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Volume 23 Number 3
JUNE / JULY 2016

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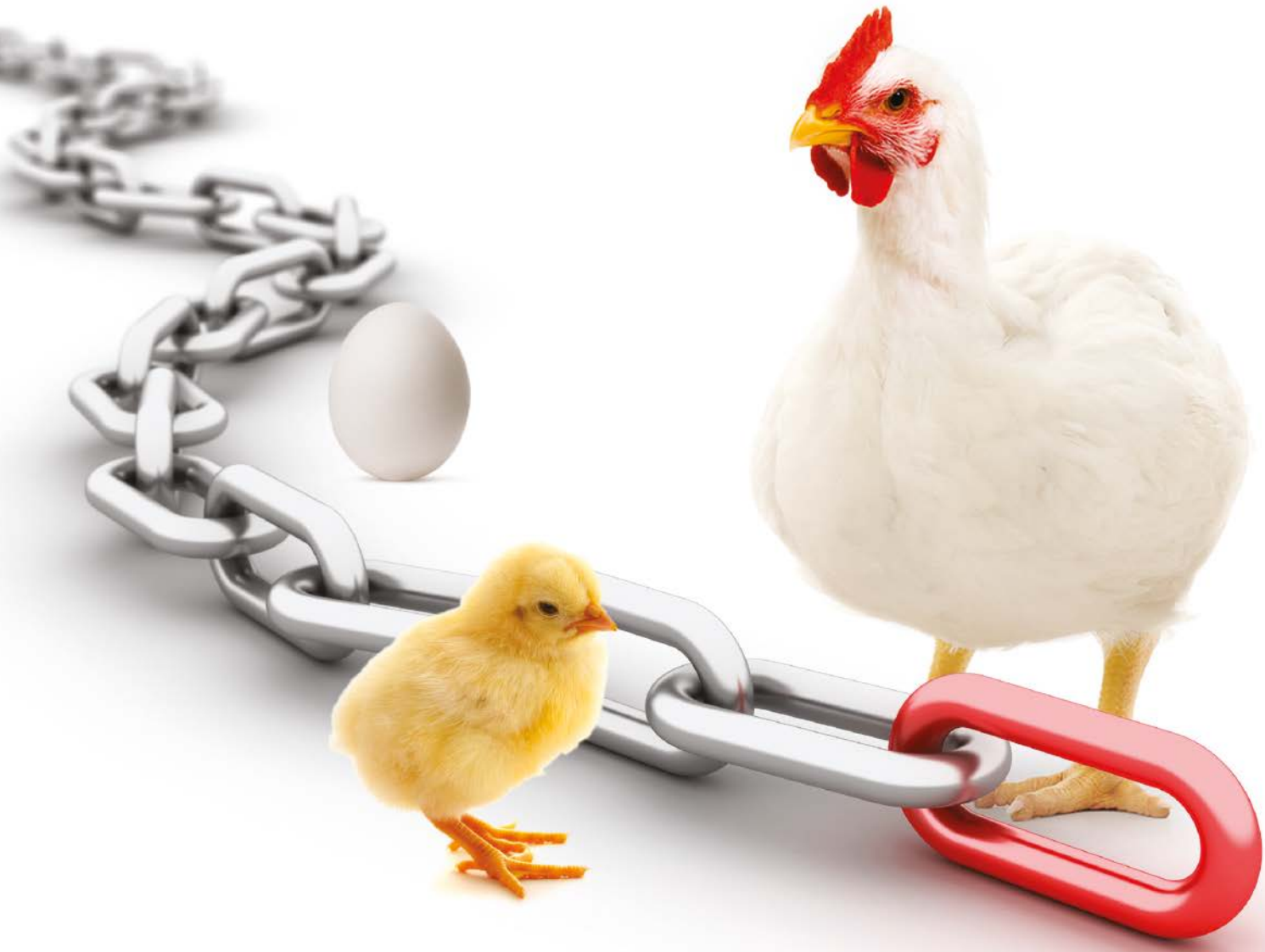

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BY LINDA LEAKE, MS

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BY LINDA BRYAN

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From The Editor

Are food safety offenders on the U.S. Department of Justice's "most wanted" list?

The Department recently launched a criminal investigation into Dole Food Co. over a *Listeria* outbreak linked to several deaths and multiple illnesses in the U.S. and Canada regarding the company's packaged salads.

Earlier this year, both Chipotle and Blue Bell Creameries were also hit with criminal charges of their own regarding alleged mishandling of consumer illnesses.

It certainly seems as though the Department of Justice has its eye on the food industry as it cracks down on prosecuting corporate executives for covering up, enabling, or not taking precautions to prevent foodborne illness outbreaks.

Daniel C. Zinman, litigation partner at Richards Kibbe & Orbe LLP, agrees. "The investigation into Dole's *Listeria* outbreak underscores the seriousness with which criminal prosecutors, notably the Department of Justice, now treat food safety outbreaks," he says.

And additional criminal investigations may soon be under way with two more recent foodborne illness outbreaks. The first deals with *Listeria* connected to CRF Frozen Foods and its frozen vegetables. The second concerns *E. coli* 0121 infections associated with General Mills flour. FDA, CDC, and state and local officials are currently investigating both of these multistate outbreaks.

Shawn K. Stevens, food safety lawyer and founding member of Food Industry Counsel LLC, points out that the FDA is working with the Department of Justice to determine whether criminal sanctions are appropriate whenever a company's food product is linked to a consumer illness. (For more information on how sending consumers to the hospital can send you to jail, read his article in this issue's Industry Insights column.)

"It is to be expected that when a foodborne illness outbreak occurs, criminal scrutiny will follow," adds Alex M. Solomon, who also practices at Richards Kibbe & Orbe. "Companies, directors, and executives need to prepare themselves for this new norm."

Marian Zboraj
Editor

Food Quality & Safety
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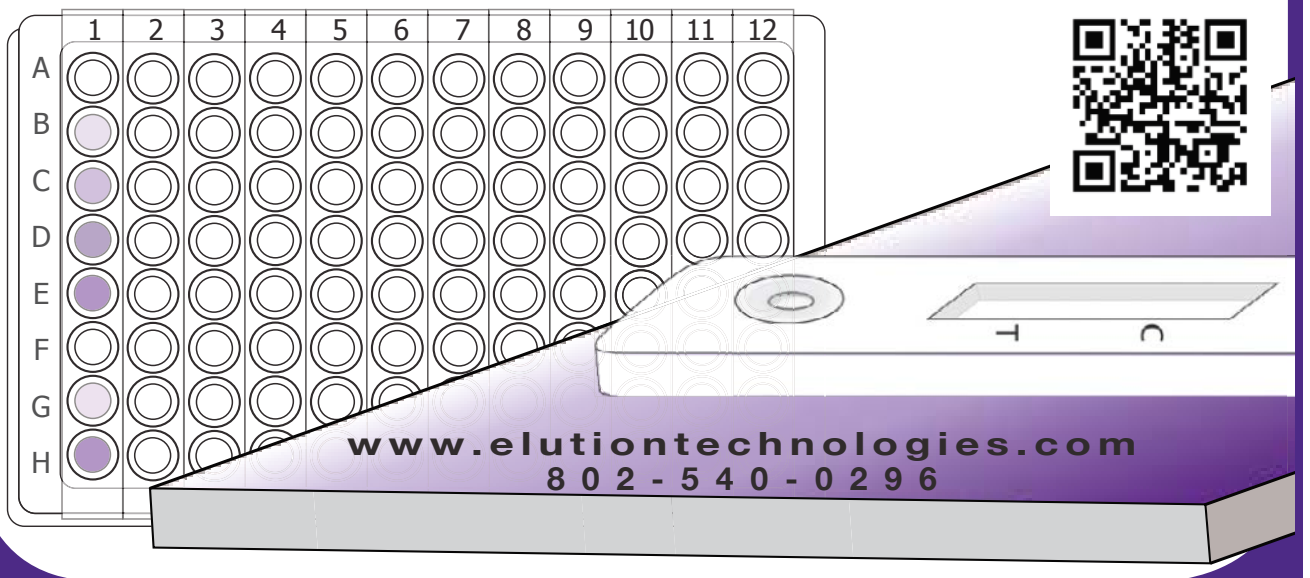

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NEWS & NOTES

Whole Foods Wins Dismissal of PETA Lawsuit

As reported by Reuters, Whole Foods Market Inc. won the dismissal of a lawsuit by a well-known animal rights group that accused the grocery chain of deceiving consumers into believing the meat it sells is raised more humanely than normal, resulting in overcharges. People for the Ethical Treatment of Animals said the use by Whole Foods of a five-step rating system for beef, chicken, pork, and turkey was a "sham" because it was not enforced against suppliers, and the standards were at best little better than normal industry practices. In a decision on April

26, U.S. Magistrate Judge Nathanael Cousins in San Jose, Calif., said PETA failed to show that Whole Foods' alleged misrepresentations on in-store signs, placards, and napkins defrauded consumers into overpaying.

Winners of NSF Food Safety Awards

During the 2016 Food Safety Summit in Rosemont, Ill., NSF International presented the Food Safety Leadership Awards. Winners were Judy A. Harrison, PhD, professor and extension food safety specialist, University of Georgia Department of Foods and Nutrition; John N. Butts, PhD, vice president, research, Land O' Frost, and president, Food Safety by Design; and Purnendu C. Vasavada, PhD, professor emeritus, University of Wisconsin-River Falls (retired), and project manager for Food Safety Preventive Controls Alliance. Dr. Vasavada is also a member of *Food Quality & Safety*'s Editorial Advisory Panel. Kevan P. Lawlor, NSF president and CEO, said their work "has contributed to important advances in food safety innovation, pathogen mitigation, education, and training."

Draft Guidance for Qualified Facilities

The U.S. FDA publishes a draft guidance to assist qualified facilities, such as very small businesses, in complying with the Preventive Controls for Human Food Rule or the Preventive Controls for Animal Food Rule under FSMA. A business that meets the definition of a "qualified facility" is subject to modified requirements of the preventive controls rules. These modified requirements can be met by submitting a form to FDA, attesting to the business' status as a qualified facility, and attesting that the facility is implementing preventive controls to address hazards associated with its food or is in compliance with non-Federal food safety laws and regulations. This draft guidance, "Qualified Facility Attestation Using Form FDA 3942a (for Human Food) or Form FDA 3942b (for Animal Food)" explains how to determine whether a business meets the definition of "qualified facility" and how to submit the FDA form attesting to its status as a qualified facility. The draft guidance is currently available for public comment at https://federalregister.gov/a/2016-11439.

Canada Comparable to U.S. Food Safety System

The U.S. FDA signs an arrangement with the Canadian Food Inspection Agency (CFIA) and the Department of Health Canada recognizing each other's food safety systems as comparable to each other. This is the second time that the FDA has recognized a foreign food safety system as comparable, the first being New Zealand in 2012. A similar system recognition process is underway between FDA and Australia and the European Commission. By recognizing each other's systems, FDA, CFIA, and Health Canada, have confidence that they can leverage each other's science-based regulatory systems. For example, each partner will consider the oversight of the other when prioritizing inspection activities. Systems Recognition establishes cooperation in various areas, from scientific collaboration to outbreak response.

GMA and Battelle Launch Tool to Fight Food Fraud

To help combat economically motivated adulteration (EMA), Grocery Manufacturers Association and Battelle partner to provide EMAlert, a web-based software tool that allows food manufacturers to rapidly analyze and understand their individual, company-specific EMA vulnerabilities in the manufacturing process. By analyzing the elements that contribute to existing vulnerabilities, food safety and defense professionals can also identify alternative strategies, such as identifying suppliers from a more favorable region of the world or investing in research to develop identity tests for targeted commodities.

Business Briefs

Clear Labs achieves lab accreditation by A2LA for technical competence in biological testing in accordance with recognized ISO/IEC 17025:2005 standards.

Waterleau Group, a provider of energy recovery and water, air, and waste treatment, acquires the anaerobic biological wastewater treatment plant design-build business of Ecovation and membership interests of Krofta Technologies and its DAF technology from Ecolab.

Mérieux NutriSciences forms Mérieux NutriSciences Certification LLC, the new name and legal entity for the organization's certification body, formerly known as Silliker Global Certification Services.

Camlin Fine Sciences opens a North American division in Urbandale, Iowa, to supply antioxidants for food, pet food, and animal feed industries. Camlin also acquires Dresen Quimica S.A. de C.V. in Mexico City to expand services in Central America.

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Washington Report

◀(Left to right) Michael R. Taylor, former FDA deputy commissioner for foods and veterinary medicine; Enrique Sánchez Cruz, executive director, SENASICA; Margaret A. Hamburg, MD, former commissioner of the U.S. FDA; and Mikel Arriola Peñalosa, commissioner, COFEPRIS, signing a statement of intent to establish a new produce safety partnership with Mexico in July 2014.

SOURCE: U.S. FDA

Michael Taylor Departs FDA

Food safety expert Taylor served in numerous high-level positions at FDA and led implementation of FSMA | BY **TED AGRES**

Michael R. Taylor's surprise departure from the FDA as deputy commissioner for foods and veterinary medicine, announced in early March and effective June 1, 2016, comes at a particularly critical time for the agency, which is in final stages of implementing the Food Safety and Modernization Act (FSMA). Taylor had been the primary point person at FDA responsible for FSMA, from overseeing the drafting of the regulations, to organizing outreach efforts with industry interest groups and other stakeholders, and to revising and finalizing the rules based on public comment and feedback.

"After almost seven years, this is the right time for me to move on to the next phase of my career," Taylor wrote in a March 8, 2016 email to his FDA colleagues. "It's not an easy decision. This job has been an honor and a pleasure for me and remains as challenging and satisfying as ever. I am privileged to work with the most talented, passionate, and resilient public servants on the planet and have learned enormously from them, as well as from our many stakeholders and partners elsewhere in government and in the consumer and industry communities."

Taylor did not disclose his future activities, saying only that he planned to continue working in the food safety arena, focusing on those settings where people lack regular access to sufficient, nutritious, and safe food.

FDA announced that Stephen Ostroff, MD, would replace Taylor as deputy commissioner for foods. Dr. Ostroff served as acting FDA commissioner until the appointment in February 2016 of Robert Califf, MD, to the top post. Dr. Ostroff joined FDA in 2013 as chief medical officer at Center for Food Safety and Applied Nutrition (CFSAN), where he served as senior public health advisor to Taylor. He became the agency's chief scientist in 2014, responsible for leading and coordinating FDA's cross-cutting scientific and public health efforts. "He knows our programs. And he is the perfect person to lead them into the future," Taylor said of Dr. Ostroff in his March email to FDA colleagues.

Competence and Professionalism

Taylor has won praise from the food industry for competence and professionalism during his multi-year, multi-stakeholder effort to usher FSMA from concept to (mostly) final rules and implementation.

"Mike Taylor has left a remarkable legacy as deputy commissioner for foods and veterinary medicine," says Pamela G. Bailey, president and CEO, Grocery Manufacturers Association. "Under his leadership, the agency successfully ushered in the most sweeping set of reforms to our nation's food safety system in a generation through the implementation of FSMA. He worked openly and fairly with stakeholders on all sides of this important—and complicated—issue, and the result has been a strengthened food safety system that benefits all Americans," Bailey tells *Food Quality & Safety* magazine. "Steve Ostroff's experience both with CFSAN and as acting FDA commissioner, and his expertise in food safety and nutrition, make him exactly the right person to follow Taylor and to continue FDA's important work in these areas."

Craig W. Henry, PhD, vice president for global business development, Americas, Decernis LLC, says he was "saddened" by Taylor's departure "because there is still so much yet to do with the implementation of FSMA regulations."

"I have known Mike since 2004 and truly appreciate and thank him for his ongoing commitment to protecting the public while engaging all stakeholders for input and guidance," Dr. Henry says. "He has served the U.S. government well over the years. As an industry professional, I find Mike to be fair and sincerely engaged to improve food safety programs and processes for the benefit of the public as well as the multiple industries supplying the highest quality food products in our global market," Dr. Henry tells *Food Quality & Safety*.

"Mike Taylor's legacy has been to push FSMA from passage into law through rules and regulations," comments David

Acheson, MD, founder and CEO of The Acheson Group and a former FDA associate commissioner for foods. "This has been no small accomplishment. The next step is to lead it into full implementation. That's the toughest part because that's where the rubber meets the road," he tells *Food Quality & Safety*.

"Stephen Ostroff is a physician who understands food science and public health. I like that. That's exactly what this position needs now," Dr. Acheson adds. "He has the credibility but he will also need to have the leadership and vision to rally the troops to bring FSMA into full implementation."

Stephen Ostroff, MD, former acting commissioner of food and drugs, U.S. FDA, during the agency's Science Writers Symposium in September 2015.

Prior to joining FDA in 2013, Dr. Ostroff served as deputy director at CDC's National Center for Infectious Diseases, where he was also acting director of the agency's Select Agent Program. While at CDC he focused on emerging infectious diseases, food safety, and coordination of complex outbreak response, according to his official bio. He retired from the Commissioned Corps of the U.S. Public Health Service at the rank of rear admiral (assistant surgeon general).

