or 6 millimeters.

Cargo Theft

There is an estimated $30 billion in cargo stolen each year in the U.S. with the most highly sought-after shipments being pharmaceuticals, consumer electronics, apparel, and food, according to an article in Inbound Logistics. Despite serious efforts by the industry to combat cargo theft, those numbers are still on the rise. In an annual report, FreightWatch stated that there were 794 reported incidents of cargo theft in the U.S. in 2014. Of those, 19 percent—or roughly 150 cases—of all cargo thefts were food and drink items,

(Continued on p. 46)

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(Continued from p. 44)

compared to 16 percent for electronics. Although total thefts were down, the average value of stolen cargo increased 36 percent to more than $232,000 per incident, compared to 2013. The FreightWatch report suggests this is due to "increased organization and innovation on the part of cargo thieves." Unsecured trailers at busy loading docks are a prime target for cargo thieves, as well as dropped trailers and those left unattended by drivers.

Terrorist Threats

According to the FBI, terrorists consider America's agriculture and food production tempting targets. America's food supply is among the most vulnerable and least protected of all potential targets of attack. Terrorists know that a successful agro-terrorism incident threatens America's economic welfare and its standing as a leading exporter of agricultural products. In fact, when American forces overran al Qaeda's Afghanistan sanctuaries in 2002, they discovered U.S. agricultural documents and al Qaeda training manuals targeting agriculture.

"Terrorists realize that America's strength stems largely from its economic vitality," says Dean Olson, a terrorism expert who holds an MA from the Naval Postgraduate School, Department of Homeland Security. "They pursue an overarching attack strategy focused on weakening America's economic strength...contaminating food can help terrorists cause economic crises in our agriculture and food industries."

Loading docks with unsecured trailers are susceptible to theft. Furthermore, a common practice that puts companies at risk is when the security seal on a trailer is broken, or put in place by non-company personnel on the drive approach. Security or surveillance may not be as present on the drive approach, which means food could be easily stolen, poisoned, and used as a terrorist weapon.

Automatic Vehicle Restraints: First Step in Food Chain Security

Restraints that automatically secure a trailer or vehicle when it backs up to the dock are the first step in establishing food chain security. Automated restraints not only enhance employee safety by ensuring the trailer can't be mistakenly pulled away when a forklift is still inside, they also help prevent theft and reduce contamination. An automatic restraint wraps around a trailer's rear-impact guard (RIG), securing the trailer to the loading dock. In addition to preventing trailer separation accidents, a tight connection reduces white space where dirt, debris, insects, and other environmental contaminants can enter a building. Additionally, some automatic restraints can be integrated into building management or security systems, providing another level of security and protection against external tampering.

The most advanced automatic vehicle restraints offer a RIG/restraint vertical engagement range of 9 to 30 inches. Some models can even help secure intermodal overseas container chassis, which are increasingly common across the food industry supply chain.

Bridging the Gap from Dock to Trailer

Once a trailer is secured at the loading dock, the next step is linking the gap between the loading dock floor and the trailer bed. A vertical-storing dock leveler is considered the gold standard for maintaining cold chain integrity, environmental control, and security. Unlike a pit-style leveler, a vertical leveler (when in the stored position) allows the loading dock door to close directly on the pit floor—rather than the leveler itself—reducing energy loss by minimizing outside air infiltration. This also helps to protect the dock door from damage and helps reduce dust, debris, rodents, and other contaminants from entering a building. Additionally, vertical dock levelers improve security by minimizing points of entry at the loading dock. And finally, the vertical design makes it easy to clean or wash down the pit floor when the leveler is in the upright and stored position.

Although a number of companies offer vertical dock levelers, food facility managers should consider a variety of specific features before committing to an installation. First, look for a "drive through" application that allows trailer doors to be opened inside the facility. Opening and closing trailer doors inside the loading dock, rather than on the drive approach, helps to ensure cold chain integrity by minimizing outside air exchange into a cold environment. Equally as important, drive through applications allow loading dock staff to place or remove the trailer's seal from inside the building. This reduces the chance of theft or tampering.