Dr. Ostroff also served as director of the Bureau of Epidemiology and acting physician general for the Commonwealth of Pennsylvania and has consulted internationally on public health projects in South Asia and Latin America. He graduated from the University of Pennsylvania's School of Medicine in 1981 and completed residencies in internal medicine at the University of Colorado Health Sciences Center and preventive medicine at CDC.

Career in Public and Private Sectors

Taylor's long career in government, industry, and academia has earned him acclaim as well as criticism. After receiving a law degree from the University of Virginia, Taylor joined FDA as a staff attorney in 1976. In 1981 he joined the law practice of King & Spalding, eventually becoming head of the firm's food and drug law practice, with Monsanto being one of his clients. He returned to FDA from 1991 to 1994 as deputy commissioner for policy. From 1994-1996 Taylor was administrator of USDA's Food Safety and Inspection Service, during which time he instituted Hazard Analysis and Critical Control Points, or HACCP, to improve the safety of meat and poultry production. Between 1996 and 2000, he joined Monsanto as a vice president for public policy. He served as a senior fellow at Resources for the Future from 2000 to 2005, and from 2006 to 2009 held academic positions at the University of Maryland Medical School and at George Washington University. He returned to FDA in July 2009.

Taylor had become a frequent target of attack by anti-GMO and other groups who demonized him for having worked for and on behalf of Monsanto Co. Online petition drives sought to force Taylor's removal from office because of his association with Monsanto and the "revolving door" nature of his career. One such effort claims to have gathered more than 466,000 signatures since first opposing Taylor's appointment as senior adviser to the FDA commissioner in July 2009. "Taylor is the same person who as a high-ranking official at the FDA in the 1990s promoted allowing genetically modified organisms into the U.S. food supply without undergoing a single test to determine their safety or risks," reads the petition, posted by MoveOn.org. "This is a travesty."

But numerous consumer groups and academics rallied in Taylor's defense. One rebuttal was signed by Michael Jacobson, executive director of the Center for Science in the Public Interest, and Carol Tucker-Foreman, a distinguished fellow at the Consumer Federation of America and a former assistant agriculture secretary. "The undersigned have diverse views regarding genetically engineered foods, but we are unanimous in our belief that Taylor is a valued deputy commissioner, and we regret that a factually untrue Internet smear campaign has attracted so much support," they wrote in an online "open letter."

"We acknowledge that Monsanto symbolizes a lot of things that many people (including some of us) don't like about modern, industrial agriculture. But Mr. Taylor's résumé is not reducible to his work at that company," they continued. "Since joining the Obama administration, Taylor has been working extraordinarily hard to transform the FDA from a reactive agency that chases down foodborne-illness outbreaks after people fall ill, to a proactive public-health-based agency focused on preventing foods from becoming contaminated in the first place.

"We are confident that his leadership, formerly at USDA and now at FDA, has and will continue to reduce the number of Americans sickened, hospitalized, and killed by foodborne pathogens," they concluded. ■

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

SOURCE: U.S. FDA

Industry Insights

Criminal Consequences of New Human Illness Standard

How sending your customers to the hospital could send you to jail | BY **SHAWN K. STEVENS**

Following the passage of the Food Safety Modernization Act (FSMA), FDA was tasked with the enormous responsibility of overhauling the safety of the nation's food supply. Virtually overnight, the agency found itself in the unenviable position of needing to author, and eventually enforce, sweeping new regulations aimed at the safety of imported and domestic foods without adequate funding or nearly enough inspectors. In turn, FDA's ultimate success or failure would be judged by consumers and Washington by the numbers of recalls and foodborne illness outbreaks being reported in the news. To bridge the vast gap between tremendously limited resources and seemingly unreachable goals, the agency worked tirelessly to identify creative new tools to enable it to accomplish its new charge. FDA's solution, it now appears, is to make any food company (or food company employee) that makes a customer sick a criminal target.

Outbreak Overload

FDA's new policy aimed at reducing the numbers of annual foodborne illness outbreaks flows from a long history of federal food safety regulation. Immediately following a massive *E. coli* O157:H7 foodborne illness outbreak on the West Coast in the early 1990s, food safety was elevated to a prominent role in our nation's dialogue. The federal government announced more stringent standards governing the safety of raw animal foods, and also worked closely with CDC and the states to develop a national foodborne illness surveillance system (PulseNet) designed to quickly detect, and in many cases solve, emerging outbreaks. As the system became more capable, the government began identifying an increasing number of annual foodborne illness outbreaks, and it quickly became clear to both industry and regulators alike that many of the foods sold in commerce were at risk of becoming contaminated with harmful pathogens.

Initially, industry responded to the increasing numbers of outbreaks by requiring more microbiological testing of incoming ingredients and finished products. In 2009, FDA joined the fight, and created the Reportable Food Registry (RFR) to help identify and contain contaminated ingredients in the food supply. Prior to the RFR, if a food company found that the ingredients it received from a supplier tested positive for a pathogen, the company would simply reject the shipment and return it to the supplier. Once the RFR was created, however, any food company which received ingredients that tested positive would be required to file a report with FDA. The agency would then take regulatory action against the original supplier, and require that all ingredients or products from all potentially affected lots be recalled. Because the RFR allowed FDA to immediately see and track contaminated food ingredients and products already in the food supply, the system caused a massive spike in the numbers of recalls being announced.

Creation of Human Illness Standard

Driven by the large numbers of outbreaks and recalls triggered by PulseNet and the RFR, it suddenly appeared to consumers that the foods they were buying were be-

coming increasingly unsafe. In response to the negative perceptions surrounding the safety of the national food supply, Congress enacted FSMA. And, as noted, with the passage of FSMA, FDA was told, with extremely limited resources, to overhaul the safety of the food supply and make foodborne illness outbreaks go away. Without the resources to merely "regulate" safety into food, the agency instead adopted a bold new policy stance that essentially created zero-tolerance for human illness. Under this new "Human Illness Standard," the agency will work with the U.S. Department of Justice (DOJ) to determine whether criminal sanctions are appropriate whenever a company's food product is linked to a consumer illness.

Indeed, DOJ recently acknowledged its partnership with FDA and the agencies' policy of initiating criminal investigations against any company (or its employees) that sells a product that causes human illness. Benjamin C. Mizer, principal deputy assistant attorney, explains that "one of the government's highest obligations is to protect citizens when they cannot protect themselves." According to the agency, and the development of recent policy, FDA and DOJ view any human illness caused by a food product as a potential violation of the law. "In deciding whether to use our civil or our criminal enforcement tools," explains Mizer, "prosecutors [will] evaluate the nature and seriousness of the offense, the deterrent effect of the prosecution and the culpability of the individuals or entities involved."

Under this new Human Illness Standard, a food company executive, manager, or employee can be charged with a crime even if they didn't know they were selling product that was contaminated or making people sick.

Under this new Human Illness Standard, a food company executive, manager, or employee can be charged with a crime even if they didn't know they were selling product that was contaminated or making people sick. According to Mizer, "Congress has made the prohibition on introducing adulterated food into interstate commerce a strict liability offense, meaning that a company or individual violates the law and can face misdemeanor charges whether or not it intended to distribute adulterated food." And, "make no mistake," says Mizer, misdemeanor violations can mean serious penalties. Indeed, a single misdemeanor violation (for selling just one contaminated product) can equate to a $250,000 fine and a year in prison.

Criminal Past

The FDA's power to bring criminal charges against corporate executives and em-

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(Continued from p. 15)

ployees originates from a 1975 Supreme Court Case. In *United States v. Park*, 421 U.S. 658 (1975), the Supreme Court upheld the conviction of the president of a major grocery chain. In that case, the president was found to be criminally liable for the insanitary conditions of a warehouse, where the conditions of the warehouse could have led to the shipment of adulterated product (adulteration was never proven), notwithstanding his argument that he had delegated the responsibility for maintaining the cleanliness of the warehouse to his subordinates.

The Supreme Court concluded that if a company ships adulterated food, the executives or managers of that company can be charged, even if they had no direct knowledge or intent. Under this standard, a company executive or QA manager can be charged simply if he or she is aware of a condition within his or her facility that could possibly lead to a foodborne illness, and then fails to take action to correct it. In each case, FDA will consider the individual's position within the company and her relationship to the violation. Following the Supreme Court's 1975 decision, the doctrine was rarely used by FDA, lying dormant for decades.

By virtue of apparent increase in the numbers of outbreaks and recalls, however, including the FDA's charge to overhaul the safety of the food supply and the its search for creative new enforcement tools, the doctrine has been resurrected. In turn, the government has proven it is neither hesitant nor shy about launching criminal investigations against food companies as demonstrated in a series of recent high-profile examples.

Indeed, following the Jensen Farms *Listeria monocytogenes* (LM) cantaloupe outbreak, company owners were investigated by FDA, criminally charged, and then sentenced to six months of home detention and individual fines of $150,000. Following the Quality Egg *Salmonella* outbreak, company executives were sentenced to three months in jail and assessed substantial fines. Notable, in each of these cases, neither the companies nor their employees knew that they were selling contaminated food. And, these are not the only cases where the government has targeted companies where knowledge was not a factor. More recently, FDA and DOJ have launched criminal investigations against Blue Bell, Chipotle, and Dole for unknowingly selling food that made people sick.

In Blue Bell, FDA linked positive samples from Blue Bell's processing facilities to 10 case patients in the PulseNet database who carried the same strain of LM. What makes the investigation concerning for industry is that the outbreak spanned approximately five years, and no one from Blue Bell knew that their products were causing illnesses. Nevertheless, FDA is conducting a criminal investigation and seeking a wide-range of company records and emails. If FDA brings criminal charges, it will likely argue that Blue Bell should have done more to eliminate LM from its processing environment.

In Chipotle, the national restaurant chain struggled for months in 2015 to contain and manage numerous foodborne illness outbreaks allegedly linked to food served at its restaurants. Although the source of many of the illnesses remains uncertain, Chipotle confirmed in public filings that it was served with a grand jury subpoena by DOJ requiring it to produce documents to FDA investigators related to company-wide food safety matters dating back to Jan. 1, 2013. In addition to attempting to determine the cause of the recent 2015 outbreaks, FDA is apparently "fishing" for examples of possible misconduct dating as far back to 2013.

More recently, Dole prepackaged salads were linked to a LM outbreak that caused 18 illnesses and one death. Reportedly, FDA cultured *Listeria* from Dole's processing facility that matched the outbreak strain. Here too, although neither Dole nor its employees knew they were selling contaminated products, DOJ and FDA launched a criminal investigation. In the event criminal charges are issued, FDA will likely argue that Dole failed to adequately test and control for LM within its facility.

Intensive Investigations

But these aren't the only companies in the FDA spotlight. Every company that falls under FDA jurisdiction is at risk. The agency is now conducting microbiological profiling inside all food processing facilities during routine inspections. The agency is also testing vast amounts of food at retail. If FDA finds that a company's products (at retail) or environment (in its facility) are contaminated, it will compare those strains against the PulseNet database to determine whether they can be linked to any unsolved illnesses occurring within the last 10 years. If so, those companies will face a massive recall and their executives and QA managers could find themselves in jail. Indeed, under FDA's new approach, even the failure to effectively eliminate sporadic LM findings in the environment completely could potentially expose company employees to criminal liability. Food companies need to take action now to prevent becoming the next Blue Bell, Chipotle, or Dole.

And, moving forward, it's clear that neither FDA nor DOJ will relent. DOJ's Benjamin Mizer recently made it clear that the use of criminal sanctions against the food industry remains a priority. In particular, he explains that "aggressive enforcement of the FDCA and other food safety laws helps to ensure that making safe food is not only the best ethical and moral decision, but also the best business decision," and concluded by confirming that FDA and DOJ "are committed to continuing to vigorously prosecute food safety cases."

There are a large number of actions companies can take now to better protect themselves from the consequences of criminal investigation. In addition to enhancing environmental monitoring and control programs, food company executives and managers should consult with legal experts to make sure their food safety programs will withstand scrutiny from FDA criminal investigators. Being self-critical now will enable a company to survive the scrutiny and criticisms of FDA during the next routine or investigational inspection.

While most insiders have long believed that FDA's success in overhauling the safety of the food supply rests with FSMA, under the new Human Illness Standard, the agency's success may instead be driven by the Park Doctrine and industry's fear of prison. ■

Stevens is a global food safety lawyer and founding member of Food Industry Counsel LLC. He also speaks regularly to national and international audiences on a wide variety of emerging scientific, regulatory, and legal food safety trends. Reach him at stevens@foodindustrycounsel.com.

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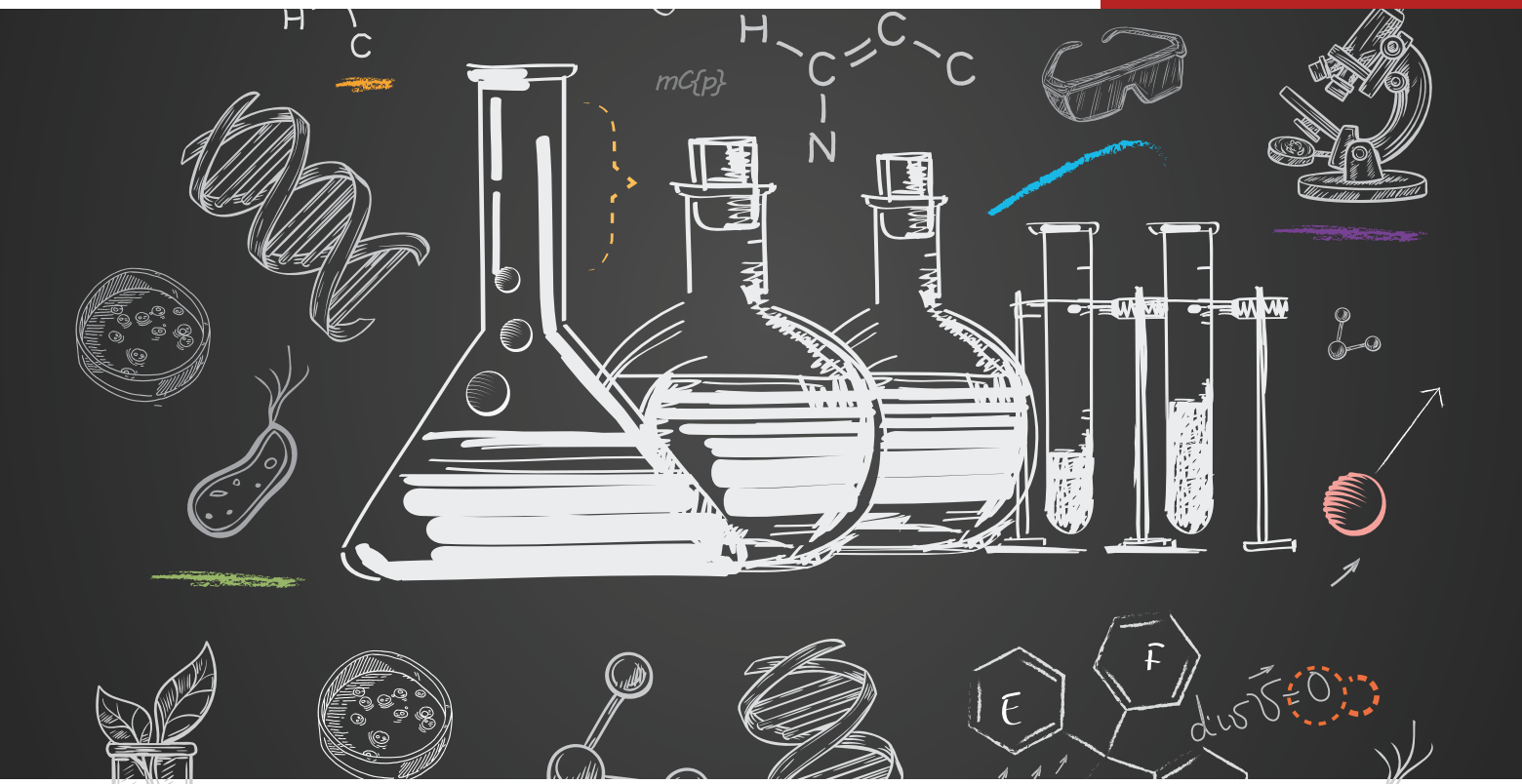

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Across The Nation

Fabulous Florida

Forecast: bright and sunny, with a chance of flip flops and an abundance of food safety initiatives

BY **LINDA L. LEAKE, MS**

Editor's Note: *This is the third installment of a year-long series that highlights the food safety initiatives, programs, and activities implemented in certain U.S. states.*

Question: What do alligators, manatees, and the world's most beloved mouse have in common?

Answer: They all live harmoniously in the state where visitors outnumber residents five to one and exemplary food safety leadership and undertakings are as commonplace as the sandy beaches, surf, and sunshine that draw and hold everyone there.

Ah, Florida. It's definitely not just for spring break. (Just ask Mickey.)

On any given day, there are 1.8 million visitors in Florida, according to VISIT FLORIDA, the state's official tourism marketing corporation.

Alabama's and Georgia's southern neighbor welcomed a whopping 105 million visitors in 2015. Since Florida's population is just over 20 million, that pencils out to five tourists for every resident.

Obviously two of the most important tourism industries in the Sunshine State are hotels and restaurants, and both are licensed and regulated by the Florida Department of Business and Professional Regulation (DBPR) Division of Hotels & Restaurants (H&R), according to Ken Lawson, DBPR secretary.

The main priorities of DBPR's inspectors are safety and sanitation, Lawson notes. "That's why H&R adheres to the standards of the FDA Food Code," he relates. "H&R has achieved an 81 percent decrease in foodborne illness outbreaks statewide since 1997, the year we began tracking data related to foodborne illnesses."

That's no small feat, since there are currently more than 51,000 licensed public food service establishments in Florida that H&R inspects.

Calling DBPR's initiative one of the most prominent food safety regulatory programs in the nation, Lawson mentions that H&R was the recipient of the prestigious Elliot O. Grosvenor Food Safety Award at the 2014 Association of Food and Drug Officials Annual Educational Conference. The Grosvenor Food Safety Award recognizes the achievements of food safety programs within state departments of agriculture, natural resources, public health, or environmental protection in the U.S. and Canada.

"With this award, H&R was recognized for leading the nation in improvement, innovation, and sustained high performance in food safety practices and procedures," Lawson boasts. "DBPR's food safety and sanitation inspectors are committed to ensuring Florida maintains its spot as a global destination for travel."

Agriculture Abounds

After tourism, agriculture is Florida's second largest industry, generating more than $120 billion for the state's economy.

It's old news that citrus fruits, especially oranges, are a major part of the Florida economy and that the state produces the majority of citrus fruit grown in the U.S. The Florida citrus industry creates a $10.8 billion annual economic impact, employing nearly 62,000 people, and covering about 515,000 acres, according to Florida Citrus Mutual, the state's largest citrus grower organization.

For the 2014-2015 season, 56 percent of all U.S. citrus, including 68 percent of oranges, 13 percent of tangerines, and 63 percent of grapefruit were grown in Florida, reports Candice Erick, the state administrator of USDA's National Agricultural Statistics Service Florida Field Office.

"About 95 percent of commercial orange production in the state is destined for processing, mostly as orange juice, the

official state beverage," Erick adds. "Florida accounts for about 20 percent of the world's processed orange supply."

As it turns out, for all that Florida vitamin C, the big issues in the citrus industry are not related to food safety.

Rather, the dominant story concerns a dreaded quality-reducing disease called Huanglongbing (HLB), which loosely translates to "yellow dragon disease," and is also known familiarly as citrus greening, according to Michelle Danyluk, PhD, an associate professor of food microbiology and safety with the University of Florida's (UF) Institute of Food and Agricultural Sciences (IFAS) Citrus Research and Education Center (CREC).

Thought to be caused by the bacterium *Candidatus* Liberibacter asiaticus, and primarily spread by the Asian citrus psyllid, a small insect, HLB was first observed in China in 1919, says Keith Schneider, PhD, an UF/IFAS professor of food science. "Since then, HLB has seriously affected citrus production in Asia, Africa, the Indian subcontinent, and South America," he relates. "HLB was first confirmed in Florida in 2005."

Since that time, HLB has been found in commercial and residential sites in all Florida counties with commercial citrus, according to Megan Dewdney, PhD, a CREC plant pathologist.

Sadly, wherever the disease has appeared, citrus production has been compromised with the loss of millions of trees, Dr. Dewdney relates.

Food safety is important to the Florida citrus grower, packer, and processor, but it's not the story dominating as the industry struggles to find a way to survive with citrus greening, Dr. Danyluk says. "As a result of HLB, citrus production in Florida is well down, almost [by] half, from a decade ago."

"The effects of HLB on the citrus industry are difficult to exaggerate and the industry is still struggling to find an effective and economical way to combat HLB and the Asian citrus psyllid, the vector," Dr. Dewdney emphasizes.

Hellooo...Tomatoes Count, Too

Oranges may seem like the big cheese in Florida, but tomatoes are actually a huge deal in the Sunshine State.

Florida is the second largest producer of tomatoes in the U.S. (after California) and is the largest producer of tomatoes for the fresh market, accounting for about 50 percent of all fresh tomatoes produced domestically, according to the Florida Tomato Committee , a Federal Marketing Order.

With a total crop value at the farm level exceeding $619 million, Florida ships more than 1.1 billion pounds of fresh tomatoes annually throughout the U.S., as well as to Canada and abroad. In fact, tomatoes comprise nearly one-third of the total value of all fresh vegetables produced in Florida.

"The Florida tomato industry has a great story to tell in terms of reacting positively to food safety issues," Dr. Danyluk says. "Florida tomatoes were actually the first commodity in the U.S. to implement state regulations related to food safety."

"The state self-regulation of Florida tomatoes story dates back to the early 2000s when there were a number of outbreaks of *Salmonella* all linked to fresh tomato consumption, about 14 such outbreaks from 2000 to 2006," Dr. Danyluk relates. "While not all of these outbreaks were related directly to Florida tomatoes, they

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certainly indicated there was a potential problem. This inspired the Florida tomato industry to make food safety a top priority, so much so that the industry embraced a proactive approach and pushed for a state food safety regulation."

This effort resulted in Florida being the first state in the country to adopt a comprehensive food safety program with mandatory government inspection and audits for tomato handling, production, and packing.

Tomato Good Agricultural Practices (T-GAPs) and Tomato Best Management Practices (T-BMPs) were adopted as state regulations, effective July 1, 2008.

Tomato Industry Food Safety Program

Highlights of the program include annual registration of all packers and repackers of tomatoes in Florida, which is facilitated by county extension offices; education, training courses, and workshops on food safety practices; regulatory inspections and audits by Florida Department of Agriculture and Consumer Services (FDACS) inspectors; and annual FDACS tomato packer/repacker permit application.

"Immediately following the release of the T-GAPs and T-BMPs rule, Florida successfully ran a GAPs program that trained over 1,400 produce growers and 90 percent of the tomato industry," Dr. Danyluk relates. "This program then morphed into three offshoots, including a 'Building Your Own Food Safety Manual' workshop, run through our UF/Florida A & M University Small Farms Center, which is designed to get small farms growing any varieties of produce through a food safety audit. The second was a Hazard Analysis and Critical Control Points (HACCP) class targeted at packinghouses that wouldn't fit into traditional HACCP-like systems, but needed a HACCP certified individual to meet their audit requirements. The third is a one-day water workshop, focused on all on pre- and post-harvest water use, quality, and testing."

One might say "Gator aid" abounds, since, from a training and education point of view, UF/IFAS has conducted numerous produce safety related trainings, starting a decade ago, Dr. Danyluk adds.

"Dr. Schneider and I serve as co-leaders for these programs, which cover basic food safety, biodefense (including recalls), GAPs, HACCP, and, most recently, FSMA [Food Safety Modernization Act] requirements," she says. "Specifically, we currently represent the USDA-funded Southern Training, Education, Extension, Outreach, and Technical Assistance Center to Enhance Produce Safety, which focuses on training, education, extension, outreach, and technical assistance to prepare the produce industry for FSMA Produce Safety rule and Preventive Controls for Human Food rule compliance."

After tourism, agriculture is Florida's second largest industry, generating more than $120 billion for the state's economy.

Also, it is another significant distinction that the CDC established the Florida Integrated Food Safety Center of Excellence in 2013, one of just six such centers in the country.

The Florida Keys: Cooperation and Collaboration

Active and aggressive, that's how best to describe Florida's approach to food safety. So says Martha Roberts, PhD, CFS, a special assistant in the UF/IFAS Office of Government Affairs.

"With a food safety law in place since 1905, Florida has long had a strong food safety program, which includes one of the first state ISO 17025 certified food laboratories in the country," she boasts.

Dr. Roberts chairs the state's FSMA External Working Group that was established by Florida Commissioner of Agriculture Adam Putnam in 2010.

Under Commissioner Putnam's leadership, Florida has embraced a proactive approach to dealing with FSMA in a team effort collaboratively with the FDACS and all segments of affected industry, Dr. Roberts emphasizes.

In a forward move, the FDACS hired a FSMA policy director, Susan Caime Mardenborough, in 2013.

"Additionally, the Commissioner wanted an external working group, open to any and all Florida food and agriculture stakeholders, including academia and industry," Dr. Roberts says. "To that end, we have engaged about 35 people, representing fruit and vegetable growers and associations, animal feed producers, retail stores, and retail processors."

To begin with, the Working Group held weekly conference calls. "We discussed the proposed rules line by line and prepared written comments to document everyone's initial concerns," Dr. Roberts relates. "We also responded to FDA's revision."

"Representing a diverse swath of Florida's agriculture industry, the Florida FSMA Working Group provides a voice for Florida producers that will be impacted by FSMA," Caime Mardenborough adds. "Along with providing comments and input to the FDA to help communicate concerns of agricultural producers, the Working Group seeks to prevent Florida producers from being at a competitive disadvantage with the implementation of these rules."

According to Dr. Roberts, under Florida's inspiring example and leadership, the FDACS and the FSMA External Working Group have been making monumental strides to engage all stakeholders, FDA, and USDA in open, cooperative, collaborative ways.

"Through agricultural tours and other educational activities, this group works tirelessly to show the FDA how FSMA would impact Florida's agriculture industry," Dr. Roberts says.

"The take home message is that Florida has long been active and aggressive relative to food safety and we have had a premier food safety program in the state for decades," Dr. Roberts boasts. "Everyone here recognizes that good, nutritious, safe food is important and we all support public health and our food and agriculture industries. All Florida stakeholders have a long term commitment to the safety of all Florida food that is grown, produced, sold, and consumed; and we are working as a team in a collaborative way to achieve it." ■

Leake, doing business as Food Safety Ink, is a food safety consultant, auditor, and award-winning journalist based in Wilmington, N.C. Reach her at LLLeake@aol.com.

For bonus content, go to June/July 2016 issue on www.foodqualityandsafety.com and click on "Florida's Abundance of Food Safety Initiatives."

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SAFE FOOD FOR THE ENTIRE FAMILY

Pets are dependent on their owners to provide food and treats free from contaminants

BY **LINDA L. LEAKE, MS**

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"Paws" for a moment and consider these statistics: A whopping 65 percent of U.S. households own a pet, which equates to 79.7 million homes, according to the 2015-2016 American Pet Products Association National Pet Owners Survey.

Some 54.4 million U.S. households own at least one dog, while 42.9 million households own at least one cat. About 77.8 million dogs and about 85.8 million cats are owned in the U.S.

For those whose lives are enhanced and enriched by pets, animals are beloved members of the family. Pet owners are devoted to their care and well-being. In 2015, an estimated $60.59 billion was spent on pets in the U.S. and $23.04 billion of that was estimated for food.

The importance of pet food safety cannot be overstated, says Robert Buchanan, PhD, director of the Center for Food Safety and Security Systems at the University of Maryland.

Dr. Buchanan is quick to point out that *Salmonella* transmission linked to contamination of pet foods has become a significant issue for pets and humans in recent years, not to mention a driving force in the pet food industry.

Since 2010, there have been more than 90 product recalls associated with pet foods potentially contaminated with *Salmonella*.

Dr. Buchanan contends that the status of pet foods in the realm of food safety has changed dramatically as a result of outbreaks of salmonellosis among pet owners.

Game Changing Outbreaks

"Now pet food safety issues are public health issues," he explains. "This mindset started in 2006 with the *Salmonella enterica* serotype Schwarzengrund contamination of pet food that led to prolonged multistate outbreaks involving 79 human patients into 2008." The resulting investigation was the first to identify contaminated dry dog food as a source of human *Salmonella* infections.

Then in 2012, there was the *Salmonella enterica* serotype infantis contamination that created a multistate outbreak impacting 49 patients. Seventeen brands representing more than 30,000 tons of dry dog and cat food produced at a single facility were recalled as a result of this outbreak.

"*Salmonella* is changing the pet food industry," Dr. Buchanan emphasizes. "Dry pet foods are now part of a much greater food safety problem, most especially how to control the microbiological safety of dry products."

There are several reasons why there may seem to be more pet foods being recalled of late due to possible *Salmonella* contamination, says Kimberly May, DVM, MS, a spokesperson with the American Veterinary Medical Association.

Dr. Buchanan contends that the status of pet foods in the realm of food safety has changed dramatically as a result of outbreaks of salmonellosis among pet owners.

"One potential reason is that the large-scale, melamine-related pet food recall of 2007 increased public and media awareness of and sensitivity to pet food safety concerns," Dr. May points out. "Another potential reason is the increased vigilance of the manufacturers and the federal government regarding *Salmonella* and other public health concerns, leading to increased surveillance and reporting."

A third potential reason for seemingly more pet food recalls, Dr. May adds, is the existence of FDA's Reportable Food Registry, an electronic portal established in 2010 for industry to report when there is reasonable probability that an article of food will cause serious adverse health consequences.

"One of the most important food safety challenges facing the entire pet food industry in recent years has been to dramatically change the food safety culture within our production facilities, as well as with our ingredient vendors, customers, and regulatory agencies," says Michele Evans, PhD, executive director of food safety and quality for Diamond Pet Foods.

The aforementioned 2012 *Salmonella* outbreak was linked to dry dog food produced at Diamond's facility in Gaston, S.C.

"Without education and acknowledgement concerning the importance of food safety within our Diamond organization and supply chain, it's very hard to implement effective food safety programs," Dr. Evans relates. "The key has been to not only educate, but also communicate the progress of the company's food safety programs.

"As an industry we have to educate our vendors that the ingredients they supply us have higher expectations today because the products we produce have higher expectations from our consumers than ever before," Dr. Evans continues.

The pet food industry has made incredible strides in strengthening the food safety culture mindset and preventive programs since those landmark *Salmonella* recalls, and the data to support that is evident, Dr. Evans adds.

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"Never in the history of the CDC has there been a human death reported attributed to pet food," says Dr. Evans. "In spite of the compelling CDC data that illustrates that pet food is of relatively low risk, the pet food industry has embraced food safety and is leading the way as an industry to best of class when it comes to food safety and food safety culture."

FSMA Quirks

The FDA Food Safety Modernization Act (FSMA) Preventive Controls for Animal Food rule is final, effective Nov. 16, 2015.

The most interesting thing about the new regulations is that FDA is requiring pet food to test negative for *Salmonella*, says James Dickson, PhD, professor of animal science at Iowa State University, noting that the FDA *Salmonella* regulation for pet food is different from the USDA rule for meat and poultry in the human food chain.

"Relative to fresh meat and poultry for human consumption, *Salmonella*-free meat is not possible in our current processing system," Dr. Dickson relates. "We accept a low level of *Salmonella* in fresh uncooked meat."

That *Salmonella* negative requirement puts a lot of burden on the pet food industry, Dr. Dickson says. "Manufacturers must ensure that their products will test negative for *Salmonella*. They have to make sure they have the right process, which is impacted by time, temperature, relative humidity, and water activity. As a result, raw material process controls have to be spot on."

"Raw pet products are a growing niche," Dr. Dickson mentions, "and alternative non-thermal processes are available to kill pathogens in raw meat while maintaining the desirable raw look.

That *Salmonella* negative requirement puts a lot of burden on the pet food industry, Dr. Dickson says.

Examples include irradiation and high pressure processing (HPP), a cold pasteurization technique."

Stella and Chewy's, Oak Creek, Wis., uses HPP on all of its products.

"HPP inactivates harmful pathogens, and is a growing practice among leading food brands within food manufacturing for both the human and animal markets," says Marie Moody, the company's founder and chairman.

All Stella and Chewy's products are 90 percent to 98 percent meat, organs, and bones, and many are single-source proteins.

"We couple HPP with SecureByNature, our patented food safety system, that employs multiple steps throughout our manufacturing process," Moody relates. "Additionally, we have each batch of our product tested by outside labs for *Salmonella*, *E. coli* 0157, and *Listeria*, and post the results to our website. That ensures complete transparency for those who have purchased our brand."

In addition, there are pet treats that aren't regulated by FSMA. These products are relatively new innovations in the canine culinary world, containing cannabidiol (CBD), a non-psychoactive cannabinoid purported to provide anti-inflammatory and anti-anxiety benefits.

Such products are part of a line of pet treats manufactured by Auntie Dolores Every Day Edibles, Oakland, Calif.

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Julianna Carella, the founder and CEO of Auntie Dolores, calls her proprietary blend CBD-infused pet goodies Treatibles, which are marketed as super food wellness treats. She mentions that Auntie Dolores voluntarily lists laboratory analysis results, including the CBD content in milligrams, on Treatibles packaging and on the company website. Treatibles are also made following a Hazard Analysis and Critical Control Points plan, even though there are no regulations requiring it.

Auntie Dolores Treatibles are created with a proprietary blend of nontoxic hemp-derived CBD and other cannabinoids, Carella points out, emphasizing that Treatibles are safe for any animal with an endocannabinoid system.