Certco Inc. of Madison, Wis. is one wholesale food distributor that recently made the switch to vertical levelers in a drive-through application, and is happy it did. Based on its experience with other storage facilities, Certco switched away from its previous dock/leveler design when building a new 133,000 square foot freezer warehouse. By installing vertical levers in a continuous pit, drive-through application, it successfully created an uninterrupted cold chain for products moving in and out with dock personnel having control over the trailer doors, which now open inside the building after the trailer is positioned at the loading dock.

"I am very pleased that we used vertical levelers in this configuration for the freezer building's docks," says the facilities maintenance manager, Tom Ellis. "They are a huge improvement in terms of food safety, sanitation, and energy efficiency."

It's also important to look for a vertical leveler that provides the smoothest path between the facility floor and the trailer. This helps reduce "dock shock" or whole-body vibration to forklift operators going in and out of the trailer, as well as damage to product and equipment. The most advanced levelers can reduce dock shock by incorporating a constant-radius rear hinge that reduces the bumps and gaps at the rear of the leveler, as well as two-point crown control and optimized lip chamfer at the front of the leveler reduce the speed bump effect normally felt by forklift drivers as they enter and exit the trailer.

Properly Sealing the Dock Perimeter

A dock seal or shelter creates an environmental barrier between the back end of the semi-trailer and the inside of the loading dock. This connection helps companies control their environment by keeping wind, rain, dust, bugs, and other contaminants outside the building, while preventing the escape of valuable energy from inside the building. An effective dock sealing system also helps prevent weather-related product damage and contamination, protecting and securing the integrity of

products as they move in and out of a facility during manufacturing, processing, and shipping. Seals and shelters can also provide deterrence against theft at the loading dock by sealing gaps that could otherwise be passageways for thieves to move product.

For maximum protection, it is important to equip all dock door openings with a system that closes the gaps that are created when a trailer is backed in for loading or unloading. This includes securing the tops, sides, and bottoms of the openings when the trailer is in place. Foam compression dock seals, or full-access dock shelters that seal trailer door hinge gaps, together with a full-coverage, under-leveler sealing system, are recommended in most applications. Further attention is often needed at the top and corners of the trailer where frequent gaps remain. A weighted header seal with corner-sealing ability provides the best means to securely seal these areas.

Leading seal and shelter designs on the market today offer solutions that allow effective sealing on all four sides. Top-of-the-line sealing products can guarantee protection against burning from the heat of trailer marker lights; provide state-of-the art materials to provide the longest wear; and offer custom designs to match the specific, unique needs of individual customers.

Some of the newest dock shelters have been specifically designed with the food industry in mind. In particular, some designs now allow the trailer doors to be opened inside the building for security purposes (drive-through applications), while still maintaining a tight, consistent seal on all four sides of the trailer. Special design features ensure tight sealing against trailer sides, across the full width of the trailer top, and at the corners without interfering with trailer doors being opened and closed after the trailer has been parked at the dock. This shelter design complements the vertical storing dock leveler design to enhance security at the dock.

The Role of High-Speed Doors

Once inside the facility, it is important to maintain cold chain integrity so frozen and refrigerated products aren't compromised. One of the traditional approaches to this was to install heavy, insulated, rigid doors with a high R-value on all cooler and freezer openings. While these side-acting doors do a good job of keeping the cold in (fighting conduction), they have a downside—they are typically slow moving, resulting in longer door cycle times and thus, higher rates of air infiltration, which hampers inside temperature control. Additionally, their slower speed means workers must either wait for the door to open or leave it open for extended periods of time. Furthermore, traditional hard-core doors are susceptible to forklift damage. Unless a damaged cooler/freezer door is quickly fixed, there can be substantial energy losses. Thus, for high-traffic openings, energy losses due to the door being open or sealing poorly (infiltration) can represent a significantly larger cost component than energy losses due to conduction. The highest R-value imaginable isn't worth a nickel if the door isn't closed.

Recent improvements in door technology combine fast cycling with high-efficiency insulation and sealing. These innovations contribute to low long-term energy costs, improved efficiency, and increased safety. In short, high R-value is no longer the main driver in door selection.

These recent advances have focused on insulated upward-acting doors. New technically advanced freezer doors have the ability to withstand forklift impact, which minimizes maintenance and downtime while maintaining a tight seal over the life of the door. Some impactable doors offer higher R-values, reducing the need for heated panel defrost systems. Other models even offer torque-sensing reversing capability, which eliminates safety and maintenance concerns with doors that use pneumatic or electrical reversing edges for the same purpose.

A vehicle restraint wraps around a trailer's RIG, securing the trailer to the loading dock.

Vertical-storing leveler allows loading dock doors to close on the pit floor.

RITE-HITE

Significant improvements in the roll-up design category include reduced cycle times and the use of insulated door panels. These insulated curtain panels provide a high enough R-value to avoid needing expensive panel defrost systems. The fastest roll-up doors can operate at 100 inches per second, a rate that minimizes air infiltration and ensures optimal productivity. Newer upward-acting doors also incorporate a perimeter thermal air seal for added energy savings through a tighter closure.

In addition to their temperature separation capabilities, the most advanced high-speed doors comply with Good Manufacturing Practice guidelines that are frequently referred to by the FDA and USDA.

Remember to Protect the Supply Chain at the Loading Dock

In most instances, a systematic approach that incorporates automatic vehicle restraints, vertical dock levelers, appropriate seals/shelters, and the proper sequence of operation is the best way to secure a loading dock. These products, working together as a system, enhance security, protect employees, reduce contamination, and improve environmental conditions within a building and throughout a given supply chain. ■

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The State of U.S. Waterways

Waterway infrastructure challenges present a crossroads for the soybean supply chain

BY **PATRICK DELANEY**

The agricultural trade is at a crossroads, quite literally. The state of American infrastructure—from our roads to our rails to our rivers—is something that should command the type of global market speculation typically reserved for the world's great financial capitals. Why? Because this system, which starts at the farm gate and ends at the ports of our export partners, will dictate the future success of so many agricultural industries in the U.S.

Soybeans in particular have the most at stake as we discuss the state of our supply chain. The farmer leaders of the American Soybean Association (ASA) grow a crop that represents the most significant American agricultural export. In the 2014-2015 crop year, the U.S. will export a record 1.77 billion bushels of soybeans.

Barge Benefits

Currently, more than half of soybeans grown in the U.S. are exported, and the vast majority of those are headed for China. Considering the country's main production areas in the Midwest, and central and northern Great Plains, most American soybeans are transported by barge down the Mississippi River to Gulf Coast export terminals near New Orleans.

A small part of our reliance on waterways transportation is born of geographic convenience, but the larger driver is the efficiency with which the barge transportation industry carries soybeans to market. Transportation via barge is by a large margin the most efficient and cost-effective transportation mode when compared with transportation of soybeans by rail and by truck.

To lend some perspective on the efficiency of moving product by barge when weighed against moving the same cargo by truck or by train, take the example of one standard 15-barge tow of soybeans. That 15-barge tow moves more than 787,000 bushels of soybeans, but it would take two 100-car trains or 870 large semitrailers to move the same volume of soybeans.

Speaking specifically of safety, moving products by rail and by truck represent a risk of 1.15 and .87 deaths per billion ton-miles, respectively, compared to a risk of only .01 for barge transport.

Barges are also clearly more fuel efficient from a miles-per-gallon perspective than rail and truck transportation, moving cargo 514 miles on 1 gallon of diesel fuel, compared to 202 miles for trains and 59 miles for trucks.

...most American soybeans are transported by barge down the Mississippi River to Gulf Coast export terminals near New Orleans.

While these numbers should be enough as standalones to secure waterways transportation as the preferred and dominant mode of moving soybeans from point A to point B, there are several factors that have prevented this from truly taking hold.