"Pet owners are giving their dogs Treatibles to alleviate symptoms and pain associated with several disorders, including separation anxiety, arthritis, hip dysplasia, cancer, and epilepsy," she says.

Treatibles are held to some labeling and marketing restrictions, however. "Because CBD is not an FDA-approved ingredient, we are restricted with regard to the claims that can be made about the products," Carella explains.

Six-Pack Against Pathogens

"Every pet food manufacturing environment is directly impacted by the details of facility design and the diet ingredients being used," says Edward Richter, PhD, founder and president of Richter International, Inc., Columbus, Ohio. He has more than 30 years of experience helping pet food manufacturers understand, develop, and implement food safety practices.

"Now many of the new specialty pet diets, such as health-condition specific, grain-free, and protein-specific, include meat, vegetables, and other wholesome ingredients, all of which further diversify the overall microbiological challenges of pet food manufacturing," Dr. Richter points out.

Dr. Richter and his team, including Jessica Dyszel, PhD, offer a six-pack brimming with what he calls the essential best practices for controlling microbiological pet food safety.

1. Environments must be monitored. "In all facilities, environmental control means having an awareness of every aspect of the production environment," Dr. Richter begins. "This includes equipment surfaces, water, air, and the materials moving in and out of the environment."

2. Ingredients must be monitored. Manufacturers need to investigate and document all incoming ingredients, Dr. Richter says. "Vendors should be audited and microbiological specifications set for all ingredients," he elaborates. "Each lot of ingredient should be tested by an agreed-upon independent laboratory using methods appropriate for the ingredient."

3. Methods must be validated. "All microbiological methods used in the testing of environmental samples, ingredients, or finished products should be validated," Dr. Richter advises. "It is essential that both the testing laboratory and the food manufacturer quality assurance staff have an in-depth understanding of the validation methods and potential problems."

4. Workflow must be mapped and managed. Managing the workflow and traffic patterns in a production facility is one of the most important and difficult best practices, Dr. Richter points out. "Along with obvious signage, there needs to be a physical separation in the plant between the raw and the finished product sides, as well as having chemical barriers in place," he says. "If possible, dedicate raw-side and finished-side equipment, employees, and maintenance tools."

Manufacturers need to investigate and document all incoming ingredients, Dr. Richter says.

5. An appropriate finished product hold/release testing program must be implemented. "If finished product sampling is statistically based and the laboratory methodology is appropriate and accurate, data collected will enhance confidence that the product was manufactured in microbiological control and the risk of pathogen contamination will be very low," Dr. Richter notes.

6. A culture of critical thinking must be created and reinforced. "Quality and food safety must start at the highest level of senior management," Dr. Richter emphasizes. "From there, a culture of critical thinking must flow to at all levels of production and quality control. This culture should be reinforced by frequent training relative to any procedural changes, including microbiological awareness training, which is often overlooked in pet food manufacturing."

FDA Policy Changes

Pet food manufacturers' continued efforts to minimize food safety risks in their products are essential because, in addition to FSMA regulations, FDA has executed a number of significant policy changes, notes Shawn K. Stevens, a food safety lawyer who operates Food Industry Counsel LLC, Random Lake, Wis.

"As part of its enforcement scheme, FDA is now conducting microbiological profiling inside food processing facilities during routine inspections and testing vast amounts of food at retail," Stevens explains. "And, as part of these initiatives, FDA announced that it is now targeting pet food aggressively."

Stevens says that, while FSMA requires more inspections more often, the agency shift to perform microbiological profiling in food facilities is unwritten. "According to my clients who are scattered across the country, the agency is now doing it as a matter of course, and this has been confirmed to me privately by the agency," he mentions. "Although FDA routinely samples all foods, including pet foods, at retail, they have in the past announced targeted efforts at pet foods."

Under the FDA's new policies, if any human or pet food is contaminated and linked to a human illness, the agency will review

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Jerky Pet Treats Mystery: The Latest Details

Since 2007, FDA has received more than 5,200 reports of illness in dogs, and a small number of cats and people, in association with the consumption of jerky pet treats (JPT), says Lee Anne Palmer, VMD, MPH, supervisory veterinary medical officer in the Division of Veterinary Product Safety in FDA's Center for Veterinary Medicine Office of Surveillance and Compliance.

These reports involve more than 6,200 dogs, 26 cats, three humans, and include more than 1,140 canine deaths, FDA tells *Food Quality & Safety*.

To date, reports of pet illnesses following consumption of JPT have been received from all 50 states and five Canadian provinces.

Illnesses have been linked to many brands of jerky treats, FDA says. The one common factor the cases share is consumption of a chicken or duck jerky treat or jerky-wrapped treat, mostly imported from China.

U.S.-based pet food manufacturers do not need to list the country of origin for each ingredient used in their products, so packages that do not state on the label that they are made in another country may still contain ingredients sourced from China or other countries that export to the U.S.

Included in the adverse event reports for dogs that FDA has received, about 60% of the reports are for gastrointestinal illness and about 30% relate to kidney or urinary signs. The remaining 10% of cases involve a variety of other signs, including convulsions, tremors, hives, and skin irritation.

FDA has met with the Chinese regulatory agency responsible for pet food to ensure that they are aware of U.S. requirements for pet food safety and to develop collaboration on sharing information to support FDA's investigation.

Some JPT products were removed from the market in January 2013 after the New York State Department of Agriculture and Marketing Food Laboratory reported finding six unapproved antibiotic drugs in certain JPT manufactured in China. Since that time, FDA reports, complaints of illnesses associated with JPT have dropped significantly.

In collaboration with several veterinary diagnostic labs in the U.S., FDA continues to actively investigate why JPT are associated with illness in dogs. The agency has conducted extensive chemical and microbial testing of JPT. However, the FDA reports that scientists have not yet been able to determine a precise cause for the reported illnesses associated with consumption of JPT.

It's possible that many of the illnesses reported may be the result of causes other than eating jerky pet treats, FDA says. *—L.L.L.*

(Continued from p. 27)

the circumstances carefully to determine whether there is any basis for criminal liability against the company or its employees, Stevens says.

Minimizing Fraud with Packaging

"Economically motivated adulteration dominates the fraud arena," says Claire Sand, PhD, owner of Packaging Technology & Research, LLC, Stillwater, Minn., and an adjunct professor of packaging at Michigan State University. "Not surprisingly, overt (visible) and covert (hidden) features are being incorporated in pet food packaging with increasing frequency."

Stevens says that, while FSMA requires more inspections more often, the agency shift to perform microbiological profiling in food facilities is unwritten.

"Overt features, such as barcodes, holograms, and watermarks, are designed to enable supply chain users to confirm the genuineness of a package and the product inside," Dr. Sand explains. "Such features are typically significantly visible and complex or expensive to reproduce. Tracking and tracing have been the main focus of overt packaging to prevent food fraud. To that end, numerous companies offer tracking and tracing via radio frequency identification and near field communication technologies."

Covert labeling and printing advances beyond traditional ink, dyes, watermarks, and micro-taggants continue to emerge, Dr. Sand continues. "Silicon dioxide micro-tags resistant to high temperatures and the environment are also gaining in popularity," she notes.

"Plant-based DNA markers for barcodes, watermarks, and microdots offer a cohesive approach to covert packaging in that use of DNA markers that form an encrypted DNA sequence are lasting and difficult to mimic," Dr. Sand says. "Covert and overt packaging enable brand owners and consumers to have greater confidence that ingredient accuracy is in place. These technologies are emerging in pet food packaging due to the high value of pet food and the increased interest in pet nutrition." ■

Leake, doing business as Food Safety Ink, is a food safety consultant, auditor, and award-winning journalist based in Wilmington, N.C. Her precious cat Jersey provided support and companionship during the writing of this article. Reach her and Jersey at LLLeake@aol.com.

For expanded content on this article, go to June/July 2016 issue on www.foodqualityandsafety.com and click on "Safe Food for the Entire Family" article. The June/July online issue also contains other pet-related articles, including the following:

- Health Issues for Pets and People,
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Hygiene is a Critical PRP

Comprehensive personal and environmental hygienic practices should be the foundation for every food safety program

BY **CHARLES J GIAMBRONE MS**

The keystone of all prerequisite programs (PRPs) in any food processing or service operation has to be "personnel personal hygiene." If the workers' hygienic practices are improper or slipshod, then the sanitation standard operating procedures for environmental and food equipment can and do become critically compromised.

Ongoing Problems with Hygiene

Despite common sense and extensive training tools that the food industry utilizes from farm to fork, there are still major issues with personal hygiene, resulting in serious foodborne disease outbreaks. In an extensive review series on the examination of food workers' roles and contributions to foodborne disease outbreaks, Todd et al researched food worker hygiene issues from every angle. In Part 3 of the review series that appeared in the Journal of Food Protection, a total of 816 outbreaks were analyzed. In many instances, infected food workers were handling food with bare hands and had poor handwashing practices. A majority of the infected implicated workers were either shedders or had poor personal hygiene behaviors. The microbial pathogens had norovirus as the largest culprit followed by *Salmonella spp*. then *S. aureus*. A total of eight categories of outbreak types were analyzed. The most problematic category involved infected workers who deny their illness and remain unreported in the outbreak data. In all scenarios, the lack or disregard of basic hygiene practices when a food worker or family member has a microbial-borne illness is still profoundly common.

Further complicating the category factors, as seen in Part 5 of this series, even when workers understand they are ill, and workers and their managers try to prevent the microbial spread of the shedded pathogens, it's difficult to screen and segregate all infected carriers with no symptoms. Also, even after ill infected workers leave the premises, they might already have contaminated food contact and environmental surfaces with residue of sputum, vomitus, or fecal matter that is almost impossible to track to properly disinfect contaminated surfaces. Many of these viral or bacterial pathogens can and do survive for long durations on inanimate surfaces, cross-contaminating ready-to-eat (RTE) food products.

Hand and Basic Surface Hygiene

Hepatitis A outbreaks in food handling are less common than norovirus, but Hep A has shown a propensity to be transferred from hands to equipment to products. While norovirus foodborne illness outbreaks are not fatal in most instances, they are the source of the majority of known outbreaks. Note that if you can control norovirus contamination in your facility, the same practices and measures will work well for controlling Hepatitis A.

In one study published in *Applied and Environmental Microbiology*, finger pads—used to mimic gloves—were utilized as a model to assess Hepatitis A viral particle transfer from hands or gloves to RTE produce (i.e. lettuce). The greater the water volume used, and especially if soap and glove sanitizer (alcohol-based products) were applied, the higher the viral particle removal. Overall, Hep A adhered far better to skin than to disposable gloves.

Norovirus and some surrogate viral strains also displayed a lengthy survival on typical non-porous food contact surfaces. As the cruise ship industry has discovered, studies in food facilities demonstrate that norovirus can survive on food contact surfaces—staying infective for weeks. Unclean employee hands and contaminated equipment/cleaning utensils can transfer the Norwalk virus. A study in *Journal of Food Protection* discussed the need to utilize norovirus surrogates to truly assess survival rates on Zones 1 thru 3 to create realistic risk assessments on norovirus transfer from infected workers.

There seems to be a high risk of contamination of food ingredients and prod-

ucts from Norwalk virus and Hep A infected workers via the direct/indirect food contact surfaces serving as the intermediate. So once gloves are contaminated from an infected food handler, the virus easily adheres to and survives on Zone 1 and Zone 2 surfaces, creating a major cross-contamination concern. This viral transfer is enhanced if the food product has a high water activity and a porous surface.

Regarding handwashing practices to remove norovirus, antibacterial hand soaps plus water with vigorous rubbing remove the most viral particles. While the alcohol-based hand sanitizers are highly effective against bacterial pathogens, studies have found them to be minimally effective on viruses like Norwalk and other enteric viral pathogens.

What biocides are effective on pathogenic viruses on environmental surfaces? A study done in 1990 by Syed Sattar's group and published in *Applied and Environmental Microbiology* screened common disinfectants and found 2 percent glutaraldehyde, 5,000 parts per million hypochlorite (bleach), and an acidic QAC product (toilet bowl cleaner) were all effective, while liquid alcohol, peracetic acid, and other organic acids were ineffective in reducing Hep A. While a high bleach concentration is effective for many plant surfaces, that level can be corrosive with persistent use. Also the type of food contact or environmental surface—non-porous versus porous, hydrophobic versus hydrophilic—strongly factor in disinfection efficiencies. It's also difficult to quantify virucidal or bacterial efficacy on porous environmental surfaces. The elimination of as many porous surfaces in washrooms and within the food plant, including porous worn food contact belts, is critical.

Many studies have focused on human non-gloved hands as being the primary culprit in Norwalk virus transmission. Another study in *Applied and Environmental Microbiology* proved even non-infected, symptom-free workers become unsuspecting carriers, at an average of nearly 4 log cycles of Norwalk virus per hand. This proves the need for a complete hand hygiene program in both the office and food handling areas. But keep in mind that glove use does not negate proper hand hygiene practices—it complements it.

These dispensers for glove and equipment use must be accessible to the production areas where gloves are mandated and critical in terms of food handling.

Pathogens like *Salmonella spp.* survive well for long time periods in dry environments, including restrooms and sinks. However, when proper cleaning followed by EPA-approved sanitizers are used, *Salmonella* can be controlled in all areas. *Shigella spp.* is also a major concern regarding improper hand hygiene and environmental sanitation of hand sinks and washrooms. A recent study in the *Journal of Food Protection* inoculated 5 to 6 Log cycles of *Shigella* on hands followed by proper handwashing then by preparation of melon balls to track the level of contamination. Antibacterial soaps achieved 3 to 4 Log cycle reductions, but the standard soaps had roughly a 2 log reduction, resulting in greater *Shigella* levels on the melon balls. This data is applicable for all enteric bacterial pathogens and proves the greater need for more quantifiable risk assessments on handwashing.

Other quantification studies have involved handwash duration, type of hand soap, level of soiling, and drying methods using a reliable pathogenic surrogate, *Enterobacter aerogenes*, in the model soil. The proper usage of hand soap with rinsing resulted in a greater microbial reduction (roughly 99 percent reduction) than when water alone was used. It was also confirmed that utilization of disposable paper towels provided more physical agitation versus air drying.

Restroom Issues and Suggestions

While it's been discussed that using cleaning cloths can transfer and contaminate hands and surfaces with pathogens, can the same be applied to disinfectant wipes commonly utilized in washrooms, offices, and inside food plants? A study in *Applied and Environmental Microbiology* quantified microbial transfer from a contaminated surface to QAC-based disinfectant wipes to employee fingers. It was found that the levels of *S. aureus*, *E. coli*, *Bacillus*, and poliovirus were markedly reduced on the subjects' fingers from ceramic tile, laminate, and granite when the disinfectant wipe was employed.

According to the USDA *FSIS* Sanitation Performance Standards Compliance Guide, toilet facilities must be:

- Adequate for the number of employees in facility,
- Sanitary and in good repair,
- Employing self-closing doors that do not open into food area,
- Adequately ventilated and not have offensive odors,
- Using lockers that are regularly emptied and cleaned and periodically fumigated, and
- Free of old clothes and trash.

Requirements for food plant equipment and environmental surfaces are the same for washrooms. The washroom's toilets, latrines, floors, covings, ceilings, and drains must be non-porous with waterproof surfaces and sloped floors. Proper hygienic design enables sanitation employees to control both bacterial and viral pathogens. All sinks, toilets, and latrines should be hands-free, which includes soap and sanitizer dispensers. The hand sanitizer dispensers, both in washrooms and in the plant, can be actuated by either a foot pedal or an arm bar. If there are doorways, hands-free swing doors are strongly recommended for all food plant restrooms to avoid another cross-contamination vector.

Both bare hand sanitizer as well as sanitizer applied to gloved hands should be accessible in a facility. The hand sanitizer and its dispenser need to be adjacent to the hand sink in the washroom or on the processing floor. Meanwhile, the glove sanitizer must be rated as a food contact surface sanitizer, preferably a QAC-alcohol blend. These dispensers for glove and equipment use must be accessible in the production areas where gloves are mandated and critical in terms of food handling.