The Competition

Until two years ago, the U.S. soybean industry was the global leader in both planted acres and exports of soybeans. Within the last 24 months, we have lost both of those titles to our South American competitors Brazil and Argentina. Even though the South American markets have eclipsed our domestic production and export capacity, U.S. soybeans still maintain a premium based on the ability to grow a high-quality soybean and deliver it more reliably with a smaller environmental impact than our competitors.

It is clear that the American waterways transportation network provides a significant portion of that competitive advantage for U.S. soybeans in global markets, especially relative to competitors in Brazil and Argentina. While South American markets can beat our production costs, we still enjoy a significant advantage over those markets on the cost to transport soybeans to foreign customers.

Illustrative of this advantage, analysis commissioned by the Soy Transportation Coalition (STC) looked last year at the costs of moving 1 ton of soybeans from an elevator in Davenport, Iowa, to a customer in China, and compared those costs to those of moving a ton of soybeans from Mato Grosso in the heart of Brazil's soybean production region to the same customer in China. What STC found clearly underscored the advantages of the American infrastructure system. Overall, moving the cargo the entirety of the route from Iowa to China cost $85.20, a decided advantage over the price tag of $141.73 for the same cargo originating from Brazil.

To a certain extent, this advantage is a residual benefit of having one of the world's largest navigable inland waterways running through the heart of our domestic soybean producing region—especially considering that the Brazilians have no comparable barge transport infrastructure. But while the location of the Mississippi River on a map is certainly a benefit, it is hardly enough to maintain the premium enjoyed by American soybeans on its own.

Lack of Investment

A huge part of maintaining that foothold is a significant national investment in our transportation infrastructure. However, the U.S. has not adequately invested in waterways infrastructure over the past few decades. When it was created, our system of locks and dams were state of the art. Unfortunately, that original construction took place in the 1930s and has far exceeded the 50-year expected lifespan.

This problem is not one with an easy solution. Ideally, if we want to optimize efficiency and our global competitiveness, we need to replace the aging locks and dams with new, larger locks and dams that accommodate the larger barges without the time and cost of breaking them up to pass through.

Like so many issues, the primary challenge of addressing this need is cost. The cost to replace the outdated locks and dams is significant and the federal process and mechanisms for funding waterways transportation infrastructure is not conducive to large-scale projects. These projects need funding certainty and up-front, lump sums rather than unpredictable, unreliable annual appropriations that only provide funding in a slow trickle at best.

At ASA, we recognize the challenges and realities of the federal government moving swiftly to provide the significant fund-

(Continued on p. 50)

(Continued from p. 49)

ing that would be needed to replace the waterways infrastructure, but we don't think that should be an excuse for taking no action at all. If the funding is not available to build new, larger locks and dams, then less costly upgrades could and should be undertaken. More funding should be provided for maintenance, renovation, or rehabilitation of existing locks and dams, which is substantially less than the cost of replacement and expansion. Certainly, this would result in lost opportunity cost of not building the optimal system, and some of the infrastructure may be beyond the point of rehabilitation and repair, but we need to invest in upgrades where they can provide immediate benefits or avoid catastrophic failures. As the nation experienced with the recent work slowdown at the west coast ports, if we suffer a failure of one or more of the outdated locks and dams on the Mississippi River system, it would have severe impacts on U.S. commerce and ripple effects throughout the economy.

Advocating for Improvements

ASA worked along with industry partners and stakeholders to champion the overdue passage of the Water Resources Reform and Development Act in 2014, as well as the increase in the barge fuel fee to increase funding for projects carried out through the Inland Waterways Trust Fund. These are certainly steps in the right direction that begin to get the process back on track and begin to address the project backlog. These are only the beginning stages, though, and much more must occur to get us where we need to be.

Now, the annual appropriations bills must reflect the policy changes achieved in the 2014 Water Resources Reform and Development Act. Also, additional sources of significant funding must be identified to replace and expand or renovate and rehabilitate our outdated locks and dams.