Like all PRPs, the proper utilization and training of personal hygiene is an ongoing and evolving process. Its critical role in your food safety program must never be compromised or minimized. ■

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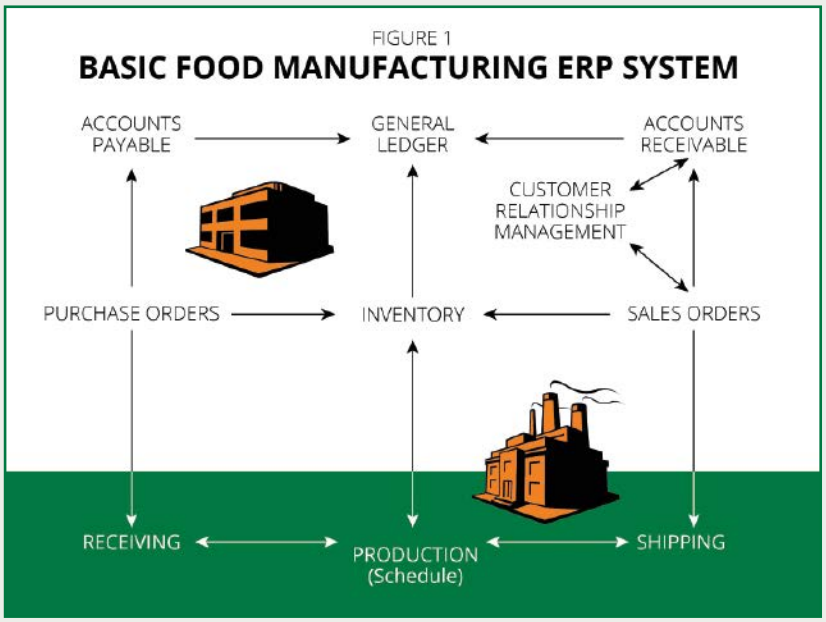


Production, Protection, and Profits

Harnessing the power of real-time GFSI and ERP integration ensures safety compliance is traceable

BY **LINDA BRYAN**

Food safety is a priority for every food company, no matter how large or small the firm may be, or where the provider fits into the supply chain. When tainted foods become public knowledge, failure to meet safety standards can literally put a company out of business.

But no food company works in isolation. Even if the firm has excellent safety processes internally, it's still at risk if any tainted foods come from outside providers.

Consequently, a number of certifications have been established worldwide to ensure food companies can prove they have ongoing food safety processes in place. These certifications may seem challenging to implement at first, but certified safety processes are more than worth the effort—especially in the food industry.

Three common scenarios are the reasons why.

1. The potential for a food recall is a significant risk for every food company.

2. Food safety compliance audits can be expensive, especially if the company's quality controls and reporting processes are deemed inadequate.

3. And most importantly, unlike the majority of manufacturing companies, spoilage and contamination are very real concerns for food companies.

In the scramble to meet compliance standards, however, the ability to view certification as an opportunity to improve production and profitability often gets lost in the shuffle. The good news is that all compliance schemes can enhance a company's ability to achieve key performance indicators (KPIs) and business goals—not just protect it from safety violations.

The Global Food Safety Initiative (GFSI) is a perfect example of how, when customized to meet a company's own specific needs, certified safety compliance can serve as a major catalyst to increase production and profitability.

GFSI is an industry-driven collaborative platform to promote food safety on a global scale. Consider for a moment what globally certified safety compliance offers a food company from a bottom-line perspective:

- It mitigates risk by confirming the ability to produce the safest food possible;
- It establishes a consistent food-safety management system which, in turn, streamlines productivity and avoids unnecessary waste;
- Third-party inspectors use GFSI schemes as an agreed-upon standard for judging food safety;
- It simplifies migration to new regulations such as the FDA's Food Safety Modernization Act, or FSMA; and
- Last but not least, proof of compliance makes a company far more competitive, whether it's a leading industry brand or a small, regional operation.

This doesn't mean that all GFSI implementation programs are created (and managed) equally. Nor does it mean that one GFSI solution is as effective as another. The difference lies in the company's ability to integrate GFSI into real-time processes that drive its primary KPIs.

How to Leverage GFSI as an Active Growth Engine

GFSI compliance is straightforward. It requires food companies to do three things transparently.

1. Say what you're going to do to ensure quality and safety.

2. Do what you say you're going to do.

3. And finally...prove it.

The optimal way to achieve all three requirements is not to manage GFSI in isolation, but to fully integrate it into the company's enterprise resource planning (ERP) software system. In fact, it may be the only way to ensure safety compliance is traceable at all times enterprise-wide.

Seamless GFSI/ERP integration provides food companies with real-time, actionable data that enables managers to trace what has happened in the past;

SOURCE: TAMLIN SOFTWARE

understand what is happening now; and control what will happen in the future.

The benefits of real-time integration far outweigh the costs. With real-time analytics, users can drive continuous food safety improvement by identifying which processes are working, which ones aren't, what needs to be changed, and where the company's focus must be to improve quality on an ongoing basis.

With integrated ERP software, food companies can safeguard their manufacturing processes by establishing and applying a variety of security and approval levels at critical quality checkpoints. For example, GFSI has requirements to ensure employee competency. These can easily be maintained by placing security levels within the ERP system, and preventing staff from working at stations where they aren't qualified to be.

A real-time processing-inspection tool also prevents the ability to skip steps in production by validating the correct completion of each step in its assigned order. In addition, recipe and raw material approval checks can prevent unauthorized substitutions during the manufacturing process. If a particular ingredient is unavailable and a substitution is required, the system will then verify the authenticity and pre-approval of all ingredient changes.

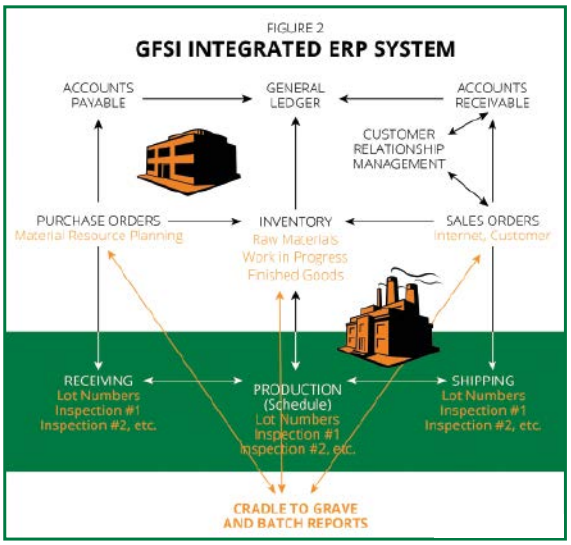
The security benefits of integration extend outside of the company as well. Real-time alerts can notify the QA team whenever a product is received from an unauthorized vendor and allow for immediate intervention and correction.

Minimize Recall Risks—and Costs

The number of food recalls continues to rise in the U.S., and the costs of foodborne illnesses are increasing at a skyrocketing pace. According to a 2015 study by Robert Scharf, associate professor at The Ohio State University, the total cost of foodborne illness could now be as high as $93.3 billion, up from an estimated $77.7 billion in 2012.

But if a recall actually does occur, one of the most important benefits of GFSI and ERP integration is its ability to minimize a food company's costs. The same is true during a food safety audit. With real-time ERP integration, food companies of any size are more able to contain costs in a crisis situation.

Figure 1 shows the relationship between a food company's core manufacturing functions and its standard accounting processes. Everything that happens on the shop floor—from receiving to production to shipping—has a corresponding impact in the accounting system; in other words, not at the plant, but at the corporate level.



A food recall requires seamless traceability throughout the entire enterprise, not just the manufacturing operation. Unless a food company can show exactly where everything is at a given point in time, it's virtually impossible to identify and isolate where the problems lie, both within and outside of the enterprise.

For example, how do you pinpoint where a particular item of inventory is in its production cycle? Is it still in receiving? Is it already in the production process? Is it now part of a finished product? Has it been shipped? And if so, where did it go?

Any discrepancy or even a short-term lag between manufacturing and accounting makes it virtually impossible to ensure accurate traceability. The only solution is to integrate safety processes into a fully integrated real-time system. Figure 2 shows what an integrated ERP-based safety system should include.

An integrated ERP program should have two key elements to satisfy GFSI compliance.

1. A complete batch history that records all ingredients used, including where they came from and when they were added to the production process. It should also record all inspection information, including who did the work. (This type of report can be used by the FDA as well as third-party auditors.)

2. Cradle to grave real-time traceability, one forward and one backward, as required by the FDA and USDA.

With the ability for real-time data capture, all processes that are done on the floor should be recorded on the floor. Raw material (RM) lot numbers should be captured and recorded when delivered. Additional inspections should also be made with corrective actions taken at each appropriate stage in the production process.

RM lot numbers should also be recorded throughout the process, and finished goods should be assigned lot numbers of their own that also include all RM lot numbers used in every final product. This way, manufacturers can be assured of real-time traceability, both forward and backward.

So can auditors. In the event of an audit or recall, documentation is critical to prove that a manufacturer has followed all required safety control steps. And when systems aren't integrated, it's far more difficult to locate documents and create a solid inspection trail.

The ability to access supporting documentation quickly and accurately will instill auditors with a sense of confidence because they know the manufacturer is being fully transparent. On the other hand, an auditor may become suspicious and far more demanding when necessary documentation isn't readily available.

Ultimately, integrating GFSI and ERP is about improving safety, productivity, and profits, not just protection against audits and food recalls. As an industry-driven initiative to certify a company's commitment to continuous food safety improvement, GFSI participation does more than develop a food safety culture. It enhances a food company's credibility and reputation, both of which drive interest and potential sales. ■

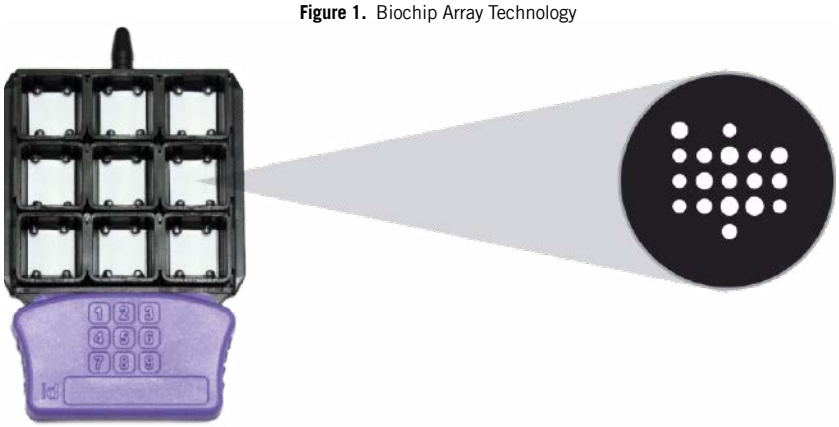
Bryan is CEO of Tamlin Software, a provider of customized traceability, ERP, and accounting solutions for small- to mid-sized manufacturers. Reach her at linda@tamlinsoftware.com.

SOURCE: TAMLIN SOFTWARE

Testing

ANIMAL FEED

Figure 1. Biochip Array Technology



Mycotoxin Screening Breaks the Mold

The struggle with feed-borne mycotoxins and their associated threat to animal health can be diminished with appropriate detection methods and sample preparations

BY **KIRSTY WINTER**

The presence of mycotoxins in feed is a major issue and presents a genuine risk to livestock and animal production across the world. As well as the suffering of animals, the occurrence of contamination in various grain crops has major implications for food and feed safety, food security, and international trade. Around 25 percent of the world's grain is contaminated with one or more mycotoxins and, according to a European Commission report, it is estimated that mycotoxins are responsible for losses of up to 5 to 10 percent of crop production globally.

Mycotoxins are classified as secondary metabolites and are produced by a wide range of different molds. Moisture is one of the most important factors in determining if and how rapidly these molds will grow in feed and comes from three sources: feed ingredients, the feed manufacturing processes, and the environment in which the feed is held or stored. Mycotoxins can occur in a variety of crops that are colonized with filamentous fungi and can affect a range of food products including cereals, grains, nuts, spices, dried fruits, apple juice, and coffee. Contamination can occur due to weather, possible climate change effects, land use, or crop management.

There are said to be between 300 and 400 mycotoxins in existence, however those that are of most concern based on their toxicity and occurrence are aflatoxins (B1, B2, G1, G2, and M1), deoxynivalenol, zearalenone, fumonisin, T-2 toxin, and T-2-like toxins. Aflatoxins, including aflatoxin B1, are considered the most toxic and while all ages are affected, young animals are most susceptible. Aflatoxins cause a variety of effects in animals, including reduced milk or egg production, gastrointestinal dysfunction, anemia, and jaundice. Other mycotoxins can produce a range of harmful effects in animals, including kidney damage, reproductive disorders, suppression of the immune system, and, in severe cases, death.

Aflatoxins, including aflatoxin B1, are considered the most toxic and while all ages are affected, young animals are most susceptible.

For feed producers, the economic impact of mycotoxin contamination is high, especially due to the lower levels that cause more subtle symptoms. Mycotoxins are not only an issue for animal health, but may also be hazardous to human health since animal products that contain residues, including tissues and milk, are consumed by people. Greater awareness of the issue, together with improved screening, is key to effectively controlling the occurrence of mycotoxins in feed and food chains.

In order to protect animal and consumer safety, rules and strict legislative limits for aflatoxins, ochratoxin A, and fusarium toxins in certain foodstuffs are specifically set out in European Commission legislation. The legislation applies to specified foods, whether they are imported into the U.K or produced in the U.K. Globally, the requirement for mycotoxin screening is varied. In an attempt to safeguard consumers, there are a number of special import conditions currently in place for some foods from certain third world countries (Africa in particular), where the risk from aflatoxin contamination is increased. Compliance with internationally acceptable limits for mycotoxins can be challenging for the food industry, requiring good plant protection, adequate storage, and good manufacturing practices in order to keep levels below the limits.

SOURCE: RANDOX FOOD

More Talk on Mycotoxins

"Got milk?"

"*Mycotoxins in Bovine Milk and Dairy Products*," published in the March 2016 issue of *Journal of Food Science*, explains how toxigenic fungi can produce mycotoxins that contaminate the lactating cow's feedstuff. During metabolism, these mycotoxins undergo biotransformation and are secreted in milk. Data shows a seasonal trend in the levels of mycotoxins in milk, with these being higher in the cold months, probably due to the prolonged storage required for the cattle feeds—providing favorable conditions for fungal growth.

Authors note that given the extensive occurrence of different types of mycotoxins not only in milk but also in other dairy products, as well as concern regarding their animal and human toxicity and the fact that milk is a source of nutrients for infants, it is essential to adopt measures to minimize these toxins. They recommend special care be taken with lactating cow's feedstuff and in increasing the awareness of Good Agricultural and Storage Practices.—*FQ&S*

A number of studies have demonstrated that mycotoxins occur simultaneously in field situations, which can profoundly affect the toxicity of the mycotoxins present. Producers must be aware that if one toxin is identified in a sample, the chance that other toxins are present is highly likely. Therefore the need to test for multiple mycotoxins simultaneously is vital to ensure that all prevalent toxins are detected quickly and adequately monitored.

Examples of Technology

One such tool used for the detection of mycotoxins in animal feed is Biochip Array Technology from Randox Food Diagnostics. This technology allows for simultaneous, sensitive, and fast screening of up to 10 of the world's most prevalent toxins from a single sample. The core of the system is the biochip, which represents the platform in which the capture molecules are immobilized and stabilized in pre-defined x,y coordinates, defined in arrays of discrete test regions on a pre-activated surface (see Image 1). The biochip is also the vessel where simultaneous chemiluminescent reactions take place. Kinetics of the immunoassays are controlled by incubating the biochip carriers in a custom thermoshaker unit also provided with the system.

Using Biochip Array Technology means that only one sample preparation is required for all 10 toxins, and is ready for testing within 20 minutes with no need for immunoaffinity columns. This saves the user time compared to alternative methods where a separate sample preparation is required for each toxin. The biochip carrier is inserted into the imaging station of the semi-automated Evidence Investigator analyzer. The chemiluminescent signal from each discrete test region on the surface of the nine biochips contained in a carrier is simultaneously detected and recorded using a charge-coupled device camera. Image processing, quantification, and validation are carried out by instrument specific software. Specialist software, designed in-house by Randox Food, will then translate data into a quantifiable result per toxin.

Randox Food offers a range of multi-analyte biochip arrays for the detection of mycotoxins. The company also offers the customizable MycoFlex, allowing the user flexibility to choose any combination of toxins from the 10 most prevalent (minimum of three). This provides laboratories with the flexibility to test only those mycotoxins of concern, which means that arrays can be specified to screen for particular mycotoxins depending on factors such as storage or harvest conditions.

Another tool for detecting mycotoxins is enzyme-linked immunosorbent assay (ELISA) screening. Randox Food offers various ELISAs, currently available for ergot alkaloids and aflatoxin B1.

A growing awareness of the issues surrounding mycotoxins in animal feed has resulted in an increase in available screening technologies on the market, used to ensure that levels are adequately monitored. With global controls on food safety and contaminants becoming ever more complex, having the right technology is key to meeting those challenges now and in the future. ■

Winter is marketing executive at Randox Food Diagnostics. Reach her at Kirsty.Winter@randoxfood.com.

European Mission: Reduce *Campylobacter* in Pre-Harvest Broiler Chickens

International research consortium is testing a range of technologies, including commercial products and combinations used in poultry feeds

BY **FRANCISCO YSUNZA, PHD,** AND **LIONEL LE VEN**

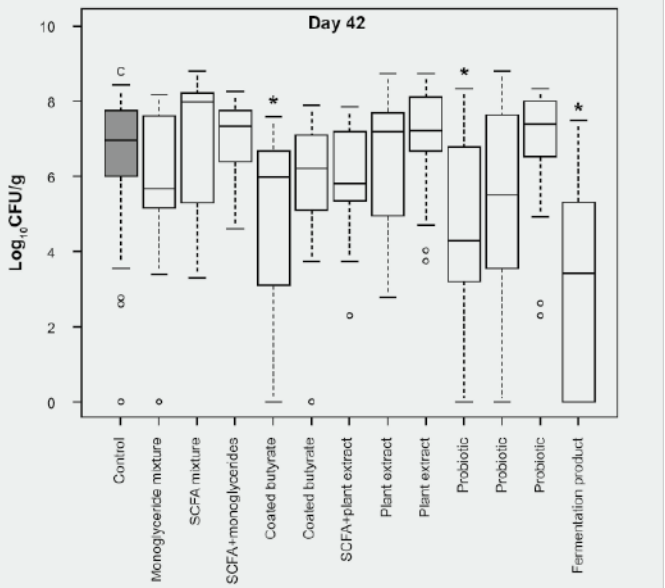


Figure 1. Effect of dietary treatment on *Campylobacter* counts in caeca of broilers at 42 days. Treatments giving significant reduction in *Campylobacter* counts compared to control groups are marked with asterisk. The fermentation product—Diamond V's Original XPC—was efficacious, followed by probiotics and other products. (Figure adapted from Feb. 2016 *Poultry Science* article, "Efficacy of feed additives against *Campylobacter* in live broilers during the entire rearing period.")

As with other foodborne pathogen reduction strategies, the primary focus for controlling *Campylobacter* contamination in broiler chicken meat is on sanitation in the processing and retailing sectors. While there is large variation in published data from surveys and specific cases, *Campylobacter* prevalence of more than 70 percent is frequently reported for the market in Europe.

Pre-harvest recommendations to reduce contamination of poultry meat remain directed basically towards biosecurity. The reason is simple: The poultry industry does not yet have an effective and widely recognized solution to reduce *Campylobacter* in live birds. Even with such a solution, there is the challenge of applying it successfully in different countries and production systems.

Fortunately, a large, diverse group of experts are actively seeking a comprehensive solution to reduce the risk of *Campylobacter* in broiler meat by fighting this persistent pathogen in the flocks from day 1. This consortium, working under the umbrella of the Campybro Project, brings together the expertise of 10 research institutions, industry associations, and companies in four European countries. This independent, collaborative project is sponsored under a grant from the European Union for research, technological development, and demonstration.

During 2015, results from several initial trials within the Campybro Project were presented at various scientific forums in Europe (Czech Republic, U.K., Italy, France, and Spain) and elsewhere (New Zealand, South Africa, and the U.S.). The first two full peer-reviewed articles about the use of available products to fight *Campylobacter* in live birds in Europe were published recently in the journal *Poultry Science* (Part A and Part B).

Variety of Products Tested

Products for inclusion in broiler feed tested in this first phase of the Campybro Project—a total of 24 alone, along with a number of combinations—are identified by their commercial or trade names and generic characterization. Most of the products are commercially available now, although some are still under development.

The products include organic acids, fatty acids, monoglycerides, plant extracts, probiotics, essential oils, flavoring compounds, and a unique, proprietary fermentation product characterized by the journal article authors as "prebiotic-like" and tested only as a stand-alone product.

It is important to note this fermentation product is listed in the European Union's *Catalog of Feed Materials* (category 12.1.5) and is not a "feed additive" according to EU regulations.

A first battery of 12 products (Part A) was evaluated at the facilities of the French Agency for Food, Environmental and Occupational Health Safety in Ploufragan, France, in an experiment with 688 one-day-old Ross PM3 male and female broiler chicks. Each product was tested once and three trials were conducted to cover all 12 products, always against a positive control. The fermentation product was included at 1.25 kilogram/metric ton of feed. Chickens (45 to 40 birds per group) were randomly assigned to the treatments from day 1 and all birds were individually inoculated with *Campylobacter jejuni* (100 microliter oral suspension) on day 11. *Campylobacter* cecal counts were performed in subsamples of birds at 2, 5, and 6 weeks of age (3, 24, and 31 days post-challenge).

Product Performance

Although 10 of the 12 products showed reductions in *Campylobacter* counts at some point during the trials, half of the products showed effects only up to day 14. However, at the end of the study on day 42 (see Figure 1), the fermentation product showed the highest mean reduction in *Campylobacter* counts—the only product with over 3 log reduction. Also, the fermentation product's reduction of *Campylobacter* was the most significantly different from the averaged control groups of the three trials at 42 days ($P < 0.001$).

SOURCE: DIAMOND V

Campylobacter Research in U.S.

BY DOUG SMITH, PHD

In the U.S., pathogenic bacteria such as *Salmonella*, *Campylobacter*, and *Escherichia coli* are frequently associated with consumption of animal protein products and are often cited among the top five pathogens causing foodborne illness. Despite significant progress by the poultry industry in reducing foodborne pathogens, the rates of human illness persist.

Poultry companies are seeking effective pre-harvest food safety programs in order to lower the risk of human illness. While most pre-harvest food safety research continues to focus on *Salmonella*, there also are recent studies of *Campylobacter* in broiler chickens and turkeys.

Research published in *Poultry Science* found that broiler chickens challenged with *Campylobacter* had lower prevalence and numbers when fed a unique, proprietary, precision fermentation product as compared to control broilers not fed the product. Birds were fed either the fermentation product diet or a control diet then inoculated with *C. coli* at 14 days of age. Ceca were collected and analyzed at 42 days of age from 10 non-inoculated broilers (exposed to horizontal transmission) per pen. Ceca from birds fed the fermentation product had significantly lower prevalence than birds fed the control diet (1.3% versus 17.5%, respectively, $P = 0.02$). Numbers of *C. coli* in the ceca of birds fed the fermentation product were lower than those fed a control diet (1 versus 37 MPN/gram, respectively, $P = 0.09$).

More research published in *Poultry Science* found that turkey hens inoculated with *C. coli* had significantly ($P < 0.05$) lower prevalence and numbers in the ceca at 84 days of age when fed a unique fermentation product as compared to hens not fed fermentation product in the diet. At 70 days of age, five turkey hens in each pen were inoculated with *C. coli;* at 84 days, ceca from both inoculated and non-inoculated hens were collected and evaluated for *C. coli*. The pathogen prevalence was significantly ($P < 0.05$) reduced in non-inoculated birds (exposed to horizontal transmission), from 93% to 75%, and overall *C. coli* was reduced by one log (from 4.5 to 3.5 log10) for fermentation product-fed turkey hens when compared to control hens.

Dr. Smith is the director of poultry food safety at Diamond V. Reach him at dsmith@diamondv.com.

The research of the Campybro Project is ongoing. Combinations of products and other strategies, such as vaccination programs and feeding management, are being evaluated in different modules.

There remain a number of challenges to conducting this type of research. Often there is high variation in levels of *Campylobacter* infection or contamination in the birds. Also, testing so many possible solutions together sometimes dilutes the power of the trials and the application of the results under commercial conditions.

In an effort to help bring safe food to consumers worldwide, Diamond V has 12 controlled research projects in place for poultry and half of the projects related to food safety are focused on *Campylobacter* in pre-harvest broilers in Europe. ■

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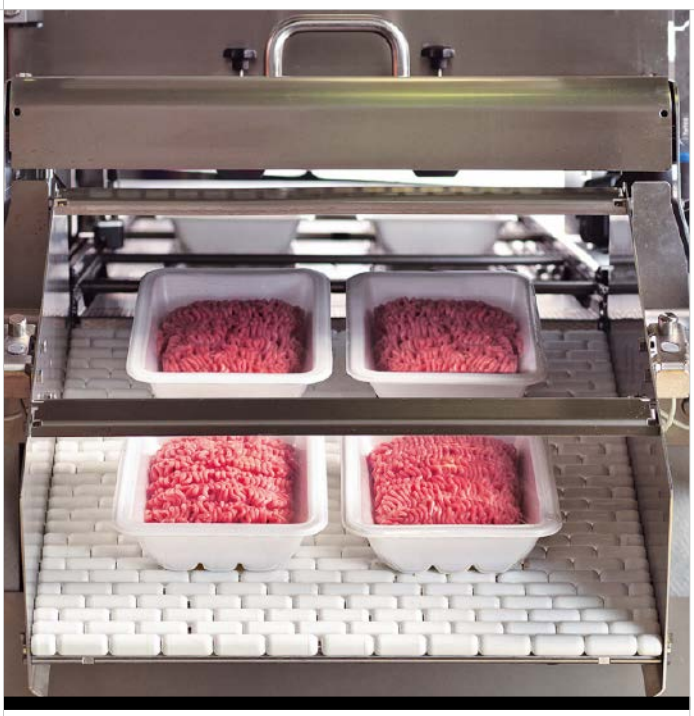
REFERENCES AVAILABLE UPON REQUEST



◀ Processors who package fresh proteins, such as ground turkey, can slow microbial growth by using modified atmosphere packaging.

CO_2 Helps You Breathe Easy

Carbon dioxide-generating pads and modified atmosphere packaging can stunt the growth of microbes in protein packaging

BY **SCOTT MAURER** AND **JOHN CALVERT**

The processors, distributors, or retailers of the food-handling industry that offer their protein products to consumers via fresh or frozen display cases wake up every morning with one mantra running through their minds, which is known as the "Three 'Cs' of Food Handling:" Keep it Clean, Keep it Cold, and Keep it Covered.

To ensure that these three Cs are strictly met, all of which are essential to offering proteins that are at the peak of freshness with little chance of harmful spoilage, a number of critical steps must be followed during the production and supply processes. One of the most significant, and one that also does the most to capture the eye of the consumer, is the packaging in which the protein is placed and presented.

For many years now, this packaging has consisted of a foam tray with an absorbent pad over which the protein—most commonly red meat, poultry, or seafood—is placed before it is sealed.

Two grades of trays are used depending on how the food product will ultimately be offered to the consumer. If the processor packages the product, it will usually be placed in a processor tray that is of a heavier or thicker grade so that it can better survive automated packaging with high-speed machinery or the jostling that can occur during shipping. Fresh proteins that are packaged in the actual store, either in a backroom or after being selected from a display case by the consumer, are typically placed in thinner supermarket foam trays since not as much rough handling is experienced before the protein is consumed.

Key to making the proteins "sustainable," i.e. giving them an optimized shelf life with reduced risk of spoilage or excessive levels of waste, are the pads on which the proteins rest in the packaging. There are many different types of pads that can be used depending on the specific processing or retailing application (see "Picking the Perfect Pad" sidebar), but they all perform one crucial function: wick away the fluids that come from the protein, while in the process, increasing the protein's "case appeal" in the display window and preventing the protein from sitting in a pool of juices, which will retard the growth of microbes that can increase food-spoilage rates.

Your Friend, Carbon Dioxide

One of the best friends of food processors and retailers when it comes to controlling microbial growth is carbon dioxide (CO_2). In basic scientific terms, CO_2 is detrimental to bacteria because it helps create an environment that is unfavorable to the growth of microbes. Specifically, when CO_2 is exposed to a meat surface, it is turned into an acid that creates a lower pH level on the meat, which helps slow bacterial growth.

While the benefits of CO_2 in retarding microbial growth have long been known, the challenge for the manufacturers of the trays and pads in which proteins are packaged has been to find ways to reliably increase the CO_2 level in the enclosed package. Two relatively recent technological innovations have proven to be exceptionally effective in raising CO_2 levels. (Note, however, that by simply raising CO_2 levels in a package that the protein will not automatically have an extended shelf life; a protein's actual shelf life is dependent on a number of interacting factors, including how it is actually processed, how clean the processing facility is, how high the actual levels of microbes are when it is packaged, etc.)

One technology is known as modified atmosphere packaging (MAP). By volume, the air we breathe contains approximately 78 percent nitrogen, 21 percent oxygen and only 0.04 percent of CO_2. When MAP is used to package proteins, the packager injects the packaging container with an air mixture that is 80 percent oxygen, which, for instance, helps keeps red meat red, and 20 per-

(Continued on p. 40)

SOURCE: NOVIPAX

Picking the Perfect Pad

While food processors and retailers are well aware that only by adhering to the three "Cs" of food handling—Keep it Clean, Cold, and Covered—will they be reasonably certain that their products will not be harmful to consumers, the best way to attain that adherence is to avoid a fourth "C," namely Confusion.

There are many types of absorbent tray pads available to the food processors and retailers, and proper food protection will only be achieved by knowing their differences and capabilities, and then choosing the best pad for the application. Therefore, below is a quick primer on the major types of pads and where they can be best utilized.

Standard absorbent pads. This class of pads uses patented sealed-edge technology and one-way valves with a highly absorbent virgin fluff pulp core to offer superior absorbency. This technology is a top choice for grocery-store retailers that are hand wrapping and packaging proteins in the back of the store, or those that are selected from an in-store display case and given directly to the customer. Since these types of packages have a very short shelf life (typically a maximum of three to five days), the pad's absorption requirement is very low, usually 40 to 50 grams. The main advantage of this pad type's design is that when moisture is absorbed into the pouch, it is completely sealed with the one-way valve preventing the purge from leaking out of the pad.

Superior absorbent pads. This style of pad is aimed for the food processor or retailer who requires much higher absorption levels. The pad's construction consists of a super-absorbent non-woven fabric with a built-in surfactant that has the capability to wick the purge into the pad via a hydraulic action, i.e. when you hold the pad at a 90-degree angle and touch a fluid with a corner, that fluid will hydraulically lift into the pad. This capability makes the pads ideal for display cases where the food will typically be displayed at a 45-degree angle (and even up to a 90-degree angle), which makes it easier for the consumer to see. Food products that are displayed in this manner that do not have a super-absorbent pad will see a .5-in. to 1-in. layer of moisture collect at the bottom, which can be off-putting to the consumer.

Slide-resistant pads. This type of pad can offer the best moisture-wicking features of the standard and superior absorbent pads, but with the added benefit of a meat-contact surface that is resistant to sliding. This feature makes the pads ideal for case-ready products such as shaved red meat, shaved pork, ground beef, or turkey, and those with smaller portions, as the product is held in place and does not slide to the bottom of the tray, even during a 45-degree-angle case presentation.—*S.M. and J.C.*

(Continued from p. 38)

cent CO_2, which, as mentioned, will help slow microbial growth. Because a small portion of the oxygen and CO_2 that is injected into the package can leak out if the product is only wrapped in a breathable film, MAP is most commonly utilized by food processors that have access to barrier foam trays that are coated with a co-extruded barrier film that creates an exceptionally high oxygen barrier, as well as a barrier lidstock that is hermetically sealed to the tray. This keeps the oxygen- and CO_2-heavy air in the package where it can interact with the protein.

Another technology is the CO_2-generating pad. This type of pad is constructed of a non-permeable/non-stick polyethylene film and hydrophilic non-woven bottom layer that is filled with an FDA-approved granular element that is a combination of citric acid and sodium bicarbonate. This granular element, which is not a powder and therefore cannot escape the pad and contact the protein, creates CO_2 when the citric acid and sodium bicarbonate are combined and contacted by the protein's juices.

A Second Look at Sustainability

Sustainability in food packaging can be looked at in two ways. The first, as described above, is identifying and implementing pad and tray packaging technologies that cannot only enhance and prolong the visual appeal of the fresh protein product, but also be used as a way to slow microbial growth, which will result in a reduced risk of spoilage and decreased levels of product waste.

▶ CO_2-generating pads keep proteins fresh and wick away any moisture, enabling packaging to be displayed on an angle, which is more eye-catching for consumers.

The second way to view sustainability in fresh-food packaging is from a holistic angle. Every industry is looking for ways to make their operations more environmentally friendly, or "green." Food processors and retailers are no different, whether it's by incorporating a more energy-efficient manufacturing process or using freezers and coolers that require lower amounts of electricity to operate but are still able to run at the required level of effectiveness.

There have also been advances in the realm of environmentally sensitive food packaging. Most notable are next-generation food trays that are manufactured from a feedstock that can contain 45 percent to 65 percent recyclable materials, with most of the materials produced at the actual tray-manufacturing facility and then reused in subsequent production runs.

Another type of sustainable packaging is made from a plant-based material, usually corn, that is biodegradable. These materials will decompose after consumer use provided that they are processed via industrial composting where temperature, pressure, and moisture metrics are managed accordingly.

Today, plant-based biodegradable resins can be expensive and their manufacturing process less efficient, so the final cost of the trays will be higher than traditional foam packaging models. However, there is a niche for these products, namely in highly regulated areas, like the city of Seattle, or in markets where the customer demands that environmentally friendly products be used.

Conclusion

The driving force for food processors and retailers is to consistently provide fresh proteins to customers that satisfy their demands for visual appeal, freshness, and taste. Falling short in any of these areas, or selling a product that has become spoiled, can be disastrous and result in loss of reputation, or in the worst case, significant fines, financial retribution to injured parties, and even the shuttering of the processing business or retail outlet.