It's important to remember that these investments are hardly empty ones. Commitment to our waterway infrastructure begets significant benefits in the form of job creation, manufacturing productivity, competitiveness of farm exports, reduced greenhouse gas emissions from reduced demand on trucking, and many others. The benefits clearly outweigh the costs of investment in these projects, but they require the kind of significant, up-front and long-term investment of which Congress and the federal government, at least of late has been incapable of achieving. ■

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Pushing for Increased Truck Capacity

Because demand for trucking is projected to continue to increase in the U.S., the American Soybean Association (ASA) is urging Congress to increase investments in every facet of transportation infrastructure. As Congress considers reauthorization of the Surface Transportation bill (aka the Highway bill) this year, ASA is advocating for the inclusion of provisions to allow states to adopt increased truck weight limits of 97,000 lbs. for six axle trucks on federal interstates. The association is touting a recent research project conducted by the Soy Transportation Coalition (STC) for support.

STC examined the effects of increasing truck weight limits on federal highways in its project, titled "Heavier Semis: A Good Idea?" Funded by the soybean checkoff, it's an update of a 2009 report that looks at the impact of increasing truck weight limits on federal roads and bridges from the current 80,000 lbs., with a five axle configuration to 97,000 lbs., with the addition of a sixth axle. The analysis specifically looked at the impacts on motorist safety, infrastructure wear and tear, and potential cost savings and efficiency gains for agriculture and the U.S. economy.

The STC study justifies that increasing trucking capacity can be done with no adverse impact to safety while providing significant economic benefits. According to the study, allowing six axle, 97,000 lbs. semis will result in fewer semis on the road compared to the status quo and fewer trucks on the road will result in fewer accidents and injuries. Additionally, the braking distance of a six axle truck weighing 97,000 lbs. is the same as a five axle, 80,000 lbs. truck. These are results that have been proven by real-world experience in other countries such as Canada and the U.K. that have implemented higher truck weight limits and seen a reduction in truck-related accidents. The STC study projects such an approach in the U.S. will result in 98 fewer motorist fatalities by 2022.

For transporting soybeans and soy products, allowing six axle, 97,000 lbs. semis will result in 1.2 million fewer truck trips, 5.5 million fewer gallons of fuel consumed, 56,000 fewer tons of carbon dioxide emissions, and from $11 million to $28 million in reduced fuel costs. The use of a six axle, 97,000 lb. semi will enable a farmer to transport at minimum an additional 183 bushels of soybeans per load. By 2022, this will annually save soybean farmers 602,000 truck trips, 1.7 million gallons of fuel, and from $4 million to $8 million in reduced fuel costs.—*FQ&S*

Advertiser Directory

Events

APRIL

28-30
Food Safety Summit
Baltimore, Md.
Visit www.foodsafetysummit.com.

MAY

4-5
Quality Control Workshop - GMP
Logan, Utah
Visit www.usu.edu/westcent/pages/QC_workshop.htm.

4-5
HACCP Training
San Jose, Calif.
Visit www.scsglobalservices.com/haccp-training.

6-7
Statistical Process Control Workshop
Logan, Utah
Visit www.usu.edu/westcent/pages/SPC_workshop.htm.

11-12
Employee "Train-the-Trainer" Food Safety Workshop
Logan, Utah
Visit www.usu.edu/westcent/pages/EmployeeBasedFoodSafetyWorkshop.htm.

19-21
Food Microbiology Short Course
University Park, Penn.
Visit http://agsci.psu.edu/foodmicro or call 877-778-2937.

30-2
asm2015
New Orleans, La.
Visit http://gm.asm.org.

JUNE

1-4
Fundamental of Food Science
University Park, Pa.
Visit http://agsci.psu.edu/fundamentals or call 877-778-2937.

8-10
United Fresh
Chicago, Ill.
Visit www.unitedfresh.org.

9-11
Food and Airborne Fungi and Mycotoxins Short Courses
University Park, Penn.
Visit http://agsci.psu.edu/fungi-mycotoxins or call 877-778-2937.

16-18
49th Annual Microwave Power Symposium – IMPI 49
San Diego, Calif.
Visit http://impi.org/symposium-short-courses/.

JULY

11-14
IFT
Chicago, Ill.
Visit www.am-fe.ift.org.

25-28
IAFP
Portland, Ore.
Visit http://www.foodprotection.org/annualmeeting.

AUGUST

3-6
2015 International Grain Quality and Food Security Conference
Manhattan, Kan.
Visit www.grains.k-state.edu/igqfsc-2015/ or call 785-532-0824.

SEPTEMBER

2-4
BRC Global Standard for Food Safety Implementation & Internal Auditor Course
San Antonio, Texas
Visit www.food-safetynet.com/docs/Training_Sellsheet.pdf.

NEW PRODUCTS

pH, DO, and EC/TDS/Salinity Meters

The HI2002 pH/ORP, HI2003 EC/TDS/Salinity, and HI2004 DO edge meters are thin and lightweight, measuring half an inch thick and weighing 9 oz. This design allows them to be used like benchtop or portable meters, which can attach to walls to free up bench space in laboratories. The meters feature a 5.5-in. LCD with a wide viewing angle, capacitive touch keypad, dual USB ports, cradle with swivel arm electrode holder, and wall mount. All edge meters use digital smart electrodes that store sensor type, ID, and calibration information. These digital electrodes also have a 3.5 mm connector. **Hanna Instruments, Inc., 800-426-6287, www.hannainst.com.**

Water Activity Meter

The AquaLab TDL uses tunable diode laser technology to measure water activity in samples. Water activity of food products is frequently measured to determine susceptibility to mold and microbial spoilage, to predict reactions that end shelf life, and to set and monitor quality in products affected by moisture. The tunable diode laser locks onto a single absorption wavelength of water and reads only that band. Because it is specific to water and negligibly absorbed by molecules of other gases, the sensor is not affected by volatiles. **Decagon Devices, Inc., 509-332-2756, www.decagon.com.**

Adulterant Software

Adulterant Screen software can help food industry professionals evaluate the integrity of food ingredients to guard against existing and potential food adulteration threats. The software performs rapid, targeted, and non-targeted screening for several types of adulterants. Its green light/red light "pass/fail" results system can allow for easy implementation, regardless of the knowledge level of its users. Adulterant Screen software, when paired with PerkinElmer's Fourier Transform Infrared and Near Infrared spectroscopy instruments, creates a combined hardware and software system that can confirm authenticity and perform nutritional analysis in a single step. **PerkinElmer, Inc., 800-762-4000, www.perkinelmer.com.**

Handwashing Timer

The SaniTimer attaches to any standard handwashing sink faucet to ensure staff rinse, lather, and wash their hands for the full 20 seconds recommended by the CDC to avoid the spread of bacteria. It automatically begins a 30-second countdown—the extra 10 seconds account for an individual's preferred handwash prep—shown on an LED display as soon as the water is turned on. At the end of the cycle, the SaniTimer beeps to alert the handwashing user and resets itself to 30 seconds for the next user. The device works with pedal sinks as well as hands-free sinks. **SaniTimer, 817-933-5399, www.sanitimer.com.**

Immersion Spiral Freezer

The hygienically designed Immersion Spiral Freezer is a two-stage cryogenic freezer with a space-saving design that can process more than 20,000 lbs. per hour. The first stage applies an instant crust freeze with liquid nitrogen to maximize yield and protect surface integrity. The cold gases from the first stage travel into the second stage to maximize the use of BTUs. Key uses include meat and poultry, glazed and marinated products, and seafood. The liquid immersion and spiral freezer stages can be custom configured to meet specific requirements. **Linde LLC, 800-755-9277, www.lindefood.com.**

Unified Chromatography System

The supercritical fluidic chromatography-based Nexera Unified Chromatography system (Nexera UC) can sequentially analyze up to 48 samples utilizing automatic extraction and chromatographic separation combined with high-sensitivity detection of targets by mass spectrometry. The Nexera UC system fulfills the measurement requirements of a range of applications, including monitoring pesticides in food products. It eliminates the need for complicated sample pre-treatment and can enable reliable and stable analysis of delicate samples that are prone to oxidation or dissociation if exposed to air. Up to 48 samples can be continuously and automatically processed. **Shimadzu Corp., www.shimadzu.com.**