The only way to avoid these end-of-days scenarios is to ensure that the proteins that make their way from the production plant to the display case are not susceptible to spoilage or waste. A valuable arrow in the quiver of the food processor and retailer in the battle against excessive microbial growth is carbon dioxide. Because of its ability to slow the generation of microbes, CO_2, whether created through the use of CO_2-generating pads or injected into the package as part of a MAP process, can be the answer in the food processor's and/or retailer's search for peace of mind. ■

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SOURCE: NOVIPAX

Trending: Responsive Food Packaging

Responsive food packaging is an emerging field in food packaging research. Unlike active packaging, responsive packaging systems react to stimuli in the food or the environment to enable real-time food quality and food safety monitoring or remediation. According to "Responsive Food Packaging: Recent Progress and Technological Prospects," published in the January 2016 issue of *Comprehensive Reviews in Food Science and Food Safety*, current research in bio-responsive and stimuli-responsive materials is expected to translate into more reactive food packaging over the next few years. Commercialization of these materials in food packaging will be possible as new technologies become more reliable and cost-effective. Currently, a very limited number of companies produce responsive packaging systems as compared to active packaging companies. However, with the recent advances discussed in this review, and the increasing demand from consumer and regulatory agencies, the authors expect the responsive packaging market to grow steadily over the next decade. It's also predicted that responsive packaging will have a tremendous impact on many aspects of the food industry by reducing spoilage, food waste, food recalls, and foodborne illness outbreaks.—*FQ&S*

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TAKE YOUR PICK!

Can It!

Understanding why some metal containers are not compatible with certain foods can help improve process efficiency

BY **DAN HOWELL**

Asking someone to pick up a few things from the market can cause one to spend a lot of time explaining what you really want. "We need a vegetable, please grab some green beans to go with dinner." This allows for several options that the store provides for shoppers today. How much product do you want? What style of green beans: whole, cut, French style? Is convenience a factor, should they be microwaveable? Do you care if the green beans were organically grown? If they are canned, are they also packed in a BPA-free container? There are a lot of decisions to be made for a simple side dish. Many decisions have also been made to improve upon the metal can that those green beans might be housed in.

Metal Can Anatomy

The metal container has improved dramatically since it was invented around 1810. By around 1920 it started to look like what is seen today in the marketplace: open top cans with a top lid that is "crimped" (double seamed) to the can body. The size and shape has not changed much over the last nearly 100 years; however, many subtle changes have occurred.

Three-piece cans are named for the number of separated pieces that make up the can: one body and two lids on either side of the can body. The body starts as one flat piece of tinplate that is welded together to form the cylindrical body. The cylindrical body is then manipulated to form flanged ends and ridged body beads (for added container strength) around the circumference of the body. One flanged end is sealed by a lid that is double seamed on the can body. A coating material is then applied to the interior of the can. Cans are then stacked and wrapped to prevent damage and then sold to food producing companies along with the other ends (lids). The food manufacturer fills the can with a food product and then hermetically seals and heat processes it to sterilize the can and the food product.

The welded side seam is a relatively new improvement to the three-piece metal can relative to the overall age of the canning industry. Before welding, the side seams were soldered and the solder contained lead that could leach into the food product and thus be ingested by the consumer. Soldered side seams also presented other problems with sealing containers. The side seam with solder was much thicker than the tinplate, which would then compromise the overlap measurement of the double seam at that point called the side seam juncture. A phase out of lead soldered side seams began in 1979 and by 1991, the FDA issued a final rule to prohibit the sale of lead soldered cans. Other soft metals, like tin and silver, can be used to make solder for can side seams, but that is rarely seen today. Modern can welds greatly reduce the thickness of the side seams at the juncture area compared to the older soldered side seams.

If a company packed and processed a food product that was later found to have a non-hermetic seal and the food product spoiled, how do you determine who put on the lid that was bad and led to the spoilage? Container manufacturers needed to identify the responsible party and root cause of the issue. A code system needed to be developed. Can bodies were soon sold to food processors with one lid on. They also made the other lids that the food processor had to hermetically seal on the open end of the can, after the food was put in and the lid was applied. An embossed code system was then implemented by the food processor to identify its lid.

The system used to identify the lid is determined by the food manufacturer and is based on the granularity it needs to identify the product. What if you knew how to trace the product that was in question, but you issued the same code for it for the entire pack season? How would you know what was good and what was a potentially unsafe product? As a solution, food producers developed embossed codes to determine the food product and within what lot code (generally related to time frame) the food product was produced in.

What defines a "lot" of food product? A rough definition from the food agency to the producer is, "How much food product are you willing to lose if we ask you to recall it and destroy it because we say it is unsafe for the general public?" The code system was developed to narrowly define a product lot in that situation. Emboss codes relied on skilled employees who could line up the "dies" used to punch the codes in the metal lids without misalignment, which could lead to a breach in the hermetic seal of the food container.

Problem Areas

The Grocery Manufacturers Association, or GMA, regularly receives cans from members seeking analysis of potential issues.

GMA has identified several critical areas on a metal can that could be potential sites for failure; several are the responsibility of the can manufacturer. The can manufacturer not only produces the metal can body, but also both metal lids, one of which it seals on the can body as a base. The food producer has the responsibility of seaming the open end of the can with the lid provided by the can manufacturer. Assuming that there are no structural defects in the tinplate metal used to make the can body and lids, there are four critical areas for potential leakage sites: the can manufacturer's double seamed lid, the food producer's double seamed lid, the embossed code, and the side seam (soldered or welded).

There are several ways to reduce the number of critical areas. One way is to replace the emboss code system and use an inkjet coding system. Ink codes will eliminate one potential leakage site on the container. They can be readily changed and provide more information that can further define lot codes in case something bad happens. However, sometimes the ink codes are hard to read, smudged, illegible, or missed on fast moving lines. Cans might also be inverted prior to coding, which then makes it hard to differentiate the can manufacturer's lid from the food producer's lid.

The invention of the two-piece can further eliminated potential leak sites on containers. One type of two-piece can is the drawn and ironed (D&I), which is mainly used for aluminum cans and the carbonated beverage industry. Internal pressure of the carbonation is needed to keep the shape of the D&I container. The walls of the D&I container body are too weak to withstand the pressure exerted during thermal processing and subsequent vacuum formation during cooling of a typical heat process for a food product. Drawn and re-drawn (DRD) cans use thicker, stronger (tinplate) metal and can be used for heat processing foods. The solid can body and base eliminates one double seamed lid and the entire side seam. It also takes the guessing out of who put the one double seamed lid on the container.

Making Improvements

Chances are that the average consumer is not going to care if a metal container is two-piece versus three-piece. The average

consumer is more likely interested in the convenience that the metal can provides. A major convenience factor is the presence of an easy open end (EZO) that does not require a can opener. The EZO has been around for a while and started with the aluminum beverage can. Early EZO tabs were designed to tear off of the lid and be discarded. The consumer did not need to have a tool for punching holes on the lid. However, trouble came from all the discarded sharp tabs not making their way to a proper receptacle. In 1990, the EZO system was improved with the eco-tab that allows the easy opening of the container by a ring and the retention of the metal ring on the lid.

Could eco-tab technology be applied to a DRD food can? The opening would have to be much bigger to allow the solid portions of a food product to easily come out. Unfortunately, there is no way to conveniently open the food can without fully removing the top to allow for easy food removal. An eco-tab ring is traditionally used to pull open the lid on a score line that is cut along the circumference of the internal portion of the lid, leaving the double seamed portion of the lid on the can body.

The early years of this technology were wrought with problems. Consistent and even score lines were difficult to produce. A score line that was too deep could lead to early failure of the hermetic seal. A score line that was not deep enough or of uneven depth posed a problem for the consumer during the opening process, which led to hand injuries. Improvements in the precision of cutting the score line have eliminated most of those problems and also made the metal edges more rounded and less sharp after the EZO lid is removed.

Another improvement in metal can design is the "necked end," which uses a smaller diameter top double seam compared to the base or bottom lid double seam of the container. This improvement allows easier can stacking in the marketplace because of the nesting that occurs with the base of the top container on the top of the lower container in the stack. This action makes the stack stronger and less likely to topple off the store shelf. Food producers also see less damage to these containers during distribution.

A Better Understanding of Canned Food

It's important for food producers to maintain open communication with their suppliers or can manufacturers. There are many things to consider when processing a food product. Some metal cans and lids simply will not work with certain food products. The internal coatings on the can bodies and lids are important as well, and have recently garnered attention. Some food products are specifically processed in cans without any internal coatings for aesthetic reasons. There are some food products that are corrosive and the coating material needs to be strong and intact. Internal metal exposure can lead to product and metal chemical reactions that will lead to early container failure and possibly cause perforations in the container that can allow for product spoilage.

Let's get back to those green beans for dinner. Green beans just happen to be a corrosive vegetable. Any food product grown in soil may have some variability in its corrosive properties because the soil itself has varying amounts of nitrates present that are then passed on to the food product. Thus a manufacturer needs to understand potential interactions between the food and the can.

The next innovation for the metal container might be around the bend. It's true that improving consumer convenience can cause initial headaches for the industry, but it also prompts new discoveries and developments so the canning industry is able to evolve. ■

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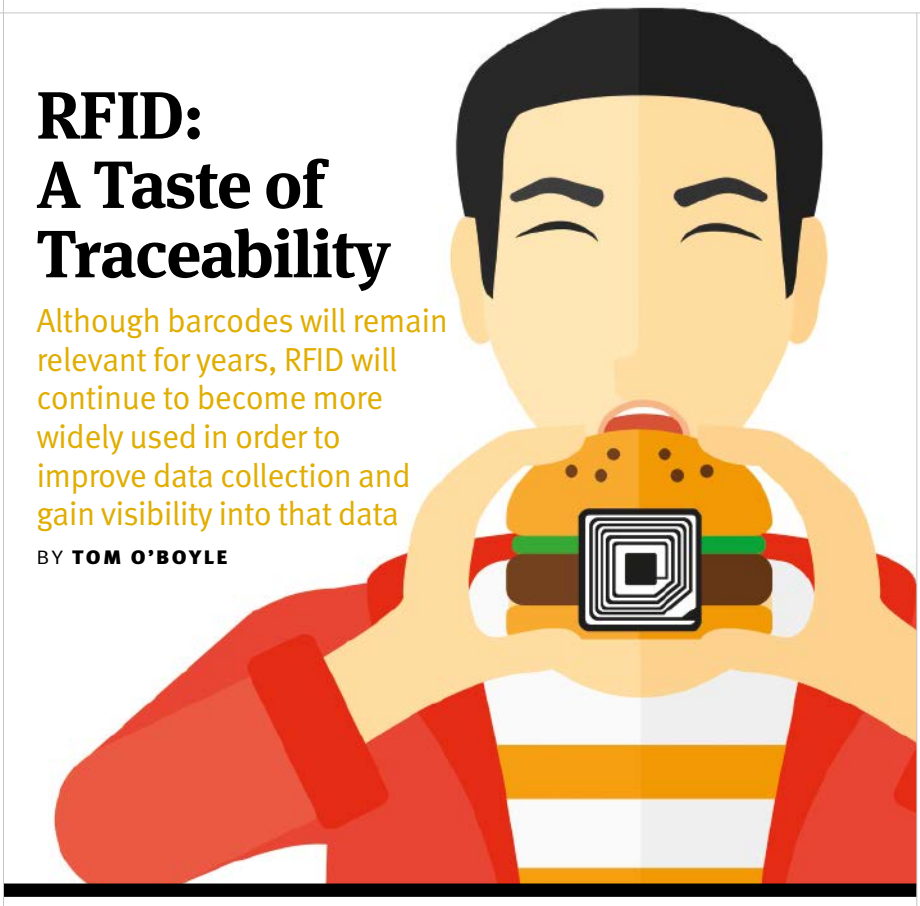
RFID: A Taste of Traceability

Although barcodes will remain relevant for years, RFID will continue to become more widely used in order to improve data collection and gain visibility into that data

BY **TOM O'BOYLE**



What happens when hundreds of people fall ill after eating a particular brand of meat? Most likely, the manufacturer will take the precaution of pulling every single product—whether or not that product is affected—from the shelves of every store to prevent further incidents. While this is just a hypothetical situation, food recalls are all too common and seem to happen nearly every day. And, their effects are detrimental.

In addition to potentially harming consumers, the average recall costs a company $10 million, according to the Grocery Manufacturers Association. To mitigate risks, keep consumers safe, comply with increasingly strict industry regulations, and assuage (if not prevent) recalls, more food and beverage manufacturers are investigating innovative technologies. One of these technologies is radio frequency identification (RFID).

RFID 101

Although RFID has been around for decades, it has quickly gained traction in recent years due to improved read rates, new industry standards, lower system costs, and greater solution reliability. In fact, IDTechEx predicts that the RFID market will reach $18.68 billion by 2026. That growth is across all industries, including food and beverage manufacturing and processing.

In the most basic sense, RFID is a data collection method that utilizes low-power radio waves to send and receive information between tags and readers. As opposed to using barcode scanning (or even the traditional "pen and paper") for collecting data, RFID does not require user-initiated, line-of-sight efforts and can simultaneously read and write to hundreds of tags within a read field. While barcodes and manual processes aren't going away anytime soon, RFID, when properly deployed, provides the added benefit of allowing enterprises to acquire data without adding labor or other resources.

For those new to RFID, it is important to distinguish between the two chief types of tags, each offering their own set of advantages. Passive, ultra-high frequency (UHF) tags, also known as RAIN RFID, are the most commonly used. Requiring a powered reader to reflect/transmit their signal, these tags are ideal for tracking large volumes of low-cost items with a continuous flow throughout a specific area. For example, food manufacturers can use passive tags to tracks pallets, bins, or returnable transport items (RTIs) containing ingredients or products as they move through the facility. Furthermore, passive tags are becoming more and more cost effective, with tag prices dropping below 10 cents apiece.

The other key type of RFID tags are active, or Wi-Fi-based, tags. Unlike passive tags, active tags draw from their own internal power supply to transmit signals to standard wireless access points. This provides real-time location information for tracking high-value, high-impact, mobile assets. A good use case for active RFID tags is tracking large machines or pieces of equipment. While active tags are more costly than passive tags, they have a much greater read range—up to 300 feet.

Traceability with RFID

So, how does RFID help with food safety efforts? A central piece of complying with industry regulations like Food Safety Modernization Act, or FSMA, is data collection—food and beverage companies must collect, access, and utilize the necessary data to track and trace products throughout the supply chain. RFID provides these capabilities, and then some.

For instance, manufacturers can attach passive (or RAIN) RFID tags to bins holding a product associated with a lot number. Every time a bin passes through an RFID portal, its tag is read, and data is collected and sent to a database, thus creating an audit trail or chain-of-custody. The audit trail contains valuable information about that product—which line produced it and when? Which machines were used? With this information readily available, manufacturers can quickly and efficiently mitigate a recall. Now, instead of pulling every single product from store shelves, it is possible to pinpoint and pull just the batch that contains the affected products.

Also attributing to traceability initiatives, RFID technology is now used to monitor temperatures. Specialty RFID tags equipped with battery-powered sensors

allow manufacturers to collect temperature data from pallets, bins, and totes. By reading the RFID tag, manufacturers can make sure a pallet maintains a certain temperature. And, if the pallet has hit a temperature above or below a certain threshold at any point in its lifecycle, the manufacturer can discard the product or adjust the expiration data as appropriate. Similarly, RFID tags now exist that can monitor humidity, pressure, and event movement, arming users with even more data to ensure food safety.

Notably, data collected via RFID is non-duplicable, as it results from a machine-to-machine transaction. Therefore, food manufacturers can authenticate processes, as well as sufficiently meet audit requirements with confidence in their data's integrity.

RFID Trends—What's Next?

As the RFID market continues to grow, there are several trends and technologies poised to make an impact. As they explore the potential benefits of RFID, food and beverage manufacturers should keep the following in mind.

Bluetooth low-energy (BLE) tags. As aforementioned, active/Wi-Fi RFID tags run on the costly side, especially in comparison to passive tags. There is finally a more cost-effective alternative: BLE tags. A technology within the ever-evolving Internet of Things, or IoT, BLE tags are not only less expensive than active tags, but they are even easier to deploy—requiring a simple connection to a Bluetooth-enabled device, like a smartphone or a mobile computer. A food manufacturer can track assets by placing a BLE tag to each item and mounting a single reader, or "Cloud Node," in the center of its facility. The manufacturer obtains the same real-time location information as it would with a Wi-Fi/active tag, but without the need for new infrastructure or multiple access points.

Temperature, humidity, and motion sensing. Passive and active RFID tags are becoming more intelligent—tags with built-in sensors that can be read via RFID readers are available to help monitor more than location events. Temperature monitoring of food products is a useful tool, without the need for returnable tracking devices. In addition, each carrier is equipped with its own sensor, so it is easy to monitor variations in pallet position and pallets that are re-built by freight organizations. Other sensors, like humidity and motion, can determine different characteristics about the products as they move through the supply chain.

Hybrid RFID systems. Systems that combine active and passive RFID technology are ideal for food manufacturers tracking both high-volume/low-cost and low-volume/high-cost assets. Yet, in the past, users had to rely on two different software interfaces to obtain tracking information from each type of tag. New hybrid systems provide a unified visibility solution for tracking all types of assets. As assets are tracked, operators can view real-time data from a software interface. It is even possible to use BLE tags in these systems, so hybrid solutions offer even more flexibility and affordability.