Digital Sorter

The DateSort system for grading dates combines mechanical pre-cleaning to remove foreign material with optical sorting to grade dates by size. DateSort handles 3.3 to 4.4 tons per hour. This gravity-fed sorter is designed for use at receiving, where date processors collect and analyze products delivered from farmers. This allows date processors to objectively and consistently determine the quality of the product coming in, not just samples pulled off the top, and to pay farmers accordingly. For processors that pit dates, DateSort is ideal for use upstream of the pitting machine. **Key Technology, Inc., 509-529-2161, www.key.net.**

Warehouse Execution System

The Savanna.NET Warehouse Execution System combines a tightly integrated warehouse management system (WMS) and warehouse control system (WCS) into a single application to help manufacturers and distributors direct, control, and optimize internal material flow and order picking. Users have the option to operate as a standalone software solution or with any automated storage and retrieval system. It also allows users to reduce the complexity of working with several different "function-specific" applications. When an order is to be fulfilled, Savanna.NET processes that order into units of work. Using the integrated WCS functionality, the application directs either automated material handling equipment or manual labor to execute the work. Inventory tracking also occurs seamlessly utilizing the software's WMS components. In addition, Savanna.NET offers various deployment options. **Westfalia Technologies, Inc., www.WestfaliaUSA.com.**

Lab Homogenizer

The PandaPLUS 2000 tabletop laboratory homogenizer is ideal for the treatment of nanoparticles, nanodispersions, nanoemulsions, and cell disruption. It can be used for the micronization of dairy products, fruit juices, liquid food, food additives, and ingredients. Due to liquid end design, it's suitable for abrasive and viscous products and offers use of high-pressure energy for new production process development and optimized product formulation. In its standard configuration, it features a touch panel. **GEA Niro Soavi, 603-606-4060, www.niro-soavi.com.**

Supply Chain Solution

Available through a partnership between Trace One and SGS, the SGS Supply Chain Solution powered by T Transparency provides brand owners, manufacturers, and suppliers with farm-to-fork visibility throughout the entire supply chain. This cloud-based tool is built upon a social network platform that enables the supply chain to communicate effectively in real-time and quickly verify data and assess risks. Organizations can prompt partners to join their network to share information and documentation. Users have their own profiles and can interconnect with various supply chains while managing the security and privacy within each of those networks. **SGS, www.sgs.com.**

In Other Product News

3M Food Safety's Petrifilm Rapid Yeast and Mold Count Plate is validated by AOAC as a First Action Official Method of Analysis for detecting yeasts and molds within food products in as little as 48 hours.

Certified as a PTM by the AOAC, the **DuPont** BAX System Real-Time PCR Assay for *L. monocytogenes* is validated on various sample matrices, including frankfurters, cooked shrimp, spinach, queso fresco, and environmental surfaces.

Originally designed for farm feed producers, **Thermo Scientific's** microPHAZIR AG analyzer can now also be calibrated for pet food manufacturers for onsite nutritional analysis.

InstantLabs expands its SpeciesID product line by offering DNA-based tests for Atlantic and Coho salmon.

S+S Separation and Sorting Technology GmbH changes its name to **Sesotec.**

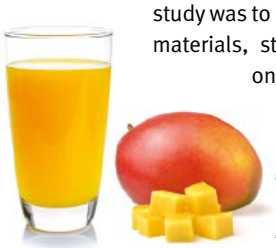
FoodChain ID is offering a 30-day guarantee for Non-GMO Project verification of low-GMO risk products.

SCIENTIFIC FINDINGS

For access to complete articles mentioned below, click on the current April/May 2015 issue at www.foodqualityandsafety.com.