The other key type of RFID tags are active, or Wi-Fi-based, tags.

Memory space. Many of today's RFID tags have additional space for storing information beyond a simple identifier. These tags serve as tiny note pads, figuratively speaking, or flash drives. This is especially useful for food manufacturers, who can now store expiration dates, lot numbers, and more, thereby enhancing the audit trail to alleviate recalls.

Pre-printed tags. Although it is convenient to print RFID labels on demand at a manufacturer's site, doing so requires time and internal resources for managing printers—performing calibrations, fixing jams, etc. A growing trend across industries, many enterprises are purchasing pre-printed/pre-encoded labels from reputable consumables vendors. By ordering thousands of pre-printed tags, manufacturers no longer have to worry about printing onsite and can focus on more important tasks at hand (like ensuring food safety).

Implementation Considerations

RFID is a powerful tool with many great tracking and tracing applications in the food and beverage industry. However, before diving into a complete system deployment, take a step back. Here are a few key considerations for a successful RFID implementation.

Define the use case. While it is easy to get wrapped up in the technology itself, it is most important to first clearly define your use case and identify exactly what you want to achieve and why.

Match the technology to the use case. Always match the technology to the use case, not the other way around. "Force fitting" a technology because it sounds promising or is the "latest and greatest" is never a good idea. If another technology, like a barcode scanning system, would be a better fit, don't be afraid to take a different path.

Understand that there may not be a cookie-cutter solution. A single type of technology isn't always the answer. Often, manufacturers require a blend of these solutions—RFID, barcodes—to attain their required results.

Get people involved. Any implementation will go much smoother with buy-in across the organization. And, it is not only important to have the right internal team, but also the right vendors or systems integrators on board to ensure that the technology aligns with the businesses' goals.

Looking forward, RFID technology shows no sign of a slowdown. The same goes for the food industry's emphasis on consumer safety, as regulations continue to increase and manufacturers seek viable options for proving compliance, improving data collection efforts, and enabling traceability. This makes for an ideal time to investigate RFID and see how it can drive safety efforts and make enterprises more efficient, accurate, and connected. ■

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Just In Time Labeling

By bringing label production in-house with an on-demand label printer, businesses can better determine perishability and differentiate quality goods

BY **ANDY SCHERZ** AND **LARRY CORRADO**

Independent commercial kitchens and culinary incubators are supporting the growth of the food and beverage industry in the U.S. While the exact number of food incubators is unknown, data from the Specialty Food Association indicates there are 150 shared kitchen spaces in the U.S., up 40 percent from about five years ago. In addition to serving as a cost-effective point of entry for entrepreneurs, specialty brands, or the trialing of product extensions, the location of these environments across the country offer a more effective logistics option for perishable goods, allowing goods to make it to shelves in a few hours rather than days.

Requirements for fast turnaround time along with the sheer volume of different products and brands processed by these kinds of facilities make them ideal candidates for on-demand color labeling. The following are some frequently asked questions on how bringing labeling production in-house can enhance efficiencies and manage SKU chaos, as well as how to get started.

Q: What are some of the common production challenges commercial kitchens and culinary incubators face?

A: Commercial kitchens and culinary incubators are classic examples of high mix, low volume environments. Seasonal and customized products will add further complexity to their already intricate supply chain. Given that many different brands and SKUs are processed and packaged on any given day, there are several challenges kitchens face in terms of production changeover, inventory management, and labeling.

For example, commercial kitchens typically employ a two-step labeling process. This method entails an outside vendor printing the color branding and messaging on the labels and then having the kitchen print the black and white variable information on the pre-printed colored labels. This approach creates many costly issues for both the commercial kitchen and private brand it is supporting. For the kitchen, it is not uncommon to find that some black and white printers may not be compatible with specific pre-printed labels. In addition, label management, such as reordering more or new labels, can create longer lead-times for production. It also creates a storage issue, as all of those pre-printed labels need to be kept somewhere.

For the brand, any label design changes, whether based on internal marketing strategies or government regulations or the need to incorporate unique graphics for seasonal and promotional products, can make pre-printed labels obsolete quickly. In these cases, brands may incur costly rush charges in order to secure new labels under tight deadlines.

Q: How can commercial kitchens and culinary incubators overcome some of these challenges and make the labeling process more efficient?

A: Not only can on-demand color labeling solve many of these issues, but it can also give commercial kitchens extra advantages. Real-time label production allows manufacturers to produce, label, and ship the same day. With the ability to print made-to-order labels on-site, any label design changes from marketing can be made quickly and sample labels can be printed immediately for review. With the trend towards greater product customization, on-demand labeling also gives kitchens the ability to print a variety of labels to differentiate seasonal products or new SKUs and to incorporate color-coding and imagery. Also, by printing on demand, kitchens can produce both primary and secondary labels with the same messaging to ensure brand consistency.

Q: How much of an investment is bringing label production in-house?

A: The start-up investment varies based on a number of factors. The space and supply chain configuration needed for the new printers is one piece of the puzzle. The good news is that, typically, benchtop printers take up very little space on the production floor. The number of new printers being implemented must also be factored in. This number will vary depending upon the size of the kitchen and the type of label media the printers will run. For example, one printer may run matte labels while another will run glossy labels.

However, no investment picture is complete without taking the long view of total cost of ownership (TCO). For most on demand color label printers, TCO is relatively low. The printers are user-friendly, so the time needed for implementation and operator training is minimal compared to other solutions. Since labels are produced as needed and in the precise quantities needed, there is no need to deal with long lead times for pre-printed labels. In addition, kitchens can use the same blank label stock for multiple SKUs or brands. This reduces waste, especially since printed labels will no longer become obsolete. Manufacturers have been seen to reduce total label costs by up to 50 percent through streamlined processing and reduced waste.

Another element to factor into TCO is ongoing service and support of the printers to keep them operating at peak efficiency. Every solutions provider takes a different approach to customer service and support. For example, IPS can log in remotely and troubleshoot both technical issues as well as template and label design questions.

Q: How can commercial kitchens start the dialogue with customers about the benefits of using on-demand color labeling instead of the two-step process?

A: It's recommended to focus on the savings that on-demand color labeling brings to the brand. Not only will real-time label production cut out the middlemen–decreasing the number of vendors the brand needs to manage–but it also gives brands total label production flexibility, reduces costs associated with rush charges and label waste, and eliminates the risk of incompatible black and white printers with pre-printed colored labels. With the ability to quickly implement label design changes, businesses have an opportunity to see samples prior to making final decisions on new labels–even if turnaround time is short.

On-demand color label printers have the potential to enhance quality assurance and product safety within the food industry. By bringing label production in-house with a label printer, businesses are able to efficiently create labels with bright colors to help determine perishability and differentiate quality goods in commercial kitchens and culinary incubators. ■

Scherz, a 22-year veteran of the industrial label printing market, is a senior product manager at Epson America Inc., tasked with developing the market for on-demand color label printers. He can be reached at Andy_Scherz@ea.epson.com. **Corrado** is president of Ideal Print Solutions.

SOURCE: EPSON AMERICA INC.

NEW PRODUCTS

X-ray System for Wider, Taller Packages

NextGuard C500 X-ray detection system features an aperture that is 35% wider and 50% taller than previous models, making it suited to inspect larger-sized products and cases. In addition, the machine footprint is only 20% to 30% larger to optimize production floor space. C500 uses a wide X-ray beam and arc-shaped detector designed to eliminate blind spots in the inspection tunnel. To assure there is enough X-ray power to penetrate thick and dense packaged products, the system is available with an optional 25% higher power source. This is desirable for products such as large meat/poultry packages, blocks of cheese, or ice cream tubs. **Thermo Fisher Scientific, 763-783-2500, www.thermofisher.com.**

Leak Testing System

LeakProtego is designed to help food processors ensure that individual modified atmosphere packages (MAP) are not going out the door with undetected micro leaks. This is of particular significance for processors who are pushing the shelf life envelope. Unit uses a patent-pending sensing system with CO_2 as a trace gas to detect leaks down to 50 microns. The technology relies on modular units, each of which can test up to 12 packages per minute. Multiple modules can be combined so that individual package testing can keep up with MAP equipment output. The modules provide processors with critical information, such as individual leak size and rate so that production line modifications can be made quickly. **Dansensor, a MOCON Co., 763-493-6370, www.dansensor.com.**

Detection of Total Aflatoxin

MycoFlow Total Aflatoxin Strip Test Kit is used for the rapid detection of total aflatoxin in corn, corn grits, corn meal, rice, wheat, soy, peanut, pistachio, and coconut. With a detection limit of 20 ppb for total aflatoxin residues and a 5-minute protocol, this kit is ideal for use in the field or the reference laboratory. Kit's relative cross-reactivity with various aflatoxins includes: B1 at 100%, B2 at 95%, G1 at 91%, and G2 at 72%. The limit of detection for total aflatoxin in this kit is 16 to 20 ppb. Samples containing less than 16 ppb aflatoxin will present an observable test line. Interpretation of results can be performed visually or using the QuickSTAR Strip Reader. **Bioo Scientific, 888-208-2246, www.biooscientific.com.**

Cold Chain Seafood Monitoring

FlashLink Mini Electronic Time-Temperature Indicator (TTI) is a single-use device that monitors seafood products. It has a pre-configured threshold of 41 deg. F (5 deg. C) and is set to trigger an alarm if accumulative temperature abuse occurs above this threshold for 4 hours or more. Receivers can make immediate accept or reject decisions on the dock based on the flashing green or red LED to indicate pass or fail. The TTI indicators are mounted on a green shipping card with adhesive strips so it can be attached to the outside of a carton to make it easy to locate when a load arrives. **DeltaTrak, 800-962-6776, www.deltatrak.com.**

In Other Product News

PURE Bioscience introduces FDA-approved PURE Control as an antimicrobial processing aid for direct application on produce to reduce foodborne pathogens.

NSF International certifies **GenEon Technologies'** product GenEon Trio+ to NSF Protocol P423: *Electrochemically Activated Water Cleaning and Sanitizing Devices in Commercial Food Operations.*

3M Food Safety launches its 3M Molecular Detection Assay 2—*E. coli* O157 (including H7), adding to a line of tests that also includes *Salmonella* and *Listeria*. The company also enhances its 3M Petrifilm Plate Reader. Software version 4.0 now automates the imaging, interpretation, and data mapping of the 3M Petrifilm Rapid Aerobic Count Plate.

Roka Bioscience adds the Extended On Board Stability feature for the Atlas System to deliver benefits of automation and quality molecular technology to mid and lower volume food testing laboratories.

Dynamic Systems improves touchscreen user interface for its SIMBA (Specialized Inventory Management with Barcode Accuracy) system for production and traceability reporting.

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Events

JUNE

20-22
United Fresh 2016
Chicago, Ill.
Visit http://www.unitedfreshshow.org/.

21-23
50th Annual Microwave Power Symposium
Orlando, Fl.
Visit www.impi.org
or call 804-559-6667.

FSPCA – Preventive Controls for Human Food 2.5 Days Training Course
Green Bay, Wis.
Visit http://www.cherneymicro.com/cherney-college
or call 920-569-4683.

23-24
Microbiology & Food Safety Course
Amarillo, Texas
Visit http://fsns.com/education.html
or call 888-525-9788 ext. 239.

27-29
Training - FSSC 22000 - Implementation and Awareness
Orlando, Fl.
Visit www.newslow.com/registration.

27-30
Biodefense World Summit 2016
Baltimore, Md.
Visit http://www.biodefenseworldsummit.com/
or call 781-972-5432.

29-1
Internal Auditor Training
Orlando, Fl.
Visit www.newslow.com/registration.

JULY

13-15
BRC Global Standard for Food Safety Implementation & Internal Auditor Course
Denver, Co.
Visit http://fsns.com/education.html
or call 888-525-9788 ext. 239.

16-19
IFT
Chicago, Ill.
Visit http://am-fe.ift.org/cms/.

21-22
Why is FDA at my Facility, and What do I do During an Inspection
Zurich, Switzerland
Email support@globalcompliancepanel.com
or call 800-447-9407.

31-3
IAFP
St. Louis, Mo.
Visit https://www.foodprotection.org/annualmeeting/.

AUGUST

2-3
SQF Training Course
Columbus, Ohio
Visit http://fsns.com/education.html
or call 888-525-9788 ext. 239.

16-17
Chemistry Analysis in the Food Laboratory – Food Safety Training Course
Green Bay, Wis.
Visit http://www.cherneymicro.com/cherney-college
or call 920-569-4683.

18-19
New FDA FSMA Rules on the Sanitary Transportation of Human and Animal Foods
Burlingame Calif.
Email support@globalcompliancepanel.com
or call 800-447-9407.

22-26
Introduction to Food Science at Rutgers University
New Brunswick, N.J.
Visit http://www.cpe.rutgers.edu/courses/current/lf0201ca.html
or call 848-932-7315.

25-26
How FDA Trains Its Investigators and Inspectors to Review Sub-Systems for State of Compliance
Linthicum, Md.
Email support@globalcompliancepanel.com
or call 800-447-9407.

SCIENTIFIC FINDINGS

For access to complete journal articles mentioned below, go to June/July 2016 issue at www.foodqualityandsafety.com or type in article headline in search box.

ARTICLE: A Potential of Biopesticides to Enhance the Shelf Life of Tomatoes in the Controlled Atmosphere

Extension of the storage life of tomatoes is a challenge due to its perishable nature, high temperature of the growing areas, and improper post-harvest practices. The search for pesticide-free organic food has led to increased interest in research to develop safe, healthy, and environment-friendly post-harvest treatments. The aim of this study was to evaluate the effect of neem leaf extract, aloe vera gel, and chitosan for preservation of tomatoes in comparison with traditional post-harvest fungicide thiophanate methyl. The effect of these biopesticides on the quality of two tomato varieties during storage was determined. Firmness, weight loss, pH, ascorbic acid, ripening index, and decay or rotting of biopesticide-treated tomatoes were compared. Journal of Food Processing and Preservation, Volume 40, Issue 1, pages 3–13, February 2016.

ARTICLE: Relationship Between Instrumental and Sensory Texture Profile of Bread Loaves Made with Whole-Wheat Flour and Fat Replacer

Food texture is one of the most widely measured quality attributes during processing and consumption, being measured by instrumental and sensory means. The aims of this study were to measure the textural parameters of the crumb of 14 whole-wheat bread loaves made with whole-wheat flour and fat replacer using instrumental methods

and a sensory trained panel, and to determine the relationship between instrumental and sensory assessments. The data of instrumental and sensory texture were individually subjected to analysis of variance and correlated using principal component analysis. The analyses showed that the less firm, more elastic, and more cohesive bread loaves have less than 60% whole-wheat flour, regardless of the content of fat replacer. Journal of Texture Studies, Volume 47, Issue 1, pages 14–23, February 2016.

ARTICLE: Use of Ozone in the Dairy Industry

Ozone treatment is a cost-effective and eco-friendly food processing technology. It has successfully been used for the removal of milk residues and biofilm-forming bacteria from stainless steel surfaces and in milk processing, including fluid milk, powdered milk products, and cheese. Ozonation has been shown to prevent mold growth on cheese and inactivate airborne molds in cheese ripening and storage facilities. Ozone treatment has also been found to be a promising method for reducing the concentrations of pollutants in dairy wastewaters. This comprehensive review discusses the transition in milk production and processing from chlorine and other conventional disinfectants to ozone, including potential and limitations of ozonation. International Journal of Dairy Technology, Volume 69, Issue 2, pages 157–168, May 2016.

ARTICLE: Electrolyzed Water as a Novel Sanitizer in the Food Industry

Electrolyzed water (EW) has gained immense popularity over the last few decades as a novel broad-spectrum sanitizer. EW can be produced using tap water with table salt as the singular chemical additive. The application of EW is a sustainable and green concept and has several advantages over traditional cleaning systems, including cost effectiveness, ease of application, effective disinfection, on-the-spot production, and safety for human beings and the environment. These features make it an appropriate sanitizing and cleaning system for use in food processing. However, there have been a number of issues related to the use of EW in various sectors, including limited knowledge on the sanitizing mechanism. Acidic EW, in particular, has shown limited efficacy on utensils, food products, and surfaces due to various factors, the most important of which include the type of surface, presence of organic matter, and type of tap water used. Comprehensive Reviews in Food Science and Food Safety, Volume 15, Issue 3, pages 471–490, May 2016.

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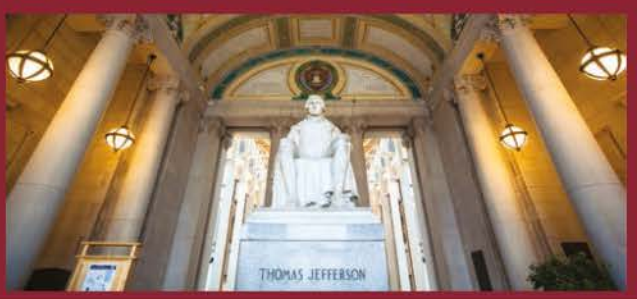

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