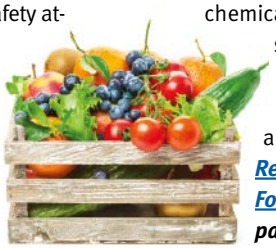
ARTICLE: Physiochemical and Antioxidant Properties of Roselle-Mango Juice Blends

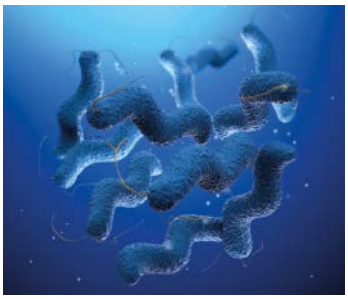
Packaging is an essential aspect in the food processing industry as it serves the important functions of containing the food, protecting against chemical and physical damage whilst providing information on product features, nutritional status, and ingredient information. Various packaging materials such as high-density polyethylene, polypropylene, and glass are commonly used for packaging of fruit juice. Different packaging materials influence the quality of the stored products differently. Therefore, the study of the effect of packaging material on the quality parameters during storage is essential. In this study, roselle-mango juice blends were stored in plastic and glass bottles at ambient and refrigerated temperatures. The aim of this study was to determine effects of packaging materials, storage temperature, and time on physiochemical changes and antioxidant properties of roselle-mango juice blends. ***Food Science & Nutrition*, Volume 3, Issue 2, pages 100–109, March 2015.**



ARTICLE: Recent Progress of Hyperspectral Imaging on Quality and Safety Inspection of Fruits and Vegetables—A Review

Hyperspectral imaging (HSI), a rapid, nondestructive, and chemical-free method, is emerging as a powerful analytical tool for product inspection by simultaneously offering spatial information and spectral signals from one object. This paper focuses on recent advances and applications of HSI in detecting, classifying, and visualizing quality and safety attributes of fruits and vegetables. First, the basic principles and major instrumental components of HSI are presented. Commonly used methods for image processing, spectral pretreatment, and modeling are summarized. Morphological calibrations that are essential for non-flat objects as well as feature wavebands extraction for model simplification are provided. Second, in spite of the physical and visual attributes, applications from the last decade are reviewed specifically categorized into textural characteristics inspection, biochemical components detection, and safety features assessment. Finally, technical challenges and future trends of HSI are discussed. ***Comprehensive Reviews in Food Science and Food Safety*, Volume 14, Issue 2, pages 176–188, March 2015.**





ARTICLE: Thermotolerant *Campylobacter* during Broiler Rearing—Risk Factors and Intervention

Thermotolerant *Campylobacters* are one of the most important bacterial causative agents of human gastrointestinal illness worldwide. In most EU member states human campylobacteriosis is mainly caused by infection with *Campylobacter jejuni* or *Campylobacter coli* following consumption or inadequate handling of *Campylobacter*-contaminated poultry meat. Currently there is not an effective strategy to control *Campylobacter* colonization of broilers during rearing. This review describes the public health problem posed by *Campylobacter* presence in broilers and lists all currently known measures that have been researched to lower the numbers of *Campylobacter* bacteria in broilers during rearing. It also discusses the most promising measures and which measures should be investigated further. ***Comprehensive Reviews in Food Science and Food Safety*, Volume 14, Issue 2, pages 81–105, March 2015.**

ARTICLE: Hydration Properties and Texture Fingerprints of Easy- and Hard-to-Cook Bean Varieties

This study's objective was to understand the factors that affect the hydration and cooking profiles of different beans. Nine bean varieties were classified as either easy-to-cook (ETC) or hard-to-cook (HTC) based on a finger-pressing test and cutting test. Rose coco, red haricot, and zebra beans were classed as ETC, while Canadian wonder, soya fupi, pinto, non-nodulating, Mwezi moja, Gwaku, and new Mwezi moja were HTC. The effect of different soaking pre-treatments on the cooking behavior and/or water absorption of whole or de-hulled beans was investigated. De-hulling, soaking in high pH, and monovalent salt solutions reduced the cooking time of beans, while soaking in low pH and $CaCl_2$ solutions increased cooking time. Moisture uptake was faster in ETC and de-hulled beans. Soaking at high temperatures also increased hydration rate. The results point to pectin-related aspects and the rate of water uptake as possible factors that influence the cooking rate of beans. ***Food Science & Nutrition*, Volume 3, Issue 1, pages 39–47, January 2015.**

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